NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement
Volume I: Non-Technical Summary

NeuConnect Britain Ltd

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Table of Contents

Figures

Tables

Glossary & Abbreviations

Glossary

Term	Meaning
NeuConnect	Also referred to as the Project, which includes all components of the interconnector between the Isle of Grain, UK and Wilhelmshaven, Germany.
GB Onshore Scheme	Includes all components of the interconnector from the connection to the existing overhead line at Perry's Farm, Grain, to Mean Low Water Spring.
the proposed substation	This is the substation that will be built and operated by National Grid Electricity Transmission to connect the interconnector to the National Electricity Transmission System.
the proposed converter station	This is the converter station proposed to be operated by NeuConnect Britain Limited on land at Perry's Farm, Grain.
GB Offshore Scheme	The subsea Direct Current cable, extending between Mean High Water Spring and the point of transition between Dutch and UK waters.
landfall	The area where offshore cables come ashore.
proposed landfall site	Also referred to as the proposed landfall, located to the north/ northwest of the settlement of Grain.
Transition Joint Pit	Buried concrete pad with joint connecting subsea and underground Direct Current cables at the proposed landfall site.
proposed DC cable route	Also referred to as the Direct Current (DC) cable route (from Mean Low Water Spring to the proposed converter station).
proposed DC cable working width	Typically 30 metre wide works corridor in which Direct Current cable installation will occur. This corridor increases in width at the West Lane crossing and at the proposed landfall.
joint bays	Buried concrete pad where adjacent sections of onshore cable are connected.
temporary construction area	Any area to be disturbed during construction. This will include working areas (i.e. Alternating Current and Direct Current cable troughs, converter station and substation footprints) in addition to the working width, temporary access tracks and temporary construction compound.
temporary construction compound	Compound for site offices, storage, welfare facilities etc.
converter station	Specialist facility to convert electricity Alternating Current to Direct Current or vice versa.
proposed converter station site	The complete converter station site including temporary working areas.
the permanent converter station area	The permanent converter station area (approx. 5 hectares).
proposed permanent access road	The permanent access to the converter station and substation from the B2001/ Grain Road.
proposed substation site	The complete substation site including temporary working areas.
permanent substation area	The permanent substation area (approx. 0.72 hectares).
Rochdale Envelope	The maximum parameters in which the converter station and substation will be designed.
the Applicant	The proponent of the Project, NeuConnect Britain Limited.
the Contractor	Party or parties responsible for the detailed design and construction.

Abbreviations

Abbreviation	Definition
AADT	Annual Average Daily Traffic
AC	Alternating Current
AIL	Abnormal Indivisible Loads
AOD	Above Ordnance Datum
BAP	Biodiversity Action Plan
BGS	British Geological Society
BNL	Basic Noise Level
BPM	Best Practicable Means
BS	British Standard
CBS	Cement Bound Sand
CEMP	Construction Environmental Management Plan
CKD	Cement Kiln Dust
CoCP	Code of Construction Practice
CO_2	Carbon Dioxide
COPC	Chemicals of Potential Concern
CRTN	Calculation of Road Traffic Noise
CSM	Conceptual Site Model
dB	Decibel
DC	Direct Current
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EC	European Commission
EIA	Environmental Impact Assessment
EMF	Electric and Magnetic Fields
ES	Environmental Statement
EU	European Union
FRA	Flood Risk Assessment
GB	Great Britain
GI	Ground Investigation
GW	Gigawatt
ha	Hectare
HDD	Horizontal Directional Drilling
HE	Historic England
HER	Historic Environment Record
HGV	Heavy Goods Vehicle
HRA	Habitat Regulations Assessment
HVDC	High Voltage Direct Current
JNCC	Joint Nature Conservation Committee
km	Kilometre
kV	Kilovolt

Abbreviation	Definition
LCA	Landscape Character Area
LCT	Landscape Character Type
LGV	Light Goods Vehicle
LNG	Liquefied Natural Gas
LOAEL	Lowest Observable Adverse Effect Level
LPA	Local Planning Authority
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
m	Metres
m^2	Square metre
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MW	Megawatt
NCA	National Character Assessment
NE	Natural England
NETS	National Electricity Transmission System
NGET	National Grid Electricity Transmission
NNR	National Nature Reserve
NOEL	No Observed Effect Level
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSR	Noise Sensitive Receptor
Ofgem	Office of Gas and Electricity Markets
OHL	Overhead Line
OS	Ordnance Survey
PAH	Polycyclic Aromatic Hydrocarbons
PPV	Peak Particle Velocity
PRA	Preliminary Risk Assessment
SAC	Special Areas of Conservation
SOAEL	Significant Observed Adverse Effect Level
SPA	Special Protection Area
SSSI	Sites of Special Scientific Interest
TCC	Temporary Construction Compound
TJP	Transition Joint Pit
TMP	Traffic Management Plan
UAEL	Unacceptable Adverse Effect Level
UK	United Kingdom
UKPN	UK Power Networks
VSC	Voltage Source Converter

1. Introduction

Introduction

1.1 NeuConnect Britain Limited has submitted a planning application to Medway Council to develop the GB onshore components of NeuConnect, (or 'the GB Onshore Scheme'). The GB Onshore Scheme consists of various specialist electrical equipment including an electricity converter station, a substation, a cable sealing end compound, and underground Direct Current (DC) and Alternating Current (AC) cables, as well as an access road, landscaping and drainage ponds.

1.2 An Environmental Statement (ES) accompanies the planning application, which reports the detailed results of the Environmental Impact Assessment (EIA) for the GB Onshore Scheme. This Non-Technical Summary (NTS) of the ES provides readers with a broad understanding of:

- The GB Onshore Scheme, its location and the components it consists of;
- The existing environmental conditions of the surrounding area, including identification of key receptors that may be impacted as a result of the GB Onshore Scheme;
- The likely significant environmental effects during the construction and operation of the GB Onshore Scheme and;
- Some of the proposed mitigation measures within the GB Onshore Scheme's design, and measures that will be implemented during construction and operation of the GB Onshore Scheme.

About NeuConnect

1.3 NeuConnect (the 'Project'), is a 1,400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks; two of the largest electricity markets in Europe. The new link will create a connection for electricity to be transmitted in either direction between Great Britain and Germany. The Project comprises approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HDVC) cables, with onshore converter stations linking into the existing electricity grids at Grain in Great Britain and at Wilhelmshaven in Germany. The subsea cables will traverse through British, Dutch and German waters. An overview of the components of the Project is illustrated in Figure 1.

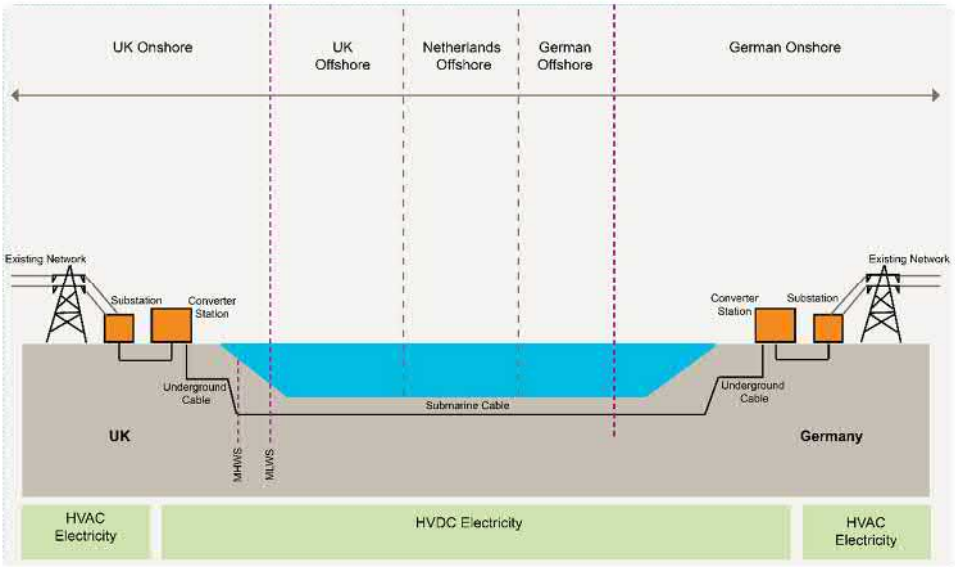


Figure 1 – Overview of NeuConnect Project

The GB Onshore Scheme

1.4 In Great Britain the onshore components of the Project (the 'GB Onshore Scheme') extend as far as Mean Low Water Springs (MLWS). The location and planning application boundary (the 'Project Area') of the GB Onshore Scheme is illustrated in Figure 2.

1.5 This ES assesses the likely significant environmental effects of the GB Onshore Scheme only. A separate ES assesses the GB Offshore Scheme. Environmental assessments will accompany the permit applications within Dutch and German jurisdictions.

1.6 The GB Onshore Scheme will comprise the following main elements extending as far as MLWS:

- Fenced cable sealing end compound;
- Substation within a fenced compound comprising a single building, some outdoor electrical equipment and an internal road for equipment access;
- Approximately 50 metre (m) long AC cable route from the substation to the converter station. The AC cable may be either underground or above ground;
- Converter station within a fenced compound comprising buildings, some outdoor electrical equipment and internal access roads;
- Improvement works at the existing B2001 / Grain Road junction to provide access to both the proposed converter station and substation compounds;
- An approximately 1,550 m long underground DC cable route from the converter station to the landfall point;
- A Transition Joint Pit (TJP) at the landfall point where underground and subsea DC cables are joined together (subsea cables are slightly larger than underground cables due to additional protective armouring) and;
- An approximately 1,700 m long section of buried ducts for the subsea DC cables from the TJP and across the intertidal zone.
- Access to the GB Onshore Scheme will be taken from the existing junction on the B2001/ Grain Road. The existing junction will be improved and a new approximately 850 m long permanent access road will be constructed. This will provide access to the proposed converter station and substation compounds and the cable sealing end compound.
- On the southern and western boundaries of the GB Onshore Scheme, boundary planting is proposed to better integrate the proposed converter station and substation buildings in to the existing landscape. These boundaries are comprised of native species which will also increase biodiversity and help screen or soften some views of the GB Onshore Scheme from viewpoints in the vicinity.

1.7 To connect the Project to the electricity transmission system, there will be modifications required to the existing overhead line (OHL) which runs roughly east to west across the Isle of Grain. These works will be subject to a separate application made by National Grid Electricity Transmission (NGET) once the design of the connection is finalised. The works are not yet confirmed and will be subject to detailed design, however they are likely to include:

- A new 50 m tall lattice tower immediately north of the proposed substation;
- Down leads from the new tower to the proposed substation;
- Down leads from the new tower to the proposed cable sealing end compound;
- Approximately 200 m long underground AC cable route between the proposed cable sealing end compound and the proposed substation; and
- A temporary diversion of the existing OHL may also be required to accommodate the construction of a new tower on the existing route.

Need for the Project

1.8 By connecting two of Europe's largest energy markets for the first time, the Project will offer a more diverse and sustainable electricity supply, offering much needed resilience, security and flexibility in Great Britain and Germany. Increased competition in Great Britain's market could also lead to lower costs for consumers and businesses, while in Germany the new link will help reduce 'bottlenecks' by opening up an important new export market for excess renewable energy.

1.9 Electricity interconnectors play a key role in supporting Great Britain and Europe's transition away from existing fossil fuel-driven power generation by allowing electricity to be imported and exported overseas according to supply and demand.

Requirement for EIA

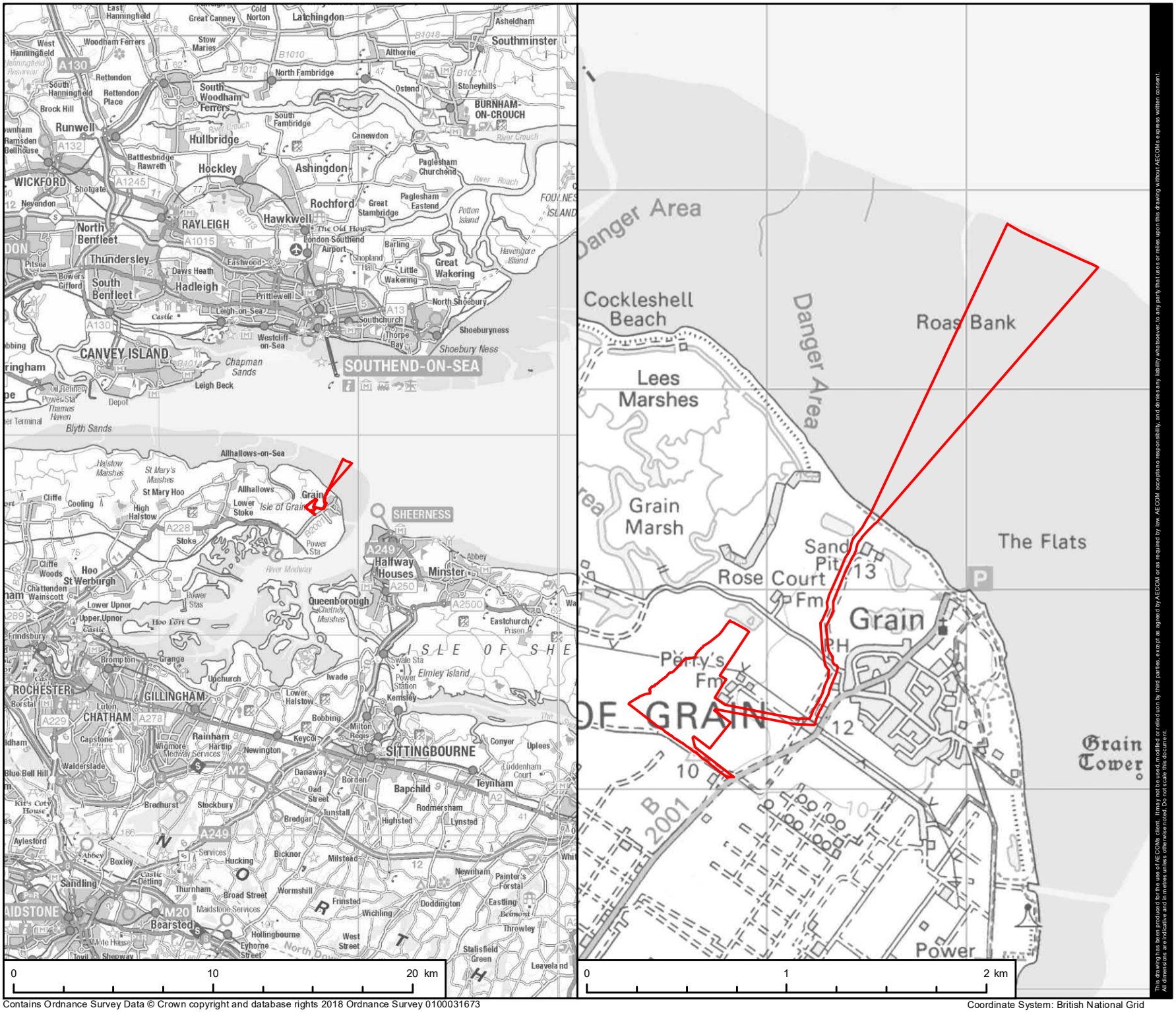
1.10 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (EIA Regulations) apply to applications for planning permission made under the Town and Country Planning Act 1990.

1.11 As part of a formal request process for an EIA Screening Opinion from Medway Council, it was determined that an EIA would be required in support of the planning application for the GB Onshore Scheme.

The Environmental Statement ('ES')

1.12 The ES accompanies planning applications and reports on the outcomes of the EIA. The ES includes the specialist assessments of the existing environment, sensitive receptors relevant to and/ or within the vicinity of the GB Onshore Scheme and the potential for the GB Onshore Scheme to result in likely significant environmental effects.

1.13 The purpose of this NTS is to provide readers with a summary of the ES.



Coordinate System: British National Grid

Project Management Initials: DR Designer: LC Checked: TC Approved: DR

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
Application Boundary

TITLE
FIGURE 2
SITE LOCATION AND APPLICATION BOUNDARY

REFERENCE
NC_191002_UKON_NTS_2_v1

SHEET NUMBER
1 of 1

DATE
02/10/19

2. Project Description

Introduction

2.1 This chapter describes the GB Onshore Scheme comprising all elements above MLWS. This includes:

- A proposed substation and cable sealing end compound to connect to the existing electricity network;
- A proposed converter station including the Direct Current (DC) cable route from the converter station to the landfall point and through the intertidal area to MLWS (overlapping with the subsea DC cable between Mean High Water Springs (MHWS) and MLWS) and;
- A new access track from the B2001/ Grain Road to access both the converter station and substation.

The Proposed Converter Station and Substation

General Overview

2.2 The Project Area (as shown on Figure 3) includes all land necessary to accommodate the proposed components of the GB Onshore Scheme as well as the land required to facilitate construction, and the proposed mitigation and landscaping. The GB Onshore Scheme is illustrated on Figure 3. The Project Area covers approximately 68 ha.

2.3 From the point of connection to the National Electricity Transmission System (NETS) via the existing OHL, is the proposed substation located adjacent to the previous landfill site (to the east) and south of the existing OHL to best 'fit' within the existing land use and landscape. The proposed substation compound will occupy an area of approximately 0.64 ha. The proposed substation will connect directly to the proposed converter station via up to six proposed AC cables across a common boundary between the two components. To the north of the proposed substation will be a cable sealing end compound, which will facilitate the connection of one of two circuits from the existing OHL to the proposed substation.

2.4 The proposed converter station will convert electricity from DC to AC (or vice versa depending on the direction of operation of the interconnector) and will therefore be connected to both the AC and DC cables. Immediately adjacent to the proposed converter station and substation platforms are two construction laydown areas which will be utilised by the appointed Contractor(s) on site for offices, welfare facilities, and material and plant storage.

2.5 Along the southern boundary of the Project Area is the proposed access track, which will allow access to the proposed converter station, proposed substation and proposed cable sealing end compound. The existing junction to the B2001/ Grain Road will be widened and improved to allow safe access to and from the Project Area. For the construction and operational phases of the GB Onshore Scheme, this access point will limit the number of vehicles that will pass residential properties and avoid the need for additional traffic in Grain village.

2.6 To the north of the proposed cable sealing end compound is the proposed attenuation basin which is incorporated within the wider landscaping plan of the Project Area. The attenuation basin will provide storage of surface water from the new platforms of the converter station and substation which require the reprofiling of the area to accommodate the GB Onshore Scheme. The attenuation basin is connected to the drainage of the platforms via a swale that extends down the western side of the Project Area. The swale also offers a boundary between the infrastructure of the GB Onshore Scheme and the landscaping to the west and south of the Project Area. The landscaping has been designed to help phase the perceived scale of the proposed converter station and substation buildings. Landscaping design also helps soften the boundary between the open marshes and the GB Onshore Scheme, whilst also providing greater biodiversity to the area from the inclusion of a variety of native plant species.

Proposed Converter Station - Outline Design

2.7 Converter stations are key parts of DC electricity systems. They convert electricity from AC to DC, or vice versa, depending on the direction of operation of the interconnector.

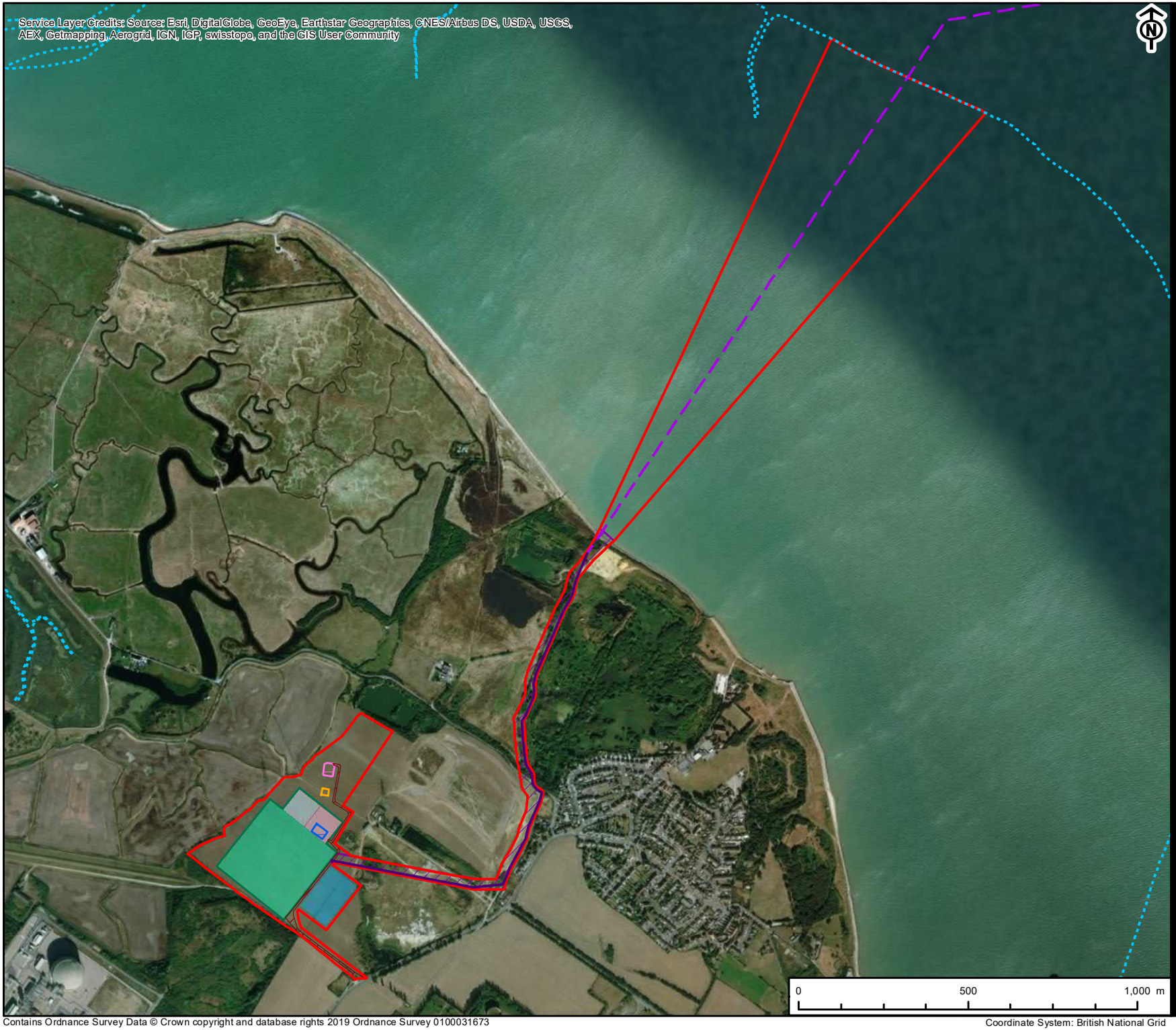
2.8 The footprint of the proposed converter station at Grain is expected to be up to approximately 250 m by 250 m (to the perimeter security fence). This area will comprise specialist electrical equipment, most of which will be located indoors in one or two building units in order to provide protection from the increased levels of salinity of the air. The building units will range in height according to the electrical equipment they contain including required safety clearances up to a maximum building height of up to 26 m. There will be a 2 m exclusion zone around the perimeter fencing.

2.9 The building units which make up the proposed converter station will be constructed to a similar specification to one another. Whilst their exact appearance is subject to detailed design, the cladding of the building units will utilise similar colours and materials to those used on developments in the immediate vicinity to help effectively integrate the converter station into its surroundings.

2.10 A description of the main components of the proposed converter station is provided in Table 2.1.

Table 2.1 Proposed Converter Station – Key Components

Component	Description
DC switch hall	This contains the termination of the DC onshore underground cables together with HVDC switchgear (specialist DC electrical equipment) to connect these to the power electronics. This equipment will be enclosed in a building up to 26 m high.
Valve halls and AC reactor (ancillary equipment)	This contains high voltage power electronics equipment that converts electricity from DC to AC and vice-versa. This is located indoors in buildings up to 26 m high. It also contains specialist equipment to control the environmental conditions within the building.
Control building	This contains control panels and associated operator stations for operating the converter station as well as protection and communication equipment. Offices, welfare facilities and other auxiliary systems are also located within the control building.
Cooling fans	This comprises external fan units located outside of the Valve Halls. The fans are used to cool down the valves. Power electronic valves may be cooled by water or glycol. Coolant is pumped through the fan units.
Transformers	These are normally located outdoors and change the AC voltage electricity between the voltage needed for transmission via the AC transmission system (the NETS) and the voltage needed to connect to the power electronic equipment for conversion from AC to DC within the Valve Halls. The transformers are separated by valve halls.
AC switchyard	This connects the proposed converter station to the NETS. It includes a range of electrical equipment which is located outdoors including harmonic filtration and reactive power compensation equipment, circuit breakers, transformers, busbars, insulators and subject to detailed design shunt reactors. Note, the AC switchyard could be located within a building, however, this is subject to detailed design.
Diesel backup Generator	This would be used in the event of a failure of the low voltage electricity supply provided by the Distribution Network Operator (DNO).
Spare parts building	This building house spare parts and components. Adjacent hardstanding areas provide storage for a spare transformer and spare cable drums.



Project Management Initials: DR Designer: LC Checked: TC Approved: DR

Scale @ A4 1:15,000

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- Mean Low Water Springs

Indicative Location of:

- Offshore Cable Route
- Onshore DC Cable Route
- DC Cable Route - 30m Working Width
- Converter Station and Substation Platform - 2m Fence Line Security & Maintenance Corridor
- Access Road
- Converter Station Platform
- Substation Platform
- Construction Laydown Area
- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed Sealing End Compound
- National Grid Proposed GIS Building (Maximum Parameters)

NOTE
The location of all components identified is indicative only, but is representative of the maximum parameters of each component. The GB Onshore Scheme is subject to detailed design.

TITLE
FIGURE 3
PROPOSED GB ONSHORE SCHEME

REFERENCE
NC_191002_UKON_NTS_3_v1

SHEET NUMBER
1 of 1

DATE
02/10/19

Coordinate System: British National Grid

Proposed Gas Insulated Substation and Cable Sealing End Compound - Outline Design

2.11 Substations contain equipment necessary to facilitate the connection of high voltage transmission systems to electricity distribution systems which then distribute electricity across the network in typically lower voltages. This system can also be operated in reverse, to increase the voltage from domestic supply networks to a voltage more readily used by long distance, high voltage, links.

2.12 The footprint of the proposed substation is expected to be approximately 80 m by 80 m (to the perimeter security fence, and the boundary of the proposed converter station), as illustrated on Figure 3. The substation will comprise specialist electrical equipment which will be located within a single building unit. The building will have a maximum height of approximately 14 m. The electrical equipment will likely be enclosed for protection against corrosion from increased levels of salinity in the air. The area will be surrounded by palisade security fencing.

2.13 As per the proposed converter station, the design and layout of the substation is subject to further design however, it will be completed such that the appearance is in keeping with the existing industrial units in the area.

2.14 The substation will be connected to the existing OHL via a new tower immediately north of the proposed substation in the centre of the Project Area, and also via the proposed cable sealing end compound. A temporary diversion of the existing OHL may be required to facilitate the connection, and/ or modifications to the existing tower structure.

2.15 The proposed cable sealing end compound footprint will be approximately 40 m by 40 m and will also be enclosed within a security fence. The cable sealing end compound will include an approximately 14 m high gantry which will facilitate the safety separation for the electrical connection from the new tower. The downleads from the tower will connect onto the gantry and then the downdroppers will be connected to cable sealing ends within the compound. From here the AC cables will be undergrounded to connect to the proposed substation.

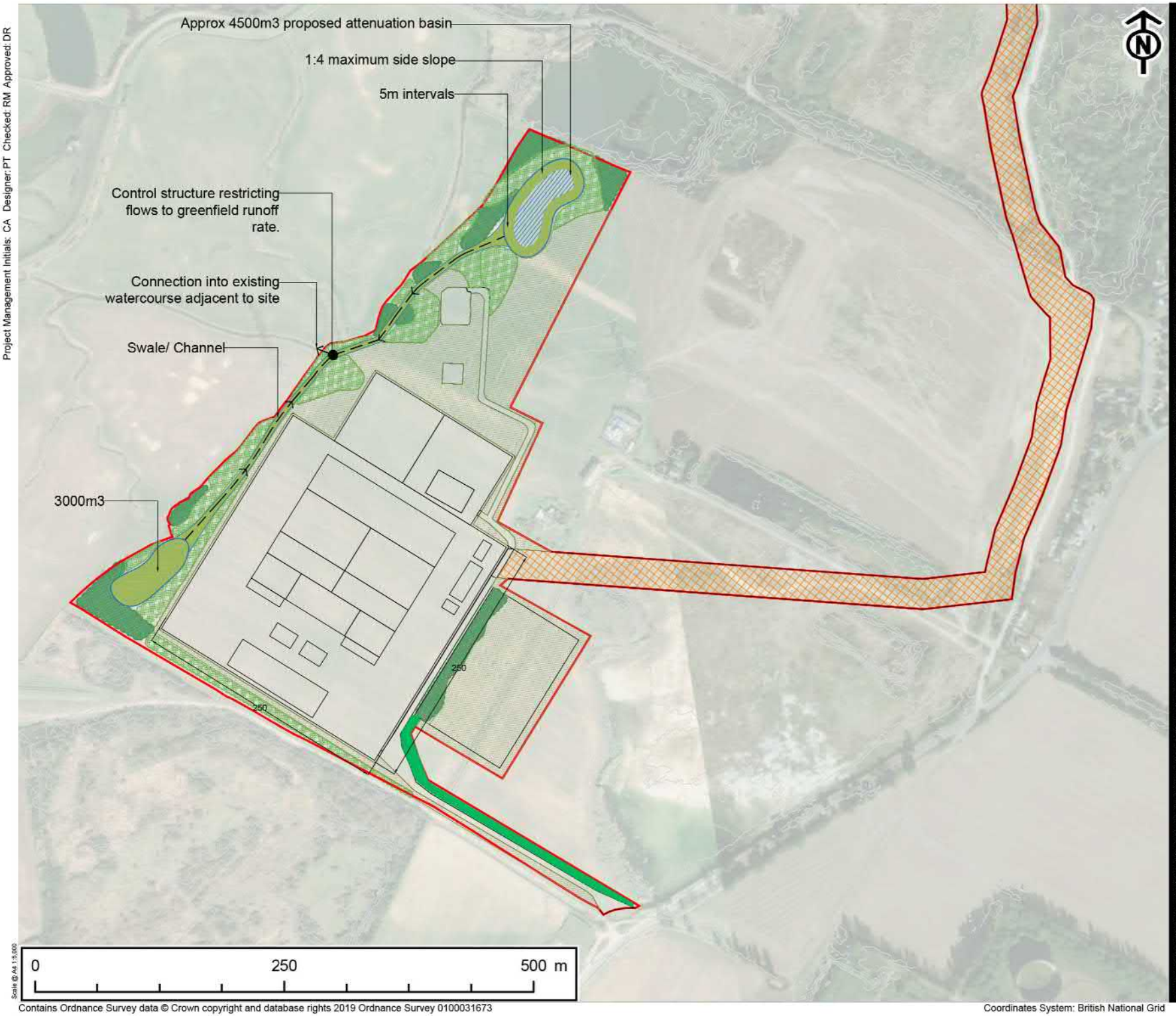
Design Mitigation Measures

2.16 The orientation of the site has been determined from review of the potential impact to surrounding residents from noise and visual amenity. The proposals for the GB Onshore Scheme have been developed in parallel with the EIA providing opportunities to embed mitigation measures within the design. Mitigation measures have been incorporated into the design of the proposed converter station and substation and therefore form part of the planning application. These measures include:

- Landscape planting;
- Noise mitigation;
- A drainage strategy;
- Pollution prevention measures; and
- Ecological mitigation and enhancement.

2.17 The landscaping strategy included within the design is outlined in Figure 4.

2.18 Due consideration has been given to electric and magnetic fields (EMFs) produced by the proposed converter station and onshore high voltage DC. It is acknowledged that equipment which generates, distributes or uses electricity produces EMFs. There is some scientific evidence of possible effects at lower levels; the electricity industry takes this evidence seriously and recognises that it can generate public concern. This evidence has been extensively reviewed and the UK Government have not considered it appropriate to implement any restrictions or guidelines. The GB Onshore Scheme uses both AC and DC technology and will produce both static (DC) and alternating (AC) electric and magnetic fields. The GB Onshore Scheme will therefore be designed to ensure that it is compliant with International Commission on Non-Ionising Radiation Protection (ICNIRP) public exposure guidelines for EMFs outside the boundary fence, to avoid all established effects on the human population.



Project Management Initials: CA Designer: PT Checked: RM Approved: DR

Scale @ A4 1:5,000

Coordinates System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- SuDs Basin
- Swale Channel
- Reinstated Ground
- Permanent Water
- Wet Marginal Planting:
  Key species:
  -Phalaris arundinacea (Reed canary grass)
  -Lythrun salicaria (Purple loosestrife)
  -Sparganium emersum (Bur-reed)
- Woodland edge Planting:
  Key species:
  -Salix caprea (Goat Willow)
  -Salix viminalis (Osier Willow)
  -Betula pubescens (Downy Birch)
- Scrub Planting:
  Key species:
  -Salix cinerea (Grey Willow)
  -Viburnum opulus (Geulder Rose)
  -Prunus spinosa (Blackthorn)
- Mixed Hedgerow Planting:
  Key species:
  -Corylus avellana (Hazel)
  -Crataegus monogyna (Hawthorn)
  -Prunus spinosa (Blackthorn)
- Species Rich Grassland:
  General purposed meadow

TITLE
FIGURE 4
LANDSCAPE MITIGATION DESIGN PLAN

REFERENCE
NC_191002_UKON_NTS_4_V1

SHEET NUMBER 1 of 1

DATE 02/10/19

Construction of the Proposed Converter Station & Substation

Construction Programme

2.19 Construction of the proposed converter station and substation is planned to begin in 2021 and is anticipated to last approximately three years.

2.20 Construction of the proposed substation will take approximately one year and will likely be aligned to be completed at the same time as the proposed converter station.

Construction Activities

2.21 Construction of the proposed converter station and proposed substation will be undertaken by the appointed Contractors.

2.22 Construction of the proposed converter station and the proposed substation will largely comprise similar outline activities as follows:

- Preliminary works: This will include further site investigation and preconstruction surveys required to be undertaken in advance of construction. This will also include utilities diversions as necessary.
- Site establishment: This includes vegetation clearance, soil removal and establishment of all temporary facilities including site offices, lay down and storage areas and welfare facilities, development of electricity and water supplies, erection of security fencing or hoarding and implementation of external lighting for security.
- Earthworks: This will include land re-profiling in order to establish the level platforms on which the proposed converter station and proposed substation will be constructed.
- Civil engineering works: This will include construction of building foundations, development of the platforms' permanent drainage system and construction of internal roads and car parking arrangements.
- Building works: This will include the construction of building units including erection of steel frames and cladding.
- Cable installation: This will include the installation of the proposed DC cables entering the proposed converter station as well as proposed AC cables between the proposed converter station and the proposed substation.
- Provision/ installation of permanent services: This will include water supplies, foul drainage, low voltage electricity supply and telecommunications.
- Mechanical and electrical works: This will include installation of high voltage AC and DC electrical equipment and transformers within the proposed converter station.
- Commissioning: Following completion of all construction works there will be a period of commissioning and testing.
- Site Reinstatement & Landscape Works: This will include removal of site offices and temporary facilities, land reinstatement and landscape works

Construction Site Layout

2.23 The exact layout of the site will depend on the Contractors appointed to design and construct the proposed converter station and proposed substation. An indicative layout is included below in Figure 5.

2.24 There will be temporary construction areas; 1.5 ha for the converter laydown and 0.64 ha for the substation laydown. These temporary construction compounds will accommodate temporary construction facilities and include provision for:

- Site offices including offices and meeting rooms;

- Staff welfare facilities including portable chemical toilets, kitchen and mess room;
- Storage areas for construction vehicles, plant, equipment and other materials;
- Appropriately bunded areas to be used for the storage of oils and other fuels;
- Wheel washing to be used by construction vehicles and plant;
- Segregated waste management and storage areas;
- Car parking for construction staff and site visitors; and
- Rock crushing and concrete batching facilities.

Operation of the Proposed Converter Station & Substation

2.25 The proposed converter station and substation will operate continuously throughout the year. Typically, the proposed converter station will import electricity from Germany to Great Britain (e.g. convert electricity from DC-from the interconnector-to AC for onwards transmission). However, the interconnector is bi-directional and will export electricity when required. Whether it is importing electricity (converting DC to AC) or exporting electricity (converting AC to DC) will depend on supply and demand of and for electricity in Great Britain and Germany.

2.26 During ordinary operation, the proposed converter station will be staffed by a small team on site. During regular maintenance and/ or repairs, the number of personnel present on site would increase with the number of staff proportionate to the nature of the maintenance or repair works being undertaken.

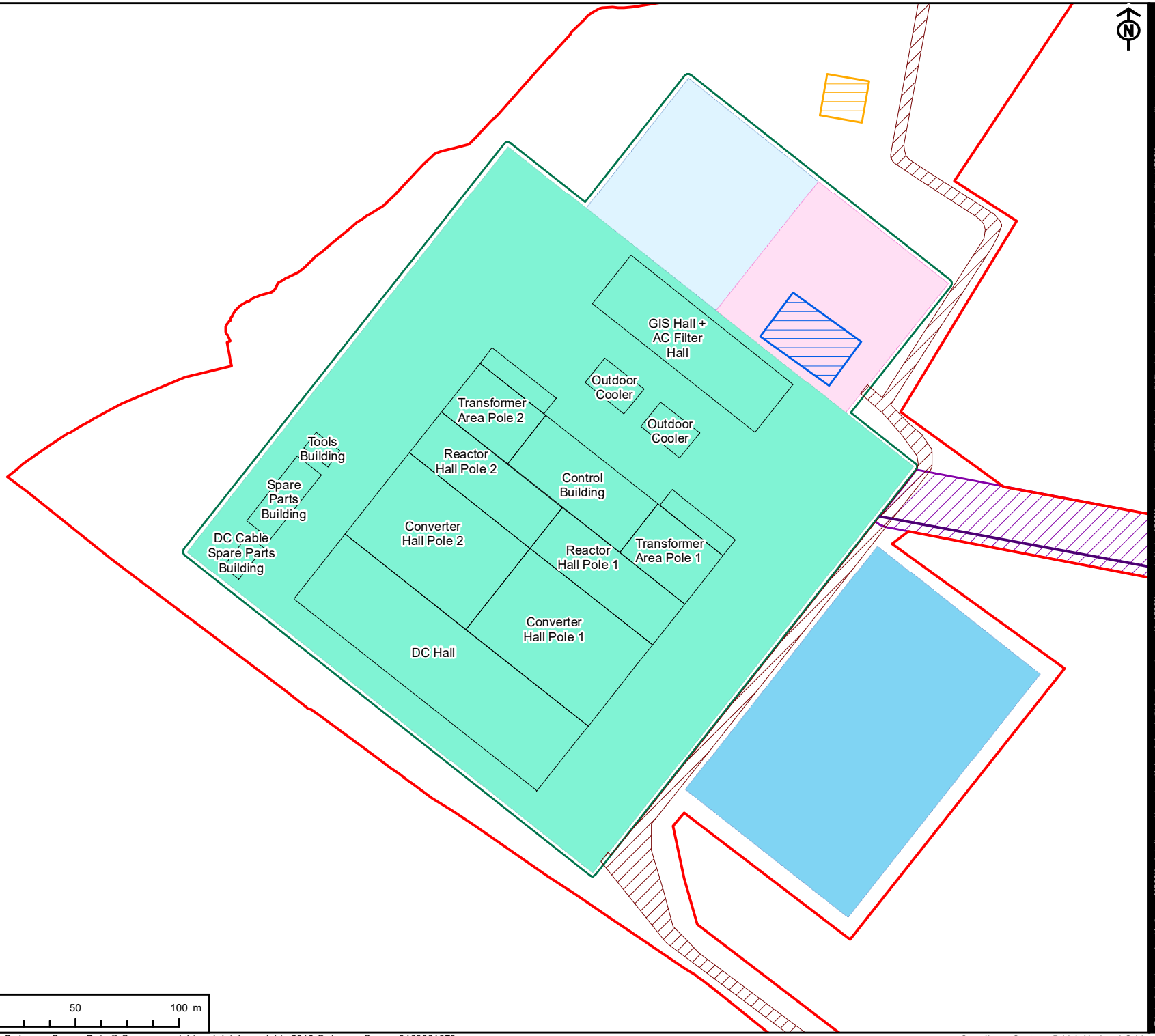
2.27 The proposed converter station will be operated by the Applicant. The proposed substation will be operated by NGET. Each site will be fully enclosed by palisade security fencing, and access to the sites will be restricted to authorised personnel throughout operation.

Decommissioning of the Proposed Converter Station & Substation

2.28 The anticipated operational life of the proposed converter station is approximately 40 years. It is likely that during this period, refurbishment and plant replacement will extend the life of the converter station rather than decommissioning taking place.

2.29 In the event that NeuConnect ceases operation at the end of its operational life, the proposed converter station would be decommissioned. In this scenario, the main components would be dismantled and removed for recycling wherever possible.

2.30 Where this is not possible, disposal would be undertaken in accordance with the relevant waste disposal regulations at the time of decommissioning. Site foundations would be removed to a level agreed with Medway Council and reinstated to agricultural land.



AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary

Indicative Location of:

- Onshore DC Cable Route
- Converter Station Layout and Maximum Building Parameters
- DC Cable Route - 30m Working Width
- Converter Station and Substation Platform - 2m Fence Line Security & Maintenance Corridor
- Access Road
- Converter Station Platform
- Substation Platform
- Construction Laydown Area
- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed GIS Building (Maximum Parameters)

NOTE
The layout presented is indicative only and is subject to detailed design.

TITLE
FIGURE 5
INDICATIVE CONVERTER STATION LAYOUT

REFERENCE
NC_191002_UKON_NTS_5_v1

SHEET NUMBER
1 of 1

DATE
02/10/19

Project Management Initials: DR Designer: LC Checked: TC Approved: DR

Scale @ A4 1:2,500

0 50 100 m

Coordinate System: British National Grid

The Proposed DC Cables

Overview of the Proposed DC Cable

2.31 From the proposed converter station, the proposed DC cable route extends east towards B2001/ Grain Road, it then extends north along the field boundary to West Lane, and after crossing West Lane follows the existing track (previously used for mineral extraction activities) to the point of landfall at the coast.

2.32 There will be two DC cables installed within a single trench, as well as up to four fibre cables for monitoring of the cables. The total length of the DC cable route between the proposed converter station and the landfall location is approximately 1.6 km. The Project Area accounts for space to facilitate the installation of the proposed DC cables, as well as allowing construction vehicle passage along the DC cable route. There is also allowance for potential variations in the DC cable route should there be technical issues or constraints during installation.

2.33 At the landfall location there will be a buried TJP, which will allow connection of the underground and subsea DC cables. From the TJP the subsea cables will be installed under the seabed out to MLWS.

2.34 The total length of the proposed DC cable route between the proposed converter station and MLWS is approximately 3.2 km. The DC cable route is illustrated in Figure 3.

Proposed DC Cables Outline Design

2.35 There will be two DC cables which will be approximately 20 cm in diameter, and both DC cables will be laid within a single trench between the proposed converter station and the TJP at the landfall location. The cable trench will be approximately 1 m wide by 1.5 m deep. The DC cables may either be laid directly within the trench, or ducts will be laid and the cables pulled through the duct.

2.36 Whilst there are only two DC cables, within the DC cable trench there may be up to four DC ducts installed within the trench. The spare ducts allow for repair or replacement works to be undertaken in the event of a cable failure. Alongside the DC cables there will also be up to four fibre cables, a temperature sensor and an optic cable. A working corridor of up to 30 m, as illustrated on Figure 3, will be required for the installation of the DC underground cables. This corridor allows for the cable trench, excavated spoil storage and plant operation, as well as allowing for some deviation of the proposed DC cable route should there be any unfavourable ground conditions or environmental sensitivities encountered during detailed investigation and/ or construction.

2.37 At the landfall location where the onshore underground cable transitions to the subsea cable a TJP will be installed. The TJP is a buried concrete pad where the underground and subsea cables are connected and will have an indicative footprint of up to 75 m^2 as a worst case (dimensions approximately 15 m by 5 m). The exact location of the TJP is subject to detailed ground investigation.

2.38 From the TJP, the proposed DC cables will be installed underneath the seabed in ducts. Each of the four DC cable ducts from the TJP will be installed using horizontal directionally drilling (HDD) methods as far as technically feasible through the intertidal area. It is assumed for this assessment that the maximum distance achievable for HDD is 800 m. As each duct is drilled individually, there will be up to four breakout points within the intertidal area. From these breakout points in the mid-intertidal area out to MLWS the proposed DC cables will be installed in three separate trenches – one for each of the DC cables and a separate trench for the fibre optic cable. These trenches will extend approximately 800 m to MLWS and the boundary of the GB Onshore Scheme application.

Proposed DC Cable Route

2.39 As illustrated on Figure 3, from the proposed converter station the DC cable route extends to the east towards B2001/ Grain Road across the former mineral extraction site. Prior to the B2001/ Grain Road the DC cable route extends to the north along the boundary of the capped landfill site utilising an existing track to West Lane. The DC cable route will pass underneath West Lane via an existing culvert and continue north towards the point of landfall following the existing access track previously used for mineral extraction activities. Between the proposed converter station and the landfall location, the proposed DC cable route will be approximately 1.6 km to the landfall location.

2.40 At the landfall location the proposed DC cable route will connect to the TJP. From the TJP the proposed DC cables will then extend another approximately 1.6 km, directly across the intertidal area to MLWS (where the scheme continues as the GB Offshore Scheme).

Design Mitigation

2.41 The route of the proposed DC cable has been chosen so that the new infrastructure is located in areas of previously disturbed land as far as reasonably practicable, including the use of the existing culvert at West Lane to limit the requirement to disturb vegetation and ecological receptors in the area. The use of the culvert at West Lane also minimises disruption to vehicle and pedestrian users of the road.

2.42 The proposed DC cable route also avoids the potential disturbance of the existing landfill site and contaminated land, therefore minimising the risk of creating new pathways of the contaminated material to impact the surrounding environment and also construction staff.

2.43 The proposed DC cable route and the installation methods have been identified and developed in parallel with the EIA providing opportunities to embed mitigation measures within the design, namely for the avoidance of impacts during installation.

Installation of the Proposed DC Cables

2.44 The preferred method for installation of the proposed underground DC cables will be by buried, open cut trenches with thermal stable backfill (subject to the ground conditions and cable specifications). The cable trench will be approximately 1 m wide by 1.5 m deep. There will be approximately 0.6 m of stabilised backfill material, along with concrete slabs (plus warning tape) and approximately 0.9 m of top soil.

2.45 Alternative methods of installation are available, such as laying the cable in surface troughs and covering or capping these, which has the benefit of not disturbing any areas of potentially contaminated ground, such as the historic landfills. The installation method will be confirmed following detailed ground investigations. Whilst there are only two DC cables, within the DC cable trench there may be up to four DC ducts installed within the trench. The spare ducts allow for repair or replacement works to be undertaken in the event of a cable failure with minimal impact to the surrounding area.

2.46 A working corridor of up to 30 m will be required for the installation of the DC underground cables. This corridor allows for the cable trench, excavated spoil storage and plant operation. Access to the working corridor will be achieved via the main Project Area access location from the B2001/ Grain, and also from West Lane. The arrangements and requirement for construction compounds and site laydown areas will be determined following the appointment of the DC cable Contractor, however it is likely that offices and welfare facilities will be located at the construction laydown area adjacent to the proposed converter station, as well as a smaller compound and storage area located at the landfall location.

2.47 The proposed DC cable from the TJP through the intertidal area will be installed in lengths of approximately 800 m. In between each length a joint bay will be required to join the lengths together. The joint bays will be similar in scale to the TJP, approximately 15 m by 5 m, and consist of a concrete slab for physically joining two lengths of cable together. The location of these and the number required is subject to detailed design, but for the purpose of the EIA it is assumed they are required every 800 m and therefore up to four will be required between the proposed converter station and MLWS as a worst-case scenario. The joint bays will be accommodated within the working width.

Installation of the Proposed DC Cable Route from MHWS to the Mid-Shore Intertidal Area

2.48 Installation of the DC cable from the landfall will be by Horizontal Directional Drilling (HDD) techniques and installing ducts through which the subsea cable is pulled. The maximum length of HDD possible is approximately 800 m, and therefore will not extend beyond the MLWS (located approximately 1.6 km from the landfall location). The remaining length of subsea DC cable required to be installed through the intertidal area to MLWS will likely be undertaken using open cut or trenching techniques.

2.49 HDD is a technique commonly used to install ducts underneath sensitive features such as rivers, highways, sea defences, and dune systems whereby a hole is typically drilled under the sensitive features, to a point a suitable distance away. A duct is inserted into the drilled hole which is then used as the duct into which the cables are installed.

2.50 Depending on the size of the duct and the ground conditions encountered the drilling operations will take place in a series of stages:

- Drill initial pilot hole (approximately 250 mm in diameter).
- Increase the pilot hole to a larger diameter (up to approximately 750 mm) in stages using “reaming/ hole opening” techniques (an operation that may be repeated a number of times to suit the diameter of the duct).

- Install the duct into the hole produced for cable installations, a messenger (draw) wire is installed within the duct (for subsequent cable pull in operations) or may be blown in afterwards using compressed air.

2.51 HDD operations utilise drilling fluids and additives such as bentonite, to assist in maintaining the integrity of the drilled hole and to transport the cutting materials out of the hole as drilling progresses. The choice of drilling mud required will be selected by the Contractor on the basis of drilling performance and environmental constraints. The majority of drilling fluids are biodegradable and have no harmful effect on the surrounding environment. It is extremely unlikely that any drilling fluids will be discharged into the marine environment.

2.52 Drilling fluid and cuttings are tested during drilling for contamination and possible reuse or disposal after the work has been completed. The drilling mud and cuttings will be transported to an appropriate licensed waste disposal site. Only licensed waste carriers will be used for the transportation of any drilling fluids.

2.53 Drilling fluid breakouts that may occur from the end of the duct will be dealt with by containing the flow within a small bunded pit, likely to be adjacent to the TJP. The drilling mud is then either pumped via a mud return line to the holding pits/ tanks located onshore or collected by a vacuum tanker. Any residual mud can then be cleaned up. The normal practice of having a supply of filled sandbags on site to contain any such breakouts will be followed.

Installation of the Proposed DC Cable Route from the Mid-Shore Intertidal Area to MLWS

2.54 From the mid-shore breakout points (from the end of the HDD) to MLWS a further approximately 800 m of cables will be laid via open cut/ trench and burial activities. Three separate trenches will be required to accommodate each of the two HVDC cables and the fibre-option cable.

2.55 Although installation details are not known at this stage, it is expected that the cable installation technique will be determined by sediment conditions. For the purposes of this assessment, cable installations which may be considered include:

- Boat based installation where the cable is ploughed, trenched or jetted using installation methods while the tide is high. A jack-up barge or anchored barge would likely be required in the low intertidal to facilitate cable installation activities. Small jack-up barges use legs with spudcans (approx. 2 m diameter). Anchor barges can utilise up to eight anchors to keep position, the anchors for this type of vessels can be large; between 1.5 m and 3 m in length. The placing and removal of anchors may result in anchor scars and seabed mounds. Designated (and as minimal as possible) anchoring areas and protocols shall be employed during marine operations. At low tide the barge/ vessel will ground and wait until next high tide to be able to move again.
- Shore based installation with trenches installed from using open cut techniques with a conventional excavator and rollers, while the tide is low. This would seek to achieve cable trenching of up to 3 m wide and between 1 and 1.5 m deep, subject to sediment conditions. Access to the installation site would be gained across the upper shore.

Operation of the Proposed DC Cables

2.57 Once operational, activity along the proposed DC cable route will be limited to non-intrusive inspections and cable repairs. Intrusive inspections would only be required in the unlikely event of a cable fault. Where a fault does occur, the location of the fault would be identified and the faulty section of the cable replaced. The activities involved in cable repair would be similar to those outlined above for installation albeit over a much smaller section.

Decommissioning of the Proposed DC Cable

2.58 In the event that the project ceases operation, the proposed underground DC cable would be decommissioned. Dependent on the prevailing requirements, the redundant cables would either be left in-situ or all parts of the cables could be removed for recycling. Where this is not possible, removed cables would be disposed of in accordance with the relevant waste disposal requirements at the time of decommissioning.

The Proposed AC Cables

Proposed AC Cables Outline Design

2.59 The specification of the proposed AC cables is subject to detailed design, and they may either be underground or above ground. If above ground these will likely be gas-insulated transmission line (GIL) tubes.

2.60 There will be up to six AC cables installed, which will be approximately 20 cm in diameter. The proposed AC cables will be installed directly between the proposed converter station and the proposed substation. They will be approximately 20 m long, with the route of the proposed AC cables dependant on the detailed design of both the proposed converter station and the proposed substation.

2.61 Through the co-siting of the proposed converter station and proposed substation, including the shared fence line, there are no further areas of disturbance required for the installation of the proposed AC cables. These will be installed within the footprint of the proposed converter station and the proposed substation, therefore reducing the overall footprint of the GB Onshore Scheme and the potential for disturbance of additional receptors within the area.

Installation of the Proposed AC Cables

2.62 If installed underground, the proposed AC cables will be installed in a similar way to the proposed DC cables – with all six cables either being installed in one or two trenches, or pulled through pre-installed ducts where necessary. Should the proposed AC cables be installed above ground these will be installed as six individual GIL tubes, which may be installed alongside one-another, or on top of one-another to best fit the technical layout of the proposed converter station and proposed substation.

Operation of the Proposed AC Cables

2.63 Similar to the proposed DC cable route operational activity for the proposed AC cables would generally be limited to non-intrusive inspections and cable repairs. The latter would only be required in the unlikely event of a cable fault. Where a fault does occur the location of the fault would be identified and the faulty section of cable replaced. The activities involved in cable repair would be similar to those outlined above for installation albeit over a much smaller section.

Decommissioning of the Proposed AC Cables

2.64 In the event that the project ceases operation, the proposed AC cable would be decommissioned. Dependent on the prevailing requirements, the redundant cables would either be left in-situ or all parts of the cables could be removed for recycling. Where this is not possible, removed cables would be disposed of in accordance with the relevant waste disposal requirements at the time of decommissioning.

3. Approach to EIA

Introduction

3.1 This chapter describes the method which has been used to undertake the assessment of likely significant environmental effects resulting from the GB Onshore Scheme. It outlines the key stages of the assessment process and the approach undertaken to identify and evaluate the potential environmental effects resulting from the GB Onshore Scheme.

3.2 The GB Onshore Scheme has three distinct phases: construction and installation, operation (including maintenance and repair) and decommissioning. This EIA considers the impacts of the GB Onshore Scheme during construction and installation as well as operation.

3.3 Due to the proposed operational lifespan of 40 years for the GB Onshore Scheme, it is recognised that the future baseline and therefore surrounding receptors are likely to change, and the works associated with the decommissioning of the GB Onshore Scheme will be subject to the relevant planning and legislative requirements adopted at that time.

About EIA

3.4 EIA is the process of identifying, evaluating and mitigating the likely significant environmental effects of a proposed development such as those potentially occurring as a result of the construction and operation of the proposed GB Onshore Scheme. Through the early identification and evaluation of the likely significant environmental effects of a proposed development, EIA enables appropriate mitigation (that is measures to avoid, reduce or offset significant adverse effects) to be identified and incorporated into the proposed development's design. EIA may also identify and specify other commitments to be made to environmentally sensitive construction methods and practices.

3.5 The EIA of the proposed GB Onshore Scheme has been undertaken in parallel with the development of the design thereby maximising opportunities to mitigate likely significant effects as they have been identified. This approach ensures mitigation is embedded in the design and forms an integral component of it.

3.6 The results of the EIA also ensure that decision makers, such as the Local Planning Authority (LPA), statutory consultees and other interested parties (including local communities) are aware of a proposed development's potential environmental impacts. Judgments can then be made as to whether impacts may be significant or not via the determination process for planning permission.

3.7 As described in Chapter 01 Introduction, in the case of the proposed GB Onshore Scheme the results of the EIA have been described within the wider ES which accompanies an application for outline planning permission to Medway Council. The results of the EIA have been reported such that Medway Council are aware of the likely significant effects of the proposed GB Onshore Scheme.

The Need for EIA of the GB Onshore Scheme

Underground AC and DC Cables, Converter Station and Substation

3.8 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (EIA Regulations) apply to applications for planning permission made under the Town and Country Planning Act 1990. It sets out two schedules of development (which are derived from Annex I and II of the amended EU 2011/92/EU (the 'Directive') on the assessment of the effects of certain public and private projects on the environment):

- Schedule 1 Development: EIA is mandatory for developments of a type referred to in Schedule 1. Such developments are considered to be "EIA development".

- Schedule 2 Development: EIA is not mandatory for developments of a type referred to in Schedule 2. Such developments may be "EIA development" only where they are considered likely to have significant effects on the environment by virtue of factors such as their nature, size or location.

3.9 There is no reference to interconnector projects or the components they comprise (e.g. converter stations, underground or submarine cables) in Schedule 1 of the EIA Regulations. Whilst the OHL works will be undertaken by NGET, for completeness consideration has also been given to whether or not these works would constitute EIA development. The construction of "overhead electrical power lines" is referenced within Schedule 1 of the EIA Regulations however the temporary diversion of the existing 400 kV OHL, and the proposed new connection between the substation and the adjacent lattice tower are below the 15 km length criteria. Therefore, EIA is not mandatory for the GB Onshore Scheme as per the EIA Regulations.

3.10 Similarly there is no reference to interconnector projects or the components that they comprise (e.g. converter stations, underground or submarine cables) in Schedule 2 of the EIA Regulations.

3.11 A request for an EIA Screening Opinion (MC/18/3363) was submitted to Medway Council the 20th November 2018 which provided an outline assessment of the likely significant environmental effects of the GB Onshore Scheme. In Medway Council's response dated the 20th December 2018 it was stated that an EIA would be required for any subsequent planning application on account of the proposal to install the DC cable within the ecologically-sensitive intertidal zone.

OHL Works

3.12 To facilitate the connection of the interconnector to the existing NETS, modifications to the existing OHL will be required. The modification works are not confirmed yet and will be subject to detailed design, however, they are likely to include:

- a new 50 m tall lattice tower immediately north of the proposed substation;
- down leads from the new tower to the proposed substation;
- down leads from the new tower to the proposed cable sealing end compound; and
- approx. 200 m long underground AC cable route between the proposed cable sealing end compound and the proposed substation.

Temporary Diversion

3.13 A temporary diversion to the existing overhead line may be required to accommodate the GB Onshore Scheme. The temporary diversion works will be undertaken by NGET and, subject to detailed design, it is hoped that these works will be undertaken in accordance with the exemptions to the requirement for section 37 consent under Regulation 3 of the Overhead Lines (Exemption) (England and Wales) Regulations 2009 (the 'Exemption Regulations'). The distance between the towers is 772 m, where the exemption is subject to a maximum distance of 850 m, and therefore the exemption applies if the diversion is not in place for more than six months.

3.14 For the purpose of this EIA the temporary diversion will be included within the assessment of cumulative effects as part of this EIA as assumed development.

Substation to New OHL Tower Connection

3.15 In respect of the new connection between the substation and new OHL tower (likely to be down leads connecting the cable sealing end compound to the tower), these will also likely be delivered by NGET. A section 37 consent would not be required provided that the electric line will be on premises which is (or will be) in the Applicant's or NGET's occupation or control (as provided for by section 37(2) of the Electricity Act 1989). The Applicant has an option over the land, and the Applicant or NGET will have occupation or control of the land.

3.16 As per the OHL works and the temporary diversion, for the purposes of the EIA of the GB Onshore Scheme these works are included within the cumulative assessment as assumed development.

Consultation & Stakeholder Engagement

3.17 As noted above, in November 2018 a Screening Opinion request was submitted to Medway Council as to whether or not an EIA was required. Medway Council were also asked to provide comment on the proposed technical or specialist assessments that would inform the design and accompany the subsequent planning application. The Screening Opinion request identified those aspects of the environment which were considered likely to be significantly affected by the proposed GB Onshore Scheme and the approach to the identification and assessment of those effects. It also scoped out those aspects of the environment which were considered unlikely to be significantly affected.

3.18 A simultaneous scoping exercise for associated technical assessments was undertaken during consultation with Medway Council and responsible authorities; consultation summaries are provided within the specialist technical assessment chapters where relevant.

3.19 Additional consultation has been undertaken throughout the development of the proposed GB Onshore Scheme and throughout the EIA informing the approaches to both baseline studies and assessment methods.

3.20 A public information event was held on 21st November 2018 during the development of the GB Onshore Scheme, with feedback helping to inform the design, such as the proposed DC cable route and the siting of the proposed converter station. Statutory and non-statutory consultees as well as members of the public provided feedback which helped to inform the selection of the proposed DC cable route and confirm the siting of the proposed converter station.

3.21 A further two pre-application consultation events were undertaken on the 20th and 22nd June 2019 to provide the local community and statutory and non-statutory consultees further information on the proposed GB Onshore Scheme initial design. Attendees provided feedback which helped to inform the design and appearance of the main structures. The approach to consultation with the community and a summary of the feedback that was received is provided in Appendix 3.B Statement of Community Involvement.

3.22 Technical specialists have also consulted with statutory and non-statutory authorities throughout the EIA process to inform approaches to specialist assessments including data requests, the scope of and approach to field surveys, assessment methods and details of other projects to be considered as part of cumulative assessments. The relevant technical chapters in the Environmental Statement summarise the topic-specific consultation which was undertaken and how it informed the scope of and/or approach to the EIA.

Approach to Environmental Impact Assessment

Overview

3.23 The assessment methodology follows a systematic approach in order to assess the potential impacts and subsequent effects of the GB Onshore Scheme on physical, biological and human receptors in a robust and transparent manner.

3.24 The GB Onshore Scheme aims to integrate environmental considerations into the design. Alternatives have been considered and assessed through desk studies and field surveys that have sought to avoid or reduce disturbance of known environmental constraints, where ever possible. The consideration of alternatives is discussed in further detail in Chapter four.

3.25 This ES aims to identify potentially significant adverse environmental effects and, if any, propose GB Onshore Scheme specific mitigation measures to avoid, reduce or offset adverse environmental effects or maximise environmental benefits. These can be incorporated into the configuration of the components of the GB Onshore Scheme.

Method of Environmental Impact Assessment

3.26 The EIA process involves the following main steps as presented in Figure 6:

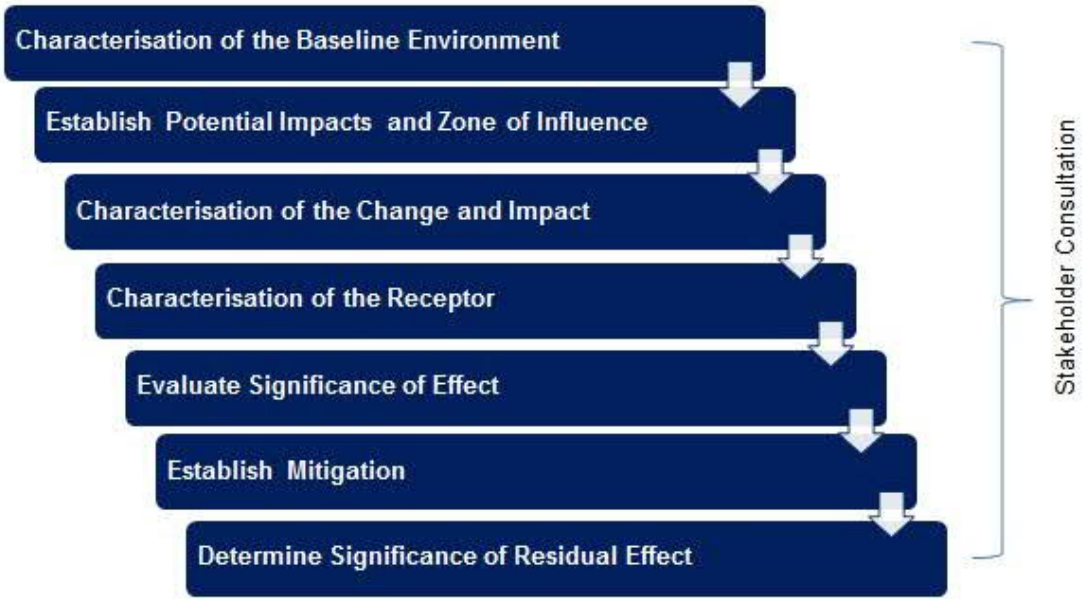


Figure 6 – EIA Process Summary

3.27 The steps are described in more detail below and are followed and presented within the receptor topic chapters of this report.

Characterisation of the Baseline Environment

3.28 In order to assess the potential impacts resulting from the GB Onshore Scheme, it is necessary to first establish the physical, biological and human conditions that currently exist along and within the vicinity of the proposed converter station and substation sites and DC cable corridors.

3.29 Appropriate understanding of the baseline for each environmental receptor has been achieved through some or all of the following:

- Review of primary baseline studies (field);
- Review of additional specialist baseline studies (desk-based);
- Detailed review of all secondary sources (i.e. existing documentation and literature);
- Stakeholder consultation.

3.30 The key data sources used to establish the baseline are described in each technical assessment chapter of the full ES. The following limitations or assumptions should be noted:

- Third party and publicly available information is correct at the time of publication.
- Baseline conditions are accurate at the time of physical surveys but due to the dynamic nature of the environment, conditions may change before or during the construction/installation and operation phases of the GB Onshore Scheme (although the effects of the natural variation are included in the assessment).

3.31 For each receptor topic, the baseline has been described at an extent relevant for their assessment between the cable sealing end compound location and Mean Low Water Spring (MLWS).

Establish Potential Impacts and Zone of Influence

3.32 The IEMA (2004) guidelines state:

"*The assessment stage of the EIA should follow a clear progression; from the characterisation of 'impact' to the assessment of the significance if the effects taking into account the evaluation of the sensitivity and value of the receptors*." (p11/2).

3.33 The prediction of potential impacts has been undertaken to determine what could happen to each environmental receptor as a consequence of the GB Onshore Scheme and its associated activities. The diverse range of potential impacts considered in the assessment process has resulted in a large range of prediction methods being used, including quantitative, semi-qualitative and qualitative. Potential impacts to be assessed are provided in each topic chapter of the full ES. The definitions used to describe impacts are presented in Table 3.1 below.

Table 3.1 Impact definitions

Term	Definition
Direct impact	Impacts that result from a direct interaction between the GB Onshore Scheme / GB Onshore Scheme activities and the receiving environment.
Indirect impact	Impacts on the environment, which are not a direct result of the GB Onshore Scheme / GB Onshore Scheme activities, often produced away from the activity or as a result of a complex pathway. For example, loss of existing screening vegetation resulting in the loss of visual amenity.
Cumulative impact	Impacts that result from incremental changes caused by other present or reasonably foreseeable actions together with the GB Onshore Scheme. Generally considered to be the same impact by from different projects e.g. construction traffic from two separate projects combining to affect the same network.
Beneficial impact	An impact that is considered to represent an improvement on the baseline condition or introduces a new desirable factor.
Adverse impact	An impact that is considered to represent an adverse change from the baseline condition or introduces a new undesirable factor.

3.34 For each potential impact, the 'Zone of Influence' (ZOI) – the spatial extent over which the activities are predicted to have an impact on the receiving environment – is established. This will vary for different activities and for the different stages of the GB Onshore Scheme (construction/installation, operation and decommissioning).

3.35 Establishing the ZOI for different activities and receptors has been undertaken quantitively where possible. Where necessary, it has been undertaken based on the GB Onshore Scheme description, project experience and literature reviews.

3.36 Potential for impacts on receptors which occur outside the ZOI and which cannot or are unlikely to travel into the zone can be screened out. Conversely, mobile species and other mobile receptors can travel into the ZOI, and may therefore be impacted by the GB Onshore Scheme.

3.37 The ZOI used in the assessment are described in the individual receptor topic chapters of this report. In some cases the ZOI only covers the GB Onshore Scheme site, in other cases, it extends further from project activities.

3.38 ZOIs have been considered for each potential impact on the receptor. Where a number of GB Onshore Scheme activities have the same impact, or the installation technique has not been determined, the largest ZoI has been applied.

Characterisation of the Change and Impact

3.39 In order to fully characterise an impact or level of change from baseline conditions, the parameters shown in Table 3.2 have been used to define the magnitude of change or the magnitude value for the impact based on the definitions provided in Table 3.2 and Table 3.3.

Table 3.2 Factors which determine the magnitude of an impact

Term	Definition
Scale of change	The scale of change refers to the degree of change to or from the baseline environment caused by the impact being described
Spatial extent	The extent of an impact is the full area over which the impact occurs

Term	Definition
Duration and frequency	The duration is the period within which the impact is expected to last prior to recovery or replacement of the feature. Frequency refers to how often the impact will occur

Table 3.3 Criteria for characterising the magnitude of an impact

Term	Definition
High	Long term (> 5 years) and/ or regional level loss; or major alteration to key elements/ features of the baseline condition such that post development character/ composition of the baseline will be fundamentally changed.
Medium	Medium term (1-5 years) loss and/ or local level change (greater than the GB Onshore Scheme footprint) or alteration to one or more key elements/ features of the baseline conditions such that post development character/ composition of the baseline condition will be materially changed.
Low	Short term (<1 year), site specific and/ or a minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/ composition of the baseline condition will be similar to the pre-development situation.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a "no change" situation.

Value of the Receptor

3.40 The value of a receptor or feature is characterised by the sensitivity, recoverability and importance of the receptor or feature (see Table 3.4). Characterisation of the receptor is achieved by balancing out these three considerations to determine the receptor's value.

Table 3.4 Factors which determine the value of the receptor

Term	Definition
Sensitivity	The sensitivity of the receptor relates to its vulnerability to change (including its capacity to accommodate change i.e. the tolerance/intolerance of the receptor to change).
Recoverability	The ability of the receptor to return to the baseline state before the GB Onshore Scheme impact caused the change.
Importance	The importance of the receptor or feature is a measure of the value assigned to that receptor based on biodiversity and ecosystem services, social value and economic value. Importance of the receptor is also defined within a geographical context, whether it is important internationally, nationally or locally.

Evaluate Significance of Effect

3.41 Having established the magnitude of change and the value of the receptor, the significance of the effect can be assessed using the significance matrix presented in Table 3.5.

Table 3.5 Significance matrix

		Magnitude of Change			
		Negligible	**Low**	**Medium**	**High**
Value of Receptor	**High**	Negligible	Moderate	Major	Major
	Medium	Negligible	Minor	Moderate	Major
	Low	Negligible	Negligible	Minor	Moderate
	Negligible	Negligible	Negligible	Negligible	Minor

3.42 The result of using this matrix approach is the assignment of the level of significance of the effect for all GB Onshore Scheme potential impacts. This is done prior to any mitigation.

3.43 Negligible or minor impacts are not considered to be significant.

Establish Mitigation

3.44 A standard hierarchical approach to identifying mitigation requirements has been used:

- Avoid or Prevent: in the first instance, mitigation should seek to avoid or prevent the adverse effect at source.
- Reduce: if the effect is unavoidable, mitigation measures should be implemented which seek to reduce the significance of the effect.
- Offset: If the effect can neither be avoided nor reduced, mitigation should seek to offset the effect through the implementation of compensatory mitigation.

3.45 Mitigation measures fall into two categories: mitigation by design which forms part of the GB Onshore Scheme design; and mitigation by practice which is part of the installation, operation and decommissioning of the GB Onshore Scheme.

Mitigation by Design

3.46 The GB Onshore Scheme has been developed through an iterative process which involved seeking to avoid or reduce potential environmental effects through location of the proposed converter station and substation and routeing of the marine cables. This was the first GB Onshore Scheme-specific step in mitigation potential effects by seeking to avoid or reduce environmental disturbance. Mitigation measures which form part of the initial design are an inherent part of the GB Onshore Scheme and are considered the 'base case' therefore they have not been included within the assessment. Following selection of the final site/ route to be considered for assessment, further mitigation measures by design have been identified and where applicable have been proposed within each of the topic chapters. GB Onshore Scheme specific mitigation by design may include, for example, micro routeing to avoid sensitive features identified during the assessment process.

Mitigation by Practice (Best or Good Practice)

3.47 Mitigation which helps reduce the likelihood or severity of potentially adverse environmental effects through measures implemented during installation, operation and decommissioning are referred to as 'mitigation by practice'. Such measures are often followed as a course of Best Practice or to comply with international statute. Within the topic chapters all proposed mitigation by practice measures have been recorded and referenced where applicable.

Determine Significance of Residual Effects

3.48 The significance assessment is repeated taking into consideration the application of Best Practice and GB Onshore Scheme specific mitigation measures. This determines whether there is likely to be a residual impact. When applied after mitigation, the resulting significance level is referred to as the residual significant effect. Tables within the topic chapters present the results of both assessments.

3.49 Residual effects as moderate or major after consideration of proposed mitigation measures will normally require additional analysis and consultation in order to discuss and possible further mitigate impacts where possible. Where further mitigation is not possible, a residual effect may remain.

Approach to Cumulative Effects Assessment

3.50 The term cumulative effects refer to effects upon receptors arising from the GB Onshore Scheme when considered alongside other plans and projects that result in an additive impact with any element of the project. Cumulative effects can be described as the net effect of both direct and indirect cumulative pressures, from different activities. An individual effect alone may be considered insignificant, but the additive effects of more than one effect, from any number of sources, could result in a significant cumulative effect, either beneficial or adverse.

3.51 Cumulative effect assessment identifies for each receptor, areas where the predicted effects of the GB Onshore Scheme could interact with effects arising from other projects, plans on the same receptor based on a spatial and/or temporal basis.

3.52 The cumulative effects assessment for the receptors is presented within each topic chapter of this report.

3.53 The convention on Environmental Impact Assessment in a Transboundary Context (UN, 1991) sets out the obligations of parties to assess the transboundary environmental effect of certain activities at an early stage of planning. It also lays down the general obligations of states to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental effect across boundaries.

3.54 It is anticipated that transboundary effects associated with the GB Onshore Scheme will be limited.

4. Results of the EIA

EIA Non-Technical Summary Structure

4.1 The following sections provide a summary of the results of each of the specialist assessments undertaken as part of the EIA for the GB Onshore Scheme. It is intended to:

- Highlight key sensitivities or receptors identified in undertaking baseline studies;
- Outline the key potential impacts of the proposed GB Onshore Scheme;
- Outline the key mitigation measures which the GB Onshore Scheme has committed to and;
- Provide a brief summary of the conclusion associated with the assessment.

4.2 This NTS is intended to provide a high-level summary of each specialist assessment undertaken as part of the GB Onshore Scheme EIA; for full details of each assessment, the full ES should be reviewed.

4.3 In order to provide this high-level summary, the structure of each specialist topic within this NTS is generally as follows:

- Overview
- Study Area and Baseline Summary
- Potential Impacts
- Mitigation
- Summary

4.4 The Cumulative Impact Assessment (CIA) summary section intentionally adopts a different structure; owing to its nature as a distinct theme and due to the complex process of CIA, only the summary, intra-project conclusions and inter-project conclusions are provided.

4.5 For purposes of brevity within this NTS, several aspects of each chapter have intentionally been omitted. This includes:

- The approach and method for each assessment;
- Details of any consultation undertaken;
- The full basis for the selected study area for each receptor;
- The approach to determining the specific value, sensitivity or significance of a receptors;
- The detailed baseline data which has been gathered to inform the assessment;
- Planning Policy, Applicable Legislation and the wider Regulatory Context;
- The residual impacts from the GB Onshore Scheme.

4.6 Each of these aspects are important parts of the EIA process and have been undertaken as part of the ES for the GB Onshore Scheme.

5. Landscape & Visual Amenity

Overview

5.1 The assessment considered the likely Landscape and Visual effects arising from the construction and operation of the proposed GB Onshore Scheme.

5.2 A detailed description of the GB Onshore Scheme and the Project Area is provided in Chapter 3, Proposed GB Onshore Scheme; the full assessment of Landscape and Visual Amenity can be found within Chapter 5 of the ES.

5.3 The scope of the landscape and visual assessment and methodology has been informed by and agreed through consultation with statutory stakeholders. In summary, the assessment included consideration of both the short term and long-term impacts in landscape character and landscape designations. The assessment also included changes in the visual amenity of residents or visits in the vicinity of the GB Onshore Scheme.

Study Area and Baseline Summary

5.4 The extent of the study area is determined by the potential visibility of the proposed GB Onshore Scheme in the surrounding landscape and is proportionate to its size and scale and the nature of the surrounding landscape. For the purposes of this assessment the study area has been defined by a combination of Zone of Theoretical Visibility (ZTV) analysis and professional judgement. The ZTV is shown on Figure 7 below.

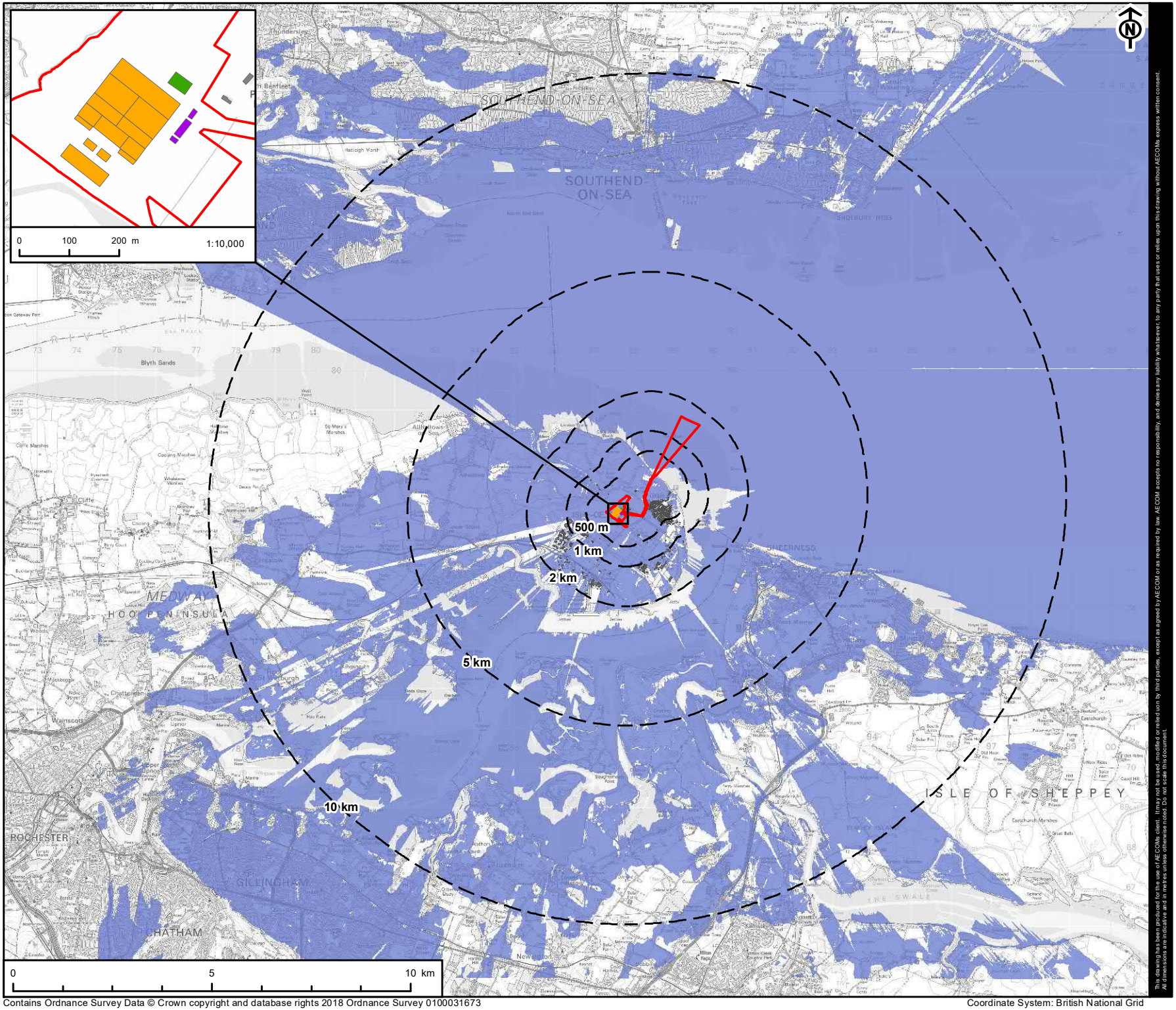
5.5 Based upon the extent of visibility and professional judgement it is considered that it is highly unlikely that significant long-term residual landscape effects will be possible from further than 5 km from the Project Area boundary. The full ES provides further narrative and justification relating to this conclusion.

5.6 The landscape baseline analysis has identified several landscape receptors that have the potential to be significantly affected by the GB Onshore Scheme. The special qualities relevant to the North Kent Marshes Special Landscape Area (SLA) are embedded within the key characteristics of each of the relevant local Landscape Character Areas (LCAs). Some of the local LCAs-and the Sheppey Court Area of High Landscape Value-are highly unlikely to be significantly affected and have therefore been excluded from further assessment.

5.7 The landscape character areas considered for more detailed assessment include:

- Allhallows to Stoke Marshes;
- Hoo Peninsula Farmland;
- Lower Stoke Marshland;
- Industrial/Urban Area; and
- Chetney and Greenborough Marshes

5.8 A summary of impacts arising from the proposed GB Onshore Scheme follows; a full assessment on the extent and significance of impact on landscape character is considered within the ES.



Project Management Initials: DR Designer: LC Checked: AR Approved: RM

Scale @ A4 1:10,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

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NeuConnect Britain Ltd.

KEY
- Application Boundary
- Study Area
- Building - OS MasterMap
- Indicative Converter Station at 16m
- Indicative Converter Station at 26m
- Indicative Substation at 14m
- Indicative Converter Station / Substation Visible

NOTE:
Zone of Theoretical Visibility (ZTV) has been generated using Ordnance Survey Terrain 5 digital terrain model which does not take account of the screening effects of vegetation, buildings or other structures. Buildings from OS MasterMap within 2km have been incorporated into the DTM.

ZTV is based upon points taken every 10m around the edge and within the converter station and substation buildings on a levelled platform at 6m AOD using the following heights and an observer height of 1.6m:
Converter station - 16m / 26m
Substation - 14m

All heights mentioned are above ground level (AGL) unless otherwise specified.

The layout presented is indicative only and is subject to detailed design.

TITLE
FIGURE 7
ZONE OF THEORETICAL VISIBILITY
CONVERTER STATION AND SUBSTATION

REFERENCE
NC_191002_UKON_NTS_3_v1

SHEET NUMBER
1 of 1

DATE
02/10/19

Potential Impacts

Construction

5.9 Potential effects at the construction phase of the proposed converter station, substation and DC cable route would be most noticeable within the Allhallows to Stoke Marshes LCA which includes potential effects on the landscape fabric of the Project Area.

5.10 Construction activities would introduce several new elements into the landscape and the greatest potential for significant effects would primarily arise from the loss of existing landscape features and the visibility of construction activities associated with the proposed converter station and substation. Construction activities related to the DC cable route could also directly affect the existing fabric of the North Kent SLA including the coastal mudflats and marshland habitats.

5.11 The potential for temporary impacts on the landscape and visual resource of the study area may arise from the activities detailed in Chapter 3. Temporary impacts associated with the installation of the DC cable route would be experienced over one year whereas construction of the converter station and substation would be experienced within a three-year construction period. The main construction activities are summarised below:

- Preliminary works;
- Site establishment;
- Earthworks;
- Civil engineering works;
- Building works;
- Cable installation;
- Provision/ installation of permanent services;
- Mechanical and electrical works;
- Commissioning; and
- Site reinstatement and landscape works.

Operation

5.12 The potential for long-term, operational and permanent impacts on the landscape and visual resource of the study area may arise from the introduction of the converter station and substation. These are considered to be permanent features within the landscape and in views which would be apparent for the long-term.

5.13 The operational elements with the potential to affect the landscape and visual receptors within the study area include the permanent buildings, outdoor equipment and associated infrastructure. The greatest potential for significant effects on landscape and visual receptors would primarily arise from:

- Physical effects within the Project Area and direct effects on the landscape fabric of the Project Area and the Allhallows to Stoke Marshes LCA including the loss of characteristic landscape elements and the introduction of uncharacteristic elements;
- Effects on the character and setting of the North Kent Marshes SLA;
- The combination of all the project components could also affect the setting of the neighbouring character areas by appreciably extending the influence of the industrial complexes within the Hoo Peninsula and fragmenting the more scenic elements of the marshland landscape; and
- Visibility of the proposed converter station and substation which are likely to be prominent features on the skyline within the open flat and expansive marshland landscape from residential settlements and recreational routes.

5.14 Following installation of the proposed DC cables all areas of the DC cable will be reinstated. There would be no perceptible change to the landscape and visual receptors during operation and maintenance of the DC cables.

Decommissioning

5.15 The scale and nature of activities undertaken during decommissioning would be similar to those described previously for construction, however they would be temporary during the period of decommissioning activities on site. Following the removal of the structures and the reinstatement of the land there would be no further potential effects to the landscape and visual amenity.

Mitigation

5.16 The siting of the converter station and substation within the Project Area has been informed by the design development and assessment process. The location of the proposed converter station and substation has been located as close as possible alongside the existing industrial development at the National Grid Liquified Natural Gas (LNG) terminal and away from the majority of residential properties in Grain. The proposed siting and massing of converter station and substation alongside the existing industrial complexes and the proposed landscape reinstatement would improve the landscape fit and therefore reduce potential impacts on the setting of the North Kent Marshes SLA and Allhallows to Stoke Marshes LCA.

5.17 Appropriate boundary vegetation within the Project Area has been developed to improve the interface between the built edge of the converter station and substation and the transition to the adjacent marshland landscape. The combination of boundary vegetation on a slightly raised earth mound would also help to reduce the overall scale and mass of the proposed building façades. The proposed selection of scrub and wetland species has been developed in conjunction with ecologists and refers to the landscape character guidelines set out to improve and restore the characteristic feature of the Allhallows to Stoke Marshes LCA.

5.18 The proposed location and working width of the primary access road has been selected in part to minimise physical impacts on the Project Area and the immediate context. The proposed route and 5.5 m working width would be in keeping with the existing landscape pattern and layout with a simple connection to the B2001/ Grain Road.

5.19 The outline Landscape Plan has been developed to enhance the biodiversity found within the Project Area. The introduction of a SUDS detention basin, attenuation pond and swale each planted with marginal wetland species will create a green corridor and more complex vegetation structure and improve the biodiversity value within the Project Area.

Summary

5.20 The Landscape and Visual Impact Assessment (LVIA) considered the potential effects on the landscape and visual receptors at the construction phase, year one of operation and year 15 of operation from the GB Onshore Scheme.

5.21 The LVIA also assessed the likely significant cumulative effects of the GB Onshore Scheme when considered in combination with the cumulative schemes. Cumulative effects is a particularly important topic for the LVIA however, as with the other chapters, this is not included within the NTS for the purposes of brevity and is instead addressed fully within the ES.

5.22 In respect of effects on the landscape fabric and landscape character, the assessment found that significant effects during construction would be limited to the eastern edge of the Allhallows to Stoke Marshes LCA. Significant effects would arise from the loss of agricultural land as a result of construction activity at the proposed converter station and substation site as well as the DC cable route corridor. These effects would be short term during construction and there would be no physical change to the most distinctive landscape elements of the marshland. The landscape assessment concluded that there would be no significant effects at years one and 15 of operation. The assessment also concluded that the North Kent SLA would not be significantly affected.

5.23 In respect of visual amenity, of the nine viewpoints assessed during construction, visual receptors at three of the viewpoints would be significantly affected over the short term, with the furthest

viewpoint located 3.9 km from the Project Area. The source of significant effects was due to receptors of medium sensitivity where the scale and extent of construction activity would be a prominent addition within the overall composition of the view.

5.24 At year one of operation of the GB Onshore Scheme, the number of viewpoints significantly affected would be the same due to the scale and prominence of the proposed converter station and substation within close proximity views. At year 15 of operation of the GB Onshore Scheme, the number of viewpoints significantly affected would be reduced to one, at West lane. This finding relates to the establishment of landscape planting at the western edge of the Project Area which would reduce the prominence of the proposed converter station and substation over time.

5.25 The cumulative assessment concluded that there would be no significant cumulative effects on the landscape and visual receptors.

6. Ecology & Nature Conservation

Overview

6.1 The assessment considered the potential effects associated with the GB Onshore Scheme on Ecology and Nature Conservation. This includes nature conservation designations, priority habitats, protected species and invasive non-native species.

6.2 A detailed description of the GB Onshore Scheme and the Project Area is provided in Chapter 3, Proposed GB Onshore Scheme; the full assessment of Ecology and Nature Conservation can be found within Chapter 6 of the ES.

6.3 Consultation responses and scoping opinions were considered during the assessment and preparation of the ES. Where appropriate, consideration was also given to third-party projects and activities and specifically, to the potential for interaction between the GB Onshore Scheme and other projects resulting in cumulative effects.

Study Area and Baseline Summary

6.4 The Proposed Development area (the 'Site') is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south.

6.5 The study areas used in the assessment were defined with reference to the likely zones of influence (ZoI) over which the GB Onshore Scheme may have potential to result in significant effects on relevant nature conservation features. The study areas also had regard to the precautionary principle to ensure sufficient data were gathered to meet worst case needs for impact assessment and ongoing design iterations.

6.6 It is important to recognise that the potential ZoI of the GB Onshore Scheme may vary over time (e.g. the construction zone of influence may differ from the operational zone of influence) and/ or depending on the individual sensitivities of different ecological features.

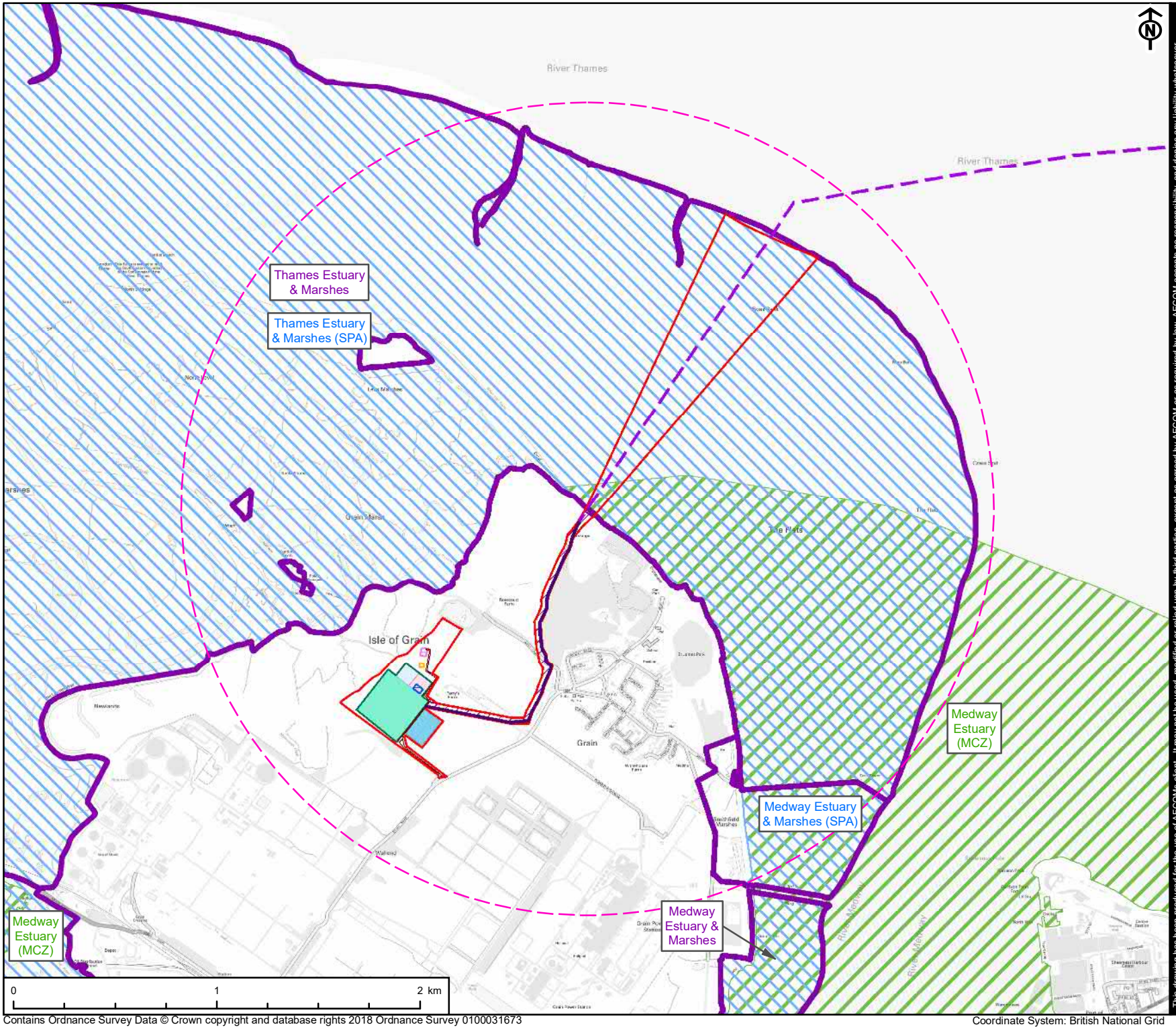
6.7 For the purpose of the assessment, the following study areas were used:

- up to 10 kilometres (km) from the Site boundary for all European statutory designated sites;
- up to 2 km from the Site boundary for all National statutory designated sites
- up to 2 km from the Site boundary for all non-statutory designated sites;
- up to 2 km from the Site boundary for records (within the last ten years) of protected/ notable species/ habitats;
- up to 50 metres (m) from the Site boundary for notable habitats;
- up to 50 m from the Site boundary for terrestrial and aquatic invertebrates;
- up to 50 m from the Site boundary for Badger *Meles meles*;
- up to 500 m from the Site boundary for Great Crested Newt *Triturus cristatus*;
- up to 100 m from the Site boundary for reptiles, Water Vole *Arvicola amphibius* and Otter *Lutra lutra*;
- up to 100 m from the Site boundary for bat roosts and notable foraging/ commuting habitat;
- up to 100 m from the Site boundary for breeding and wintering birds (although habitats within the Site boundary are given greater emphasis); and
- up to 500 m from the Site boundary for waterbirds using the intertidal areas.

6.8 There are seven statutory sites of International Importance within 10 km of the Site; they include Special Area of Conservation (SAC), SPA and Ramsar designations. There are three sites of

National Importance (two SSSI and one MCZ) designated for ecological reasons within 2 km of the Site. Ecologically designated sites are shown on Figure 8 below.

6.9 There are various other non-statutory, regional and local features within the study area; for the purposes of brevity within this NTS, they are not discussed here. Full details of these features and any specific considerations for them can be found within Chapter 6 of the full ES.



Project Management Initials: DR Designer: BF Checked: AB Approved: NG

Scale @ A4 1:25,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary

Indicative Location of:

- Offshore Cable Route
- Onshore DC Cable Route
- DC Cable Route - 30m Working Width
- Converter Station and Substation Platform - 2m Fence Line Security & Maintenance Corridor
- Access Road
- Converter Station Platform
- Substation Platform
- Construction Laydown Area
- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed Sealing End Compound
- National Grid Proposed GIS Building (Maximum Parameters)

Designated Sites

- Search area
- Special Protection Area (SPA)
- Ramsar
- Marine Conservation Zone (MCZ)

NOTE
The location of all components identified is indicative only, but is representative of the maximum parameters of each component. The GB Onshore Scheme is subject to detailed design.

TITLE
FIGURE 8
Designated sites within 2 km of the Site

REFERENCE
NC_191002_UKON_NTS_8_v1

SHEET NUMBER
1 of 1

DATE
02/10/19

Potential Impacts

6.10 Comprehensive 'screening' of ecological impacts was undertaken within the full ES for both construction and operational impacts. Again, for the purposes of brevity, the full screening matrices are not supplied within this NTS but can be found within Chapter 6 of the full ES.

Construction

6.11 The potential effects of construction relating to relevant ecological features which were subject to further assessment are summarised below:

- temporary loss of natural or semi-natural habitats; and
- temporary disturbance from noise or light pollution, human activity and vehicular movement.

6.12 Construction lighting, if night working is required, has the potential to disrupt breeding Marsh Harrier through light spill and glare if this falls onto reedbed habitat outside of the Site boundary. However, construction lighting will be temporary. Task-specific lighting may be used during darkness hours that occur within regular working hours (i.e. in the winter months), or during periods of low levels of natural light, but these will be outside of the breeding season for Marsh Harrier (typically March to August inclusive). It is considered unlikely that any light pollution would impact upon breeding Marsh Harrier during the day.

6.13 Lighting associated with construction of the proposed DC cable corridor is unlikely to have an adverse effect on Marsh Harriers and the magnitude of impact is very low and is assessed as a short-term neutral effect on breeding Marsh Harrier that is not significant.

Operation

6.14 There are no pathways for effects on species or designated sites during operation of the proposed DC cables and therefore will not be further assessed within the Ecological Impact Assessment (EcIA). There will be no loss of reedbed habitat used by breeding Marsh Harrier, during installation of the proposed DC cables. Therefore, there will be no effects of habitat loss on Marsh Harrier.

Decommissioning

6.15 Decommissioning and demolition impacts are likely to be similar to those during construction. It is anticipated that the existing protected species legislation would remain in place.

Mitigation

6.16 The development design, impact avoidance and reduction measures that have been, or will be, adopted include:

- Recognition that the design of the GB Onshore Scheme needs to deliver compliance with industry good practice and environmental protection legislation during both construction and operation e.g. prevention of surface and ground water pollution, fugitive dust management, noise prevention or amelioration.
- The preparation and implementation of a Construction and Environmental Management Plan (CEMP) to manage the environmental effects of the GB Onshore Scheme and to demonstrate compliance with environmental legislation. This will then be implemented by the selected construction contractor.
- Standard environmental best practice and mitigation would be implemented to ensure construction and operation of the GB Onshore Scheme complies with legislation relating to protected species. It would also aim to ensure the GB Onshore Scheme does not compromise the local conservation status of ecological receptors present within or in the vicinity of the GB Onshore Scheme. Where protected species licences are required, these would be obtained from Natural England sufficiently in advance of the works to meet with the optimum time for mitigation and to minimise any changes to the construction programme.

- Production of mitigation strategies for protected species and application for species licences for translocation of animals away from construction areas where required.
- Site vegetation clearance, to avoid incidental injuring or killing of reptiles would be undertaken in advance of construction and at an appropriate time of year;
- Wetland habitats supporting Water Vole (a legally protected species) will be avoided, where possible. Where avoidance is not possible, mitigation measures will be implemented in consideration of the legal status of the species.
- Any habitat removed from within the DC cable corridor will be restored, post-construction;
- The wetland habitats (lagoons) outside of the Application Boundary will be retained;
- Soft landscaping on Site will create diverse habitats for locally important species, using trees and shrubs of local provenance;
- Site vegetation clearance would aim to avoid the nesting bird period i.e. March to September (inclusive). Any vegetation clearance proposed outside of this time would be checked for the presence of any nest by a suitably qualified ornithologist, prior to removal. If active nests are found, then appropriate buffer zones would be put in place and the area monitored until the young birds have fledged.
- An outline Lighting Strategy will be prepared. Any lighting that is required for the construction and operation of the GB Onshore Scheme will be directed away from surrounding habitat to minimise light disturbance to off Site habitats.

6.17 Good practice precautionary mitigation measures are required on the grounds of animal welfare and to ensure works are undertaken in a manner that provides certainty of compliance with relevant legislation and these will be implemented as detailed within the relevant mitigation strategies. This is considered to be adopted and implemented through the CEMP adopted prior to and throughout the construction phase of the GB Onshore Scheme.

6.18 To limit disturbance to wintering populations of birds utilising the mudflats for foraging when food availability is scarce, works will be scheduled to avoid the wintering months and will be undertaken in summer only (March to September).

6.19 No further mitigation is determined to be required for the construction of the proposed GB Onshore Scheme and no pathways to effects on ecology are predicted during operation of the GB Onshore Scheme. No mitigation or enhancement measures are identified as required for the decommissioning and demolition phases.

6.20 The design process for the GB Onshore Scheme includes consideration of ecological constraints and has incorporated, where possible, measures to reduce the potential for adverse ecological effects in accordance with the 'mitigation hierarchy' and relevant planning policy. The measures identified and adopted include those that can realistically be expected to be applied as part of construction environmental best practice, or as a result of legislative requirements.

Summary

6.21 The Ecological Impact Assessment (EcIA) considered the potential effects associated with the GB Onshore Scheme on Ecology and Nature Conservation. It evaluated relevant ecological receptors (including nature conservation designations, priority habitats, protected species and invasive non-native species (INNS)) associated with the GB Onshore Scheme, with each being assigned a nature conservation value (sensitivity).

6.22 Thereafter, the GB Onshore Scheme's potential impacts and effects on ecological receptor conservation status, inter-relationships, and their contribution to local (and if appropriate regional and national) biodiversity were identified. The assessment takes into account impact avoidance design measures and management activities when determining the significance of potential effects.

6.23 The assessment found that the residual effects – those that will remain after the implementation of mitigation measures – and not significant during construction or operation of the GB Onshore

Scheme. Requirements for mitigation relating to potential effects are minimal and relate primarily to requirements to comply with good practice and relevant legislation.

7. Noise and Vibration

Overview

7.1 The assessment considered the effects associated with noise and vibration occurring as a result of the construction, operation and decommissioning of the GB Onshore Scheme.

7.2 A detailed description of the GB Onshore Scheme and the Project Area is provided in Chapter 3, Proposed GB Onshore Scheme. The full assessment of Noise and Vibration can be found within Chapter 7 of the ES.

7.3 The scope of the assessment was to identify the potential for significant effects to occur at Noise Sensitive Receptors (NSRs) due to the following:

- Noise and vibration impacts from construction and/or decommissioning works;
- Noise impacts from the operation of the converter station and substation; and
- Noise impacts associated with road traffic movements attributable to the construction activities.

7.4 No sources of significant vibration, DC cable noise or significant volumes of road traffic were anticipated to be associated with the operation of the GB Onshore Scheme. Therefore, assessments of operational vibration, operational noise from the proposed DC cables and operational road traffic noise were scoped out of the assessment. A full justification of this judgment can be found within Chapter 7 of the full ES.

Study Area and Baseline Summary

7.5 The extent of the study area was defined to include the nearest NSRs in each direction from the Project Area and alongside the transport corridors that may be affected by changes in road traffic flows during the construction of the GB Onshore Scheme.

7.6 The Project Area is situated within the centre of the Isle of Grain to the west of Grain, the main settlement in the vicinity. The land surrounding the Project Area is either in agricultural use or is brownfield. In addition to Grain there are several scattered residential properties to the north and east of the Project Area.

7.7 The identified NSRs were those nearest the Project Area i.e. the NSRs that will experience the highest level of sound from the GB Onshore Scheme. Although sound may be perceivable at other NSRs in the area, effects will not be significant if they are suitability controlled at the identified NSRs.

7.8 The nearest NSRs to the Project Area were selected for assessment, where the intention was to apply appropriate sound level data at each NSR location for assessment purposes. Sensitive NSRs that were considered in the assessment and underpinning monitoring locations are detailed fully within Chapter 7 of the ES.

Potential Impacts

Construction

7.9 The construction activities have the potential to result in temporary noise and vibration impacts at the closest NSRs to the works. The main construction activities are:

- Preliminary works;
- Site establishment;
- Earthworks;

- Civil engineering works;
- Building works;
- Cable installation;
- Provision/installation of permanent services;
- Mechanical and electrical works;
- Commissioning; and
- Site reinstatement and landscape works.

7.10 As no predictions have been performed, the significance of the construction noise effect on NSRs without mitigation cannot be conclusively stated. Typically, earthworks cause the greatest noise impacts at NSRs due to the requirement for large numbers of noisy plant for a relatively long duration. The earthworks associated with the construction of the proposed substation and converter station are likely to have the greatest impacts on the residential property at Perry's Farm due to its proximity to these locations.

7.11 Given the proximity of the proposed DC cable route to residential properties on Grain Road (18 m to the site boundary) there is the potential for high construction noise levels to occur at these properties whilst works are undertaken in close proximity; however these works are likely to be of relatively short duration.

7.12 The potential for temporary construction vibration impacts is dependent on the need for construction activities which are a potentially significant source of vibration, such as piling, ground improvement or compaction works.

7.13 Mobile plant is unlikely to give rise to high levels of ground borne vibration. Typically, the levels of ground borne vibration from tracked earth moving equipment (such as a bulldozer or excavator) are imperceptible to humans at a distance of approximately 20 m, and those generated by vehicles with rubber tyres (e.g. a heavy lorry or dump truck) would be imperceptible at more than 10 m from the haul road[1]. Mobile plant may occasionally come within 10 or 20 m of an identified sensitive NSR; hence vibration may be perceptible but is highly unlikely to be of a magnitude that would cause complaint. Worst-case effects from vibration caused by mobile plant are therefore anticipated to be not significant.

7.14 Construction traffic can have a temporary noise impact on sensitive NSRs located along existing roads used by these vehicles. The potential for such impacts is dependent on the volume and route of construction traffic.

7.15 During the construction phase there would be additional vehicle movements from staff and delivery HGVs accessing the site from the surrounding road network. These vehicles have the potential to increase noise levels at nearby NSRs. The routes these vehicles would take will be included within the outline CEMP and will be restricted to the major roads in the vicinity, which would help minimise the potential for significant adverse effects at NSRs.

Operation

7.16 Operational noise impacts were also considered fully within the ES. In line with the guidance in BS 4142: 2014, it is considered that the contextual assessment has shown that the effect of the operational noise impacts will be not significant irrespective of the initial conclusion of the BS 4142 assessment.

7.17 For the purposes of brevity, the full operational assessment and supporting matrices underpinning this conclusion are not attached within this NTS. The full results of this assessment can be found within Chapter 7 of the ES.

[1] D.J.Martin (1977). Ground Vibrations Caused by Road Construction Operations. Transport and Road Research Laboratory.

Decommissioning

7.18 Decommissioning noise and vibration effects are anticipated to be similar to those during construction. These should be assessed at the time when the works are proposed.

Mitigation

7.19 A CEMP will be prepared and implemented by the construction contractors. The final CEMP will include the relevant noise and vibration criteria, giving regard to applicable criteria established within the assessment, proposed surveys and a range of Best Practical Means (BPM) which are likely to include the following:

- Implementing processes to minimise noise before works begin and ensuring that BPM are being achieved throughout the construction programme, including the use of localised screening around significant noise producing plant and activities where appropriate;
- Ensuring that modern plant is used, complying with the latest European noise emission requirements. Selection of inherently quiet plant where possible;
- Use of lower noise piling (such as rotary bored or hydraulic jacking) rather than driven piling techniques if any piling is required, where possible;
- Off-site pre-fabrication, where practical;
- All plant and equipment being used for the works to be properly maintained, silenced where appropriate, operated to prevent excessive noise and switched off when not in use;
- Ensuring contractors are made familiar with current legislation and the guidance in BS 5228 which should form a prerequisite of their appointment;
- Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials around the Project Area to be conducted in such a manner as to minimise noise generation;
- Consultation with MC and local residents as appropriate to advise of potential noisy works that are due to take place; and
- Monitoring of any noise complaints and reporting to the contractor for immediate investigation.

7.20 Full details of these and additional mitigating measures is provided within the ES; given the extent of BPM and wider mitigation relating to Noise and Vibration, a comprehensive account is not included in the NTS for purposes of brevity.

Summary

7.21 The assessment considered the potential significant impacts from noise and vibration generated from the construction and operation of the GB Onshore Scheme. The assessment was based on existing noise levels monitored from various surrounding receptors, namely residential properties within close proximity to the Project Area.

7.22 From the assessment of the potential noise and vibration generated during construction, including noise generated by construction traffic, it was concluded that the potential impacts to adjacent residences would not be significant. This assessment was based on the adoption of ‘best practicable means’ of mitigation measures to control noise, which would be documented within a CEMP to ensure Contractor compliance. A project route map and delivery schedule would also be required to control construction traffic, in line with active onsite management of access points.

7.23 Noise emissions from operational activities will be considered during the detailed design, however the assessment concluded that the appropriate operational noise limits can readily be achieved at the nearest residential receptor, and therefore operational impacts will not be significant.

8. Archaeology & Cultural Heritage

Overview

8.1 The assessment considered the likely significant effects on Cultural Heritage as a result of the components of NeuConnect proposed on the Isle of Grain, Kent, (hereafter referred to as the 'GB Onshore Scheme').

8.2 A detailed description of the GB Onshore Scheme and the Project Area is provided in Chapter 3, Proposed GB Onshore Scheme; the full assessment of Archaeology and Cultural Heritage can be found within Chapter 8 of the ES.

Study Area and Baseline Summary

8.3 For designated assets (World Heritage Sites, Scheduled Monuments, Listed Buildings, Conservation Areas, Registered Parks and Gardens, Registered Battlefields), a 1 km Study Area around the Site was applied. The Study Area ensured that designated heritage assets were identified to a sufficient distance to anticipate or identify any likely changes to their setting. Given the low-lying location of the Site, the Study Area was extended to the west to take in the villages of Allhallows and Lower Stoke, which are located on higher ground.

8.4 For non-designated assets (archaeological sites, findspots, locally Listed Buildings and other non-designated buildings) a search of 3 km was used to obtain data from the Kent Historic Environment Record (KHER) and the Kent Archives.

8.5 Intertidal heritage assets located within the application boundary between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS) have been identified in a cultural heritage Desk Based Assessment (DBA) intended for the offshore aspect of the Scheme (GB Offshore Scheme ES Chapter 16)). These assets are referred to and cross referenced in this chapter where relevant but are assessed as part of the 'GB Offshore Scheme'.

8.6 A baseline summary is provided below. A full and detailed description of the baseline conditions within the Site and surrounding Study Area is provided within Chapter 7 of the full ES; it is supported by the full DBA which again is available within the ES. In summary, the baseline assets considered:

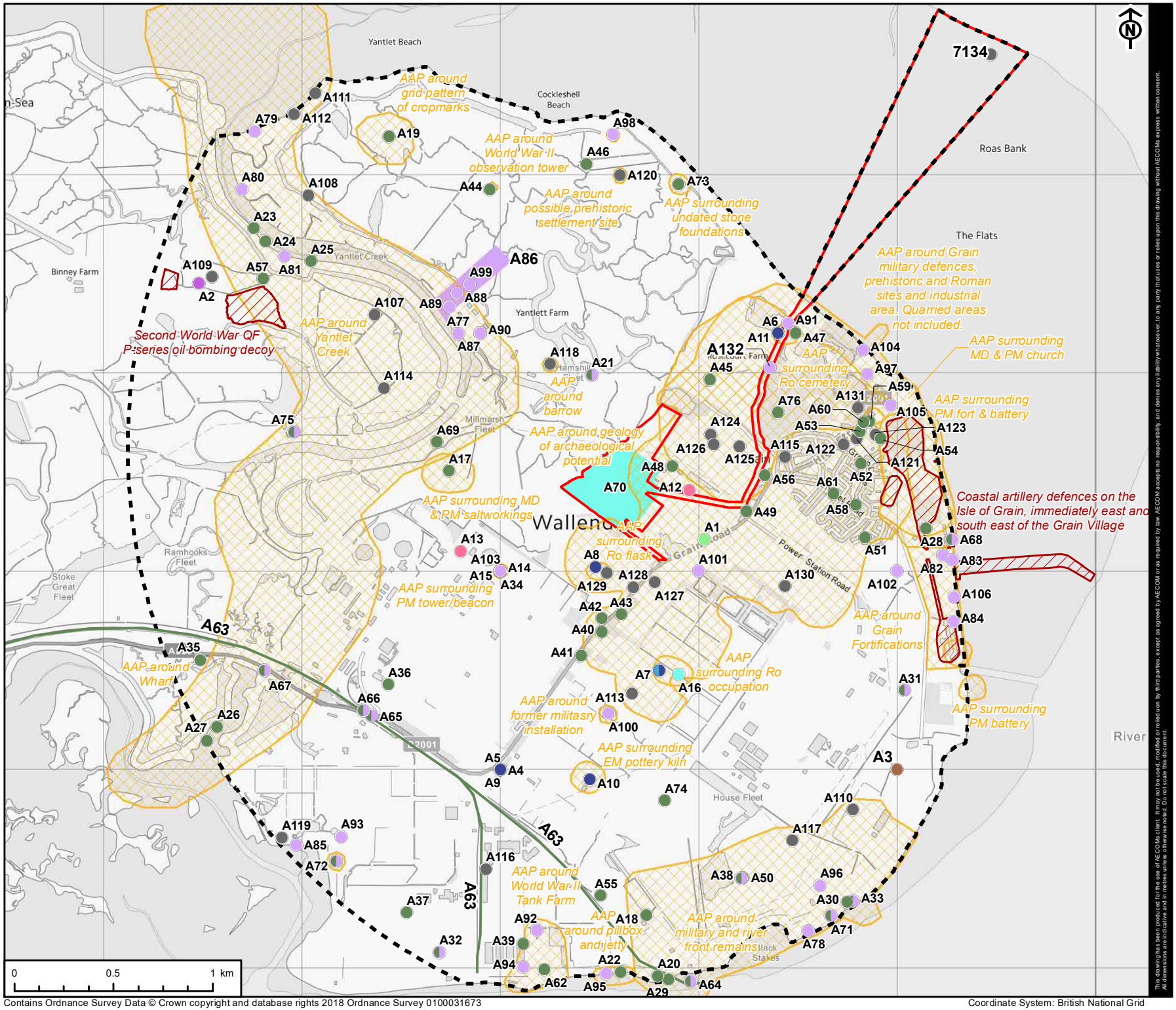
- The topography and geology of the Site (Cultural Heritage DBA section 4.1);
- The designated and non-designated heritage assets within the Site and Study Area (Cultural Heritage DBA sections 4.2, 4.3, and 4.4);
- The historic development of the Site and Study Area (Cultural Heritage DBA section 4.4);
- The historic landscape character within the wider area and features of the historic landscape within the Site (Cultural Heritage DBA section 4.5);
- The significance of the known designated and non-designated heritage assets within the Site and Study Area (Cultural Heritage DBA section 5.1 and 5.2);
- The potential for the survival of previously unknown archaeological remains within the Site and their heritage significance (value) (Cultural Heritage DBA section 5.3); and
- The character of the historic landscape and its sensitivity to change within the Site (Cultural Heritage DBA section 5.4).

8.7 Figure 9 below depicts the study area and these features.

8.8 There are no World Heritage Sites, Scheduled Monuments, Registered Battlefield or Registered Parks and Gardens within the Site. Two Scheduled Monuments, one grade I listed and two grade II Listed Buildings (Figure 10) are located in the Study Area. A further two Listed Buildings, one grade I and one grade II, are located within the village of Allhallows approximately 4 km to the west of the Site.

8.9 Five non-designated archaeological assets have been identified within the application boundary, in addition to two Areas of Archaeological Potential (AAP) as shown on Figure 9. These non-designated assets are archaeological in nature and date from the Iron Age to the post-medieval periods. The AAPs date to the Palaeolithic and the Iron Age and Roman periods respectively.

8.10 A further 143 non-designated assets lie within the Study Area, 11 of which are built heritage assets, while the remainder are archaeological; these features are assessed in full within Chapter 8 of the ES.



Project Management Initials: DR Designer: SM Checked: LB Approved: TC

AECOM

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KEY

- Application Boundary
- Heritage Study Area
- Area of Archaeological Potential (AAP)
- Scheduled Monument

Archaeological Assets

- Palaeolithic
- Lower Palaeolithic
- Neolithic
- Iron Age
- Iron Age to Roman
- Roman
- Early Medieval
- Medieval
- Post-medieval
- Post-medieval to Modern
- Modern
- Unknown
- Post-medieval
- Medieval
- Modern

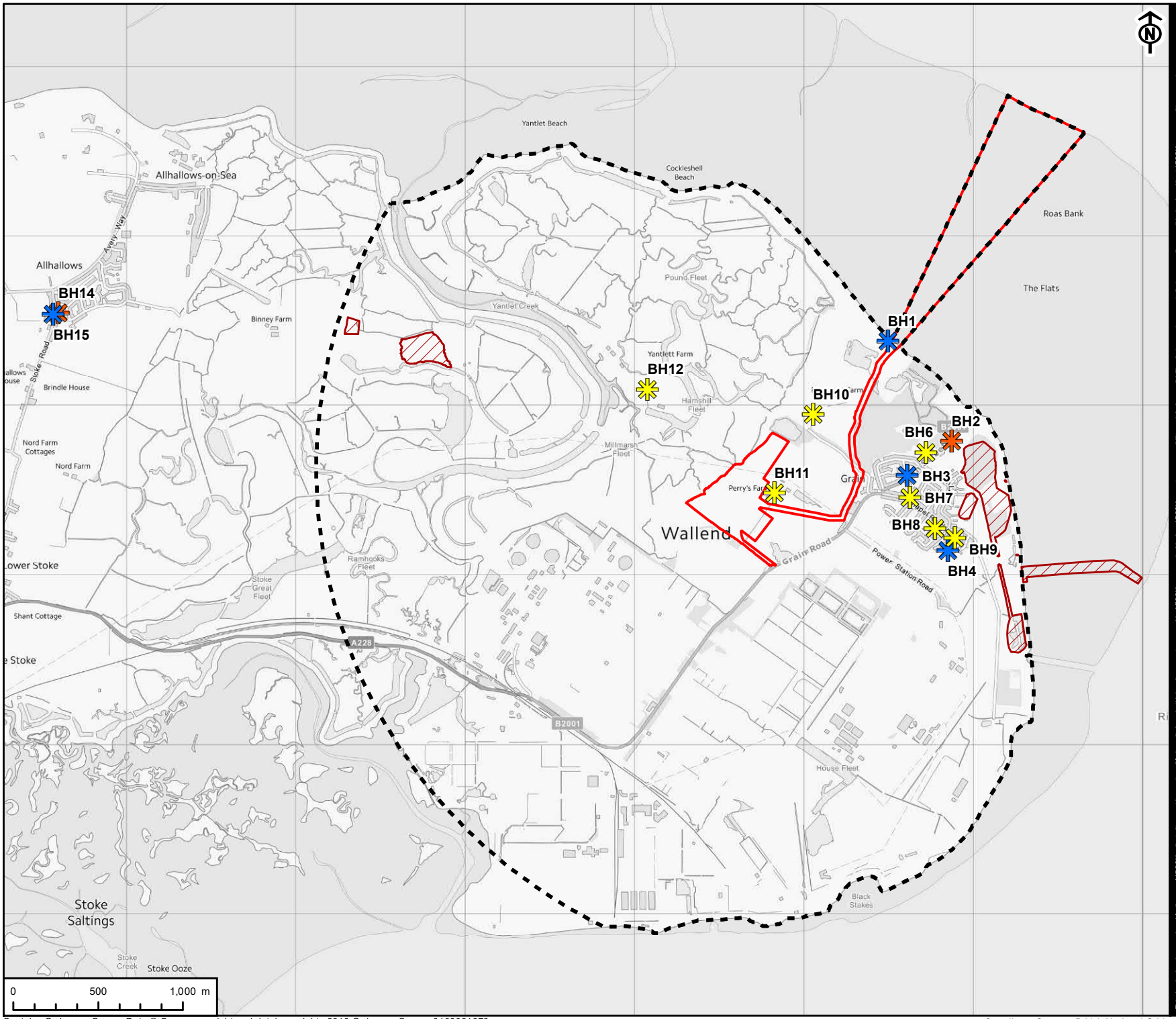
TITLE
FIGURE 9
ARCHAEOLOGICAL ASSETS

REFERENCE
NC_191002_NTS_9_v1

SHEET NUMBER
1 of 1

DATE
02/10/19

Coordinate System: British National Grid



Project Management Initials: DR Designer: LC Checked: TC Approved: DR

Scale @ A4 1:30,000

AECOM

PROJECT
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KEY
- Application Boundary
- Heritage Study Area
- Scheduled Monument

Built Heritage Assets
- Grade I Listed Building
- Grade II Listed Building
- Non-designated Heritage Asset

TITLE
FIGURE 10
BUILT HERITAGE ASSETS

REFERENCE
NC_191002_UKON_NTS_10_v1

SHEET NUMBER
1 of 1

DATE
02/10/19

Coordinate System: British National Grid

Potential Impacts

Construction

8.11 Construction of the converter station will entail the following activities which may impact the cultural heritage resource outlined above:

- The construction of access roads, which are expected to be topsoil stripped to a depth of 0.4 m below surface;
- The establishment of temporary facilities including site offices, lay down and storage areas and welfare facilities, development of electricity and water supplies, erection of security fencing or hoarding and implementation of external lighting for security. Approximately 1.5 ha will be required for the construction compound, laydown, and storage areas, which are expected to be stripped of topsoil to a depth of approximately 0.4 m below surface;
- The levelling and land re-profiling in order to establish a level platform on which the proposed converter station will be constructed. The areas are expected to be levelled to a depth of approximately 5.8 m above Ordnance Datum (AOD);
- The construction of a converter station approximately 250 m by 250 m (or up to 5 ha) with a maximum height of approximately 26 m. The layout of this zone is still in the design stages but is expected to include a DC switch hall, valve halls, a control building, cooling fans, transformers, Alternating Current (AC) switchyard, diesel backup generator, and a spare parts building. Some of these structures will be placed on piled foundations;
- The installation of an AC cable route from the substation to the converter station, which may be either above or below ground. For this assessment it is assumed to be underground and laid within a trench 1 m wide and 1.5 m deep; and
- The excavation of an attenuation pond approximately 1.1 ha in size and a smaller overflow pond approximately 0.3 ha in size connected by a swale/ channel. The larger pond is expected to extend to a depth of approximately 2 m below surface.

8.12 Construction of the substation would entail the following activities which may impact the cultural heritage resource outlined above:

- Preliminary works, which would include utilities diversions as necessary;
- The establishment of a lay down and storage areas of approximately 0.64 ha would be required, which is expected to be stripped of topsoil to a depth of approximately 0.4 m below surface;
- The levelling and land re-profiling in order to establish a level platform on which the proposed substation would be constructed. The areas are expected to be levelled to a depth of approximately 5.8 m AOD;
- The construction of a new substation approximately 80 metres (m) by 80 m (or up to 0.64 ha) with a maximum height of approximately 14 m and which may be placed on piled foundations.

8.13 Construction of the proposed DC cable route would entail the following activities which may impact the cultural heritage resource outlined above:

- An underground DC cable route from the converter station to the landfall point, and through the intertidal area to MLWS (overlapping with the subsea DC cable between MHWS and MLWS). The 30 m easement is expected to be topsoil stripped to approximately 0.4 m depth and the cable is expected to be placed in an open cut trench 1 m wide and 1.5 m deep;
- The construction of a concrete pad (TJP) of 15 m by 5 m where the subsea cable and onshore underground cables meet, which will be excavated to a depth yet to be determined;
- The laying of buried concrete pads 15 m by 5 m placed every 800 m to connect the cables. These areas will be excavated to a depth of 1.5 m;
- Three open-cut trenches approximately 800 m in length to carry the subsea DC cables and optic cable from the last breakout point in the mid-intertidal area to MHWS.

8.14 A detailed assessment of the potential for these impacts to effect local receptors is provided within Chapter 8 of the full ES; given the extent of analysis carried out, for the purposes of brevity within this NTS, it is not included here.

Operation

8.15 Effects once the GB Onshore Scheme is complete and occupied comprise operational effects arising from the presence of permanent structures, enclosing security palisade, maintenance activities, road traffic, and lighting. The Site is expected to be in operation for approximately 40 years prior to decommissioning.

8.16 All physical impacts on the archaeological resource will occur during the construction stage of the GB Onshore Scheme. Therefore, it is considered that there would be no additional impacts to the archaeological resource once the GB Onshore Scheme is operational.

Decommissioning

8.17 The scale and nature of activities undertaken during decommissioning would be similar to those described previously for the construction phase, however they would only be temporary over the period of activities on site and would not extend beyond the footprint and depth of the existing structures.

Mitigation

8.18 Typical appropriate measures that may be employed to achieve preservation by record of any surviving archaeological remains are summarised below.

8.19 The first stage of investigation would be archaeological monitoring of any new geotechnical investigations in order to understand the nature of the made ground and magnitude of previous ground disturbance. This would be particularly relevant along the proposed DC cable route to clarify the extent of gravel extraction activities and determine whether there is any potential for undisturbed archaeological deposits to have survived. The result of this monitoring would be used to inform the need for further archaeological evaluation in the form of targeted trial trenching evaluation within the area of impact.

8.20 Archaeological trial trench evaluation would be targeted to investigate areas of proposed ground disturbance resulting from topsoil stripping and areas of intrusive excavation of the underlying surficial deposits. Areas of topsoil stripping would be investigated to determine the presence/ absence and extent of any surviving archaeological remains dating to the Iron Age, Roman, medieval, post-medieval, or modern periods cutting into the underlying superficial deposits, whereas areas of deeper excavation would be investigated to determine the presence/ absence of Palaeolithic material.

8.21 A programme of sample recovery and analysis undertaken to investigate palaeoenvironmental conditions and soil sediment development that may be relevant to the research of archaeological remains recovered within the vicinity. Achieved through trial pit excavations or other geotechnical soil sample retrieval methods (such as soil cores or boreholes).

8.22 A programme of observation, investigation and recording of archaeological remains during or alongside construction activities in which the contractor's preferred method of working would be controlled as necessary to allow archaeological recording to take place to the required standard.

8.23 A programme of observation, investigation and recording of archaeological remains during or alongside construction activities in which the contractor's preferred method of working would be controlled as necessary to allow archaeological recording to take place to the required standard.

8.24 A flexible programme of fieldwork, which is of particular value where the presence of archaeological remains is known but the extent of areas requiring archaeological excavation is unclear. Topsoil and overburden would be stripped under archaeological control, over a defined area, in order carefully to expose archaeological remains. This work will be undertaken prior to the main construction programme in order to allow sufficient time for archaeological recording. A

scope of work appropriate to record any archaeological remains exposed would be agreed on site during consultation with KCC archaeological officer and implemented immediately

8.25 Either targeted or sample-based investigation in which mechanical excavated trenches are excavated in order to establish the presence/absence, location, extent, and character of archaeological deposits or activity foci identified by non-intrusive baseline survey methods. Trial trenching would also inform the need for any further appropriate mitigation strategy. Trial trenching would also be applied to areas where no significant archaeological remains have been identified to control the risk to the construction programme and the risk for disturbing 'unforeseeable' finds.

8.26 Detailed Excavation would be undertaken where significant archaeological remains are either known previously or discovered during the course of the works. This may be targeted at specific area locations such as the sites of archaeological interest identified during the baseline assessment or identified as the result of a programme of trial trench evaluation or watching brief monitoring.

Summary

8.27 The cultural heritage assessment considered the potential impact of the GB Onshore Scheme on designated and local heritage assets and their setting during construction and operation; the assessment also considered the likely risk of disturbing previously unrecorded assets.

8.28 The GB Onshore Scheme would not affect any World Heritage Sites, Registered Battlefields, Registered Parks and Gardens or Scheduled Monuments. It will cause change to the settings of two Listed Buildings, and two non-designated built heritage assets. Furthermore, the GB Onshore Scheme would directly impact on five non-designated archaeological assets located within the Site and may impact on potential archaeological remains dating to the Palaeolithic, Iron Age, Roman, medieval, post-medieval, and modern periods.

8.29 The construction phase of the GB Onshore Scheme would have a temporary Minor adverse effect on the grade II listed World War II Anti-Tank Obstacles on the foreshore. The operational phase of the GB Onshore Scheme would have a Minor adverse effect on the Church of All Saints, Allhallows. Convention and professional judgement dictate that neither effect is significant.

8.30 The construction and operational phases of the GB Onshore Scheme would have Negligible to Minor adverse effects on the non-designated built heritage assets of Rosecourt Farm and Perry's Farm and Wilford's Farm. Convention and professional judgement dictate that these effects are not significant.

8.31 Five archaeological assets have been identified within the Site consisting of the remains of the post-medieval White Hall Farm, the remains of medieval ridge and furrow, the remains of a Second World War camp, and the remains of the a modern outfarm south of White Hall Farm. The fifth asset consists of a dipole anomaly of possible anthropogenic origin which is assessed in the GB Offshore Scheme ES (Chapter 16). It has also been determined that the Site holds a potential to contain Palaeolithic, Iron Age, Roman, medieval, post-medieval and modern remains ranging in value from negligible to high.

8.32 It has been established that the GB Onshore Scheme would result in the truncation and/ or removal of archaeological assets, resulting in, at most, a permanent major adverse effect to the archaeological resource which would be significant. It has been recommended that a staged program of archaeological investigations is undertaken to identify the extent and further assess the significance of known and potential archaeological remains within the Site.

9. Water Resources & Flood Risk

Overview

9.1 The assessment considered the potential effects of the GB Onshore Scheme on water resources and flood risk. It identified the likely impact risks and mitigation measures and/ or best practice measures that will be incorporated into the construction and operational phases of the GB Onshore Scheme in order to avoid, reduce or offset potential adverse effects, or enhance potential beneficial effects.

9.2 The potential impacts considered include those on hydrology and surface water resources that form part of the onshore environment to mean low water (MLW). Impacts on hydrogeology and groundwater are considered in Chapter 11: Ground Conditions. Impacts associated to receptors within the coastal and offshore waters are assessed within the GB Offshore Scheme Environmental Appraisal.

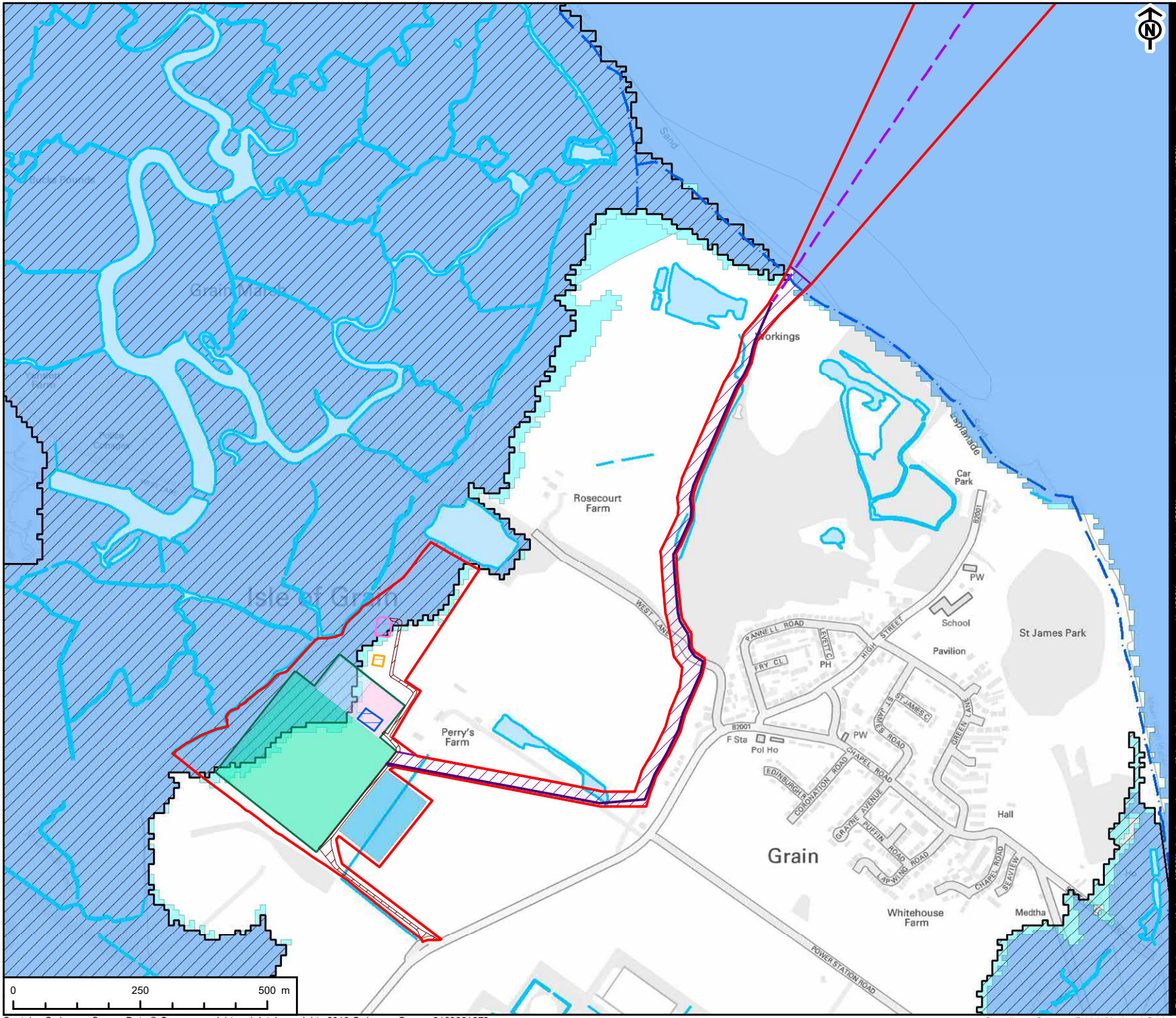
Study Area and Baseline Summary

9.3 The importance of receptors was identified from a review of Project Area and land uses within the surrounding area with respect to the vulnerability classifications as set out in the Planning Policy Guidance (PPG). With respect to flood defence and flood storage features, as is typical for EIA, the value of the receptor is based on the scale and type of development that is being protected.

9.4 There are several land drains and unnamed ponds within the Project Area, and a number of tidal creeks, ponds and ordinary watercourse to the west of the site within the Grain Marsh, including the Hamshill Fleet (ordinary watercourse) and Millmarsh Fleet (Main River).

9.5 These waterbodies are within the Medway Lower operational area. The Catchment Data Explorer identifies that none of these waterbodies have a designated WFD status. The Grain Marsh is a designated Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Ramsar site.

9.6 The importance of these and other receptors is considered fully within Chapter 9 of the ES. Given the variety and diversity of features in the study area, for the purposes of brevity, they are not detailed fully within the NTS. Figure 11 below depicts the study area and receptors of relevance to this topic.



Project Management Initials: DR Designer: LC Checked: SL Approved: TC

Scale @ A4 1:10,000

Coordinate System: British National Grid

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KEY

- Application Boundary

Indicative Location of:

- Offshore Cable Route
- Onshore DC Cable Route
- DC Cable Route - 30m Working Width
- Converter Station and Substation Platform - 2m Fence Line Security & Maintenance Corridor
- Access Road
- Converter Station Platform
- Substation Platform
- Construction Laydown Area
- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed Sealing End Compound
- National Grid Proposed GIS Building (Maximum Parameters)
- Surface Water (OS)
- Flood Defences
- Areas Benefiting from Flood Defences
- Flood Zone 3
- Flood Zone 2

NOTE
The location of all components identified is indicative only, but is representative of the maximum parameters of each component. The GB Onshore Scheme is subject to detailed design.

TITLE
FIGURE 11
WATER RESOURCES AND FLOOD RISK

REFERENCE
NC_191002_UKON_NTS_11_v1

SHEET NUMBER
1 of 1

DATE
02/10/19

Potential Impacts

Construction

9.7 The following potential impacts on water resources and flood risk during the construction phase have been identified:

- The proposed works include the installation of a cable beneath the natural embankment that forms the existing tidal flood defence line. The works may have the potential to increase the risk of tidal flooding.
- Processes during the construction phase may require significant volumes of water supply.
- Processes during the construction phase may generate significant volumes of wastewater.
- There is potential for machinery and construction works on the site to cause a disturbance of the ground leading to an increase in sediment runoff to surrounding surface water resources.
- Leakages and spillages from machinery during construction have the potential to result in pollutant pathways that may impact surrounding groundwater and surface water resources.
- Increased areas of hard standing across the site may alter surface water runoff rates and patterns to the Project Area and receiving Grain Marsh during the construction phase.
- Uncontrolled surface water runoff may lead to surface water flooding on the Project Area and surrounding area.
- There is a risk of flooding to the Project Area should significant amounts of groundwater be encountered during construction.
- The Project Area is partially located within an area that is at residual risk of tidal flooding; there is residual risk of tidal flooding to the GB Onshore Scheme.

9.8 For the purposes of brevity, construction impacts are only briefly referenced within this NTS but are fully assessed within Chapter 9 of the ES.

Operation

9.9 The following potential impacts on water resources and flood risk during the operational phase have been identified:

- The operation of the GB Onshore Scheme will not require the use of significant volumes of water, nor will it generate significant volumes of wastewater on account of the limited staff required for operation, therefore the site is unlikely to have significant impacts on water supply and wastewater generation.
- Increased areas of hard standing and modifications to land drains within the Project Area may alter surface water runoff rates and patterns to the Project Area and surrounding area.
- Uncontrolled surface water runoff may lead to surface water flooding on the Project Area and surrounding area.
- The GB Onshore Scheme is partially located within an area that is at residual risk of tidal flooding.

9.10 For the purposes of brevity, operational impacts are only briefly referenced within this NTS but are fully assessed within Chapter 9 of the ES.

Decommissioning

9.11 The potential effects during the decommissioning and demolition phase are very similar to those identified during the construction phase. The same mitigation measures will therefore be applied during the decommissioning and demolition phase.

Mitigation

9.12 Through the adoption of best practice construction methods, operational management, and design of the GB Onshore Scheme, there are several measures that will reduce the risk and hence likelihood that some potential impacts on water resources or flood risk would occur. Mitigation measures for the proposed converter station, substation and DC cable have been assessed collectively.

9.13 For construction related impacts, these measures will be developed, detailed and implemented via a Construction and Environmental Management Plan (CEMP).

9.14 During construction, the embankment along the coastline will be avoided by the use of horizontal directional drilling (HDD) construction methods (as opposed to trenching or cut and cover techniques) to drill underneath the defences. The depth of the defences and appropriate standoff distances will be agreed in consultation with the Environment Agency prior to the submission of a Flood Risk Activity Permit (FRAP) application and works being undertaken.

9.15 Processes during the construction phase that may require significant volumes of water supply include supply for washing down and potable water for sanitary facilities for site staff. The most intensive use of water, for the mixing of concrete, will be done off-site where possible and therefore will not affect water supply to the Project Area.

9.16 Water supply to the site during construction phase will be provided from the existing Southern Water sources, via an application to use an existing water supply for building purposes.

9.17 Wastewater generation on construction sites includes effluent from sanitary facilities provided on-site and from washing down and wheel wash facilities. It is expected that foul water generated at the Project Area will be drained via the existing combined sewers in the surrounding area, following treatment if required. If dewatering is required during excavations, then abstracted water may be discharged to the Southern Water network, following sediment removal.

9.18 As detailed in Appendix 9B, suitable construction phasing should be used to enable the SuDS features to be constructed at the beginning of the works. This would ensure that any rainfall events during construction of the substation and converter building would be intersected and attenuated by the SuDS before being discharged at a restricted rate into the agreed receiving waterbody.

9.19 It is proposed that surface water quality monitoring of the receiving waterbodies should be undertaken throughout construction to ensure any discharges from the works are not adversely impacting these waterbodies.

9.20 Should any negative impacts be identified such as water pollution, site drainage pathways will be immediately reviewed.

9.21 The following mitigation measures will be put in place and embedded within the CEMP:

- Development of an Erosion and Sediment Control Plan prior to execution of the project;
- Sufficient rumble pads will be provided at site access points to prevent tracking of sediments onto public roads;
- Sediment traps will be provided at downstream edges of site to treat runoff prior to it leaving site; and,
- Where possible, all runoff will be directed to the onsite sediment basin for treatment.

9.22 There is potential for hydraulic leaks from plant and machinery, as well as spills from chemical storages and sources such as concrete mixing to result in pollutant pathways to surrounding water resources.

9.23 In relation to leaks and spillages of contaminants, the following mitigation measures will be embedded within a CEMP to reduce the risk of leaks and spills:

- An emergency spillage action plan will be produced and included within the CEMP, which site staff will have read and understood, and will have been trained in its implementation on site;
- Any damage to the drainage network will be repaired as soon as practical;
- Any maintenance of plant and machinery will take place in a bunded impermeable area a minimum 20 m from any external drainage lines and the onsite waterbodies and those adjacent to the boundary;
- The majority of concrete used will be pre-mixed and delivered from an off-site source, thereby negating the need to mix concrete on-site and reducing the creation of alkaline wastewater. Any mixing and handling of wet concrete on-site will be undertaken in designated impermeable areas, away from any drainage channels or surface water; and,
- A designated impermeable area will be used for any washing down or equipment cleaning associated with concrete or cementing processes and wastewater will be discharged to the foul drainage system (with approval from Southern Water) or contained and removed by tanker to a suitable discharge location via a licensed waste operator.

9.24 Water requirements and wastewater generation during operation will be minimal; and will entail provision of sanitary facilities for a small team of onsite staff.

9.25 Should larger teams of site personnel be needed for periods of maintenance, temporary welfare facilities will be provided and suitable arrangements made at that time.

9.26 The proposed Drainage Strategy for the site is described in Appendix 9B and summarised below.

9.27 During operation, the GB Onshore Scheme will generate several storm and wastewater sources including process waste, foul waste from sanitary facilities and surface water runoff from buildings, car parks and landscaped areas. Process and foul water management will be addressed as information about the sources of these flows becomes available and the design progresses.

9.28 All surface water will be collected by rainwater pipes, gullies and linear drainage channels from all areas of hardstanding including building roofs, carparks and access roads. Runoff will be attenuated onsite by the proposed SuDS features, prior to being conveyed via swales to discharge at greenfield runoff rates to the agreed receiving waterbodies.

9.29 The total volume of storage required, to attenuate surface water runoff arising from the 100 year plus 20% climate change storm event, is approximately 6000 m^3.

9.30 Silt traps will be incorporated into the surface water pipe networks to intersect silt and sediment before runoff is attenuated within the SuDS features. Silt traps will require periodic maintenance to ensure they remain operational throughout the design life of the GB Onshore Scheme.

9.31 There is a residual risk of silts and sediments entering the SuDS features. However, the nature of the proposed SuDS will provide a treatment train and will trap potentially contaminated sediments within the vegetation, thus preventing the conveyance of silts and sediments into the receiving waterbodies

9.32 Oil separator units will be installed upstream of all attenuation systems on all drainage serving roads and yard areas, where potential hydrocarbon contamination could occur.

9.33 The proposed converter station and substation are located in the southwestern part of the Project Area, located away from the settlement of Grain and towards the existing industrial developments in the vicinity.

9.34 Correspondence with the Environment Agency included in the FRA Report has confirmed that proposed infrastructure associated with the convertor station and substation should be set above the flood level for the defended 0.5% AEP flood event, including climate change over the lifetime of the development. In this location, this corresponds to a flood level of 3.1 m AOD.

The platform for the converter station and substation will be set above this level including a suitable freeboard.

Summary

9.35 As part of the development of the design of the GB Onshore Scheme Sustainable Drainage Systems (SuDS) have been incorporated within the landscaping masterplan, including two attenuation basins connected via swales to collect runoff from the Project Area. These SuDS have been designed to accommodate increased runoff from the areas of hardstanding introduced to the area, and also compensation for some loss of flood storage capacity.

9.36 The phasing of construction activities will be managed to ensure that the SuDS measures are implemented at the beginning of construction to allow these measures to mitigate potential impacts from runoff. Further good practice measures will be embedded within the CEMP to avoid impacts from leaks and spillages of contaminants and sediment in runoff during construction, such as the use of rumble pads and sediment traps, and the use of hardstanding, bunded areas for the storage and use of potential contaminants.

9.37 A Flood Warning and Response Plan will be prepared prior to construction commencing detailing the planned response in the event of receiving a flood warning from the Environment Agency.

9.38 Based on the implementation of such mitigation measures there will be no significant residual effects during the construction of the GB Onshore Scheme.

9.39 No significant effects to water resources and flood risk are expected during the operation of the GB Onshore Scheme assuming a suitable Flood Warning and Evacuation Plan is established.

10. Transport & Access

Overview

10.1 The assessment considered the potential effects of the GB Onshore Scheme on transport and access. It identified the likely impact risks and mitigation measures and/ or best practice measures that will be incorporated into the construction and operational phases of the GB Onshore Scheme in order to avoid, reduce or offset potential adverse effects, or enhance potential beneficial effects.

10.2 Traffic and transport impacts are interrelated with Noise and Vibration impacts, and therefore reference should also be made to that section the Noise and Vibration section of this NTS and Chapter 7 of the full ES.

Study Area and Baseline Summary

10.3 The southern boundary lies adjacent to the B2001 Grain Road. The B2001 heads west, continuing into the A228 and is the only route along the along the Hoo Peninsula to the Isle of Grain, linking the site with Rochester, Chatham Docks and the A2/ M2 for onwards destinations. The following roads on the surrounding highway network were considered as part of the assessment:

- The B2001 Grain Road / High Street;
- The A228;
- Chapel Road;
- Power Station Road;
- The A289; and
- The M2 / A2.

10.4 Baseline traffic levels were established in order to quantify the magnitude of impact of the development traffic. Automatic Traffic Counters (ATC) and data obtained from the Department for Transport (DfT) were used to inform and define the baseline.

10.5 ATCs were placed on the B2001 Grain Road near the site access and recorded 24-hour traffic flows over a seven-day period. The surveys were initially conducted from the 1st November 2018 – 7th November 2018. ATC one and three were found to be faulty and were subsequently re-surveyed from the 9th November to the 15th November.

10.6 Collision Data was analysed to determine the presence of any underlying road safety issues on the surrounding highway network. STATS19 data obtained from ‘crashmap.co.uk’ for the most recent five-year period available was analysed within the study area covering the village of Grain and the B2001 continuing west along the A228 until Upper Stoke.

Potential Impacts

Construction

10.7 The prediction of construction effects focused on activities that could directly and indirectly impact on receptors within the defined study area. The ZoI includes those roads which may be utilised during construction, and upon which there is the potential for a significant impact.

10.8 The worst-case potential impacts of traffic are likely to be temporary in nature (e.g. the peak period of construction). Whilst traffic would be expected throughout the construction period, only the peak month for traffic has been assessed. This ensures that a robust worst-case traffic scenario is considered.

10.9 A number of impacts were specifically assessed:

- HGV construction traffic;
- Road Safety;
- Severance; and
- Pedestrian/ Cycle amenities.

10.10 The assessment of significance of each of the above elements has been assessed within Chapter 10 of the full ES. Owing to the level of detail in this assessment and the high-volume of supporting figures, it is not included within this NTS for the purpose of brevity.

Decommissioning

10.11 The effects during the decommissioning phase would be no worse than those presented in the construction assessment, as decommissioning would essentially be the reverse of the construction period.

Mitigation

10.12 By way of design mitigation, the permanent access road will provide access during the construction of the proposed development. As additional design mitigation, Highway improvements would also be included on the B2001 itself, with a right turn ghost island and acceleration/ deceleration lanes incorporated, designed in accordance with Design Manual for Road and Bridges (DMRB) (Ref 25-4) standards.

10.13 In order to minimise any effect relating to traffic and transport, several mitigation measures have been proposed. Mitigation would be committed and delivered through the outline Construction Traffic Management Plan (CTMP) which will be agreed prior to construction with Medway Council.

10.14 CTMP Mitigation relating to traffic movements associated with the proposed converter station, proposed DC cable route and permanent access road would be focused primarily on HGV traffic, as the additional car/ Light Goods Vehicle (LGV) trips will have a negligible impact on future traffic flows. However, the impacts of car/ LGV trips could also be mitigated through the encouragement of worker car share.

10.15 The CTMP will include the following:

- Location of site and the entry/ exit arrangements;
- Traffic routeing plans – defining the routes to be taken by HGVs to the site. For example, prioritising the use of A and B-roads as far as possible, avoidance of built-up areas and other sensitive locations;
- Construction hours and delivery times stipulated to best avoid peak periods;
- Strategy for traffic management and measures for informing construction traffic of local access routes, road restrictions, timing restrictions and where access is prohibited;
- Measures to protect the public highway (e.g. wheel wash facilities);

- Measures for the monitoring of the CTMP to ensure compliance from drivers and appropriate actions in the event of non-compliance;
- Mechanism for responding to traffic management issues arising during the works (including concerns raised from the public) including a joint consultation approach with relevant highways authorities;
- Details of traffic management requirements; and
- Strategy for traffic management and measures for informing construction traffic of local access routes, road restrictions (statutory limits: width, height, axle loading and gross weight), timing restrictions (if applicable) and where access is prohibited.

10.16 Control measures will include:

- All construction traffic to adhere to the Traffic Route Plans included in the CTMP;
- All vehicles will be able to access and egress the site in a forward gear, with sufficient room off the public highway to allow them to wait without blocking the main carriageway;
- Welfare facilities will be provided so as to minimise the need for off-site trips by staff during the working day;
- At all site accesses, suitable supervision will be provided as required to ensure that traffic is controlled at access points during construction (for example banksman checking road traffic and controlling construction vehicle movements) and mud deposits on the roads are minimised; and
- Where required, traffic signals (in accordance with New Roads and Street Works Act (NRSWA), (Ref 25-7) or stop-go boards will be used to control road traffic. Road signs will conform to Chapter 8 of TSRG (Traffic Signs Manual, Ref 25-8) and NRSWA.

10.17 In terms of road safety, whilst the majority of impacts are ‘Negligible’ or ‘Minor’, the access from the public highway at the B2001 would use Banksmen to manage the movement of HGVs on and off the public highway. Warning signage would be provided on the approaches to the access junction.

10.18 There would however be very few pedestrian/ cyclist movements expected as part of the construction phase of the development, which relates to the relatively low number of additional workers expected.

10.19 A Travel Plan would be introduced in order to encourage sustainable travel to the site. The Travel Plan would include measures such as; encouragement of car sharing and public transport usage, better marketing of information and implementation of a Travel Plan Co-ordinator. Where appropriate, a shuttle bus to transport workers to key interchange locations could be introduced.

10.20 The applicant will ensure, in line with NRSWA and any Section 278 Agreements with the Highway Authorities, that the Contractor maintains good communication with affected communities, keeping them informed about the timing and extent of activities which may affect them.

10.21 So far as practicable material will be retained on site including the retention of all soils and spoils, therefore minimising the need to move material on and off the site.

10.22 It is considered that with the implementation of the above measures, any minor effects on road users during the construction period will be reduced further. Where appropriate, HGVs would access and egress in a forward gear. At all accesses, warning signage will be provided on the approaches to the access junctions.

Summary

10.23 Access to the proposed converter station and substation will be via the B2001 Grain Road. An existing unnamed road runs west/ northwest from Grain Road along the southern boundary of the site, which is the preferred point of access during construction and operation of the GB Onshore Scheme.

10.24 Prediction of construction effects has focused on activities that could directly and indirectly impact on receptors within the defined study area. The ZoI includes those roads which may be utilised during construction, and upon which there is the potential for a significant impact.

10.25 The results of the assessments indicate that the impacts are likely to be not significant. However, some receptors experience an effect deemed 'moderate'. These concern Severance and Pedestrian facilities on Grain Road. These are not considered to be significant due to the lack of pedestrians or cyclists around to experience the effect brought on by the increase in HGV traffic.

11. Ground Conditions

Overview

11.1 The assessment considered the potential impacts from the construction and operation of the GB Onshore Scheme in relation to ground conditions; it included assessment of the potential for land contamination to impact upon the GB Onshore Scheme, or for contamination to be disturbed or caused by the GB Onshore Scheme.

11.2 A detailed description of the GB Onshore Scheme and the Project Area is provided in Chapter 03, Proposed GB Onshore Scheme; the full assessment of Ground Conditions can be found within Chapter 11 of the ES.

Study Area and Baseline Summary

11.3 The study area for the ground conditions assessment comprises the Project Area and an additional radial zone of 250 metres (m). A radial zone of 1 kilometre (km) is considered for groundwater, and surface water abstractions within the context of identifying potential receptors to any soil and/ or groundwater contamination and is herein referred to as the 'extended study area'.

11.4 This study area was deemed appropriate for the consideration of historical and current potentially contaminative land uses which may have resulted in contamination and is consistent with how study areas for ground conditions are defined with other schemes.

11.5 Establishment of the baseline environment has involved reference to existing data sources and consultation with statutory bodies and other organisations. Information has been obtained from the following sources:

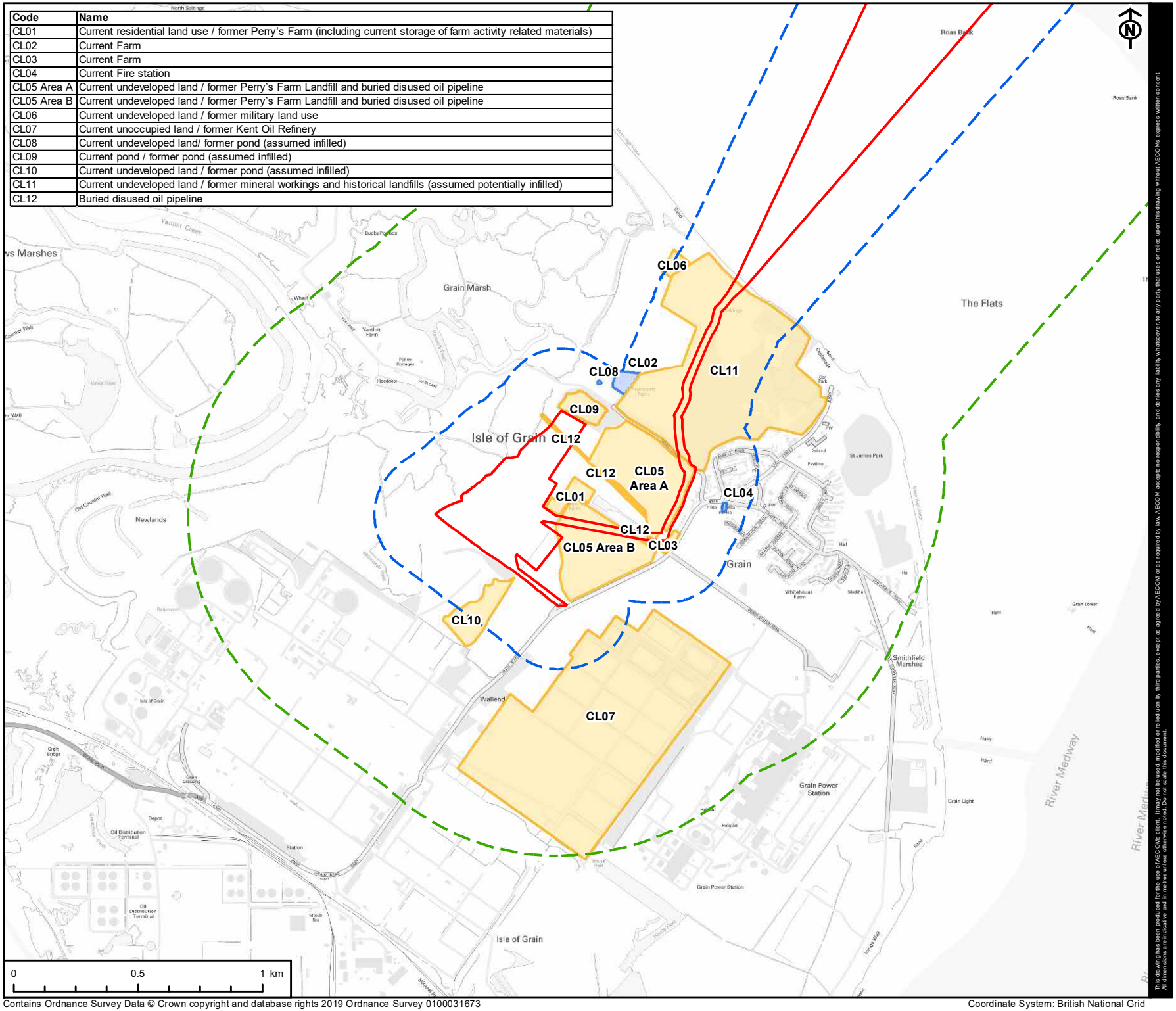
- BGS[2];
- DEFRA[3];
- Environment Agency[4];
- Landmark GIS Data[5];
- Natural England[6];
- Medway Council[7];
- GeoConservation website[8]; and
- Historical site investigation information pertinent to the ground conditions topic including any relevant information recorded in the Environmental Liability Desk Study.

11.6 Areas of land within and surrounding the Project Area are illustrated on Figure 12.

11.7 Given the range and diversity of considerations made as part of the baseline creation, full details are not provided within this NTS but can be found within Chapter 11 of the ES.

[2] British Geological Survey (BGS) (2019), https://www.bgs.ac.uk/.
[3] Department for Environment, Food and Rural Affairs (2019), https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs.
[4] Environment Agency (2019), https://www.gov.uk/government/organisations/environment-agency.
[5] Landmark Envirocheck Report (Order Number: 193022474_1_1, dated 5th February 2019).
[6] Natural England (2019), https://www.gov.uk/government/organisations/natural-england.
[7] Medway Council (2019), https://www.medway.gov.uk/.
[8] GeoConservation Kent (2019), https://www.geoconservationkent.org.uk/

Code	Name
CL01	Current residential land use / former Perry's Farm (including current storage of farm activity related materials)
CL02	Current Farm
CL03	Current Farm
CL04	Current Fire station
CL05 Area A	Current undeveloped land / former Perry's Farm Landfill and buried disused oil pipeline
CL05 Area B	Current undeveloped land / former Perry's Farm Landfill and buried disused oil pipeline
CL06	Current undeveloped land / former military land use
CL07	Current unoccupied land / former Kent Oil Refinery
CL08	Current undeveloped land/ former pond (assumed infilled)
CL09	Current pond / former pond (assumed infilled)
CL10	Current undeveloped land / former pond (assumed infilled)
CL11	Current undeveloped land / former mineral workings and historical landfills (assumed potentially infilled)
CL12	Buried disused oil pipeline



Project Management Initials: DR Designer: LC Checked: JOK Approved: DR

Scale @ A4 1:20,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Application Boundary
- 250m Study Area
- 1km Extended Study Area

Potential Sources of Land Contamination
- Included in Risk and Impact Assessment
- Excluded from Risk and Impact Assessment

TITLE
FIGURE 12
POTENTIAL CONTAMINATED LAND SITES

REFERENCE
NC_191002_UKON_NTS_12_v1

SHEET NUMBER
1 of 1

DATE
02/10/19

Potential Impacts

Construction

11.8 Several activities will occur at the Project Area during the construction phase that have the potential to interact with the underlying ground conditions. These have been identified as:

- Soil stripping;
- Cut and fill earthworks;
- Excavations for foundations and ground works for the proposed substation, converter station and cable sealing end compound, drainage, utilities and AC cable route;
- Dewatering of excavations;
- Excavated materials management and soil storage; and
- Establishment of temporary construction compounds and the storage of hazardous materials within them for use in construction e.g. fuels and oils.

11.9 A comprehensive review of these and additional construction impacts is provided within the ES; for the purposes of brevity in this NTS, this is not included.

Operation

11.10 There are not expected to be any longer term operational or permanent impacts on ground conditions resulting from the operation of the proposed DC cable route. On completion, there will be limited permanent above ground infrastructure with the exception of cable marker posts at locations along the route and it is planned to restore the land and features that have been affected by the construction works to a condition suitable for its original use/ function.

11.11 In view of appropriate drainage solutions being implemented, no potential longer term, operational or permanent impacts on hydrogeological conditions associated within the proposed DC Cable Route have been identified.

11.12 There are not expected to be any operational risks from contaminated soil and groundwater to, or from, the proposed DC cable route.

Decommissioning

11.13 Decommissioning impacts are assumed to be similar to, but no worse than, the temporary impacts defined in the assessment of construction impacts on the basis of the similar nature of activities envisaged during construction and decommissioning

Mitigation

11.14 Mitigation by design has been a consideration since the early optioneering stages. Opportunities have been taken, where possible, to avoid potential ground constraints and in particular any areas of landfilling or potentially infilled ground in relation to the site selection for the proposed substation/ converter station and associated infrastructure.

11.15 Owing to the diverse range of mitigation proposed for this topic, a brief summary of some of the key mitigating measures is provided below:

- Chemical substances and hazardous materials will be stored in accordance with Environment Agency Pollution Prevention Guidance (withdrawn but widely considered good practice) and applicable storage regulations and it is assumed that accredited operational and environmental management standards will be employed for these activities.
- Materials used in buildings and infrastructure will be specified accordingly, taking due account of the ground conditions such as elevated sulphate or ground gases
- A CEMP will be developed and secured by planning condition that will contain measures to ensure compliance with relevant standards and legislation. The CEMP will set out the

environmental mitigation requirements and also the project level expectations on how the proposed substation, converter station, AC/ DC cable routes and ancillary infrastructure will be constructed. Measures contained within the CEMP would be designed to limit the potential for dispersal and accidental releases of potential contaminants, soil-derived dusts and uncontrolled run-off to occur during construction.

- A Pollution Response Plan will be in place prior to the commencement of construction works. The plan will outline key pollution mitigation measures to be adopted including a Control of Substances Hazardous to Health (COSHH)/ fuel inventory and key contacts to be notified in the event of a significant pollution incident, which may subsequently lead to the contamination of controlled waters or soils.
- All bulk fuel and COSHH items will be stored in accordance with the relevant Environment Agency Pollution Prevention Guidance notes40 (withdrawn but widely considered good practice) and storage regulations. Tanks and dispensing pumps will be locked when not in use to prevent unauthorised access.
- Any hazardous materials will be stored in designated locations with specific measures to prevent leakage and the release of their contents. This will include a requirement to position storage areas at least 10 m away from surface water features/ drains (and take into consideration the positions of any groundwater abstraction wells), on an impermeable base with an impermeable bund that has no outflow and is of adequate capacity to contain at least 110% of the contents. Valves and trigger guns will be protected from vandalism and kept locked when not in use.
- Only well-maintained plant will be used during construction to minimise the potential for accidental pollution from leaking machinery or damaged equipment. Static machinery and plant are expected to be stored in hardstanding areas when not in use and, where necessary, to make use of drip trays beneath oil tanks/ engines/ gearboxes/ hydraulics. Spill response kits containing equipment that is appropriate to the types and quantities of materials being used and stored during construction will be maintained on-site.
- The re-use of excavated materials during construction will be governed by either a Materials Management Plan developed in accordance with the CL:AIRE Definition of Waste: Development Industry Code of Practice , an environmental permit or a relevant exemption. The CL:AIRE Code of Practice is a voluntary framework for excavated materials management and re-use. Following this framework results in a level of information being generated that is sufficient to demonstrate to any regulator that excavated material has been re-used appropriately and is suitable for its intended use. It demonstrates that waste material has not been used in the development.

11.16 Additional details of mitigation related to this specific topic can be found within Chapter 11 of the ES.

Summary

11.17 The ground conditions topic assesses the potential impacts of the construction and operation of the GB Onshore Scheme in relation to ground conditions.

11.18 The assessment of temporary effects has shown that whilst there are predicted minor adverse impacts associated with the construction stage, none of these would be regarded as significant following adoption of the measures as part of a CEMP which will be prepared prior to the commencement of construction activities.

11.19 There are not expected to be any significant operational effects on ground conditions as the design of the GB Onshore Scheme is expected to include measures that would contain and control any releases of contaminants to the Project Area and its associated infrastructure during the operation period.

11.20 It is not considered that any of the identified committed schemes will generate cumulative effects in relation to ground conditions.

12. Cumulative Assessment

Summary

12.1 A cumulative assessment has been undertaken to take in to account both inter-project and intra-project effects.

12.2 Intra-project effects have considered the impact of multiple environmental topics on the same receptor (i.e. the combined impact of increased disturbance (such as noise) and reduced visual amenity on walkers and visitors, as well as in-combination effects from different components the Scheme (i.e. the proposed DC cable route and the proposed converter station) on the same receptor.

12.3 Inter-project effects have considered the potential cumulative impacts from the simultaneous development of the UK Onshore Scheme with other projects within the near vicinity of the Scheme. A systematic review of projects either already within or known to soon enter the planning system were reviewed by each of the specialists to determine potential cumulative impacts.

Conclusions

12.4 The assessment potential cumulative effects on an individual receptor from different components of the GB Onshore Scheme, and from multiple sources has determined that whilst there have been some impacts identified these are not likely to be of greater significance than when considering the potential effects individually. Intra-project effects are limited to the amenity of residential receptors, and users of surrounding walking routes adjacent to the Project Area.

12.5 Of the four short-listed projects identified that had the potential to result in cumulative impacts when taken in to consideration with the Scheme, only potential traffic-related impacts associated with the construction and operation of the proposed cement plant at Thamesport was considered for further assessment. However, it was concluded that the network would not be significantly impacted as a result of the simultaneous development of the GB Onshore Scheme and the cement plant.

13. Schedule of Mitigation

Introduction

13.1 This chapter sets out in once place all of the measures proposed to mitigate the potential environmental impacts of construction and operation of the GB Onshore Scheme.

Approach to Mitigation

13.2 As set out in chapter 4 of the Environmental Statement a standard hierarchal approach to the development of mitigation measures has been followed with the aim of 'designing out' adverse effects as much as possible (avoiding or preventing, reducing adverse effects) as well as seeking opportunities to maximise or enhance beneficial effects. The Environmental Impact Assessment (EIA) has been undertaken in parallel with the development of the GB Onshore Scheme providing opportunities to incorporate mitigation measures into its design or how it will be constructed.

13.3 Mitigation measures fall into two categories: mitigation by design which forms part of the GB Onshore Scheme design; and mitigation by practice which is part of the installation, operation and decommissioning of the GB Onshore Scheme.

Purpose of the Schedule of Mitigation

13.4 The purpose of the Schedule of Mitigation is to set out in one place all of the measures which have been embedded with the design of the GB Onshore Scheme and how it will be constructed such that they can be easily transposed into the relevant construction management plans.

13.5 It should be noted that for some topics common mitigation measures have been identified for example pollution prevention measures may apply to water as well as ecology; for completeness these have been repeated for each specialist topic.

14. Summary & Conclusions

Introduction

14.1 This chapter summarises the results of the Environmental Impact Assessment (EIA) of the potential effects of the construction and operation of the components of NeuConnect (also referred to as 'the Project') that are located at Grain, UK to Mean Low Water Spring (MLWS) (the 'GB Onshore Scheme'), as presented in this Environmental Statement ES.

About NeuConnect

14.2 NeuConnect is a 1,400 megawatt (MW) bidirectional interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks; two of the largest electricity markets in Europe. The new link will create a connection for electricity to be transmitted in either direction between Great Britain and Germany. The Project comprises approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HDVC) cables, with onshore converter stations linking into the existing electricity grids at Grain in Great Britain and at Wilhelmshaven in Germany. The subsea cables will traverse through British, Dutch and German waters.

14.3 In Great Britain the GB Onshore Scheme extend as far as MLWS. The GB Onshore Scheme will comprise the following main elements:

- Cable sealing end compound within a fenced compound occupying an area of approximately 1,600 square metres (m^2) or 0.16 hectares (ha).
- Substation within a fenced compound occupying an area of approx. 6,400 m^2 or 0.64 ha. The substation will comprise a single building and some outdoor electrical equipment, and an internal road will allow access to equipment within the compound.
- Approximately 50 metre (m) long AC cable route from the substation to the converter station. The AC cable may be either underground or above ground.
- Converter station within a fenced compound occupying an area of approximately 62,500 m^2 or 6.25 ha. The converter station will comprise buildings and some outdoor electrical equipment, as well as internal roads around the buildings/ equipment.
- Access to the GB Onshore Scheme will be taken from the existing junction on the B2001/ Grain Road. The existing junction will be improved and a new approximately 850 m long permanent access road will be constructed. This provide access to both the proposed converter station and substation compounds.
- An approximate 1,550 m long underground DC cable route from the converter station to the landfall point.
- At the point of landfall, there will be a Transition Joint Pit (TJP), where underground and subsea DC cables are joined together (subsea cable are slightly larger than underground cables due to additional protective armouring).
- From the TJP and across the intertidal zone subsea DC cables will be installed in buried ducts for a distance of approximately 1,700 m.

Development of the GB Onshore Scheme

14.4 The development of the GB Onshore Scheme has been undertaken in parallel to the consideration of environmental and technical constraints and restrictions. The siting and orientation of the components of the GB Onshore Scheme, and the landscape of the Application Boundary have been designed to best align the development to the existing surroundings.

14.5 The GB Onshore Scheme is subject to further detailed design by the appointed Contractor, and as such the design of GB Onshore Scheme is set in terms of maximum parameters within which the final design will be constructed. In undertaking the EIA in parallel to the development of the

maximum parameters a number of embedded mitigation measures have been included within the design that have avoided or minimised potential environmental impacts. This approach allows for flexibility and efficiencies for the Contractor whilst also establishing commitments and requirements that will be embedded within the construction methods and final design of the GB Onshore Scheme.

Conclusions

14.6 The results of the EIA ensure that the LPA and statutory consultees as well as other interested parties including local communities are aware of the GB Onshore Scheme's environmental impacts and whether these may be significant or not. The purpose of identifying the significant effects (adverse and beneficial) is to ensure that they may be considered alongside other material considerations in determining the applications for planning permission.

14.7 The EIA of the GB Onshore Scheme has identified and assessed the likely significant effects which would result from its construction and operation. Through the iterative development of the design in line with the EIA, NeuConnect Britain Limited, the Applicant, has prevented or reduced a number of potentially significant environmental effects. However, given the scale of the GB Onshore Scheme some significant environmental effects are unavoidable and as such some will remain following mitigation. As set out above, the significant environmental effects will be limited to landscape character during construction, visual amenity during construction and operation, and potentially to unrecorded archaeological assets during construction (although impact would be permanent. The operational impacts regarded to be significant are from West Lane only, which would include users of the road and users of the Coastal Path (which is yet to be established).

14.8 The GB Onshore Scheme has been designed to incorporate measures to help mitigate identified potential impacts, including the enhancement and establishment of boundary screening planting, for the provision of green corridors and to phase the development in to the existing landscape context including with the industrial units to the south of the existing overhead line. Further to this mitigation embedded in the design, the Applicant has committed to a number of additional measures to be implemented during construction to further avoid and minimise potential adverse impacts.

14.9 Should planning permission for the GB Onshore Scheme be granted the Applicant is committed to working with their appointed Contractor(s) to reduce the GB Onshore Scheme's environmental effects as far as practicable in finalising the detailed scheme design and undertaking construction works. This approach will ensure that the actual effects of the GB Onshore Scheme would be no greater than the likely effects identified and assessed in this ES.

AECOM Imagine it. Delivered.

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement
Main Report

NeuConnect Britain Ltd

September 2019

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Table of Contents

Figures

Tables

Glossary & Abbreviations

Glossary

Term	Meaning
NeuConnect	Also referred to as the Project, which includes all components of the interconnector between the Isle of Grain, UK and Wilhelmshaven, Germany.
GB Onshore Scheme	Includes all components of the interconnector from the connection to the existing overhead line at Perry's Farm, Grain, to Mean Low Water Spring.
the proposed substation	This is the substation that will be built and operated by National Grid Electricity Transmission to connect the interconnector to the National Electricity Transmission System.
the proposed converter station	This is the converter station proposed to be operated by NeuConnect Britain Limited on land at Perry's Farm, Grain.
GB Offshore Scheme	The subsea Direct Current cable, extending between Mean High Water Spring and the point of transition between Dutch and UK waters.
landfall	The area where offshore cables come ashore.
proposed landfall site	Also referred to as the proposed landfall, located to the north/ northwest of the settlement of Grain.
Transition Joint Pit	Buried concrete pad with joint connecting subsea and underground Direct Current cables at the proposed landfall site.
proposed DC cable route	Also referred to as the Direct Current (DC) cable route (from Mean Low Water Spring to the proposed converter station).
proposed DC cable working width	Typically 30 metre wide works corridor in which Direct Current cable installation will occur. This corridor increases in width at the West Lane crossing and at the proposed landfall.
joint bays	Buried concrete pad where adjacent sections of onshore cable are connected.
temporary construction area	Any area to be disturbed during construction. This will include working areas (i.e. Alternating Current and Direct Current cable troughs, converter station and substation footprints) in addition to the working width, temporary access tracks and the temporary construction compound.
temporary construction compound	Compound for site offices, storage, welfare facilities etc.
converter station	Specialist facility to convert electricity Alternating Current to Direct Current or vice versa.
proposed converter station site	The complete converter station site including temporary working areas.
the permanent converter station area	The permanent converter station area (approx. 5 hectares).
proposed permanent access road	The permanent access to the converter station and substation from the B2001/ Grain Road.
proposed substation site	The complete substation site including temporary working areas.
permanent substation area	The permanent substation area (approx. 0.72 hectares).
Rochdale Envelope	The maximum parameters in which the converter station and substation will be designed.
the Applicant	The proponent of the Project, NeuConnect Britain Limited.

Term	Meaning
the Contractor	Party or parties responsible for the detailed design and construction.

Abbreviations

Abbreviation	Definition
AADT	Annual Average Daily Traffic
AC	Alternating Current
AIL	Abnormal Indivisible Loads
AOD	Above Ordnance Datum
BAP	Biodiversity Action Plan
BGS	British Geological Society
BNL	Basic Noise Level
BPM	Best Practicable Means
BS	British Standard
CBS	Cement Bound Sand
CEMP	Construction Environmental Management Plan
CKD	Cement Kiln Dust
CoCP	Code of Construction Practice
CO_2	Carbon Dioxide
COPC	Chemicals of Potential Concern
CRTN	Calculation of Road Traffic Noise
CSM	Conceptual Site Model
dB	Decibel
DC	Direct Current
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EC	European Commission
EIA	Environmental Impact Assessment
EMF	Electric and Magnetic Fields
ES	Environmental Statement
EU	European Union
FRA	Flood Risk Assessment
GB	Great Britain
GI	Ground Investigation
GW	Gigawatt
ha	Hectare
HDD	Horizontal Directional Drilling
HE	Historic England
HER	Historic Environment Record
HGV	Heavy Goods Vehicle
HRA	Habitat Regulations Assessment
HVDC	High Voltage Direct Current
JNCC	Joint Nature Conservation Committee

Abbreviation	Definition
km	Kilometre
kV	Kilovolt
LCA	Landscape Character Area
LCT	Landscape Character Type
LGV	Light Goods Vehicle
LNG	Liquefied Natural Gas
LOAEL	Lowest Observable Adverse Effect Level
LPA	Local Planning Authority
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
m	Metres
m^2	Square metre
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MW	Megawatt
NCA	National Character Assessment
NE	Natural England
NETS	National Electricity Transmission System
NGET	National Grid Electricity Transmission
NNR	National Nature Reserve
NOEL	No Observed Effect Level
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSR	Noise Sensitive Receptor
Ofgem	Office of Gas and Electricity Markets
OHL	Overhead Line
OS	Ordnance Survey
PAH	Polycyclic Aromatic Hydrocarbons
PPV	Peak Particle Velocity
PRA	Preliminary Risk Assessment
SAC	Special Areas of Conservation
SOAEL	Significant Observed Adverse Effect Level
SPA	Special Protection Area
SSSI	Sites of Special Scientific Interest
TCC	Temporary Construction Compound
TJP	Transition Joint Pit
TMP	Traffic Management Plan
UAEL	Unacceptable Adverse Effect Level
UK	United Kingdom
UKPN	UK Power Networks
VSC	Voltage Source Converter

1. Introduction

Introduction

1.1 NeuConnect Britain Limited (hereafter also referred to as the 'Applicant') is seeking outline planning permission from Medway Council under the Town and Country Planning Act 1990 for the construction, operation and maintenance of an electricity converter station and underground Direct Current (DC) and Alternating Current (AC) cables as part of the development of an electricity link (interconnector) between Great Britain and Germany. In addition, the Applicant is seeking outline planning permission for a substation and cable sealing end compound which will enable connection of the interconnector to the GB transmission system. The construction and operation of the substation will be the responsibility of National Grid Electricity Transmission (NGET), who is the licensed Transmission Operator.

1.2 This Environmental Statement has been prepared by AECOM Infrastructure & Environment UK Limited (AECOM) on behalf of the Applicant. The Environmental Impact Assessment (EIA) process and production of the Environmental Statement has been coordinated and managed by Tom Cramond, who has over seven years' experience as an environmental consultant. AECOM are members of the Institute of Environmental Assessment and Management (IEMA) EIA Quality Mark as a commitment to excellence in EIA activities.

About NeuConnect

Overview of the Project

1.3 NeuConnect (the 'Project'), is a 1400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks; two of the largest electricity markets in Europe. The new link will create a connection for electricity to be transmitted in either direction between Great Britain and Germany. The Project comprises approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HDVC) cables, with onshore converter stations linking into the existing electricity grids at Grain in Great Britain and at Wilhelmshaven in Germany. The subsea cables will traverse through British, Dutch and German waters. An overview of the components of the Project is illustrated in Figure 1.1

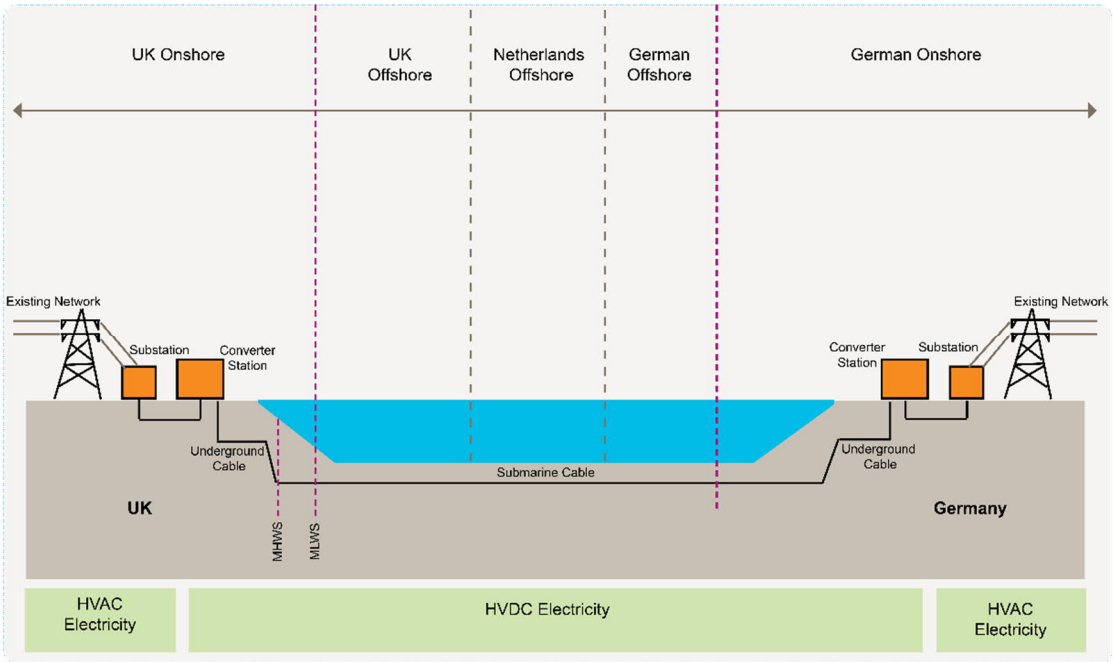

Figure 1-1: Overview of NeuConnect Project

The GB Onshore Scheme

1.4 In Great Britain the onshore components of the Project (the 'GB Onshore Scheme') extend as far as Mean Low Water Springs (MLWS). This Environmental Statement assesses the likely significant environmental effects of the GB Onshore Scheme only. A separate Environmental Statement assesses the likely significant environmental effects of the GB Offshore Scheme. Environmental reports will also accompany permit applications within Dutch and German jurisdictions.

1.5 The GB Onshore Scheme will comprise the following main elements extending as far as MLWS:

- Cable sealing end compound within a fenced compound occupying an area of approximately 1,600 square metres (m^2) or 0.16 hectares (ha).
- Substation within a fenced compound occupying an area of approx. 6,400 m^2 or 0.64 ha. The substation will comprise a single building and some outdoor electrical equipment, and an internal road will allow access to equipment within the compound.
- Approximately 50 metre (m) long AC cable route from the substation to the converter station. The AC cable may be either underground or above ground.
- Converter station within a fenced compound occupying an area of approximately 62,500 m^2 or 6.25 ha. The converter station will comprise buildings and some outdoor electrical equipment, as well as internal roads around the buildings/ equipment.
- An approximate 1,550 m long underground DC cable route from the converter station to the landfall point.
- At the point of landfall, there will be a Transition Joint Pit (TJP), where underground and subsea DC cables are joined together (subsea cable are slightly larger than underground cables due to additional protective armouring).
- From the TJP and across the intertidal zone subsea DC cables will be installed in buried ducts for a distance of approximately 1,700 m.
- Access to the GB Onshore Scheme will be taken from the existing junction on the B2001/ Grain Road. The existing junction will be improved and a new approximately 850 m long permanent access road will be constructed. This will provide access to the proposed converter station and substation compounds and the cable sealing end compound.

- On the southern and western boundaries of the GB Onshore Scheme, boundary planting is proposed to better integrate the proposed converter station and substation buildings in to the existing landscape. These boundaries are comprised of native species which will also increase biodiversity and help screen or soften some views of the GB Onshore Scheme from viewpoints in the vicinity.

1.6 To connect the Project to the electricity transmission system there will be modifications required to the existing overhead line (OHL) which runs roughly east to west across the Isle of Grain. These works will be the responsibility of NGET and are not the subject of this application. The works are not yet confirmed and will be subject to detailed design, however they are likely to include:

- A new 50 m tall lattice tower immediately north of the proposed substation;
- Down leads from the new tower to the proposed substation;
- Down leads from the new tower to the proposed cable sealing end compound;
- Approximately 200 m long underground AC cable route between the proposed cable sealing end compound and the proposed substation (together the "Substation to New OHL Tower Connection"); and
- A temporary diversion of the existing OHL may also be required to accommodate the construction of a new tower on the existing route (the "Temporary OHL Diversion") (together the "OHL Works").

1.7 These works do not form part of the GB Onshore Scheme, but are subject to cumulative assessment as part of this environmental assessment.

Need for the Project

1.8 Electricity interconnectors play a key role in supporting Great Britain and Europe's transition away from existing fossil fuel-driven power generation by allowing additional generation capacity to be imported overseas and exported according to supply and demand.

1.9 By connecting two of Europe's largest energy markets for the first time, the Project will offer a more diverse and sustainable electricity supply, offering much needed resilience, security and flexibility in Great Britain and Germany. Increased competition in Great Britain's market could also lead to lower costs for consumers and businesses, while in Germany the new link will help reduce 'bottlenecks' by opening up an important new market for excess renewable energy to be exported to.

1.10 The development of the Project provides benefits for both Great Britain and Germany helping to meet national and European objectives:

- Affordability: NeuConnect will connect electricity networks in Great Britain and Germany and in turn connect both countries to the wider European electricity market. This should stimulate competition in electricity markets through cross border trade in electricity and shared use of the cheapest or optimal generation sources and help put pressure on wholesale electricity prices in both Britain and Germany. NeuConnect will benefit both countries by increasing the market for electricity generators (i.e. providing access to larger pool of consumers) and by providing consumers with more affordable electricity (i.e. providing access to a larger pool of suppliers).
- Security of supply: Interconnection provides access to a wide range of electricity generation sources. It is a means to import or bring in extra electricity when not enough is being generated to meet demand at that time or when there is a surplus it is a means to export electricity to where demand is greater. This increases energy continuity and security if demand rises or electricity generation falls suddenly in one country. It can also act as an important balancing tool helping to improve the stability of the British and German electricity transmission systems.
- Sustainability: Interconnectors are an important means to help manage the fact that electricity cannot be stored efficiently at a large scale and not all electricity sources can generate consistently and predictably. With the increasing utilisation of renewable energy

such as wind, generation often outweighs demand, and likewise does not always generate regionally when required. Interconnectors are therefore used to provide a means to transfer surplus energy between countries when too much is generated at once to be used domestically. This helps to balance out the intermittency of renewable generation. This should make a significant contribution in the continuing transition to a net zero carbon economy in Great Britain, Germany and Europe by helping with the challenge of integrating low carbon and renewable sources of electricity and retiring fossil fuel and nuclear plants.

1.11 It is noted that within the draft UK National Energy and Climate Plan the UK Government confirmed its commitment to the support and utilisation of interconnectors for their benefit in the "diversification of energy sources" and "increasing the resilience if regional and national energy systems".

The Applicant

1.12 The Project is being developed by NeuConnect Britain Limited (the Applicant). The Applicant is an international consortium comprised of Meridiam Infrastructure SAS, Allianz Capital Partners on behalf of Allianz Group and Kansai Electric Power, with the Project also supported by Greenage Power and Frontier Power. In August 2018 the Applicant was granted a UK Interconnector Licence by regulators the Office of Gas and Electricity Markets (OFGEM).

Consents Required for NeuConnect

1.13 As noted previously, the works required for the GB Onshore Scheme extend from the connection point at the proposed substation to MLWS and therefore are located entirely within Medway Council's administrative area. The Applicant will be seeking planning permission from Medway Council under the Town and Country Planning Act 1990 for the entire GB Onshore Scheme. It is noted that for the subsea DC cable, the Applicant will be seeking a marine licence from the Marine Management Organisation (MMO) to lay the DC cables between Mean High Water Springs (MHWS) and the boundary between Great British and Dutch territorial waters.

Table 1.1: Consents Required for NeuConnect

Scheme	Component	Consent(s) required
GB Onshore Scheme	Converter station, substation (inc. AC cable), cable sealing end compound, and DC cable to MLWS, new permanent access track and landscaping.	Town and Country Planning Act 1990
GB Offshore Scheme	Cables (DC cable MHWS to median line)	Marine and Coastal Access Act 2009 (as amended in 2011)
Netherlands (NL) Offshore Scheme	Cables (DC cable median line to median line)	Water Act
		Nature Conservation Act
Germany (DE) Offshore Scheme	Cables (DC cable from median line to coastal sea)	Federal Mining Law Bundesbergbaugesetz (BBerG)
		State Office for Mining, Energy and Geology (LBEG)
Germany (DE) Onshore Scheme	Cables (DC cable from coastal sea to converter station and	Energy Economy Law Energiewirtschaftsgesetz (EnWG)
		Federal Immission Control Act

Scheme	Component	Consent(s) required
	AC cable to substation) and converter station	Bundesimmissionsschutzgesetz (BImSchG)

Requirement for EIA

Underground AC and DC Cables, Converter Station, Substation and Cable Sealing End Compound

1.14 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (EIA Regulations) apply to applications for planning permission made under the Town and Country Planning Act 1990. It sets out two schedules of development (which are derived from Annex I and II of the amended EU 2011/92/EU (the 'Directive') on the assessment of the effects of certain public and private projects on the environment):

- Schedule 1 Development: EIA is mandatory for developments of a type referred to in Schedule 1. Such developments are considered to be “EIA development”.
- Schedule 2 Development: EIA is not mandatory for developments of a type referred to in Schedule 2. Such developments may be “EIA development” only where they are considered likely to have significant effects on the environment by virtue of factors such as their nature, size or location.

1.15 There is no reference to interconnector projects or the components they comprise (e.g. converter stations, underground or submarine cables) in Schedule 1 of the EIA Regulations. Therefore EIA is not mandatory for the GB Onshore Scheme as per the EIA Regulations. Similarly there is no reference to interconnector projects or the components that they comprise (e.g. converter stations, underground or submarine cables) in Schedule 2 of the EIA Regulations.

1.16 A request for an EIA Screening Opinion (MC/18/3363) was submitted to Medway Council on the 20th November 2018 which provided an outline assessment of the likely significant environmental effects of the GB Onshore Scheme, and a proposed scope of assessment. In Medway Council’s response dated the 20th December 2018 it was stated that an EIA would be required for any subsequent planning application on account of the proposal to install the DC cable within the ecologically-sensitive intertidal zone. A copy of Medway Council’s opinion is contained in Appendix 3.1. Simultaneous scoping of technical assessments was also undertaken during consultation with Medway Council and responsible authorities, summaries of consultation are provided within the specialist technical assessment chapters where relevant.

OHL Works

1.17 To facilitate the connection of the interconnector to the electricity transmission system, modifications to the existing OHL will be required. Whilst the exact modification works are not yet confirmed and will be subject to detailed design, they are likely to include:

- A new 50 m tall lattice tower immediately north of the proposed substation;
- Down leads from the new tower to the proposed substation;
- Down leads from the new tower to the proposed cable sealing end compound;
- Approximately 200 m long underground AC cable route between the proposed cable sealing end compound and the proposed substation (together the Substation to New OHL Tower Connection Works); and
- A temporary diversion of the existing OHL may also be required to accommodate the construction of a new tower on the existing route (the Temporary OHL Diversion) (together the OHL Works).

1.18 These works do not form part of the GB Onshore Scheme but are subject to cumulative assessment as part of this environmental assessment.

The Environmental Statement

Scope of the Environmental Impact Assessment

1.19 As part of the screening opinion request and subsequent discussions with Medway Council, the proposed scope of the EIA was discussed. The specialist's assessments included within the EIA are those relevant to the existing environment, sensitive receptors within the vicinity of the GB Onshore Scheme and the potential for the GB Onshore Scheme to result in likely significant environmental effects.

1.20 A detailed assessment of potential impacts to air quality have been scoped out of the EIA from the Scoping process, on account of the negligible emissions from the GB Onshore Scheme during operation. Other assessments that are not directly covered in individual assessments include human health and climate change, as the pertinent aspects of these assessments are covered elsewhere in the EIA.

1.21 Potential impacts to human health as a result of the GB Onshore Scheme are considered to be assessed in the noise assessment (Chapter 7), and the generation of electric and magnetic fields (EMF) from the Project are outlined in Chapter 3. Potential impacts to the GB Onshore Scheme from the effects of climate change, and the GB Onshore Scheme's potential to contribute to factors causing climate change are determined to be highly limited. The control and management of increased runoff and higher intensity runoff from greater precipitation, as well as the GB Onshore Scheme's potential contribution to extending existing areas of potential flood risk are all assessed in the flood risk assessment.

This Environmental Statement

1.22 The structure of the ES is set out below in Table 1.2. It comprises four volumes:

- Volume 1 - Non-Technical Summary. This is intended to be readily accessible to the general public. It is concise and written in non-technical language providing a description of NeuConnect, in particular the GB Onshore Scheme and a summary of the assessment of likely significant environmental effects and proposed mitigation measures.
- Volume 2 - Main Report. This comprises the main text including a description of the Scheme (including the alternatives considered), the baseline conditions, an assessment of the likely significant environmental effects resulting from the GB Onshore Scheme, and proposed measures to mitigate those effects.
- Volume 3 - Figures. This comprises supporting figures, plans and other illustrations or visualisations which are cross referenced throughout Volume 2.
- Volume 4 - Technical Appendices. This comprises the supporting technical information such as baseline surveys which are cross referenced throughout Volume 2.

Table 1.2: Environmental Statement Structure

Volume	Chapter No.	Chapter Title
Volume 1.	**Non Technical Summary**	
Volume 2.	**Main Report**	
	01	Introduction
	02	Alternatives and Design Evolution
	03	Proposed GB Onshore Scheme
	04	Approach to Assessment
	05	Landscape & Visual Amenity

Volume	Chapter No.	Chapter Title
	06	Ecology & Nature Conservation
	07	Noise & Vibration
	08	Archaeology & Cultural Heritage
	09	Water Resources & Flood Risk
	10	Transport & Access
	11	Ground Conditions
	12	Cumulative Assessment
	13	Schedule of Mitigation
Volume 3.	**Figures**	
Volume 4.	**Technical Appendices**	

Other Supporting Documents

1.23 Further to the ES, other documents have been prepared and submitted to Medway Council in respect of the Applicant's planning application including:

- Planning application drawings
- Planning Statement
- Design and Access Statement
- Habitat Regulation Assessment Report

Availability of the Environmental Statement

1.24 Hard copies of the ES are available to the public for viewing in the offices of Medway Council. Copies of the ES can also be downloaded from the project website: https://neuconnect.eu/

1.25 Further information about the Project can be requested by email (neuconnect@communityfeedback.co.uk) or by telephone (0800 298 7040).

2. Alternatives and Design Evolution

Introduction

2.1 This chapter describes the evolution of the Great Britain (GB) Onshore Scheme design, including the selection of the proposed technology, alternatives that have been considered and rationale for selection of the proposed site. Details of subsea cable route selection within British, Dutch and German waters as well as the identification of the onshore components in Germany are described within the reports which accompany consent applications in those jurisdictions.

Strategic Alternatives

The Do-Nothing Scenario

2.2 The 'do nothing' option considers a scenario in which NeuConnect is not developed. There would be no interconnection between the British and German electricity transmission systems and therefore no export and / or import of electricity between the two countries. In this scenario the contribution that NeuConnect makes to the European Union's (EU) interconnection targets of 10% by 2020 and 15% by 2030 as set out in the 2030 climate and energy framework would not be realised. Further to this the wider benefits of increased interconnection as means for addressing energy security, sustainability and affordability would also not be realised.

The Do-Something Scenario

2.3 A range of specialist studies have been undertaken by NeuConnect Britain Limited which confirm the feasibility of the 'do something' option. Following this consideration has been given to the identification of the Project and alternatives including:

- Selection of the most appropriate electricity transmission technology,
- Identification of connection points to British and German electricity transmission systems,
- Selection of the proposed converter station sites in Britain and Germany,
- Selection of the proposed underground cable routes in Britain and Germany, and
- Selection of the proposed subsea cable route through British, Dutch and German waters.

2.4 The following sections of this chapter describe the selection of the proposed electricity transmission technology and selection of the proposed converter station site and underground cable route in GB. As noted above information on alternatives in relation to other jurisdictions is set out in the relevant consent applications.

Selection of the Proposed Technology

Transmission Technology

2.5 In order to connect the British and German electricity transmission systems, a subsea cable approximately 700 km long is required. It is more efficient to use High Voltage Direct Current (HVDC) technology to transmit electricity between the two countries, rather than High Voltage Alternating Current (HVAC) due to the physical distance involved.

2.6 At longer distances HVDC technology is more efficient as it can transmit larger volumes of electricity with less losses than an equivalent HVAC system. In addition to this, the existing electricity transmission systems in both countries are not synchronised. This means that they operate at different frequencies which would prevent direct HVAC interconnection.

2.7 HVDC systems also only require two cables whereas equivalent HVAC systems need multiples of three cables (i.e. one cable per phase) to accommodate the volume of electricity being transmitted. The physical footprint of a HVDC system in the is therefore smaller than an equivalent HVAC system.

2.8 Further for high voltage AC submarine cables exceeding 70 km in length, the associated reactive power created would reduce the capability of the system to transmit power efficiently. This can be overcome in the terrestrial environment by the use of intermediate shunt compensation reactors (SCRs), however, it would be impractical to install and operate these in the marine environment. Consequently, the Applicant considers that HVDC technology is the most efficient choice for the Project.

HVDC Conversion Technology

2.9 As the existing high voltage electricity networks in Great Britain and Germany predominantly use HVAC technology, converter stations are required at each 'end' of the interconnector in order to convert electricity from HVDC into HVAC or HVAC into HVDC. There are two conversion technologies currently available that could meet the requirements of NeuConnect. These are self-commutated voltage source conversion (VSC) and line-commutated current source conversion (CSC) technologies.

2.10 The Applicant has selected VSC technology for the Project. The main benefits of this technology are its ability to control reactive and active power independently of each other, and as a result keep both the voltage and frequency stable. In addition, VSC technology would allow for a more compact converter station design and layout thereby reducing the operational land take required compared to a converter station using CSC technology.

Selection of the Connection Point

2.11 The selection of a connection point, the point on the electricity transmission system in Great Britain where the Project is connected (e.g. where electricity is either imported to or exported from), was a key early consideration. The selection of the connection point was undertaken by the Applicant in conjunction with the National Grid Electricity System Operator (ESO) and National Grid Electricity Transmission (NGET) as part of the ESO's Connection Infrastructure Options Note (CION) process. The Applicant, the ESO and NGET have a number of statutory obligations under the terms of their interconnector and electricity transmission licences respectively. This means that the parties must balance technical, economic and environmental considerations in identifying the most appropriate connection point. This section provides a high-level summary of how the proposed connection point was identified.

2.12 The feasibility of connecting to the existing Grain 400 kV Substation was considered. NGET identified that this would trigger a six-bay extension of the existing substation requiring additional land as well as a diversion of the existing Medway Power Station overhead line. It was also noted that connection of further interconnectors to Grain Substation could impact the operation of the network. On that basis it was concluded that the use of the existing Grain Substation was neither economic nor efficient.

2.13 Whilst the existing Grain Substation was not considered feasible, the electricity transmission network at Grain has sufficient capacity to accommodate the import or export of power via the Project. NGET and the ESO therefore considered the development of a new 400 kV substation on the Isle of Grain which would enable connection to the existing electricity network. By co-locating the substation and the converter station it would provide a more economic and efficient solution by:

- Reducing the length of underground cable or overhead line which could be required to connect the converter station and the substation, and
- Minimising the footprint of the converter station as far as possible; at greater distances from the connection point additional specialist equipment would be required to make up for power losses.

2.14 On that basis, the development of a new substation was identified as the most feasible solution.

Approach to Site Selection and Design

Site Selection

2.15 Selection of a site requires consideration of a number of environmental, technical and economic factors and attempting to balance these. The Applicant's objective in identifying the proposed site has been to select a site which best balances these; that is one which is technically feasible, economically efficient and reduces environmental impacts as far as possible. Key factors which have influenced site selection include:

- Land availability: the availability of land to accommodate the footprint of the development.
- Electricity network: the proximity of the site to the existing electricity transmission system.
- Accessibility: the proximity of the site to the road network.
- Existing land use: the current use of the site and adjacent areas.
- Settlement: the proximity of the site to residents and potential for noise and visual effects.
- Landscape character: the character of Grain and ability to accommodate the development.
- Ecological impact: the proximity to ecological sites and potential to affect these.
- Archaeological impact: the proximity to archaeological sites and potential to affect these.
- Ground conditions: the underlying ground and risk of encountering contamination.
- Flood risk: the location of the site with respect to areas of known flood risk.
- Underground and subsea cable routes: the feasibility of routes to or from the site.
- Planning policy: the presence of any relevant planning policy allocations.

2.16 For the purposes of site selection there are a number of constraints or features (see Figure 2.1) that help to establish the extent of a search area in which to consider potential site options. In particular, this includes:

- Thames Estuary and Marshes and Medway Estuary and Marshes Special Protection Areas (SPAs): These sites occupy significant sections of the coastline of Isle of Grain but also extend across the peninsula. The parts of the SPAs which extend across the peninsula define the western extent of the search area for potential sites. It was concluded that sites should not be located within the SPAs in order to prevent permanent habitat loss but noted that underground cable routes would require to cross them resulting in some temporary impacts.
- The existing 400 kV overhead line (OHL): This crosses the Isle of Grain in a broadly east-west direction. Land to the north mainly comprises undeveloped coastal land as well as settlement such as Grain Village and individual properties. As a result it was concluded that land to the north of the OHL was not suitable for potential sites. Land to the south of the overhead line mainly comprises large scale industrial development such as Grain Liquified Natural Gas (LNG) Terminal or brownfield land such as the former Grain Power Station site. This does provide opportunities for siting the development and in general terms is likely to be less environmentally impacting.
- The River Medway: this forms the boundary eastern and southern extent of the Isle of Grain. The River Medway is a key shipping channel for vessels accessing the Grain LNG Terminal as well as London Thamesport Container Facilities. The volume of shipping traffic transiting the River Medway adjacent to the Isle of Grain, as well as existing and planned cables in this area are key considerations in the routeing of subsea HVDC cables. This exerts an influence on site selection as it is preferable to minimise the distance between where the subsea cable route reaches land and where the development is sited.

2.17 The potential for a site within or adjacent to the former Grain Power Station site was considered but discounted due to a combination of onshore and offshore issues. Whilst it would benefit from being within an area characterised by industrial development and which is well served by the existing road network, it is constrained by the feasibility of HVDC and HVAC routes to and from the site. The HVDC route would be required to enter the River Medway in order to make landfall on the east side of the Isle of Grain. As noted above the River Medway is a key navigation channel. In combination with the potential impact on shipping the proximity to a number of other existing and planned subsea cables a landfall on the eastern side of the peninsula was discounted.

2.18 Based on an initial review of the environmental and planning related constraints it is recommended that the converter station and substation are located to the west of the Project Area as illustrated on Figure 2.2. In this area they would be outside of the land which has been used for landfill reducing the risk of encountering contaminated land and it also maximises the distance from Grain. Land to the east could be used to extend existing woodland planting on the western boundary of Grain and provide further screening of the converter station and substation. Dependent on technical requirements it would be preferable to locate both the converter station and substation to the south of the OHL as this defines a boundary for the extent of industrial development.

Site Design

2.19 The layout of the GB Onshore Scheme within the Project Area has been developed as part of an iterative process with the EIA, specifically in regards to the potential adverse impacts on landscape and visual amenity and noise.

2.20 The proposed converter station and substation have been collocated south of the existing OHL, to best 'fit' the GB Onshore Scheme within the existing land use, with the heavy industry located to the south. This also presents benefits technically, and limits the potential extent of impacts by reducing the need for further disturbance from longer AC cable connections between the proposed converter station and the substation.

2.21 The existing landform in this location slopes towards the northwest, and the development of a level platform for the proposed converter station will allow for the built form to be 'sunk' in to the existing landscape, and the development of the landscape mitigation further phases the proposed converter station in to the landscape whilst screening potential views from the east.

2.22 The permanent access track will include a new junction to the B2001/ Grain Road at the south-eastern corner of the Project Area. This location was selected to avoid the need for the majority of the construction vehicles to pass residences on the B2001 on the edge of Grain village. This will also prevent any additional vehicles required for operations and maintenance of the proposed converter station and substation needing to enter Grain. The point of access is also on the outside of a bend in the existing network allowing for clear line of sight in both directions for vehicles exiting the Project Area.

2.23 Further information on the design of the site layout is contained in the Design and Access Statement which accompanies the planning application.

Underground Cable Route Selection

2.24 With regard to the DC underground cable route the majority of constraints are north of West Lane and include residential properties to the east and west, historic landfills (extent of contamination) and the ecological designations in the intertidal area. It is preferable for the route to broadly follow the unnamed track from West Lane to the coast. This provides a separation distance from Rose Court Farm and keeps the route to the west of Grain using existing woodland/ scrub as a screen. A number of alternative routes were considered in the identification of the preferred route, as illustrated in Figure 2.3. these predominantly varied between West Lane and the proposed converter station.

2.25 In order to avoid the capped landfill to the northeast of the proposed converter station site, the preferred DC cable route crosses West Lane at the existing culvert and then follows the existing hardstanding track on the eastern boundary of the capped landfill site. The use of the existing culvert will also minimise the disruption to West Lane during installation.

2.26 The precise route is subject to detailed design and should be informed by Ground Investigation (GI) in order to ensure care is taken to avoid/ minimise contact with areas of contamination associated with the historic landfills. In the intertidal area it is not possible to avoid the designated sites, however, these are designated for their bird interests (breeding and wintering) and not habitat features.

Conclusion

2.27 The Applicant has given consideration to a range of alternatives in identifying the proposed site of the GB Onshore Scheme. This has included consideration of a range of technical, economic and environmental factors in line with their interconnector licence. As a result of this analysis it was concluded that the development of a converter station and substation on land to the south west of Grain Village (see Figure 2.2) adjacent to the existing 400 kV OHL best balances the Applicant's obligations under the terms of their interconnector licence whilst also taking account of the ESO's and NGET's obligations under the terms of their electricity transmission licence. That is, the proposed site is technically feasible, economically efficient and prevents or reduces adverse environmental effects as far as possible.

3. Project Description

Introduction

3.1 This chapter describes the GB Onshore Scheme comprising all elements above Mean Low Water Springs (MLWS). This includes a proposed substation and cable sealing end compound to connect to the existing electricity network, a proposed converter station including the proposed Direct Current (DC) cable route, which runs from the converter station to the landfall point, and through the intertidal area to MLWS (overlapping with the subsea DC cable between Mean High Water Springs (MHWS) and MLWS), and a new access track from the B2001/ Grain Road to access both the converter station and substation.

3.2 This chapter provides details of:

- Construction: Provides details of the construction of the proposed converter station and substation including an indicative construction programme, description of the main construction works and indicative details of the site office, storage and laydown areas.
- Operation: Describes the main components of the proposed converter station and substation including information about its design and appearance, operation and maintenance as well as details of the permanent site access arrangements.
- Decommissioning: provides details of the likely activities which would be undertaken at the end of NeuConnect's (the Project's) operational life should the Applicant decommission the GB Onshore Scheme.

The GB Onshore Scheme

General Overview

3.3 The GB Onshore Scheme will be entirely within the Project Area (the application boundary, as illustrated on Figure 3.1) which will be under the ownership or control of the Applicant prior to the commencement of construction.

3.4 The GB Onshore Scheme will comprise the following main elements extending as far as MLWS:

- Cable sealing end compound within a fenced compound occupying an area of approximately 1,600 square metres (m^2) or 0.16 hectares (ha).
- Substation within a fenced compound occupying an area of approx. 6,400 m^2 or 0.64 ha. The substation will comprise a single building and some outdoor electrical equipment, and an internal road will allow access to equipment within the compound.
- Approximately 50 metre (m) long AC cable route from the substation to the converter station. The AC cable may be either underground or above ground.
- Converter station within a fenced compound occupying an area of approximately 62,500 m^2 or 6.25 ha. The converter station will comprise buildings and some outdoor electrical equipment, as well as internal roads around the buildings/ equipment.
- Access to the GB Onshore Scheme will be taken from the existing junction on the B2001/ Grain Road. The existing junction will be improved and a new approximately 850 m long permanent access road will be constructed. This provide access to the proposed converter station and substation compounds and to the cable sealing end compound.
- An approximate 1,550 m long underground DC cable route from the converter station to the landfall point.
- At the point of landfall, there will be a Transition Joint Pit (TJP), where underground and subsea DC cables are joined together (subsea cable are slightly larger than underground cables due to additional protective armouring).

- From the TJP and across the intertidal zone subsea DC cables will be installed in buried ducts for a distance of approximately 1,700 m.

Site Description

3.5 The study area is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The study area is located to the west of the settlement of Grain, as illustrated on Figure 3.1. Land use comprises a mix of industrial development to the south, the small settlement of Grain to the southeast and undeveloped land, much of which is designated for ecological interests, to the north (along the coastline) and to the west. There are also some small areas of brownfield or derelict land and some small areas of agricultural land (some of these coincide with brownfield land). The existing 400 kilovolt (kV) overhead line (OHL) which is broadly routed east to west generally marks the boundary between the extent of industrial or brownfield land and settlement or undeveloped coastal land. The only road access to the peninsula is from the B2001/ Grain Road.

3.6 The GB Onshore Scheme, as shown on Figure 3.2, is located on the fringes of industrial land (this is based on the existing 400 kV OHL defining the extent of industrial land) and extends north/ northeast to the coast. Land within the Project Area and in the immediate vicinity is either in agricultural use or is brownfield land which has no current discernible use. The Project Area is located approximately 0.5 km to the west of Grain, the main settlement, however, there are individual unnamed properties in the centre of and to the west (Rose Court Farm) of the Project Area. An existing access track is located within Project Area between Grain Road and centre of the Project Area (west of the proposed substation). West Lane also crosses the proposed DC cable route in a broadly east-west direction which is a private road to properties to the west of the Project Area and is also part of Natural England's proposed England Coast Path: Grain to Woolwich.

3.7 Land within the Project Area and in the immediate vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill. Historic landfills have been capped however an existing permitted leachate monitoring system still operates from the historic landfill (to the east of Perry's Farm) to the pond (to the northeast of Rose Court Farm).

Consents Required

3.8 Outline planning permission is being sought from Medway Council under the Town and Country Planning Act 1990 (TCPA) for the following components:

- The proposed cable sealing end compound,
- Proposed AC cables,
- Proposed substation,
- Proposed converter station,
- Proposed underground DC cables, and
- Proposed new permanent access track.

3.9 The detailed design of the GB Onshore Scheme is subject to the Applicant's selection of a Contractor, following a competitive tender process. The outline design as described within this Chapter has been developed for the purposes of seeking outline planning permission. This outline design establishes the maximum parameters and principals of the GB Onshore Scheme within which the Contractor's detailed design will be developed and constructed. It is therefore intended that details on the layout and appearance of the GB Onshore Scheme will be agreed with Medway Council post-application as part of reserved matters application.

3.10 The proposed modifications to the existing overhead line, the down leads from the tower to the proposed substation and cable sealing end compound, and the proposed underground cables between the proposed cable sealing end compound and the proposed substation will be undertaken by National Grid Electricity Transmission (NGET, hereafter referred to as 'National Grid'). It is hoped that these works are to be undertaken under National Grid's permitted

development rights under Class B(a) or Part 15 of Schedule 2 of The Town and Country Planning (General Permitted Development) (England) Order 2019 (the 'GPDO'). However if subject to detailed design, consent is required for the OHL works under Section 37 of the Electricity Act 1989 such permitted development rights may not be relevant.

The Proposed Converter Station and Substation

General Overview

3.11 The application boundary, or Project Area, is illustrated on Figure 3.1. The Project Area includes all land necessary to accommodate all of the proposed components of the GB Onshore Scheme as well as the land required to facilitate construction, and the proposed mitigation and landscaping. The Project Area covers an area of approximately 68 ha.

3.12 From the point of connection to the NETS via the existing OHL, is the proposed substation located adjacent to the previous landfill site (to the east) and south of the existing OHL. The proposed substation compound will occupy an area of approximately 0.64 ha. The proposed substation will connect directly to the proposed converter station via up to six proposed AC cables across the boundary between the two components. To the north of the proposed substation will be a cable sealing end compound, which will facilitate the connection of one of two circuits from the existing OHL to the proposed substation.

3.13 The proposed converter station will convert electricity from DC to AC (or vice versa depending on the direction of operation of the interconnector) and will therefore be connected to both the AC and DC cables. Immediately adjacent to the proposed converter station and substation platforms are two construction laydown areas which will be utilised by the Contractor on site for offices, welfare facilities, and material and plant storage.

3.14 Along the southern boundary of the Project Area is the proposed access track, which will allow access to the proposed converter station, proposed substation and proposed cable sealing end compound. The existing junction to the B2001/ Grain Road will be widened and improved to allow safe access to and from the Project Area.

3.15 To the north of the proposed cable sealing end compound, is the proposed attenuation basin which is incorporated within the wider landscaping plan of the Project Area. The attenuation basin will provide storage of surface water from the new platforms of the converter station and substation which require the reprofiling of the area to accommodate the GB Onshore Scheme. The attenuation basin is connected to the drainage of the platforms via a swale that extends down the western side of the Project Area. The swale also offers a boundary between the infrastructure of the GB Onshore Scheme and the landscaping to the west and south of the Project Area. The landscaping has been designed to help phase the perceived scale of the proposed converter station and substation buildings and also soften the boundary between the open marshes and the GB Onshore Scheme, whilst also providing greater biodiversity to the area from the inclusion of a variety of native plant species.

Proposed Converter Station - Outline Design

3.16 Converter stations are key parts of DC electricity systems. They convert electricity from AC to DC, or vice versa, depending on the direction of operation of the interconnector.

3.17 The footprint of the proposed converter station at Grain is expected to be up to approximately 250 m by 250 m (to the perimeter security fence). This area will comprise specialist electrical equipment, most of which will be located indoors in one or two building units in order to provide protection from the increased levels of salinity of the air. The building units will range in height according to the electrical equipment they contain including required safety clearances up to a maximum building height of up to 26 m. There will be a 2 m exclusion zone around the perimeter fencing.

3.18 The building units which make up the proposed converter station will be constructed to a similar specification to one another. Whilst their exact appearance is subject to detailed design the

cladding of the building units will utilise similar colours and materials to those used on developments in the immediate vicinity as this will help to effectively integrate the converter station with its surroundings.

A description of the main components of the proposed converter station is provided in Table 3.1.

Table 3.1: Proposed Converter Station – Key Components

Component	Description
Converter station	The converter station will include specialist electrical equipment to convert DC electricity to AC electricity, and vice versa. The converter station will be located on a hardstanding platform measuring 250 m by 250 m.
DC switch hall	This contains the termination of the DC onshore underground cables together with HVDC switchgear (specialist DC electrical equipment) to connect these to the power electronics. This equipment will be enclosed in a building up to 26 m high.
Valve halls and AC ancillary equipment	This contains high voltage power electronics equipment that converts electricity from DC to AC and vice-versa. This is located indoors in buildings up to 26 m high. It also contains specialist equipment to control the environmental conditions within the building.
Control building	This contains control panels and associated operator stations for operating the converter station as well as protection and communication equipment. Offices, welfare facilities and other auxiliary systems are also located within the control building. Indicative dimensions – 40 m wide; 60 m long; 16 m high.
Cooling fans	This comprises external fan units located outside of the Valve Halls. The fans are used to cool down the valves. Power electronic valves may be cooled by water or glycol. Coolant is pumped through the fan units.
Transformers	These are normally located outdoors and change the AC voltage electricity between the voltage needed for transmission via the AC transmission system (the NETS) and the voltage needed to connect to the power electronic equipment for conversion from AC to DC within the Valve Halls. The transformers are separated by valve halls. The transformers will be approximately 16 m in height.
AC switchyard	This connects the proposed converter station to the NETS. It includes a range of electrical equipment which is likely to be located indoors including harmonic filtration and reactive power compensation equipment, circuit breakers, transformers, busbars, insulators and subject to detailed design shunt reactors. This building will be a maximum height of 26 m.
Diesel backup Generator	This would be used in the event of a failure of the low voltage electricity supply provided by the Distribution Network Operator (DNO).
Spare parts building	This building will house spare parts and components. Adjacent hardstanding areas provide storage for a spare transformer and spare cable drums. Indicative dimensions: 15 m wide; 40 m long; 14 m high.
Substation	The substation will include specialist electrical equipment that facilitates the transformation of electricity voltages, from high voltages (from the interconnector) to lower voltages as used on the electricity transmission network. This transformation can also work in the opposite direction as needed. The substation will be located on a hardstanding platform measuring 80 m by 80 m.
GIS Building	The gas insulated substation (GIS) building will be up to 14 m tall.

Component	Description
Gantry	A gantry will be required to facilitate the connection of the downleads between the new lattice tower and the substation and maintain safety separation distances. The gantry will be a simple structure which will be up to 14 m tall.

3.19 The layout of the buildings is subject to detailed design, however an indicative layout of a typical converter station is illustrated in Figure 3.3.

Proposed Gas Insulated Substation and Cable Sealing End Compound - Outline Design

3.20 Substations contain equipment which is necessary to connect high voltage transmission systems to electricity distribution systems which then distribute electricity across the network in typically lower voltages. This system can also be operated in reverse, to increase the voltage from domestic supply networks to a voltage more readily used by long distance, high voltage, links.

3.21 The footprint of the proposed substation is expected to be approximately 80 m by 80 m (to the perimeter security fence, and the boundary of the proposed converter station), as illustrated on Figure 3.2. The substation will comprise specialist electrical equipment which will be located within a single building unit. To accommodate the equipment and required safety clearances the building will have a maximum height of approximately 14 m. The electrical equipment will likely be enclosed for protection against corrosion from salinity in the air. The area will be surrounded by palisade security fencing.

3.22 As per the proposed converter station, the design and layout of the substation is subject to further design but will be done so in that the appearance will be in keeping with the existing industrial units in the area. The exact location of the substation within the identified substation platform (as per Figure 3.2) is subject to further design by National Grid who will operate the substation and will be agreed with Medway Council post application.

3.23 The substation will be connected to the existing OHL via a new tower immediately north of the proposed substation in the centre of the Project Area, and also via the proposed cable sealing end compound. A temporary diversion of the existing OHL may be required to facilitate the connection, and/ or modifications to the existing tower structure. The requirements for modification and/ or a temporary diversion is subject to further investigation by National Grid.

3.24 The proposed cable sealing end compound footprint will be approximately 40 m by 40 m and will also be enclosed within a security fence. The cable sealing end compound will include an approximately 14 m high gantry which will facilitate the safety separation for the electrical connection from the new tower. The downleads from the tower will connect onto the gantry and then the downdroppers will be connected to cable sealing ends within the compound. From here the AC cables will be undergrounded to connect to the proposed substation. As noted in Chapter 1 the cabling works from the new tower will be consented by NGET.

Design Mitigation Measures

3.25 The location of the proposed converter station and substation has been chosen so that they are located as far as reasonably practicable from surrounding residents and the settlement of Grain. This location also allowed the point of access for the site to be located prior to any residential properties in Grain limiting disruption from construction traffic.

3.26 The technology selection for both the proposed converter station, voltage source conversion (VSC), and the proposed substation, gas insulated substation (GIS), has allowed for a minimal footprint compared to the alternative options available (current source conversion (CSC) and air insulated substation (AIS), respectively).

3.27 The orientation of the site has been determined from review of the potential impact to surrounding residents from noise and visual amenity.

3.28 The design of the GB Onshore Scheme has been developed in parallel with the EIA providing opportunities to embed mitigation measures within the design. Mitigation measures have been incorporated into the design of the proposed converter station and substation and therefore form part of the planning application. These measures include:

- Landscape planting;
- Noise mitigation;
- A drainage strategy;
- Pollution prevention measures; and
- Ecological mitigation and enhancement.

3.29 The landscaping strategy included within the design is outlined in Figure 3.4.

3.30 Due consideration has been given to electric and magnetic fields (EMFs) produced by the proposed converter station and onshore high voltage DC. It is acknowledged that all equipment that generates, distributes or uses electricity produces EMFs. There is some scientific evidence of possible effects at lower levels, and the electricity industry takes this evidence seriously and recognises that it can generate public concern however the evidence has been extensively reviewed, and the UK Government have not considered it appropriate to implement any restrictions or guidelines on the basis of this evidence.

3.31 The GB Onshore Scheme uses both AC and DC technology, and will produce both static (DC) and alternating (AC) electric and magnetic fields will be produced. The GB Onshore Scheme will therefore be designed to ensure that it is compliant with International Commission on Non-Ionising Radiation Protection (ICNIRP) public exposure guidelines for EMFs outside the boundary fence, to avoid all established effects on the human population.

Construction of the Proposed Converter Station & Substation

Overview

3.32 Subject to outline planning permission being granted it is anticipated that construction will start in early 2021 and will take approximately three years to complete. An additional area, beyond the required area to accommodate the permanent footprint of the GB Onshore Scheme, of approximately 1.5 ha will be required for the converter station construction compound, laydown and storage areas, and 0.64 ha will be required for the substation construction compound and laydown area.

Construction Programme

3.33 Construction of the proposed converter station and substation is planned to begin in 2021 and is anticipated to last approximately three years. Construction of the proposed substation will take approximately one year, and will likely be programmed to be completed at the same time as the proposed converter station.

3.34 Construction works across this period will include following activities:

- Preparatory works including access road construction and site establishment;
- Civil construction works including earthworks, foundations and erection of buildings;
- Mechanical and electrical works including installation of AC and DC cables;
- Testing, commissioning and site reinstatement including landscape planting.

Construction Activities

3.35 Construction of the proposed converter station and proposed substation will be undertaken by the appointed Contractors. As the converter station and the substation will be owned and operated by different organisations (the Applicant, and NGET respectively), separate Contractors will be appointed for each.

3.36 Construction of the proposed converter station and the proposed substation will largely comprise similar outline activities as set out below:

- Preliminary works: This will include further site investigation and preconstruction surveys required to be undertaken in advance of construction. This will also include utilities diversions as necessary.
- Site establishment: This includes vegetation clearance, soil removal and establishment of all temporary facilities including site offices, lay down and storage areas and welfare facilities, development of electricity and water supplies, erection of security fencing or hoarding and implementation of external lighting for security.
- Earthworks: This will include land re-profiling in order to establish the level platforms on which the proposed converter station and proposed substation will be constructed.
- Civil engineering works: This will include construction of building foundations, development of the platforms' permanent drainage system and construction of internal roads and car parking arrangements.
- Building works: This will include the construction of building units including erection of steel frames and cladding.
- Cable installation: This will include the installation of the proposed DC cables entering the proposed converter station as well as proposed AC cables between the proposed converter station and the proposed substation.
- Provision/ installation of permanent services: This will include water supplies, foul drainage, low voltage electricity supply and telecommunications.
- Mechanical and electrical works: This will include installation of high voltage AC and DC electrical equipment and transformers within the proposed converter station.
- Commissioning: Following completion of all construction works there will be a period of commissioning and testing.
- Site Reinstatement & Landscape Works: This will include removal of site offices and temporary facilities, land reinstatement and landscape works

Construction Site Layout

3.37 The exact layout of the site will depend on the Contractors appointed to design and construct the proposed converter station and proposed substation.

3.38 There will be temporary construction areas; 1.5 ha for the converter laydown and 0.64 ha for the substation laydown. These temporary construction compounds will accommodate temporary construction facilities and include provision for:

- Site offices including offices and meeting rooms;
- Staff welfare facilities including portable chemical toilets, kitchen and mess room;
- Storage areas for construction vehicles, plant, equipment and other materials;
- Appropriately bunded areas to be used for the storage of oils and other fuels;
- Wheel washing to be used by construction vehicles and plant;
- Segregated waste management and storage areas;
- Car parking for construction staff and site visitors; and
- Rock crushing and concrete batching facilities.

Access Arrangements

3.39 The A228/ B2001 Grain Road is the only road access to the Isle of Grain. Access to the proposed converter station will be via the B2001 Grain Road from the development of a new access point and internal road, this will be the primary point of access during construction and operation of the GB Onshore Scheme. Temporary access for construction of the proposed DC cable route will also be taken from Grain Road from the Perry's Farm access track, as well as from West Lane further to the north which provides access to Rose Court Farm and Peat Way which may also be used for temporary and/ or permanent access.

Hours of Working

3.40 For the purposes of EIA it has been assumed that construction activities will in general be undertaken during daytime periods, Monday to Friday, with limited hours and restricted activities on Saturday morning. There may be some working activities which require out of hours working and/ or 24 hour working such as delivery of abnormal loads, during concrete pouring activities or works within buildings once they've been erected.

Staffing and Employment

3.41 The number of staff present on site will vary according to the construction phase and activities being undertaken. Due to the nature of the construction works it is likely that staff levels will be at their highest during the earthworks and civil engineering works, likely to be between 12 and 18 months from the start of construction, with up to 150 personnel on site at any one time. Staffing levels will generally decrease as construction is progressed through to the commissioning phase.

Site Environmental Management

3.42 During construction, the Contractor will be required to undertake all works in accordance with a Construction Environmental Management Plan (CEMP). As a minimum, the CEMP will implement the mitigation measures identified within this Environmental Statement. The CEMP will set out a variety of control measures for mitigating the potential environmental effects of construction works including control and management of noise, dust, surface water runoff, waste and pollution control.

3.43 The Contractor will employ an Environmental Clerk of Works (ECoW) who will be responsible for the implementation of the CEMP. The ECoW will be supported by environmental specialists such as ecologists or archaeologists as required.

Operation of the Proposed Converter Station & Substation

Overview

3.44 Following a period of commissioning and testing the proposed converter station will operate continuously throughout the year. Typically it will import electricity from Germany to Great Britain (e.g. convert electricity from DC (from the interconnector) to AC for onwards transmission), however, as noted above the interconnector is bi-directional and will export electricity when required. Whether it is importing electricity (converting DC to AC) or exporting electricity (converting AC to DC) will depend on supply and demand of and for electricity in Great Britain and Germany.

3.45 During ordinary operation the proposed converter station will be staffed by a small team on site. During regular maintenance and/ or repairs the number of personnel present on site would increase with the number of staff proportionate to the nature of the maintenance or repair works being undertaken.

3.46 The proposed converter station will be operated by the Applicant. The proposed substation will be operated by NGET. Each site will be fully enclosed by palisade security fencing, and access to the sites will be restricted to authorised personnel throughout operation.

Regular Maintenance

3.47 Maintenance works and inspections will be undertaken periodically during operation. Typically, this will require staff to access the site in cars and/ or vans. The frequency and duration of maintenance activities and safety checks will be dependent on the Contractor's recommendations for the equipment installed.

Unplanned Maintenance

3.48 In the event of a breakdown, corrective repairs would be required. These repairs could occur at any time and for this reason 24/7 access to the proposed site would be required for all vehicle types including HGVs and AILs. Dependent on the nature of the breakdown, temporary accommodation such as site offices may be required on site.

Staffing and Employment

3.49 The proposed converter station will be operated by a small team based on site with a minimum of two operators present at all times. During normal operation there will be approximately six personnel on site, divided between three shifts over a 24-hour period.

Emissions to Air, Water and Land

3.50 During general operation the proposed converter station will not generate significant emissions to air, water or land. Rainfall within the site will be collected, treated and drained via a drainage system.

3.51 Backup diesel generators will be present on the proposed site. These will only be operated in the event of a fault with the converter station's power supply, however, they will require to be regularly tested. Whilst operation of diesel backup generators will result in some emissions of Sulphur Oxide (SOx), Nitrogen Oxide (NOx) and Particulate Matter (PM) to air, these are considered to be negligible given the short-term duration they would be in operation.

3.52 Sulphur hexaflouride (SF6) will be utilised in the proposed converter station and the proposed substation for electrical insulation purposes. It is an extremely effective electrical insulator that has significant advantages over alternative materials. It is non-flammable, a critical requirement in the high-voltage applications for which it is used, and because of its effectiveness, takes up less volume than an equivalent insulating volume of an oil alternative. All SF6 insulated switchgear is fully tested in the factory by a gas leakage detector to ensure that as far as reasonably practicable there is no leakage from any of the components, however, during operation some minor leakage of trace amounts may occur.

Decommissioning of the Proposed Converter Station & Substation

3.53 The anticipated operational life of the proposed converter station is approximately 40 years. It is likely that during this period refurbishment and plant replacement will extend the life of the converter station rather than decommissioning taking place. In the event that NeuConnect ceases operation at the end of its operational life, the proposed converter station would be decommissioned.

3.54 The scale and nature of activities undertaken would be similar to those described previously for construction. The main components would be dismantled and removed for recycling wherever possible. Where this is not possible, disposal would be undertaken in accordance with the relevant waste disposal regulations at the time of decommissioning. Site foundations would be removed to a level agreed with Medway Council and reinstated to agricultural land.

3.55 The requirement to decommission the substation would depend on NGET's operational requirements, however, should this be decommissioned it would follow a similar approach to that outlined for the converter station.

The Proposed DC Cables

Overview of the Proposed DC Cable

3.56 From the proposed converter station, the proposed DC cable route extends east towards B2001/ Grain Road, it then extends north along the field boundary to West Lane, and after crossing West Lane follows the existing track (previously used for mineral extraction activities) to the point of landfall at the coast. There will be two DC cables installed within a single trench, as well as up to four fibre cables for monitoring of the cables. The total length of the DC cable route between the proposed converter station and the landfall location is approximately 1.6 km. The Project Area accounts for space to facilitate the installation of the proposed DC cables, as well as allowing construction vehicles passage along the DC cable route. There is also allowance for potential variations in the DC cable route should there be technical issues or constraints during installation.

3.57 At the landfall location there will be a buried TJP, which will allow connection of the underground and subsea DC cables. From the TJP the subsea cables will be installed under the seabed out to MLWS.

3.58 The total length of the proposed DC cable route between the proposed converter station and MLWS is approximately 3.2 km.

Proposed DC Cables Outline Design

3.59 There will be two DC cables which will be approximately 20 cm in diameter, and both DC cables will be laid within a single trench between the proposed converter station and the TJP at the landfall location. The cable trench will be approximately 1 m wide by 1.5 m deep. The DC cables may either be laid directly within the trench, or ducts will be laid and the cables pulled through the duct.

3.60 Whilst there are only two DC cables, within the DC cable trench there may be up to four DC ducts installed within the trench. The spare ducts allow for repair or replacement works to be undertaken in the event of a cable failure. Alongside the DC cables there will also be up to four fibre cables, a temperature sensor and an optic cable. A working corridor of up to 30 m, as illustrated on Figure 3.2, will be required for the installation of the DC underground cables. This corridor allows for the cable trench, excavated spoil storage and plant operation, as well as allowing for some deviation of the proposed DC cable route should there be any unfavourable ground conditions or environmental sensitivities encountered during detailed investigation and/ or construction.

3.61 At the landfall location where the onshore underground cable transitions to the subsea cable a TJP will be installed. The TJP is a buried concrete pad where the underground and subsea cables are connected and will have an indicative footprint of up to 75 m^2 as a worst case (dimensions approximately 15 m by 5 m). The exact location of the TJP is subject to detailed ground investigation.

3.62 From the TJP, the proposed DC cables will be installed underneath the seabed in ducts. Each of the four DC cable ducts from the TJP will be installed using horizontal directionally drilling (HDD) methods as far as technically feasible through the intertidal area. It is assumed for this assessment that the maximum distance achievable for HDD is 800 m. As each duct is drilled individually, there will be up to four breakout points within the intertidal area. From these breakout points in the mid-intertidal area out to MLWS the proposed DC cables will be installed in three separate trenches – one for each of the DC cables and a separate trench for the fibre optic cable. These trenches will extend approximately 800 m to MLWS and the boundary of the GB Onshore Scheme application.

Proposed DC Cable Route

3.63 As illustrated on Figure 3.2, from the proposed converter station the DC cable route extends to the east towards B2001/ Grain Road across the former mineral extraction site. Prior to the B2001/ Grain Road the DC cable route extends to the north along the boundary of the capped landfill site utilising an existing track to West Lane. The DC cable route will pass underneath

West Lane via an existing culvert, and continue north towards the point of landfall following the existing access track previously used for mineral extraction activities. Between the proposed converter station and the landfall location, the proposed DC cable route will be approximately 1.6 km to the landfall location.

3.64 At the landfall location the proposed DC cable route will connect to the TJP. From the TJP the proposed DC cables will then extend another approximately 1.6 km, directly across the intertidal area to MLWS (where the scheme continues as the GB Offshore Scheme).

Design Mitigation

3.65 The route of the proposed DC cable has been chosen so that the new infrastructure is located in areas of previously disturbed land as far as reasonably practicable, including the use of the existing culvert at West Lane to limit the requirement to disturb vegetation and ecological receptors in the area. The use of the culvert at West Lane also minimises disruption to vehicle and pedestrian users of the road.

3.66 The proposed DC cable route also avoids the potential disturbance of the existing landfill site and contaminated land, therefore minimising the risk of creating new pathways of the contaminated material to impact the surrounding environment and also construction staff.

3.67 The proposed DC cable route and the installation methods have been identified and developed in parallel with the EIA providing opportunities to embed mitigation measures within the design, namely for the avoidance of impacts during installation.

Installation of the Proposed DC Cables

3.68 The preferred method for installation of the proposed underground DC cables will be by buried, open cut trenches with thermal stable backfill (subject to the ground conditions and cable specifications). The cable trench will be approximately 1 m wide by 1.5 m deep. There will be approximately 0.6 m of stabilised backfill material, along with concrete slabs (plus warning tape) and approximately 0.9 m of top soil.

3.69 Alternative methods of installation are available, such as laying the cable in surface troughs and covering or capping these, which has the benefit of not disturbing any areas of potentially contaminated ground, such as the historic landfills. The installation method will be confirmed following detailed ground investigations. Whilst there are only two DC cables, within the DC cable trench there may be up to four DC ducts installed within the trench. The spare ducts allow for repair or replacement works to be undertaken in the event of a cable failure with minimal impact to the surrounding area.

3.70 A working corridor of up to 30 m will be required for the installation of the DC underground cables. This corridor allows for the cable trench, excavated spoil storage and plant operation. Access to the working corridor will be achieved via the main Project Area access location from the B2001/ Grain, and also from West Lane. The arrangements and requirement for construction compounds and site laydown areas will be determined following the appointment of the DC cable Contractor, however it is likely that offices and welfare facilities will be located at the construction laydown area adjacent to the proposed converter station, as well as a smaller compound and storage area located at the landfall location (see Figure 3.2).

3.71 The proposed DC cable from the TJP through the intertidal area will be installed in lengths of approximately 800 m. In between each length a joint bay will be required to join the lengths together. The joint bays will be similar in scale to the TJP, approximately 15 m by 5 m, and consist of a concrete slab for physically joining two lengths of cable together. The location of these and the number required is subject to detailed design, but for the purpose of the EIA it is assumed they are required every 800 m and therefore up to four will be required between the proposed converter station and MLWS as a worst case scenario. The joint bays will be accommodated within the working width.

Installation of the Proposed DC Cable Route from MHWS to the Mid-Shore Intertidal Area

3.72 Installation of the DC cable from the landfall will be by Horizontal Directional Drilling (HDD) techniques and installing ducts through which the subsea cable is pulled. The maximum length of HDD possible is approximately 800 m, and therefore will not extend beyond the MLWS (located approximately 1.6 km from the landfall location). The remaining length of subsea DC cable required to be installed through the intertidal area to MLWS will likely be undertaken using open cut or trenching techniques.

3.73 HDD is a technique commonly used to install ducts underneath sensitive features such as rivers, highways, sea defences, and dune systems whereby a hole is typically drilled under the sensitive features, to a point a suitable distance away. A duct is inserted into the drilled hole which is then used as the duct into which the cables are installed.

3.74 Depending on the size of the duct and the ground conditions encountered the drilling operations will take place in a series of stages:

- Drill initial pilot hole (approximately 250 mm in diameter).
- Increase the pilot hole to a larger diameter (up to approximately 750 mm) in stages using “reaming/ hole opening” techniques (an operation that may be repeated a number of times to suit the diameter of the duct).
- Install the duct into the hole produced for cable installations, a messenger (draw) wire is installed within the duct (for subsequent cable pull in operations) or may be blown in afterwards using compressed air.

3.75 HDD operations utilise drilling fluids and additives such as bentonite, to assist in maintaining the integrity of the drilled hole and to transport the cutting materials out of the hole as drilling progresses. The choice of drilling mud required will be selected by the Contractor on the basis of drilling performance and environmental constraints. The majority of drilling fluids are biodegradable and have no harmful effect on the surrounding environment. It is extremely unlikely that any drilling fluids will be discharged into the marine environment.

3.76 Drilling fluid and cuttings are tested during drilling for contamination and possible reuse or disposal after the work has been completed. The drilling mud and cuttings will be transported to an appropriate licensed waste disposal site. Only licensed waste carriers will be used for the transportation of any drilling fluids.

3.77 Drilling fluid breakouts that may occur from the end of the duct will be dealt with by containing the flow within a small bunded pit, likely to be adjacent to the TJP. The drilling mud is then either pumped via a mud return line to the holding pits/ tanks located onshore, or collected by a vacuum tanker. Any residual mud can then be cleaned up. The normal practice of having a supply of filled sandbags on site to contain any such breakouts will be followed.

Installation of the Proposed DC Cable Route from the Mid-Shore Intertidal Area to MLWS

3.78 From the mid-shore breakout points (from the end of the HDD) to MLWS a further approximately 800 m of cables will be laid via open cut/ trench and burial activities. Three separate trenches will be required to accommodate each of the two HVDC cables and the fibre-option cable.

3.79 Although installation details are not known at this stage, it is expected that the cable installation technique will be determined by sediment conditions. For the purposes of this assessment, cable installations which may be considered include:

- Boat based installation where the cable is ploughed, trenched or jetted using installation methods while the tide is high. A jack-up barge or anchored barge would likely be required in the low intertidal to facilitate cable installation activities. Small jack-up barges use legs with spudcans (approx. 2 m diameter). Anchor barges can utilise up to eight anchors to keep position, the anchors for this type of vessels can be large; between 1.5 m and 3 m in length. The placing and removal of anchors may result in anchor scars and seabed mounds.

Designated (and as minimal as possible) anchoring areas and protocols shall be employed during marine operations. At low tide the barge/ vessel will ground and wait until next high tide to be able to move again.

- Shore based installation with trenches installed from using open cut techniques with a conventional excavator and rollers, while the tide is low. This would seek to achieve cable trenching of up to 3 m wide and between 1 and 1.5 m deep, subject to sediment conditions. Access to the installation site would be gained across the upper shore.

Operation of the Proposed DC Cables

3.80 Once operational, activity along the proposed DC cable route will be limited to non-intrusive inspections and cable repairs. Intrusive inspections would only be required in the unlikely event of a cable fault. Where a fault does occur, the location of the fault would be identified and the faulty section of the cable replaced. The activities involved in cable repair would be similar to those outlined above for installation albeit over a much smaller section.

Decommissioning of the Proposed DC Cable

3.81 In the event that the project ceases operation, the proposed underground DC cable would be decommissioned. Dependent on the prevailing requirements, the redundant cables would either be left in-situ or all parts of the cables could be removed for recycling. Where this is not possible, removed cables would be disposed of in accordance with the relevant waste disposal requirements at the time of decommissioning.

The Proposed AC Cables

Proposed AC Cables Outline Design

3.82 The specification of the proposed AC cables is subject to detailed design, and they may either be underground or above ground. If above ground these will likely be gas-insulated transmission line (GIL) tubes.

3.83 There will be up to six AC cables installed, which will be approximately 20 cm in diameter. The proposed AC cables will be installed directly between the proposed converter station and the proposed substation. They will be approximately 20 m long, with the route of the proposed AC cables dependant on the detailed design of both the proposed converter station and the proposed substation.

3.84 Should the proposed AC cables be installed in GIL tubes, these will be gas insulated with SF6, as per the proposed converter station and the proposed substation as it is an extremely effective electrical insulator and is non-flammable.

Design Mitigation

3.85 Through the co-siting of the proposed converter station and proposed substation, there are no further areas of disturbance required for the installation of the proposed AC cables. These will be installed within the footprint of the proposed converter station and the proposed substation, therefore reducing the overall footprint of the GB Onshore Scheme and the potential for disturbance of additional receptors within the area.

Installation of the Proposed AC Cables

3.86 If installed underground, the proposed AC cables will be installed in a similar way to the proposed DC cables – with all six cables either being installed in one or two trenches, or pulled through pre-installed ducts where necessary. Should the proposed AC cables be installed above ground these will be installed as six individual GIL tubes, which may be installed alongside one-another, or on top of one-another to best fit the technical layout of the proposed converter station and proposed substation.

Operation of the Proposed AC Cables

3.87 Similar to the proposed DC cable route operational activity for the proposed AC cables would generally be limited to non-intrusive inspections and cable repairs. The latter would only be required in the unlikely event of a cable fault. Where a fault does occur the location of the fault would be identified and the faulty section of cable replaced. The activities involved in cable repair would be similar to those outlined above for installation albeit over a much smaller section.

Decommissioning of the Proposed AC Cables

3.88 In the event that the project ceases operation, the proposed AC cable would be decommissioned. Dependent on the prevailing requirements, the redundant cables would either be left in-situ or all parts of the cables could be removed for recycling. Where this is not possible, removed cables would be disposed of in accordance with the relevant waste disposal requirements at the time of decommissioning.

4. Approach to EIA

Introduction

4.1 This chapter describes the method which has been used to undertake the assessment of likely significant environmental effects resulting from the GB Onshore Scheme. It outlines the key stages of the assessment process and the approach undertaken to identify and evaluate the potential environmental effects resulting from the GB Onshore Scheme.

4.2 The GB Onshore Scheme has three distinct phases: construction/installation, operation (including maintenance and repair) and decommissioning. This Environmental Impact Assessment (EIA) considers the impacts of the GB Onshore Scheme during construction/ installation and operation.

4.3 Due to the proposed operational lifespan of 40 years for the GB Onshore Scheme, it is recognised that the future baseline and therefore surrounding receptors are likely to change, and the works associated with the decommissioning of the GB Onshore Scheme will be subject to the relevant planning and legislative requirements adopted at that time.

About EIA

4.4 EIA is the process of identifying, evaluating and mitigating the likely significant environmental effects of a proposed development such as those potentially occurring as a result of the construction and operation of the proposed GB Onshore Scheme. Through the early identification and evaluation of the likely significant environmental effects of a proposed development EIA enables appropriate mitigation (that is measures to avoid, reduce or offset significant adverse effects) to be identified and incorporated into the proposed development's design, or commitments to be made to environmentally sensitive construction methods and practices.

4.5 The EIA of the proposed GB Onshore Scheme has been undertaken in parallel with the development of the design thereby maximising opportunities to mitigate likely significant effects as they have been identified. This approach ensures mitigation is embedded in the design and forms an integral component of it.

4.6 The results of the EIA also ensure that decision makers, such as Local Planning Authority (LPA) and statutory consultees as well as other interested parties including local communities, are aware of a proposed development's potential environmental impacts and whether these may be significant or not so that they may be considered in the determination of an application for planning permission.

4.7 As described in Chapter 01 Introduction, in the case of the proposed GB Onshore Scheme the results of the EIA have been described within this Environmental Statement which accompanies an application for outline planning permission to Medway Council. The results of the EIA have been reported such that Medway Council are aware of the likely significant effects of the proposed GB Onshore Scheme.

The Need for EIA of the GB Onshore Scheme

Underground AC and DC Cables, Converter Station and Substation

4.8 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (EIA Regulations) apply to applications for planning permission made under the Town and Country Planning Act 1990. It sets out two schedules of development (which are derived

from Annex I and II of the amended EU 2011/92/EU (the 'Directive') on the assessment of the effects of certain public and private projects on the environment):

- Schedule 1 Development: EIA is mandatory for developments of a type referred to in Schedule 1. Such developments are considered to be “EIA development”.
- Schedule 2 Development: EIA is not mandatory for developments of a type referred to in Schedule 2. Such developments may be “EIA development” only where they are considered likely to have significant effects on the environment by virtue of factors such as their nature, size or location.

4.9 There is no reference to interconnector projects or the components they comprise (e.g. converter stations, underground or submarine cables) in Schedule 1 of the EIA Regulations. Whilst the OHL works will be undertaken by NGET, for completeness consideration has also been given to whether or not these works would constitute EIA development. The construction of “overhead electrical power lines” is referenced within Schedule 1 of the EIA Regulations however the temporary diversion of the existing 400 kV OHL, and the proposed new connection between the substation and the adjacent lattice tower are below the 15 km length criteria. Therefore EIA is not mandatory for the GB Onshore Scheme as per the EIA Regulations.

4.10 Similarly there is no reference to interconnector projects or the components that they comprise (e.g. converter stations, underground or submarine cables) in Schedule 2 of the EIA Regulations.

4.11 A request for an EIA Screening Opinion (MC/18/3363) was submitted to Medway Council the 20th November 2018 which provided an outline assessment of the likely significant environmental effects of the GB Onshore Scheme. In Medway Council’s response dated the 20th December 2018 it was stated that an EIA would be required for any subsequent planning application on account of the proposal to install the DC cable within the ecologically-sensitive intertidal zone. A copy Medway Council’s opinion is contained in Appendix 3.A.

OHL Works

4.12 To facilitate the connection of the interconnector to the existing NETS, modifications to the existing OHL will be required. The modification works are not confirmed yet and will be subject to detailed design, however, they are likely to include:

- a new 50 m tall lattice tower immediately north of the proposed substation;
- down leads from the new tower to the proposed substation;
- down leads from the new tower to the proposed cable sealing end compound; and
- approx. 200 m long underground AC cable route between the proposed cable sealing end compound and the proposed substation.

4.13 For the purpose of this EIA the OHL works will be included within the assessment of cumulative effects as part of this EIA as assumed development.

Temporary Diversion

4.14 A temporary diversion to the existing overhead line may be required to accommodate the GB Onshore Scheme. The temporary diversion works will be undertaken by NGET and, subject to detailed design, it is hoped that these works will be undertaken in accordance with the exemptions to the requirement for section 37 consent under Regulation 3 of the Overhead Lines (Exemption) (England and Wales) Regulations 2009 (the ‘Exemption Regulations’). The distance between the towers is 772 m, where the exemption is subject to a maximum distance of 850 m, and therefore the exemption applies if the diversion is not in place for more than six months.

4.15 For the purpose of this EIA the temporary diversion will be included within the assessment of cumulative effects as part of this EIA as assumed development.

Substation to New OHL Tower Connection

4.16 In respect of the new connection between the substation and new OHL tower (likely to be down leads connecting the cable sealing end compound to the tower), these will also likely be delivered

by NGET. A section 37 consent would not be required provided that the electric line will be on premises which is (or will be) in the Applicant's or NGET's occupation or control (as provided for by section 37(2) of the Electricity Act 1989). The Applicant has an option over the land, and the Applicant or NGET will have occupation or control of the land.

4.17 As per the OHL works and the temporary diversion, for the purposes of the EIA of the GB Onshore Scheme these works are included within the cumulative assessment as assumed development.

Consultation & Stakeholder Engagement

Determination of EIA Scope

4.18 As noted above in November 2018 a Screening Opinion request was submitted to Medway Council as to whether or not an EIA was required and to comment on the proposed technical or specialist assessments that would inform the design and accompany the subsequent planning application. The Screening Opinion request identified those aspects of the environment which were considered likely to be significantly affected by the proposed GB Onshore Scheme and the approach to the identification and assessment of those effects. It also scoped out those aspects of the environment which were considered unlikely to be significantly affected. A copy of the opinions provided is contained in Appendix 3.A. Simultaneous scoping of technical assessments was also undertaken during consultation with Medway Council and responsible authorities, summaries of consultation are provided within the specialist technical assessment chapters where relevant.

4.19 Additional consultation has been undertaken throughout the development of the proposed GB Onshore Scheme and throughout the EIA informing the approaches to both baseline studies and assessment methods.

4.20 The potential impacts from climate change have been assessed where directly applicable to the specialist assessments in the proceeding Chapters, such as the consideration of flood risk within the water resources and flood risk assessment (Chapter 9).

Consultation and Community Engagement

4.21 A public information event was held on 21st November 2018 during the development of the GB Onshore Scheme, with feedback helping to inform the design, such as the proposed DC cable route and the siting of the proposed converter station. Statutory and non-statutory consultees as well as members of the public provided feedback which helped to inform the selection of the proposed DC cable route and confirm the siting of the proposed converter station.

4.22 A further two pre-application consultation events were undertaken on the 20th and 22nd June 2019 to provide the local community and statutory and non-statutory consultees further information on the proposed GB Onshore Scheme initial design. Attendees provided feedback which helped to inform the design and appearance of the main structures. The approach to consultation with the community and a summary of the feedback that was received is provided in Appendix 3.B Statement of Community Involvement.

4.23 Technical specialists have also consulted with statutory and non-statutory authorities throughout the EIA process to inform approaches to specialist assessments including data requests, the scope of and approach to field surveys, assessment methods and details of other projects to be considered as part of cumulative assessments. The relevant technical chapters in the Environmental Statement summarise the topic-specific consultation which was undertaken and how it informed the scope of and/or approach to the EIA.

Approach to Environmental Impact Assessment

Overview

4.24 The assessment methodology follows a systematic approach in order to assess the potential impacts and subsequent effects of the GB Onshore Scheme on physical, biological and human receptors in a robust and transparent manner.

4.25 The GB Onshore Scheme aims to integrate environmental considerations into the design. Alternatives have been considered and assessed through desk studies and field surveys that have sought to avoid or reduce disturbance of known environmental constraints, where ever possible. The consideration of alternatives is discussed in further detail in Chapter 4.

4.26 This ES aims to identify potentially significant adverse environmental effects and, if any, propose GB Onshore Scheme specific mitigation measures to avoid, reduce or offset adverse environmental effects or maximise environmental benefits. These can be incorporated into the configuration of the components of the GB Onshore Scheme.

Method of Environmental Impact Assessment

4.27 The EIA process involves the following main steps as presented in Figure 4.1.

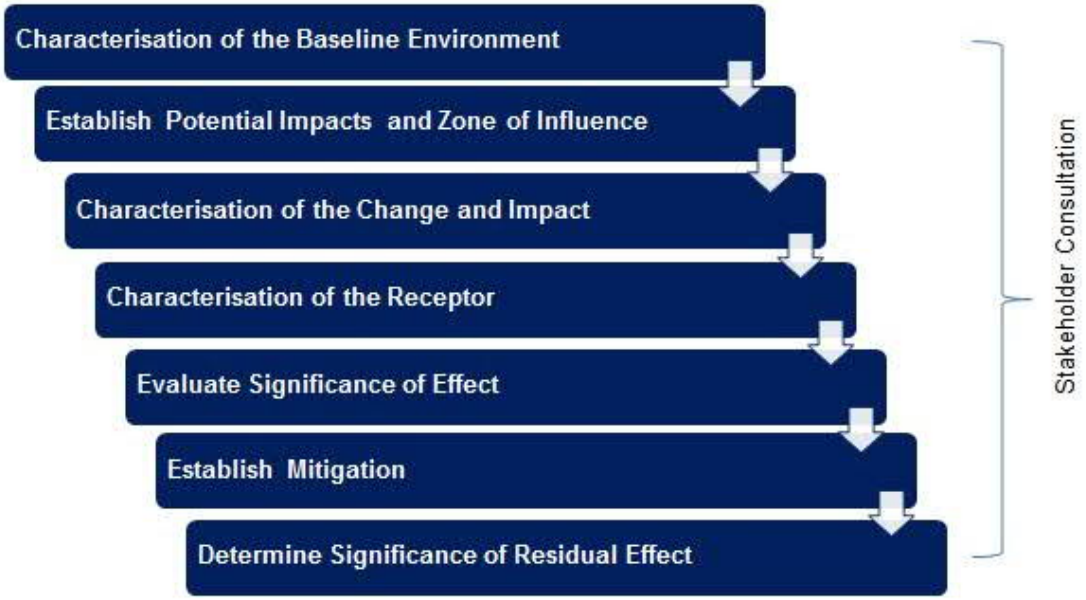

Figure 4-1: Steps of an EIA

4.28 The steps are described in more detail below and are followed and presented within the receptor topic chapters of this report.

Characterisation of the Baseline Environment

4.29 In order to assess the potential impacts resulting from the GB Onshore Scheme, it is necessary to first establish the physical, biological and human conditions that currently exist along and within the vicinity of the proposed converter station and substation sites and DC cable corridors.

4.30 Appropriate understanding of the baseline for each environmental receptor has been achieved through some or all of the following:

- Review of primary baseline studies (field);
- Review of additional specialist baseline studies (desk-based);
- Detailed review of all secondary sources (i.e. existing documentation and literature);
- Stakeholder consultation.

4.31 The key data sources used to establish the baseline are described in each technical assessment chapter. The following limitations or assumptions should be noted:

- Third party and publicly available information is correct at the time of publication.
- Baseline conditions are accurate at the time of physical surveys but due to the dynamic nature of the environment, conditions may change before or during the construction/installation and operation phases of the GB Onshore Scheme (although the effects of the natural variation are included in the assessment).

4.32 For each receptor topic, the baseline has been described at an extent relevant for their assessment between the cable sealing end compound location and Mean Low Water Spring (MLWS).

Establish Potential Impacts and Zone of Influence

4.33 The IEMA (2004) guidelines state:

"*The assessment stage of the EIA should follow a clear progression; from the characterisation of 'impact' to the assessment of the significance if the effects taking into account the evaluation of the sensitivity and value of the receptors*." (p11/2).

4.34 The prediction of potential impacts has been undertaken to determine what could happen to each environmental receptor as a consequence of the GB Onshore Scheme and its associated activities. The diverse range of potential impacts considered in the assessment process has resulted in a large range of prediction methods being used, including quantitative, semi-qualitative and qualitative. Potential impacts to be assessed are provided in each topic chapter. The definitions used to describe impacts are presented in Table 4.1 below.

Table 4.1: Impact definitions

Term	Definition
Direct impact	Impacts that result from a direct interaction between the GB Onshore Scheme / GB Onshore Scheme activities and the receiving environment.
Indirect impact	Impacts on the environment, which are not a direct result of the GB Onshore Scheme / GB Onshore Scheme activities, often produced away from the activity or as a result of a complex pathway. For example, loss of existing screening vegetation resulting in the loss of visual amenity.
Cumulative impact	Impacts that result from incremental changes caused by other present or reasonably foreseeable actions together with the GB Onshore Scheme. Generally considered to be the same impact by from different projects e.g. construction traffic from two separate projects combining to affect the same network.
Beneficial impact	An impact that is considered to represent an improvement on the baseline condition or introduces a new desirable factor.
Adverse impact	An impact that is considered to represent an adverse change from the baseline condition or introduces a new undesirable factor.

4.35 For each potential impact, the 'Zone of Influence' (ZOI) – the spatial extent over which the activities are predicted to have an impact on the receiving environment – is established. This will vary for different activities and for the different stages of the GB Onshore Scheme (construction/installation, operation and decommissioning).

4.36 Establishing the ZOI for different activities and receptors has been undertaken quantitively where possible. Where necessary, it has been undertaken based on the GB Onshore Scheme description, project experience and literature reviews.

4.37 Potential for impacts on receptors which occur outside the ZOI and which cannot or are unlikely to travel into the zone can be screened out. Conversely, mobile species and other mobile receptors can travel into the ZOI, and may therefore be impacted by the GB Onshore Scheme.

4.38 The ZOI used in the assessment are described in the individual receptor topic chapters of this report. In some cases the ZOI only covers the GB Onshore Scheme site, in other cases, it extends further from project activities.

4.39 ZOIs have been considered for each potential impact on the receptor. Where a number of GB Onshore Scheme activities have the same impact, or the installation technique has not been determined, the largest ZoI has been applied.

Characterisation of the Change and Impact

4.40 In order to fully characterise an impact or level of change from baseline conditions, the parameters shown in Table 4.2 and Table 4.3 have been used to define the magnitude of change.

Table 4.2 Factors which determine the magnitude of an impact

Term	Definition
Scale of change	The scale of change refers to the degree of change to or from the baseline environment caused by the impact being described
Spatial extent	The extent of an impact is the full area over which the impact occurs
Duration and frequency	The duration is the period within which the impact is expected to last prior to recovery or replacement of the feature. Frequency refers to how often the impact will occur

Table 4.3 Criteria for characterising the magnitude of an impact

Term	Definition
High	Long term (> 5 years) and/ or regional level loss; or major alteration to key elements/ features of the baseline condition such that post development character/ composition of the baseline will be fundamentally changed.
Medium	Medium term (1-5 years) loss and/ or local level change (greater than the GB Onshore Scheme footprint) or alteration to one or more key elements/ features of the baseline conditions such that post development character/ composition of the baseline condition will be materially changed.
Low	Short term (<1 year), site specific and/ or a minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/ composition of the baseline condition will be similar to the pre-development situation.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a “no change” situation.

Value of the Receptor

4.41 The value of a receptor or feature is characterised by the sensitivity, recoverability and importance of the receptor or feature (see Table 4.4). Characterisation of the receptor is achieved by balancing out these three considerations to determine the receptor’s value.

Table 4.4 Factors which determine the value of the receptor

Term	Definition
Sensitivity	The sensitivity of the receptor relates to its vulnerability to change (including its capacity to accommodate change i.e. the tolerance/intolerance of the receptor to change).
Recoverability	The ability of the receptor to return to the baseline state before the GB Onshore Scheme impact caused the change.
Importance	The importance of the receptor or feature is a measure of the value assigned to that receptor based on biodiversity and ecosystem services, social value and economic value. Importance of the receptor is also defined within a geographical context, whether it is important internationally, nationally or locally.

Evaluate Significance of Effect

4.42 Having established the magnitude of change and the value of the receptor, the significance of the effect can be assessed using the significance matrix presented in Table 4.5.

Table 4.5 Significance matrix

		Magnitude of Change			
		Negligible	**Low**	**Medium**	**High**
Value of Receptor	**High**	Negligible	Moderate	Major	Major
	Medium	Negligible	Minor	Moderate	Major
	Low	Negligible	Negligible	Minor	Moderate
	Negligible	Negligible	Negligible	Negligible	Minor

4.43 The result of using this matrix approach is the assignment of the level of significance of the effect for all GB Onshore Scheme potential impacts. This is done prior to any mitigation.

4.44 Negligible or minor impacts are not considered to be significant.

Establish Mitigation

4.45 A standard hierarchical approach to identifying mitigation requirements has been used:

- Avoid or Prevent: in the first instance, mitigation should seek to avoid or prevent the adverse effect at source.
- Reduce: if the effect is unavoidable, mitigation measures should be implemented which seek to reduce the significance of the effect.
- Offset: If the effect can neither be avoided nor reduced, mitigation should seek to offset the effect through the implementation of compensatory mitigation.

4.46 Mitigation measures fall into two categories: mitigation by design which forms part of the GB Onshore Scheme design; and mitigation by practice which is part of the installation, operation and decommissioning of the GB Onshore Scheme.

Mitigation by Design

4.47 The GB Onshore Scheme has been developed through an iterative process which involved seeking to avoid or reduce potential environmental effects through location of the proposed converter station and substation and routeing of the marine cables. This was the first GB Onshore Scheme-specific step in mitigation potential effects by seeking to avoid or reduce environmental disturbance. Mitigation measures which form part of the initial design are an inherent part of the GB Onshore Scheme and are considered the 'base case' therefore they have not been included within the assessment. Following selection of the final site/ route to be considered for assessment, further mitigation measures by design have been identified and where applicable have been proposed within each of the topic chapters. GB Onshore Scheme specific mitigation by design may include, for example, micro routeing to avoid sensitive features identified during the assessment process.

Mitigation by Practice (Best or Good Practice)

4.48 Mitigation which helps reduce the likelihood or severity of potentially adverse environmental effects through measures implemented during installation, operation and decommissioning are referred to as 'mitigation by practice'. Such measures are often followed as a course of Best Practice or to comply with international statute. Within the topic chapters all proposed mitigation by practice measures have been recorded and referenced where applicable.

Determine Significance of Residual Effects

4.49 The significance assessment is repeated taking into consideration the application of Best Practice and GB Onshore Scheme specific mitigation measures. This determines whether there

is likely to be a residual impact. When applied after mitigation, the resulting significance level is referred to as the residual significant effect. Tables within the topic chapters present the results of both assessments.

4.50 Residual effects as moderate or major after consideration of proposed mitigation measures will normally require additional analysis and consultation in order to discuss and possible further mitigate impacts where possible. Where further mitigation is not possible, a residual effect may remain.

Approach to Cumulative Effects Assessment

4.51 The term cumulative effects refer to effects upon receptors arising from the GB Onshore Scheme when considered alongside other plans and projects that result in an additive impact with any element of the project. Cumulative effects can be described as the net effect of both direct and indirect cumulative pressures, from different activities. An individual effect alone may be considered insignificant, but the additive effects of more than one effect, from any number of sources, could result in a significant cumulative effect, either beneficial or adverse.

4.52 Cumulative effect assessment identifies for each receptor, areas where the predicted effects of the GB Onshore Scheme could interact with effects arising from other projects, plans on the same receptor based on a spatial and/or temporal basis.

4.53 The cumulative effects assessment for the receptors is presented within each topic chapter of this report.

4.54 The convention on Environmental Impact Assessment in a Transboundary Context (UN, 1991) sets out the obligations of parties to assess the transboundary environmental effect of certain activities at an early stage of planning. It also lays down the general obligations of states to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental effect across boundaries.

4.55 It is anticipated that transboundary effects associated with the GB Onshore Scheme will be limited.

5. Landscape & Visual Amenity

Introduction

5.1 This chapter provides an assessment of the likely Landscape and Visual effects arising from the construction and operation of the proposed GB Onshore Scheme. A detailed description of the GB Onshore Scheme and the Project Area is provided in Chapter 03 Proposed GB Onshore Scheme. The scope of the landscape and visual assessment and methodology has been informed by and agreed through consultation with the statutory stakeholders.

5.2 This chapter is supported by the following Figures:

- Figure 5.1 Zone of Theoretical Visibility
- Figure 5.2 Site Topography
- Figure 5.3 Landscape Designations
- Figure 5.4 Landscape Character Areas
- Figure 5.5 Recreational Routes and Public Rights of Way
- Figure 5.6 Representative Viewpoints
- Figure 5.7a Landscape Mitigation Design Plan
- Figure 5.7b Landscape Mitigation Design Sections
- Figure 5.8 Viewpoint 1: Grain Coastal Park
- Figure 5.9a Viewpoint 2: Existing view
- Figure 5.9b Viewpoint 2: Photomontage year 1
- Figure 5.9c Viewpoint 2: Photomontage year 15
- Figure 5.10a Viewpoint 3: Existing view
- Figure 5.10b Viewpoint 3: Photomontage year 1
- Figure 5.10c Viewpoint 3: Photomontage year 15
- Figure 5.11a Viewpoint 4: Existing view
- Figure 5.11b Viewpoint 4: Photomontage year 1
- Figure 5.11c Viewpoint 5: Photomontage year 15
- Figure 5.12a Viewpoint 5: Existing view
- Figure 5.12b Viewpoint 5: Photomontage year 1
- Figure 5.12c Viewpoint 5: Photomontage year 15
- Figure 5.13a Viewpoint 6: Existing view
- Figure 5.13b Viewpoint 6: Photomontage year 1
- Figure 5.14a Viewpoint 7: Existing view
- Figure 5.14b Viewpoint 7: Photomontage year 1
- Figure 5.15a Viewpoint 8: Existing view
- Figure 5.15b Viewpoint 8: Photomontage year 1
- Figure 5.16a Viewpoint 9: Existing view
- Figure 5.16b Viewpoint 9: Photomontage year 1

5.3 This Chapter is also supported by the following technical appendices presented in:

- Appendix 05.A- Landscape Assessment, and
- Appendix 05.B- Visual Assessment.

Approach to Assessment

Overview

5.4 This section presents the following:

- details of consultation undertaken with respects to the landscape and visual resource;
- identification of the information sources that have been consulted throughout the preparation of this Chapter;
- the methodology behind the assessment of landscape and visual effects, including the criteria for the determination of the significance of the receptor and the magnitude of change from the baseline conditions;
- an explanation as to how the identification and assessment of potential landscape and visual effects has been reached; and
- the significance criteria and terminology for assessment of the residual effects to the landscape and visual resource.

Study Area

5.5 The extent of the study area is determined by the potential visibility of the proposed GB Onshore Scheme in the surrounding landscape and is proportionate to its size and scale and the nature of the surrounding landscape. For the purposes of this assessment the study area has been defined by a combination of Zone of Theoretical Visibility (ZTV) analysis and professional judgement. The ZTV is shown on Figure 5.1.

5.6 Based upon the extent of visibility and professional judgement it is considered that it is highly unlikely that significant long term residual landscape effects will be possible from further than 5 km from the Project Area boundary. Three viewpoints beyond the 5 km study area have been included in the assessment. Each of these viewpoints is representative of potential visual effects from recreational receptors in elevated locations with long distance views across the landscape and have been informed by consultation with Medway Council. Whilst the visual assessment considers representative viewpoints beyond 5 km, it is not considered proportionate to extend the study area, as fieldwork has demonstrated that significant adverse effects on visual amenity would be limited to within 5 km of the Project Area.

Consultation

5.7 Consultation relevant to the landscape and visual assessment has been undertaken with relevant stakeholders and has informed the scope of the assessment. A summary of the comments raised, and responses are detailed in Table 5.1 Summary of Consultation.

Table 5.1 Summary of Consultation

Consultee	Key Issue	Consultee Response	Action Taken
Medway Council	AECOM sent a letter of consultation to Medway Council (23/01/2019) that outlined the scope of the Landscape and Visual Assessment. Key issues included: Extent of study area Landscape Character areas; Proposed Viewpoint Locations and preparation of visualisations.	Medway Council Response (22/02/2019): In agreement of scope and guidance, with the following additions: Proposed 15 no. additional viewpoints; Proposed that the study area for the visual assessment should be considered beyond 5 km.	AECOM undertook field surveys and visited each of the additional viewpoints proposed by Medway Council within Medway and Swale authority areas and other locations representative of visual receptors up to 10 km from the Project Area boundary. AECOM's Landscape Architects proposed that 2 of the15 additional viewpoints proposed by Medway Council would be added to the scope of the visual assessment as they were representative of visual

Consultee	Key Issue	Consultee Response	Action Taken
			receptors where the view has the potential to be significantly affected. These were: Furze Hill PRoW; and The Riverside Country Park, (viewing platform) Set out in email sent from AECOM to Medway Council dated 7/3/2019.
Medway Council	In response to AECOM's email of 7/3/19 following the site survey the Landscape Officer maintained the request for additional viewpoint locations along the south Essex coastline and Southend (12/03/2019).	Medway Council Landscape Officer stated that: '*The reasoning behind the exclusion of a number of viewpoints put forward is understandable with selected viewpoints being representative of different visual receptors*.' Medway Council Landscape officer also requested that views from the south Essex coastline and Southend be taken into consideration, even if this means that the resulting views can be discounted as a result of visual evidence.	AECOM have prepared visualisations from viewpoints 5, 7 and 9 which are of similar distance and background context to those on the South Essex coastline where the proposals are not likely to result in significant visual effects. AECOM have excluded viewpoints from the Essex coastline and Southend from the visual assessment to focus the assessment on the likelihood of significant effects in line with best practice (27/06/2019)

Assessment Method

Guidance

5.8 The approach to the Landscape and Visual Impact Assessment (LVIA) has been devised to address the specific effects likely to result from developments of this scale and nature. The methodology draws upon the following established best practice guidance:

- Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3) (Ref. 5.1); and
- Photographs from representative viewpoints have been produced in compliance with Landscape Institute Advice Note 01/11: Photography and photomontage in landscape and visual impact assessment (Landscape Institute, 2011) (Ref. 5.2).

Scope of Assessment

5.9 GLVIA3 requires that a clear distinction is drawn between landscape and visual effects:

- Landscape effects relate to the degree of change to characteristics or physical components of a rural area, which together form the character of that landscape, e.g. topography, land use, vegetation and open space.
- Visual effects relate to the degree of change to an individual receptor or a receptor group's view of that landscape, e.g. local residents, users of public open space, footpaths or motorists passing through the area.

5.10 By assessing the construction, operation and maintenance and decommissioning stages of the GB Onshore Scheme separately, distinctions may be drawn between temporary and permanent effects, with permanent effects typically being of greater importance. Residual effects are those likely to arise from the GB Onshore Scheme taking into account all additional mitigation measures.

5.11 In understanding that the GB Onshore Scheme is subject to detailed design, and that the layout of the converter station and substation is still to be determined, the LVIA has considered the worst case scenario. In consideration of the proposed layout of the converter station as identified in Figure 3.3, the LVIA has assessed the converter station layout to be rotated 180 degrees with the DC hall located to the north of the converter station platform. In this layout the greatest massing of buildings would be closest to the residential area to the north and would be closer to the Perry's Farm property to the east of the GB Onshore Scheme.

Temporal Scope

5.12 Landscape and visual effects change over time as the existing landscape external to the Project Area evolves and the embedded mitigation planting establishes and matures. The assessments therefore report on potential effects during the construction phase and at operation both during winter (Year 1 of opening) and summer (Year 15 once the embedded mitigation is expected to be established). The assessments have been carried out, as is best practice, by assuming the worst case scenario, i.e. on a clear bright day, when haze would not interfere with the clarity of the view obtained.

5.13 The following provides details of the process and classification criteria employed in undertaking the landscape and visual assessments. The criteria detailed in Table 5.2 to Table 5.11 are not intended to be prescriptive. Rather these examples are used to illustrate potential combinations of judgements which relate to the scales for value, susceptibility, sensitivity to change, magnitude of change and significance of effect as described subsequently.

Professional Judgement

5.14 GLVIA3 places a strong emphasis on the importance of professional judgement in identifying and defining the significance of landscape effects. This LVIA has been undertaken by two Chartered Landscape Architects and professional judgement has been used in combination with structured

methods and criteria to evaluate landscape value, sensitivity, magnitude and significance of effect.

Sensitivity of Landscape Receptors

5.15 Landscape receptors are described as components of the landscape that are likely to be affected by the GB Onshore Scheme. These can include overall character and key characteristics, individual elements or features and specific aesthetic or perceptual aspects. It is the interaction between the different components of the GB Onshore Scheme and these landscape receptors which has potential to result in landscape effects (both adverse and beneficial).

5.16 The sensitivity of the landscape receptor is a combination of the value of the landscape (undertaken as part of the baseline study) and the susceptibility to change of the receptor to the specific type of development being assessed.

5.17 Landscape value is frequently addressed by reference to international, national, regional and local designations, determined by statutory bodies and planning agencies. Absence of such a designation does not necessarily imply a lack of quality or value. Factors such as accessibility and local scarcity can render areas of nationally unremarkable quality, highly valuable as a local resource.

5.18 Factors that can help in identifying the value of a landscape include:

- landscape quality/ condition – the measure of the physical state of the landscape including the intactness of the landscape and the condition of individual elements;
- scenic quality – the extent that the landscape receptor is recognised for its perceptual qualities (e.g. remoteness or tranquillity);
- perceptual aspects – the extent that the landscape receptor is recognised for its perceptual qualities (e.g. remoteness or tranquillity);
- rarity – the presence of unusual elements or features;
- representativeness – the presence of particularly characteristic features;
- recreation – the extent that recreational activities contribute to the landscape receptor; and
- association – the extent that cultural or historical associations contribute to the landscape receptor.

5.19 The evaluation of landscape value has been undertaken with reference to a three-point scale, as outlined in Table 5.2 Landscape Value Criteria below.

Table 5.2 Landscape Value Criteria

Classification	Criteria
High	Protected by a statutory landscape designation, a landscape contributing strongly to a sense of place, or an unspoilt landscape containing unique or scarce elements/ features with few, if any, detracting elements/ features
Medium	Locally designated landscape or an undesignated landscape with locally important, but more commonplace, features and containing some detracting elements/ features.
Low	Undesignated landscape with few, if any, notable elements/ features, or containing several detracting elements/ features.

5.20 The susceptibility to change is a measure of the ability of a landscape to "*accommodate the proposed development without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies*" (Ref. 5.3, para 5.40).

5.21 Landscape susceptibility has been appraised through consideration of the baseline characteristics of the landscape, and in particular, the scale or complexity of a given landscape.

The evaluation of landscape susceptibility has been undertaken with reference to a three-point scale, as outlined in Table 5.3 Landscape Susceptibility Criteria.

Table 5.3 Landscape Susceptibility Criteria

Classification	Criteria
High	Attributes that contribute to a landscape which is considered to be intolerant of even minor change of the type proposed without fundamentally altering key characteristics.
Medium	Attributes that contribute to a landscape which offers some opportunities to accommodate change of the type proposed without fundamentally altering the key characteristics.
Low	Attributes that contribute to a landscape which is considered to be tolerant of a large degree of change of the type proposed without fundamentally altering the key characteristics.

5.22 Landscape sensitivity to change has been determined by employing professional judgement to combine and analyse the identified value and susceptibility and has been defined with reference to the three-point scale outlined in Table 5.4 Sensitivity of Landscape Receptors.

5.23 Combining susceptibility and value GLVIA3 indicates that this can be achieved in a number of ways and needs to include professional judgement. However, it is generally accepted that a combination of high susceptibility and high value is likely to result in the highest sensitivity, whereas a low susceptibility and low value is likely to result in the lowest level of sensitivity.

Table 5.4 Sensitivity of Landscape Receptors

Classification	Criteria
High	Landscape of national or regional value with distinctive elements and characteristics, considered to have a limited ability to absorb the type of change proposed without fundamentally altering the key characteristics.
Medium	Landscape of regional or local value, or rarity, exhibiting some distinct elements/ features, considered tolerant of some degree of the type of change proposed without fundamentally altering the key characteristics.
Low	Landscape with few distinctive elements/ features or valued characteristics and considered tolerant of a large degree of the type of change proposed without fundamentally altering the key characteristics.

Sensitivity of Visual Receptors

5.24 Sensitivity of visual receptors has been defined through appraisal of the viewing expectation, or value placed on the view as identified in the baseline study, and its susceptibility to change.

5.25 Value of the view is an appraisal of the value attached to views and is often informed by the appearance on Ordnance Survey or tourist maps and in guidebooks, literature or art. Value can also be indicated by the provision of parking or services and signage and interpretation. The nature and composition of the view is also an indicator. Value of the view has been determined with reference to the three-point scale and criteria outlined in Table 5.5 Value of the View.

Table 5.5 Value of the View

Classification	Criteria
High	Nationally recognised view, a view with cultural associations (recognised in art, literature, or other medium), or a recognised high quality view of the landscape with very few, if any detracting elements.
Medium	Locally recognised view, or unrecognised but pleasing and well composed view, with few detracting elements.

Classification	Criteria
Low	Typical or poorly composed view, often with numerous detracting elements.

5.26 Visual susceptibility relates to the importance of views to receptors at a certain location and is informed by the type of receptor and the activity with which they are engaged. This considers the extent to which receptors' attention or interest is focused on the view or visual amenity. For example, residents in their home, walkers whose interest may tend to be focused on the landscape or a particular view, or visitors at an attraction where views are an important part of the experience, may indicate a higher level of susceptibility. Whereas, receptors occupied in outdoor sport where views are not important or at their place of work could be considered less susceptible to change. Visual susceptibility has been determined with reference to the three-point scale and criteria outlined in Table 5.6 Visual Susceptibility Criteria.

Table 5.6 Visual Susceptibility Criteria

Classification	Criteria
High	Locations where the view is of primary importance and receptors are likely to notice even minor change.
Medium	Locations where the view is important but not necessarily the primary focus and receptors are tolerant of some change.
Low	Locations where the view is incidental or unimportant to receptors and tolerant of a high degree of change.

5.27 Visual sensitivity to change has been determined by employing professional judgement to combine and analyse the identified value and susceptibility and has been defined with reference to the three-point scale outlined in Table 5.7 Sensitivity of Visual Receptors below. In combining susceptibility and value it is generally accepted that a combination of high susceptibility and high value is likely to result in the highest sensitivity, whereas a low susceptibility and low value is likely to result in the lowest level of sensitivity.

Table 5.7 Sensitivity of Visual Receptors

Classification	Criteria
High	Locations where receptors experience an impressive or well composed view containing few detracting elements, with limited ability to absorb change.
Medium	Locations where receptors experience a valued view which generally represents a pleasing composition but may include some detracting features and is tolerant of a degree of change.
Low	Locations where the view is incidental or not important to the receptors and the nature of the view is of limited value or poorly composed with numerous detracting features and is tolerant of a large degree of change.

Landscape Magnitude of Change

5.28 The magnitude of landscape change refers to the extent to which the GB Onshore Scheme would alter the existing characteristics of the landscape. Changes to landscape characteristics can be both direct and indirect.

5.29 Magnitude of landscape change refers to the extent to which the GB Onshore Scheme would alter the existing characteristics of the landscape. It is an expression of the size or scale of change to the landscape, the geographical extent of the area influenced and its duration and reversibility. The variables involved are described below:

- The extent of existing landscape elements that would be lost, the proportion of the total extent that this represents and the contribution of that element to the character of the landscape.

- The extent to which aesthetic or perceptual aspects of the landscape are altered either by removal of existing components of the landscape or by addition of new ones.
- Whether the change alters the key characteristics of the landscape, which are integral to its distinctive character.
- The geographic area over which the change will be felt (within the application boundary itself, the immediate setting, at the scale of the landscape character area, on a larger scale influencing several landscape character areas).
- The duration of the change short term, medium term or long term and its reversibility (whether it is permanent, temporary or partially reversible).

5.30 The magnitude of landscape change has been evaluated with reference to Table 5.8 Magnitude of Landscape Change below ranging from higher to lower levels of magnitude described using a four-point scale (high, medium, low, very low).

Table 5.8 Magnitude of Landscape Change

Size or Scale of Change	Geographical Extent	Duration	Reversibility
Highly noticeable change, affecting many key characteristics and dominating the experience of the landscape; and Introduction of highly incongruous GB Onshore Scheme.	Very extensive affecting several landscape types or character areas.	Long-term (10 years +)	Irreversible
Noticeable change, affecting some key characteristics and the experience of the landscape; and Introduction of some uncharacteristic elements.	Affecting a substantial proportion of the landscape character area.	Medium-term (5-10 years)	Partially reversible
Minor change, affecting some characteristics and the experience of the landscape to an extent; and Introduction of elements that are not uncharacteristic.	Affecting the immediate setting of the Project Area.	Short-term (0-5 years)	Reversible
Little perceptible change.	Limited to within the GB Onshore Scheme application boundary.	Short-term (0-5 years)	Reversible

Visual Magnitude of Change

5.31 Visual magnitude of change relates to the extent to which the GB Onshore Scheme would alter the existing view and is an expression of the size or scale of change in the view, the geographical extent of the area influenced and its duration and reversibility. The variables involved are described below:

- The scale of the change in the view with respect to the loss or addition of features in the view and changes in its composition, including the proportion of the view occupied by the GB Onshore Scheme.
- The degree of contrast or integration of any new features or changes in the form, scale, composition and focal points of the view.
- The nature of the view of the GB Onshore Scheme in relation to the amount of time over which it will be experienced and whether views will be full, partial or glimpsed.
- The angle of view in relation to the main activity of the receptor, distance of the viewpoint from the GB Onshore Scheme and the extent of the area over which the changes would be visible.

- The duration of the change short term, medium term or long term and its reversibility (whether it is permanent, temporary or partially reversible).

5.32 Visual magnitude of change has been evaluated with reference to Table 5.9 Magnitude of Visual Change, ranging from higher to lower levels of magnitude described using a four-point scale (high, medium, low, very low).

Table 5.9 Magnitude of Visual Change

Size or Scale of Change	Geographical Extent	Duration	Reversibility
Extensive change to the existing view including the loss of existing characteristic features, and/ or introduction of new discordant features. A change to an extensive proportion of the view. Views where the GB Onshore Scheme would become the dominant landscape feature or contrast heavily with the current view.	The GB Onshore Scheme is located in the main focus of the view; and or at close range over a large area.	Long-term (10 years +)	Irreversible
The GB Onshore Scheme will result in a change to the view but not fundamentally change its characteristics. Changes that would be immediately visible but not the key feature of the view.	Changes where the GB Onshore Scheme is located obliquely to the main focus of the view; and/ or at medium range; and/ or over a narrow area.	Medium-term (5-10 years)	Partially reversible
The GB Onshore Scheme would result in a small change to the composition of the view. Changes that would only affect a small portion of the view or introduce new features that were partially screened.	Changes where the GB Onshore Scheme is located on the periphery to the main focus of the view; and/or long range; and/ or over a small area.	Short-term (0-5 years)	Reversible
Little perceptible change in the existing view.	Changes where the GB Onshore Scheme is peripheral to the overall view.	Short-term (0-5 years)	Reversible

Significance of Landscape Effect

5.33 Determination of the significance of landscape effects has been undertaken by employing professional judgement and experience to combine and analyse the magnitude of change, against the identified sensitivity of the receptor. The assessment takes account of direct and indirect change on existing landscape elements, features and key characteristics and evaluates the extent to which these would be lost or modified, in the context of their importance in determining the existing baseline character.

The levels of landscape effects are described with reference to the four-point scale outlined in Table 5.10 Significance of Landscape Effect, below.

Table 5.10 Significance of Landscape Effect

Classification	Criteria
Major	Considerable change over an extensive area of a more sensitive landscape, fundamentally affecting the key characteristics and the overall impression of its character.
Moderate	Small or noticeable change to a more sensitive landscape or more intensive change to a less sensitive landscape, affecting some key characteristics and the overall impression of its character.
Minor	Small change to a limited area of more sensitive landscape or a more widespread area of a less sensitive landscape, affecting few characteristics and not altering the overall impression of its character.
Negligible	Scarcely any perceptible change to the existing landscape.

5.34 Following the classification of an effect as detailed in Table 5.10 Significance of Landscape Effect, a clear statement is made as to whether the effect is 'significant' or 'not significant'. As a general rule, major and moderate effects are considered to be significant and minor and negligible effects are considered to be not significant. However, professional judgement is also applied where appropriate.

Significance of Visual Effect

5.35 Determination of the significance of visual effects has been undertaken by employing professional judgement and experience to combine and analyse the magnitude of change against the sensitivity of the receptor. The assessment takes into account likely changes to the visual composition, including the extent to which new features would distract or screen existing elements in the view or disrupt the scale, structure or focus of the existing view.

The levels of visual effects are described with reference to the four-point scale outlined in Table 5.11 Significance of Visual Effect below.

Table 5.11 Significance of Visual Effect

Classification	Criteria
Major	Substantial loss, alteration or replacement of existing components which causes a very noticeable change in the existing view.
Moderate	Whilst some existing characteristic components of the existing view remain, there is a noticeable change in the overall composition.
Minor	The GB Onshore Scheme would be visible in the view but would form a small component and the majority of the view would be unaffected.
Negligible	The GB Onshore Scheme would be scarcely perceptible in the existing view.

5.36 Following the classification of an effect as detailed in Table 5.11 Significance of Visual Effect, a clear statement is made as to whether the effect is 'significant' or 'not significant'. As a general rule, major and moderate effects are considered to be significant and minor and negligible effects are considered to be not significant. However, professional judgement is also applied where appropriate.

Planning Policy & Applicable Legislation

National Planning Policy Framework

5.37 The revised National Planning Policy Framework (NPPF) was published in July 2018 which replaced the NPPF published back in March 2012. It sets out national planning policies that reflect priorities of the Government for England of the planning system and the economic, social and environmental aspects of the development. The NPPF has a strong emphasis on the achievement of sustainable development.

5.38 The NPPF outlines 12 core planning policies, one of which is conserving and enhancing the natural environment. This is of relevance to landscape and visual considerations as it sets out the requirement to protect and enhance natural and local environment.

Medway Local Plan 2003

5.39 The Medway Local Plan (Ref 5.3) was adopted in 2003 provides a framework for local planning policies that reflects priorities of Medway Council for guiding strategic development over the plan period. The policies which are relevant to the landscape and visual resource are outlined below:

- S4: Landscape and Urban Design: This general policy states that new development responds appropriately to its context specifically to the local character.
- BNE1: General Principles for Built Development: This policy outlines the requirement for careful consideration of site planning of new developments that respects existing features, landscape character and visual amenity of the surrounding area.
- BNE6: Landscape Design: states all major developments should include a structural landscape scheme to enhance the character of the locality including the retention of important existing landscape features such as trees and hedgerows.
- BNE22: Environmental Enhancement: This policy encourages development proposals that lead to the improvement of the appearance and environment of existing and proposed areas of development, transport corridor, open spaces and areas adjacent to the River Medway.
- BNE33: Special Landscape Areas: This policy states that development will only be permitted within the North Kent Marshes Special Landscape Area if it conserves and enhances the natural beauty of the area's landscape unless the economic and social benefits are so important to outweigh the county priority to conserve the natural beauty of the landscape.
- BNE43: Trees on Development Sites: This policy seeks to retain any trees, woodlands, hedgerows and other landscape features that provide valuable local character. It ensures that any tree loss is compensated on development sites.

5.40 Medway Local Plan (2018 to 2035) will set the future vision for Medway and replace the 2003 local plan. At the time of writing this assessment, the new local plan had not yet been adopted and as such the adopted policies contained in the 2003 local plan remain valid.

The Swale Borough Local Plan 2017

5.41 The Borough of Swale occupies a proportion of the study area to the east of the Project Area and as such the local planning policies related to the protection and enhancement of the landscape are relevant to this assessment. The relevant policies contained within the Swale Borough Local Plan 2017 (Ref 5.4) include:

- Policy DM 24 Conserving and Enhancing Valued Landscapes: This policy related to the value, character amenity and tranquillity of the Borough's landscapes. This policy outlines that development proposals to be considered in relation to the extent to which they would protect the local landscape character and enhance the future appearance of the designated landscape and, where relevant, its nature conservation interest.

Baseline Conditions

Project Area and Surrounding Context

Location and Site Context

5.42 The Project Area is located within Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The Project Area is located to the west of the settlement of Grain. The only road access to the peninsula is from the B2001/ Grain Road. The Project Area is located on the fringes of industrial land and extends north/ northeast to the coast and is located approximately 0.5 km to the west of Grain.

Topography

5.43 Topography within the Project Area slopes from 14 m AOD in the east to 4 m AOD in the west. The marshland to the west of the Project Area extends to Allhallows is low lying at about 1-2 m AOD whilst the settlement of Grain sits on higher ground between 14-15 m AOD. Topography is shown on Figure 5.2.

Movement and Connectivity

5.44 The B2001/ Grain Road is the main road through the Project Area linking Grain to the A228. Access to the Project Area is via a small unnamed road which is connected to Grain Road. An alternative access is from West Lane which is routed along the northern boundary of the Project Area in a broadly east-west direction. There are also a number of private access roads to adjacent land. There are no Public Rights of Way (PRoW) within the Project Area, although there are several PRoW within the wider study area which are considered within the visual baseline.

Settlement and Land use

5.45 Land use within the Project Area and in the immediate vicinity is either in agricultural use or is brownfield land which has no current discernible use. The existing 400 kilovolt (kV) overhead line (OHL) which is broadly routed east to west generally marks the boundary between the extent of industrial or brownfield land and settlement or undeveloped coastal land. The small settlement of Grain is located to the southeast.

5.46 There are individual residential properties in the centre of and to the west (Rose Court Farm) of the Project Area. Land to the west of the Project Area is largely dominated by open marshland and grazing marsh extending to the arable farmland at Allhallows and Lower Stoke. The National Grid Liquefied Natural Gas (LNG) Terminal is located immediately south of the Project Area whilst to the south-east is a mix of vacant land and Grain Power Station.

Landscape Fabric of the Project Area

5.47 The landscape fabric of the Project Area consists of agricultural farmland and vacant land extending north to an area of woodland which continues to the coastline, to the west of Grain Coastal Park. The landscape fabric (physical character) of the Project Area is distinctly different and not representative of the key characteristics of the Allhallows to Stoke Marshes Landscape Character Area in which the Project Area is located.

5.48 The Project Area is largely contained by fragmented boundary vegetation (scrub and hedgerow) to the west and hedge with low post and wire fence to the south and east. The interface with the distinctive marshland to the west is somewhat diffuse and formed of; linear dykes, semi-natural scrub and wet pasture between the agricultural field and the core areas of marshland to the west where the tidal influence varies.

5.49 This interface between the two distinct areas is an important band of separation that helps to differentiate between the core character of the marshland landscape and the Project Area. There are two pylon towers within the Project Area, linked by the overhead line (OHL) that extends through the study area from Lower Stoke to Grain Power Station.

5.50 The combination of the OHL, pylons, Grain Power Station and the National Grid LNG Terminal and other industrial development form the backdrop to the south and south-east of the Project Area and have a strong bearing on the setting (refer to Figures 5.9a, 5.10a, 5.11a and 5.12a).

Landscape Designations

5.51 Landscapes can be given designations in recognition of their importance, natural beauty and distinct attractiveness. There are two landscape designations within the study area shown on Figure 5.3 and outlined below.

The North Kent Marshes Special Landscape Area

5.52 The North Kent Marshes Special Landscape Area (SLA) occupies the broad area of coastal marshlands extending over the northern and eastern coastline of the Isle of Grain, extending east across Swale estuary to the Sheppey Marshes and south across the Conyer, Luddenham, Graveny and Chetny Marshes.

5.53 The now archived Regional Planning Guidance (The South East Plan) removed the county-wide landscape protection designations of SLA. This designation was originally applied under the now archived Kent and Medway Structure Plan to a large proportion of Medway's North Kent Marshes as well as some tracts of adjacent farmland situated on the Hoo Peninsula. This designation recognised the special quality of this landscape in terms of its natural beauty.

5.54 The Medway Landscape Character Assessment 2011 recognises the 'special qualities of the North Kent Marshes SLA within relevant character areas and ensures that the high landscape value and distinctive quality of these areas continue to be recognised'. (Ref 5.5) The SLA designation is saved within the current Local Plan.

Areas of High Landscape Value (Swale level) - The Sheppey Court and Diggs Marshes

5.55 The Sheppey Court and Diggs Marshes is an area of landscape value recognised under the Swale Local Plan (Ref 5.4). The key characteristics and special qualities of this local designation are covered in the landscape character description of the Sheppey Court and Diggs Marshes Landscape Character Area.

National Landscape Character

5.56 The Project Area and the majority of the study area are located within the Greater Thames Estuary National Character Area (NCA Profile: 81). This national character area is ‘predominantly a remote and tranquil landscape of shallow creeks, drowned estuaries, lowlying islands, mudflats and broad tracts of tidal salt marsh and reclaimed grazing marsh that lies between the North Sea and the rising ground inland. It forms the eastern edge of the London Basin and encompasses the coastlines of South Essex and North Kent, along with a narrow strip of land following the path of the Thames into East London.’ There is a marked contrast between the wild and remote coastal marshes and the industrial and urban developments which are highly visible in the low-lying landscape. (Ref 5.6).

Local Landscape Character

5.57 The Isle of Grain and surrounding landscape fall within the Kent Landscape Assessment 2004 (Ref 5.7) which draws together all the existing character assessments of the county. The Project Area and surrounding context fall within the Medway Marshes Character Area.

5.58 The Medway Marshes are typically low lying and flat, with huge open skies and extensive views. To the north of the river, the marshes are dominated by the massive industrial complexes of Grain and Kingsnorth which sit in grand isolation amidst open marshland. This contrasts markedly with the more confined and industrial marshland landscapes of parts of the Thames Marshes and the more tranquil, pastoral landscape of the Swale Marshes. The southern Medway Marshes are much smaller and fragmented with a much less coherent character.

5.59 The majority of marshland is reclaimed and the traditional landcover is coastal grazing marsh, large areas of typically flat low-lying pasture with characteristic network of creeks and dykes to the west of the Isle of Grain. The landscape of the Medway Marshes has long been associated with industrial use. Large areas of the north Medway Marshes are now occupied by extensive industrial complexes, with their associated jetties, roads and rail links, while to the south of the river smaller-scale urban and industrial development has occurred in a piecemeal fashion along the immediate coastline where marshes now barely exist.

5.60 The saltmarshes, mudflats and grazing marshes of the Medway form an integral part of the North Kent estuarine and marshland habitat complex. The grazing marshes which separate Allhallows and the Isle of Grain and coastal mud flats in the north of the study area fall within the North Kent Marshes SLA.

5.61 The study area is covered by the Medway Landscape Character Assessment 2011 (Ref 5.5), and Swale Landscape Character and Biodiversity Appraisal 2011 (Ref 5.8). These documents identify the local Landscape Character Areas (LCA) which are considered as recognisable distinctions in landform, land use pattern, vegetation, historic and cultural features combined that lead to a unique sense of character. The key characteristics of each LCA have been refined within the study area to reflect the findings of the site surveys. The landscape character areas relevant to this assessment are shown on Figure 5.4, their key characteristics and judgements on landscape value are noted below.

Allhallows to Stoke Marshes

5.62 This LCA covers the majority of the central and western proportion of the study area and is predominantly comprised of marshland with large pockets of saltmarsh between Allhallows, Grain and Kingsnorth. This landscape has a strong historical influence. The relevant key characteristics are as follows:

- open, flat and expansive marshland landscape with open and expansive panoramic views across the Thames Estuary and to Southend-On-Sea;
- industrial development and infrastructure has a strong influence on the setting and back-cloth to the south and south east (at Grain and Kingsnorth);
- strong industrial influence with the OHL and pylons extend from Middle Stoke to Grain Power Station which marks the boundary of this LCA and is a strong vertical feature that contrasts with the flat open marshland;
- there are a number of historic military features to the north of Grain, including the Grain Foreshore flood defence wall, former mineral workings and earthworks to site Grain Fort;
- range of natural features such streams, pools, marshland and regenerating scrub with protected wildlife zones which contribute to a strong sense of place and is particularly distinctive in relation to the adjacent landscapes;
- substantial areas of water along Yantlett Creek at Stoke Marshes form a particularly distinctive landscape feature marking historic boundary between Isle of Grain and the Hoo Peninsula;
- the presence of water meandering to the coastline contributes to the strong sense of place built up by the complex arrangement of creeks, fleets and pools interrupted by the rectilinear dykes and sea walls further emphasising the sense of place and contributes to the relative sense of tranquillity experienced within this LCA;
- characteristic vegetation consists of extensive tracts of grazing marsh with isolated trees and pockets of scrub and managed grassland;
- this LCA also offers some recreational routes including Circular Walks of the Hoo Peninsula but there are not local paths or PRoW that link the main communities of Allhallows and Grain; and
- large pockets of salt marsh with varied habitats of wetlands and scrub habitats. Wild birds and grazing animals contribute to the noticeable overall biodiversity value.

5.63 The majority of this LCA is located within the North Kent Marshes SLA. This LCA demonstrates a number of high quality landscape elements that contribute to a strong sense of place, relative sense of tranquillity that is particularly representative of the special qualities of the SLA. Landscape value is therefore considered to be Medium.

Hoo Peninsula Farmland

5.64 This LCA occupies an area to the west of Allhallows and is generally characterised as a flat to undulating open farmland that extends beyond the study area and occupies the central part of the Hoo Peninsula. The relevant key characteristics are as follows:

- undulating, predominantly arable farmland with large open fields and little sense of enclosure. There are extensive views from elevated areas towards the Thames and Medway estuaries;
- weak landscape structure, lack of distinctive elements and overall coherence;
- mixed field boundaries consisting of fences, hedges, isolated trees and sparse hedgerows most of which are not particularly intact; and
- some detracting and discordant features including poor quality edges to farms and settlements, the influence of the road networks, OHL and pylons with prominent views to industrial areas at Grain and Kingsnorth.

5.65 This LCA does not lie within any designation and consists of a weak landscape structure therefore value is considered to be Low.

Lower Stoke Farmland

5.66 This LCA covers a small area at the western extent of the study area. This LCA is comprised of arable farmland to the south and east of Lower Stoke. Beyond the study area this character area runs east/ west between St Werhbugh to Middle Stoke. The relevant key characteristics are as follows:

- consists of open and undulating, arable farmland with medium scale fields;
- varied field boundaries range from hedgerows, isolated trees and fences and although more enclosed than the Hoo Peninsula farmland LCA, the field boundaries within the study area are noticeably fragmented; and
- strong industrial influence surrounding the southern edge of the LCA with large infrastructure and largescale complexes at Grain and Kingsnorth form a strong industrial backcloth to the south.

5.67 Although part of this LCA falls within the North Kent SLA it is not particularly representative of any of the special qualities. The landscape elements within the study area are relatively discordant therefore landscape value is considered to be Low.

St Mary's Farmland

5.68 This LCA covers a small portion at the north western extent of the study area. This landscape is comprised of mixed farmland from upper slopes with open elevated views north across the Thames Estuary. The medium to large scale rectilinear field patterns, with upper slopes form a contrast against the adjacent flat marshland fringe.

5.69 As shown on Figure 5.1, there would be no intervisibility between this LCA and the GB Onshore Scheme and as such would result in no change to the character of this LCA. Therefore the St Mary's Farmland LCA has been excluded from further assessment.

Urban/ Industrial Area

5.70 Although this area has no specific character classification or published characteristics, it occupies a noticeable portion of the study area and is strongly influenced by the presence of industry and infrastructure. This area is comprised of largescale industrial development associated with the energy infrastructure network as well as the residential settlement of Grain. The industrial developments including the National Grid LNG Terminal and Grain Power Station dominate the urban fabric of this area. There are however, remains of military defences along the western coastline of grain which are of historical and cultural importance. To the east of Grain the urban fabric is dominated by the industrial expanse within Sheerness extending south to Queenborough where large areas of hardstanding, wind turbines and dockyard prevail.

5.71 The Urban/ Industrial area is not designated, is dominated by industrial complexes, and the landscape value is considered to be Low.

Chetney and Greenborough Marshes

5.72 This LCA covers the south eastern extent of the study area. This landscape is an area of extensive coastal marshland comprised of grazing marsh, mudflats and broad skylines. The relevant key characteristics are as follows:

- extensive flat coastal marsh comprised of grazing marsh, saltmarsh, mudflats and including features of ditches and fleets;
- isolated and remote landscape with high degree of intervisibility between marshland and surrounding landscape which influence a sense of place;
- scattered trees with patches of vegetation cover;
- detracting features of overhead lines and major transportation routes across the landscape; and
- interrupted distant views by adjacent industrial complexes.

5.73 This LCA is predominantly located within the North Kent SLA. The LCA demonstrates a strong sense of place and the quality of the coastal marshland is kept isolated from human influence contributing to a relative sense of tranquillity and is particularly representative of the special qualities of the SLA. Therefore landscape value is considered to be Medium.

Elmley Marshes

5.74 The Elmley Marshes is a flat open expanse comprised of coastal grazing marsh with sinuous reed filled ditches. This landscape is a relatively unspoilt, natural and tranquil landscape, epitomised by open flat land with broad skies, few landscape features and an overriding sense of remoteness. This LCA occupies only a very small area at the edge of the study area adjacent to the Chetney and Greenborough Marshes. The proportion of this LCA within the study area is so peripheral to the overall character and impression of this LCA which extends south-east across the central part of the Isle of Sheppey. The qualities of this LCA within the study area are reflected in the characterisation and assessment of the Chetney and Greenborough Marshes LCA as such the Elmeny Marshes LCA is not considered further within this assessment.

Sheppey Court and Diggs Marshes

5.75 This LCA covers a small area to the south of Mile Town and east of Queenborough at the eastern periphery of the study area. This landscape is characterised by flat, low lying, open alluvial marshland with urban fringe and industrial complexes at its boundary. There are expansive views interrupted by industrial developments, major transportation routes and overhead lines that contain this LCA to the east, south and west.

5.76 This LCA is located within an area designated as of 'high landscape value (Swale level)' identified within the Swale Local Plan. However the GB Onshore Scheme would have little bearing on the character of this LCA due to the scale and mass of intervening industrial development and infrastructure. Therefore the GB Onshore Scheme would not result in significant effects as such this LCA is not considered for further assessment.

Minster Marshes

5.77 This is a rural landscape to the north west of the Isle of Sheppey characterised by the low-lying alluvial marshlands. This landscape is generally flat but gently rises to the south-east with long interrupted views. This LCA occupies a very small proportion of the eastern extent of the study area adjacent to the Sheppey Court and Diggs LCA. As is the case for the Sheppey Court and Diggs LCA the GB Onshore Scheme would have little bearing on the character of the Minster Marshes LCA due the scale and mass of intervening industrial development within Grain and Sheerness. Therefore this LCA is not considered for further assessment.

Summary of Landscape Baseline

5.78 The landscape baseline analysis has identified a number of landscape receptors that have the potential to be significantly affected by the GB Onshore Scheme. The special qualities relevant to the North Kent Marshes SLA are embedded within the key characteristics of each of the relevant local LCAs. Some of the local LCAs and the Sheppey Court Area of High Landscape Value are highly unlikely to be significantly affected and have therefore have been excluded from further assessment.

5.79 The landscape character areas considered for more detailed assessment include:

- Allhallows to Stoke Marshes;
- Hoo Peninsula Farmland;

- Lower Stoke Marshland;
- Industrial/Urban Area; and
- Chetney and Greenborough Marshes

5.80 The extent of impact on landscape character and significance is considered in subsequent sections of this chapter and Appendix 05.A.

Visual Baseline

Zone of Theoretical Visibility (ZTV)

5.81 In order to identify visual receptors and locations with the potential to have views of the GB Onshore Scheme, a ZTV has been produced as described below. The ZTV identifies those areas that have the potential to experience views of the GB Onshore Scheme and is illustrated on Figure 5.1. This has been used to inform the selection of representative viewpoints and to illustrate the potential influence of the GB Onshore Scheme in the wider landscape.

5.82 The ZTV map indicates areas from where it may be possible to view part of or the entire GB Onshore Scheme. However, the use of the map needs to be qualified by the following considerations:

- the ZTV is based on a bare ground model - Ordnance Survey (OS) Terrain 5 data based on a 5 m grid terrain model across the study area;
- screening from buildings taken from OS MasterMap has been included within first 2 km of the project area however, beyond 2 km the bare ground ZTV mapping is limited by the detail of the digital terrain model data used and does not take account screening from built form or vegetation;
- some areas of theoretical visibility may comprise woodland, or agricultural land, where there is effectively no public access and the likelihood of views being experienced is consequently low; and
- the ZTV does not take account of the likely orientation of a viewer, such as the direction of travel and there is no allowance for reduction of visibility with distance, weather or light.

5.83 These limitations mean that the ZTV map tends to overestimate the extent of the visibility, both in terms of the area from which the GB Onshore Scheme is visible and the extent of the GB Onshore Scheme which is visible. It should be considered as a tool to assist in assessing the theoretical visibility of the GB Onshore Scheme and not a measure of the visual effect.

5.84 The ZTV illustrates that the theoretical visibility of the GB Onshore Scheme would be widespread across the study area. However actual visibility is partially constrained by the presence of other industrial scale complexes particularly to the south and east. Nonetheless upper portions of the proposed 26 m high converter station would be widely visible but less distinguishable when viewed alongside larger industrial complexes. The extent of impact on visual amenity and significance is considered in detail in section 7 and Appendix 05.B.

Visual Receptors

5.85 Visual receptors within the scope of this assessment are described in the following section and are grouped into the following visual receptor categories:

- views from residential areas;
- views from recreational routes; and
- views from roads.

Views from Residential Areas

5.86 Grain is the main settlement within the study area and is adjacent to the Project Area. Views towards the Project Area are limited to those properties at the western and south-western extent of the settlement most notably those residential properties on West Lane and Grain Road. Views towards the Project Area from the majority of the settlement are contained by the immediate context of the buildings.

5.87 Allhallows, Lower Stoke and Middle Stoke are located to the west of the Project Area. Properties at the eastern edge of these settlements experience open long distance views east across farmland and marshland towards Grain, and the industrial complexes that extend across the backdrop of views to the east and south-east.

5.88 In addition to the main settlements on the Hoo Peninsula there are a number of properties typically grouped in linear clusters and isolated farmsteads located either along or connecting to Ratcliffe Highway. Many of these residential properties experience open and long distance views east, south-east and south across the undulating farmland landscape against a backcloth of industrial complexes at Grain and Kingsnorth.

5.89 Residential areas in Swale, on the Isle of Sheppey include Sheerness, Mile Town, Queenborough, Halfway Houses and Minster on Sea. Views towards the Project Area from these settlements are heavily filtered by the presence of industrial infrastructure that stretches along the western coastline of the Isle of Sheppey.

5.90 Views experienced from residential settlements are represented by Viewpoints 2, 4 and 5.

Views from Recreational Routes

5.91 The Saxon Shore Way is a 262 km historic long distance route from Gravesend to Hastings that offers a diversity of scenery. People using the section of this route within the study area experience wide angle views dominated by expanses of marshland bordering the Medway Estuary.

5.92 Walk 3-Allhallows Marshes is one of the Circular Walks of the Hoo Peninsula (Ref 5.9) and is a 7 km circular route accessed from the eastern edge of Allhallows. This route is comprised of flat unmade paths and tracks. Points of interest include Allhallows-on-Sea, Yantlett Creek and the London Stone. Views are typically expansive and panoramic across the North Kent Marshes SLA and extend north towards the Thames Estuary and Southend on Sea. Part of this route also follows the proposed coastal path between Grain and Woolwich (England Coast Path Stretch Grain to Woolwich GWO 1) which extends across the study area to Grain.

5.93 There are a number of PRoW concentrated in three principal areas within the study area. A few PRoW in the west of the area typically follow some farmland fields and link small clusters of residential areas to Allhallows where views are typical open and expansive across the Hoo Peninsula. In the central portion of the study area a number of PRoW provide access from Grain to a small section of the coastline and extend south to a jetty to the south of Grain Power Station where views are focused east along the coastline and towards Sheerness. There is no PRoW or recreational route across the marshlands that connect Allhallows to Grain. The PRoW within the eastern portion of the study area is largely concentrated within the urban context of Sheerness with occasional routes across farmland such as Furze Hill where there are more elevated views across the Isle of Sheppey.

5.94 All of the recreational Routes and PRoWs are shown on Figure 5.5.

5.95 Views experienced from recreational routes are represented by Viewpoints 1, 3, 6, 7, 8 and 9.

Views from Roads

5.96 The B2001/ Grain Road is the main route within the study area linking the settlement of Grain to the rest of the Hoo Peninsula. Views experienced from this road vary from long distance and open views across the marshland landscape to views dominated by the scale and mass of industrial complexes in close proximity. Views towards the Project Area are partially interrupted by intervening development and fragmented road corridor vegetation.

5.97 Views from West Lane and other local roads are low level and typically interrupted by either sporadic patches of vegetation to the west or by intervening buildings. There are occasional longer distance views from West Lane across the vacant land within the Project Area. Stoke Road connects the residential settlement of Allhallows, Lower Stoke and Middle Stoke. Sections of this road experience open views across arable farmland and marshland towards the Project Area. The industrial complexes that occupy large swathes of the Isle of Grain coast are prominent across the backdrop of easterly views.

Representative Viewpoints

5.98 A total of nine representative viewpoints have been selected by ZTV and site based analysis to represent the visual receptors detailed above. These viewpoints have been agreed with the statutory consultees and are shown on Figure 5.6 and are identified in Table 5.12 Representative Viewpoints below.

Table 5.12 Representative Viewpoints

Viewpoint	Receptor Type	Easting	Northing
1 - Grain Coastal Park	Recreational	589078	176926
2 - West Lane	Residential	588328	176613
3 - Circular Walk 3-Allhallows Marshes	Recreational	585870	177537
4 - Stoke Road	Residential	583442	177143
5 - Ratcliffe Highway	Residential	582861	177572
6 - Saxon Shore Way	Recreational	584986	169149
7 - Queenborough Coastal Path	Recreational	590321	172726
8 - Riverside Country Park	Recreational	580806	168446
9 - Furze Hill	Recreational	592762	172062

Viewpoint 1: Grain Coastal Park

5.99 This viewpoint is representative of recreational users of Grain Coastal Park. This is a popular area used by the local community for coastal walks where the primary focus of views is along the coastline and north towards Southend-On-Sea. Foreground views north and north-west extend from the coastal defences along the coastline extending across the Thames Estuary. The taller buildings within Southend-On-Sea and the south Essex coastline form the backdrop of the view. This is a dynamic view strongly influenced by the changing tides where the extent of mudflats is more obvious at low tide and the movement of large container ships are a frequent occurrence in views. This is a well composed view across the North Kent Coastline, offers a mix of scenic elements typical of the North Kent SLA as well as some detracting features. On balance value is considered to be Medium.

Viewpoint 2: West Lane

5.100 This viewpoint is representative of residential receptors at the western extent of Grain along West Lane and the B2001/ Grain Road. Residents experience long range expansive views across the landscape towards Allhallows. Foreground views of the adjacent vacant land are partially interrupted by sporadic vegetation. The gently rising foreground obscures the lower lying marshland landscape before the land gently rises again to the farmland and built form within Allhallows that forms the backdrop of the view. The height and contrasting scale of the electrical pylons and OHL alongside the Tanks at the National Grid LNG Terminal tend to dominate the focus of views and as such value is considered to be Low.

Viewpoint 3: Circular Walk 3-Allhallows Marshes

5.101 This viewpoint is representative of recreational users of the Allhallows Marshes Circular Walk (Walk 3 of the Hoo Peninsula Walks) (Ref 5.9). This viewpoint offers long distance and panoramic views across a distinctive part of the North Kent Marshes SLA comprised of dykes, grazing marsh, creeks and grasslands that occupy the foreground in all directions. Mid-ground views north extend across the mouth of the Thames Estuary with views of Southend-On-Sea. Views south-east towards the Project Area are dominated by the presence of the pylons and OHL and storage tanks at the National Grid LNG Terminal that extend across a noticeable horizontal extent of the mid-ground. Other tall industrial infrastructure including stacks at Grain Power Station, wind turbines at Queenborough and the distinctive container gantry cranes at London Thamesport form the south-eastern and southern backdrop of the view. The appearance of such infrastructure only appears beyond the pylons and OHL which appear to contain the extent of the industrial development whereas views to the east experience big skies and a largely uninterrupted skyline. This viewpoint demonstrates many of the scenic aspects of the North Kent

Marshes SLA and views north are particularly well composed. However a noticeable proportion of the mid-to-background view is dominated by the scale and mass of industrial complexes. On balance value is considered to be Medium.

Viewpoint 4: Stoke Road

5.102 This viewpoint is representative of residential receptors at the southern extent of Allhallows along Stoke Road. Views are typically open and expansive. Foreground views extend east across the arable farmland and gently fall to the low lying marshland. Mid-ground views across the marshland area are punctuated by pockets of scrub vegetation and occasional trees that extend across the horizontal extent of views. The background is comprised of large scale industrial development including the pylons and OHL, large cylindrical storage tanks at the National Grid LNG Terminal, the series of stacks at Gain Power Station and gantry cranes at London Thamesport that extend across half of the horizontal extent of the view to the south. Background views to the north of the pylons and OHL remain uninterrupted and extend seaward where cargo ships sailing to and from ports is a distinguishable feature on the skyline. Mid to long distance views north demonstrate some of the more scenic aspects of the North Kent Marshes SLA. However the scale and mass of the storage tanks at the National Grid LNG Terminal and industrial backcloth is prominent therefore value is considered to be Low.

Viewpoint 5: Ratcliffe Highway

5.103 This viewpoint is representative of residential receptors located on and adjacent to Ratcliffe Highway. Views from this location are slightly elevated and offer open and expansive vistas towards the coastline and the industrial complexes that extend across the Isle of Grain. The primary focus of views is north to north-east across the mouth of the Thames Estuary where the Southend-On-Sea coastline forms the backdrop of the view. Views south-east towards the Project Area extend across the arable fields that occupies the foreground before the land falls away into the mid-distant low level marshland. The expanse of industrial complexes including pylons and OHL, storage tanks at the National Grid LNG Terminal, stacks at Grain Power Station, container gantry cranes at London Thamesport and other structures extend across half of the horizontal extent of the background view. The storage tanks and other industrial structures are seen alongside the residential properties at Grain and provide an indication of the contrast in scale. The expansive relatively undisturbed skyline to the north is representative of the more scenic quality experienced within the North Kent Marshes SLA. However this is seen alongside the large scale industrial development that strongly influences the background to the east and south. Taking this into account value is considered to be Medium.

Viewpoint 6: Saxon Shore Way

5.104 This viewpoint is representative of the open and long distance views experienced by people using the Saxon Shore Way. This section of this long distance route offers open and long distance views north across the Greenborough Marshes towards the Hoo Peninsula. Foreground views extend north across the marshlands to the Medway Estuary which then terminate at the Isle of Grain where a backcloth of industrial development extends across the background of the view. Industrial scale development at Grain Power Station, BP terminal and London Thamesport where the four blue container gantry cranes are particularly distinctive tall structures on the skyline. Large scale industrial developments on the Isle Sheppey including wind turbines at Queenborough are also visible in the background to the north-east. Extensive views of the open distinctive marshland demonstrate many of the more scenic elements of the North Kent Marshes SLA and are the main focus of views whilst the presence of the industrial backcloth reduces the overall quality and composition. Taking this into account value is considered to be Medium.

Viewpoint 7: Queenborough Coastal Path

5.105 This viewpoint is representative of recreational users using the local coastal path and waterfront at Queenborough. This location is a well-used PRoW at the edge of the sea defence wall and offers wide angle, long distance views west across the mudflats of the Medway Estuary at the edge of Queenborough. The flood wall itself contains views east and north-east. The immediate focus of views is of the dynamic mudflats of the estuary with boats and other watercraft that extend from fore-to-mid ground. The large structures at the industrial complexes on the Isle of Grain including the blue container gantry cranes at London Thamesport, stacks at Grain Power Station and the storage tanks at the National Grid LNG terminal extend across the full horizontal extent of the background view. Given the scale and close proximity of the industrial complexes that extend across the view, value is considered to be Low.

Viewpoint 8: Riverside Country Park

5.106 This viewpoint is located at the viewpoint platform at the Riverside Country Park, Rainham and is representative of people visiting the park and users of this section of the Saxon Shore Way. This location offers panoramic views of the park and beyond, however the primary focus of the view is north across the Medway Estuary. Foreground views north extend from the path network to the saltmarsh islands and meandering creeks across the mid-ground and beyond to Darnet Fort, Nor Marsh and the wider Medway Estuary. The tall structures at the industrial complexes Kingsnorth on the Isle of Grain and Queenborough including power station stacks, container gantry cranes at London Thamesport and wind turbines form the backdrop of views and punctuate the skyline. Elements in the view are of historical importance and the fore-to mid-ground is relatively well composed however the scale and horizontal extent of industrial complexes are prominent features across the background. On balance value is considered to be Medium.

Viewpoint 9: Furze Hill

5.107 This viewpoint is representative of recreational users of this PRoW and is located at the top of Furze Hill where views are relatively elevated and panoramic across the Isle of Sheppey. Agricultural fields occupy the immediate foreground in every direction and views north towards the Project Area slope down towards the residential area of Halfway Houses. The Sheppey Court and Diggs Marshes occupy the area between the Halfway Houses and Sheerness where the comparatively larger scale industrial developments extend south from Garrison Point to Queenborough where the four wind turbines punctuate the skyline. Beyond the Isle of Sheppey the industrial complexes on the Isle of Grain extend across the backdrop of the view. Largescale industrial development occupies almost all of the background view in every direction. Elevated views from this location are not particularly well composed and large industrial complexes are prominent in all directions therefore value is considered to be Low.

Future Baseline

5.108 The future baseline considers future conditions of the Project Area and study area should the GB Onshore Scheme not come forward in the context of the surrounding landscape. Overall there would be very limited change to the future landscape and visual baseline. It is anticipated that there would be no discernible change within the majority of the landscape immediately west of the site given the presence and proximity of the North Kent Marshes SLA which is protected under the Local Plan. The potential for future change to the landscape and visual receptors within the study area would likely be limited to the expansion of other industrial development within the existing complexes to the south and south-east of the Project Area which would further reinforce the existing character. Taking this into account there would be no substantial change to the sensitivity of the landscape and visual receptors between the existing and future baseline.

Potential Impacts

Sources of Potential Construction Effects

5.109 Potential effects at the construction phase of the proposed converter station, substation and DC cable route would be most noticeable within the Allhallows to Stoke Marshes LCA which includes potential effects on the landscape fabric of the Project Area.

5.110 Construction activities would introduce a number of new elements into the landscape and the greatest potential for significant effects would primarily arise from the loss of existing landscape features and the visibility of construction activities associated with the proposed converter station and substation. Construction activities related to the DC cable route could also directly affect the existing fabric of the North Kent SLA including the coastal mudflats and marshland habitats.

5.111 The potential for temporary impacts on the landscape and visual resource of the study area may arise from the activities detailed in Chapter 03. Temporary impacts associated with the installation of the DC cable route would be experienced over 1 year whereas construction of the converter station and substation would be experienced within a 3 year construction period. The main construction activities are summarised below:

- preliminary works;
- site establishment;
- earthworks;
- civil engineering works;
- building works;
- cable installation;
- provision/ installation of permanent services;
- mechanical and electrical works;
- commissioning;
- access and traffic within the site and to the site and
- site reinstatement and landscape works.

Sources of Potential Effects at Operation (Year 1) and Operation (Year 15)

5.112 The potential for long-term, operational and permanent impacts on the landscape and visual resource of the study area may arise from the introduction of the converter station and substation. These are considered to be permanent features within the landscape and in views which would be apparent for the long-term.

5.113 The operational elements with the potential to affect the landscape and visual receptors within the study area include the permanent buildings, outdoor equipment and associated infrastructure as detailed in Chapter 03: Proposed GB Onshore Scheme, Table 3.1.

5.114 The greatest potential for significant effects on landscape and visual receptors would primarily arise from:

- Physical effects within the Project Area and direct effects on the landscape fabric of the Project Area and the Allhallows to Stoke Marshes LCA including the loss of characteristic landscape elements and the introduction of uncharacteristic elements;
- Effects on the character and setting of the North Kent Marshes SLA;
- The combination of all the project components could also affect the setting of the neighbouring character areas by appreciably extending the influence of the industrial complexes within the Hoo Peninsula and fragmenting the more scenic elements of the marshland landscape; and

- Visibility of the proposed converter station and substation which are likely to be prominent features on the skyline within the open flat and expansive marshland landscape from residential settlements and recreational routes.

5.115 Following installation of the proposed DC cables all areas of the DC cable will be reinstated. There would be no perceptible change to the landscape and visual receptors during operation and maintenance of the DC cables.

Sources of Potential Effects at Decommissioning

5.116 The scale and nature of activities undertaken during decommissioning would be similar to those described previously for construction, however they would be temporary during the period of decommissioning activities on site. Following the removal of the structures and the reinstatement of the land there would be no further potential effects to the landscape and visual amenity.

Mitigation

Overview

5.117 Chapter 02 describes the alternatives that have been considered as part of the initial design process which led to the siting of the proposed GB Onshore Scheme. The siting will be further refined as part of the detailed design stage. Integral to the evolution of the design has been the iterative process to design and assessment which the LVIA has been embedded from feasibility through consultation to design refinement and the submitted design. From the outset, landscape and visual considerations have informed the siting and design of the various components of the GB Onshore Scheme to ensure that the submitted design proposals respond as sensitively as possible to the landscape and visual resource. Landscape Design Mitigation is shown on Figure 5.7a and 5.7b.

Medway Landscape Character Assessment – Allhallows to Stoke Marshes LCA Guidelines

5.118 The approach to embedded mitigation takes account of the guidelines set out in the Landscape Character Assessment - Allhallows to Stoke Marshes LCA (Ref 5.5. Page 96).

5.119 In response to these guidelines the landscape mitigation design:

- takes into account wetland creation linked to storage capacity through the Sustainable Drainage System (SUDS), including an attenuation pond, swale and dry attenuation basins;
- respects the open remote character of the marshland landscape and seeks to reduce the visual intrusiveness through careful siting of the larger buildings and the introduction of water tolerant planting that suits the character of the open marshland;
- reinforces the interface with the coastal grazing marshes; and
- vegetation and ditches (proposed swale) improves the strength of the boundary features along the western boundary of the Project Area.

5.120 Specific aspects of the design evolution and landscape mitigation design considerations are summarised below.

Siting, Orientation and Massing

5.121 The siting of the converter station and substation within the Project Area has been informed by the design development and assessment process. The location of the proposed converter station and substation has been located as close as possible alongside the existing industrial development at the National Grid LNG terminal and away from the majority of residential properties in Grain. The proposed siting and massing of converter station and substation alongside the existing industrial complexes and the proposed landscape reinstatement would improve the landscape fit and therefore reduce potential impacts on the setting of the North Kent Marshes SLA and Allhallows to Stoke Marshes LCA.

Boundary Vegetation and Landform

5.122 Appropriate boundary vegetation within the Project Area has been developed to improve the interface between the built edge of the converter station and substation and the transition to the adjacent marshland landscape. The combination of boundary vegetation on a slightly raised earth mound would also help to reduce the overall scale and mass of the proposed building façades. The proposed selection of scrub and wetland species has been developed in conjunction with ecologists and makes reference to the landscape character guidelines set out to improve and restore the characteristic feature of the Allhallows to Stoke Marshes LCA.

Access

5.123 The proposed location and working width of the primary access road has been selected in part to minimise physical impacts on the Project Area and the immediate context. The proposed route

and 5.5 m working width would be in keeping with the existing landscape pattern and layout with a simple connection to the B2001/ Grain Road.

Drainage and Habitat Creation

5.124 The outline Landscape Plan has been developed to enhance the biodiversity found within the Project Area. The introduction of a SUDS detention basin, attenuation pond and swale each planted with marginal wetland species will create a green corridor and more complex vegetation structure and improve the biodiversity value within the Project Area.

Residual Impacts

5.125 This section presents the findings of the landscape and visual effects assessment for the construction and operational phases of the GB Onshore Scheme. A detailed assessment of landscape and visual effects is provided in Appendix 05.A Landscape Assessment and Appendix 05.B Visual Assessment. The following section therefore, provides a summary of the likely significant effects during construction, operation and maintenance and decommission on the landscape and visual resource. The sensitivity of the landscape and visual receptors between the existing and future baseline is not considered to change as explained in section 5.108 and therefore not considered further in the assessment of effects.

5.126 This section should be read in conjunction with the following appendices, figures and visualisations:

- Appendix 05.A –Landscape Assessment;
- Appendix 05.B – Visual Assessment; and
- Figures 5.1 – 5.16.

Effects on the Landscape Fabric

5.127 Effects on the landscape fabric relate to the physical effects on the fabric of the Project Area such as changes to the land cover and use. Physical effects are found only on the Project Area where existing landscape elements may be removed or altered by the introduction of the proposed converter station and substation and the DC cable route corridor including the landfall. The detailed assessment of effects on the landscape fabric is inherent within the assessment of the local character area and is therefore contained within the assessment of effects on the Allhallows to Stoke Marshes LCA.

Effects on Landscape Designations during Construction

North Kent SLA

5.128 As described in section 5.54 the Medway Landscape Character Assessment recognises the special qualities of the North Kent Marshes SLA through the key characteristics of the relevant LCAs. Construction activities within the SLA are limited to those associated with the DC cable route and subsea cable (to MLWS) across a narrow corridor of the coastal mudflats leading to the landfall site. The increased sense of activity in the estuary would result in a very limited change to the special qualities and overall impression of the character of the North Kent SLA and would not result in significant effects on the natural beauty of the landscape of this designated area.

Landscape Effects during Construction

5.129 Significant landscape effects are predicted at one of the five LCAs assessed; Allhallows to Stoke Marshes LCA. The other four LCAs would not result in significant landscape effects during construction. The detailed assessment of landscape effects is contained within Appendix 05.A.

Allhallows to Stoke Marshes LCA

5.130 Overall sensitivity of this LCA is considered to be Medium. Construction activity related to the proposed converter station and substation would be located within this LCA at the eastern edge resulting in effects on both the landscape fabric and character.

5.131 Construction activities would be concentrated at the eastern edge, adjacent to the National Grid LNG terminal complex where extensive earthworks to create the platform, storage of materials, lay down areas, movement of plant and operation of cranes would be more apparent. However the area of land occupied by construction activities is somewhat physically detached from the majority of this LCA due to pockets of boundary vegetation, land use and most notably higher topography with very limited access. Therefore construction activities would be confined to a small portion of this LCA and concentrated away from the core area of the marshland where there would be no change to the most distinctive elements of the landscape fabric.

5.132 The presence and scale of activity would have a noticeable bearing on the setting and perceptual quality of this LCA. In particular the scale and intensity of activity would reduce the existing level of tranquillity experienced and is more prevalent in eastern areas.

5.133 Construction activities related to the DC cable route corridor would result in temporary physical changes to the fabric of the landscape and character within a very small footprint to the north-east of this LCA. Construction of the intertidal section of the subsea cable route (to MLWS) would extend across the distinctive mudflats which are a characteristic feature of the North Kent Marshes SLA. Construction activities would extend from the intertidal mudflats leading to the landfall site and within the corridor for the proposed DC cable route leading to the proposed converter station and would further increase the scale and extent of activity within the landscape and North Kent Marshes SLA.

5.134 Activities associated with the onshore length of the DC cable route would include the movement of plant and earthworks required for open cut trenches within a 30 m wide corridor between the proposed converter station and the landfall at the eastern extent of this LCA.

5.135 Overall construction activities would affect some of the key characteristics and special qualities across a noticeable portion of the landscape. However there would be no physical change to the distinctive core landscape elements of the marshland landscape. On balance the magnitude of change is considered to be Medium.

5.136 The magnitude of change, assessed alongside the sensitivity would result in a Moderate Adverse effect, which is considered significant.

Visual Effects during Construction

5.137 Three of the nine viewpoints assessed would result in significant construction effects on visual amenity of residential and recreational receptors represented by:

- Viewpoint 2- West Lane;
- Viewpoint 3- Circular Walk 3-Allhallows Marshes; and
- Viewpoint 4- Stoke Road.

5.138 The main source of significant effects would result from the contrasting nature and scale of construction activity and its prominence within relatively close proximity of the views. Significant visual effects are experienced within 4 km of the construction of the proposed converter station and substation.

5.139 The predicted influence of construction activity at the other six viewpoints is less distinguishable largely due to a combination of more distant locations (beyond 4 km) where the extent of view occupied by construction activity was contained by and seen alongside existing industrial complexes. Visual effects from these six viewpoints were predicted to be Minor adverse or Negligible and therefore not significant. The detailed assessment of visual effects is contained within Appendix 05.B.

Significant Visual Effects from Residential Areas

5.140 Residential receptors at the western edge of Grain and along the B2001/ Grain Road are represented by Viewpoint 2- West Lane where overall visual sensitivity is considered to be Medium.

5.141 Construction activity at the proposed converter station and substation site would be prominent in mid-range views across half of the horizontal extent of views. The majority of the tallest building works associated with the converter station and substation would be contained between the National Grid LNG Terminal and the OHL however lay down areas and civil engineering works associated with the proposed cable sealing end compound would extend north of the OHL.

5.142 Construction activity associated with the DC cable route corridor would occur in incremental lengths of 800 m with a 30 m wide construction corridor in close proximity and adjacent to West Lane and a number of properties along the B2001/ Grain Road and would temporarily dominate the focus of close range views.

5.143 The overall magnitude of change is considered to be Medium. The magnitude of change, assessed alongside the sensitivity would result in a Moderate Adverse effect, which is considered significant.

5.144 Residential receptors on Stoke Road are represented by Viewpoint 4- Stoke Road where overall visual sensitivity is considered to be Medium. Construction activities at the converter station and substation would be noticeable in distant views across a small section of the background mostly between the OHL and the National Grid LNG Terminal.

5.145 Construction activities related to the proposed DC cable route would be barely perceptible across the distant background of the view.

5.146 Overall, the open expansive nature of the marshland landscape and the seaward views would remain undisturbed key features and the magnitude of change is considered to be Medium. The magnitude of change, assessed alongside the sensitivity would result in a Moderate Adverse effect, which is considered significant.

Significant Visual Effects from Recreational Routes

5.147 Significant effects on views from recreational routes are predicted along sections of a local recreational route through Allhallows Marshes, represented by Viewpoint 3- Circular Walk 3- Allhallows Marshes where sensitivity is considered to be Medium.

5.148 Construction activity at the converter station and substation would appear in mid-range views between the OHL and the National Grid LNG Terminal against the backdrop of more distant industrial complexes. Construction activities would also appear to the north of the OHL at the proposed cable sealing end compound. The extent of construction activities visible would be more prominent in closer proximity sections of this walk. Construction activities would be highly noticeable and would distract from the visual amenity across a noticeable horizontal extent of the view.

5.149 Construction activities related to the proposed DC cable route including movement of plant along incremental lengths of 800 m across a 30 m wide corridor would be perceptible in the background extending from the coast to the substation against the backdrop of the distinctive marshland landscape.

5.150 Overall the magnitude of change is considered to be Medium. The magnitude of change, assessed alongside the sensitivity would result in a Moderate Adverse effect, which is considered significant.

Effects on Landscape Designations at Operation (Year 1)

North Kent SLA

5.151 As described in section 5.54 the Medway Landscape Character Assessment recognises the special qualities of the North Kent Marshes SLA through the key characteristics of the relevant LCAs. At year 1 of operation the GB Onshore Scheme would result in little perceptible change to the special qualities and overall impression of the character of the North Kent SLA and would not result in significant effects on the natural beauty of the landscape of this designated area.

Landscape Effects at Operation (Year 1)

5.152 There would be no significant landscape effects predicted at any of the five LCAs assessed. Significant landscape effects during the construction phase at the Allhallows to Stoke Marshes LCA would have reduced. The detailed assessment of landscape effects is contained within Appendix 05.A.

Allhallows to Stoke Marshes LCA

5.153 The operational converter station and substation would occupy an area within this LCA but outside of the North Kent Marshes SLA. Therefore the proposed converter station and substation would result in physical changes to the landscape fabric however changes to the special qualities of the SLA would be limited to the setting and perceptual aspects. The strong sense of place, open and panoramic views of the coastline and distinctive landscape elements would all remain intact.

5.154 The operational DC cable route corridor would be reinstated and no permanent structures would remain in the landscape. Therefore the completed DC cable route would have no bearing on this LCA. The overall magnitude of change is considered to be Low. The magnitude of change, assessed alongside the sensitivity would result in a Minor Adverse effect, which is not considered significant.

Visual Effects at Operation (Year 1)

5.155 At year 1 of operation three of the nine viewpoints assessed would result in significant effects on visual amenity of residential and recreational receptors represented by:

- Viewpoint 2- West Lane;
- Viewpoint 3- Circular Walk 3-Allhallows Marshes; and
- Viewpoint 4- Stoke Road.

5.156 The main source of significant effects would result from the contrasting scale and mass of the converter satiation and substation and its prominence within relatively close proximity of the views. Significant visual effects are only experienced within 4 km of the converter station and substation.

5.157 The predicted influence of the proposed converter station and substation at the other six viewpoints is less distinguishable largely due to a combination of more distant locations (beyond 4 km) where the extent of view occupied by the proposed converter station and substation was contained by and seen alongside existing industrial complexes.

5.158 The proposed DC cable route would be reinstated and would have no bearing on views.

5.159 Visual effects from these six viewpoints were predicted to be Minor adverse or Negligible and therefore not significant. The detailed assessment of visual effects is contained within Appendix 05.B.

Significant Visual Effects from Residential Areas

5.160 Residential receptors at the western edge of Grain and along the B2001/ Grain Road are represented by Viewpoint 2- West Lane where overall visual sensitivity is considered to be Medium. At year 1 of operation the proposed converter station and substation would occupy a noticeable proportion of mid-range views but contained between the taller National Grid LNG Terminal storage tanks and the OHL. The substation would be noticeable against the façade of the converter station alongside outdoor electrical equipment. The proposed converter station and substation would be immediately visible in mid-range views strongly associated with the existing industrial facilities but would be prominent albeit oblique to the main focus. Taking all of this into account, the magnitude of change is considered to be Medium. The magnitude of change, assessed alongside the sensitivity would result in a Moderate Adverse effect, which is considered significant.

5.161 Residential receptors on Stoke Road are represented by Viewpoint 4- Stoke Road where visual sensitivity is considered to be Medium. At year 1 of operation the proposed converter station and substation would occupy a noticeable horizontal extent of the background view between the OHL and National Grid LNG Terminal storage tanks. However the height of the proposed converter station and substation would appear smaller than the adjacent National Grid LNG Terminal storage containers. The open marshland landscape that fills the majority of the background view north would remain unaffected. The magnitude of change is considered to be Medium. The magnitude of change, assessed alongside the sensitivity would result in a Moderate Adverse effect, which is considered significant.

Significant Visual Effects from Recreational Routes

5.162 Significant effects on views from recreational routes are predicted along sections of a local recreational route through Allhallows Marshes, represented by Viewpoint 3- Circular Walk 3-Allhallows Marshes where sensitivity is considered to be Medium. At year 1 of operation the scale and mass of the proposed converter station and substation would be noticeable across a horizontal extent between the taller OHL and National Grid LNG Terminal storage tanks which is associated with lower quality elements within the view. Overall the proposed converter station

and substation would not compromise the more scenic and attractive quality of marshland and seaward views. The magnitude of change is considered to be Medium. The magnitude of change, assessed alongside the sensitivity would result in a Moderate Adverse effect, which is considered significant.

Effects on Landscape Designations at Operation (Year 15)

North Kent SLA

5.163 At year 15 of operation the GB Onshore Scheme would result in little perceptible change to the special qualities and overall impression of the character of the North Kent SLA and would not result in significant effects on the natural beauty of the landscape of this designated area.

Landscape Effects at Operation (Year 15)

Landscape Effects at Operation (Year 15)

5.164 There would be no significant landscape effects predicted at any of the five LCAs assessed. The Allhallows to Stoke Marshes LCA, the landscape in which the proposed converter station and substation is located would not result in significant landscape effects. The detailed assessment of landscape effects is contained within Appendix 05.A.

Allhallows to Stoke Marshes

5.165 Physical changes to the landscape fabric of the Allhallows to Stoke Marshes LCA would be the same at year 1 of operation. However the establishment of vegetation would help to reduce the scale and mass of proposed buildings and subsequently reduce the influence of the proposed converter station and substation would have on this LCA. The boundary vegetation would provide a transitional interface between the marshland landscape and the proposed converter station and substation. The resulting impression would be that the proposed converter station and substation would no longer be associated within the character of this LCA. The establishment of native scrub and wetland vegetation would improve the strength of the boundary vegetation and biodiversity at the interface between proposed converter station and substation site and the core of the marshland landscape. The most integral characteristics and high quality elements of the landscape would remain intact. The magnitude of change is considered to be Low. The magnitude of change, assessed alongside the sensitivity would result in a Minor Adverse effect, which is not considered significant.

Visual Effects at Operation (Year 15)

5.166 At year 15 of operation only one of the nine viewpoints assessed would result in significant effects on visual amenity of residential receptors represented by Viewpoint 2- West Lane.

5.167 The magnitude of change and significance of visual effects predicated at year 1 of operation at Viewpoints 3 and 4 would have reduced from Moderate Adverse to Minor Adverse due to the establishment of mitigation planting. Scrub and woodland edge vegetation would partially screen lower level buildings which would help to assimilate the proposed converter station and substation into the landscape and subsequently the view. Established vegetation would also break up the built façade, reduce the sense of scale and mass of the taller buildings within the converter station platform and reinforce the delineation between the open marshland landscape and the industrial complexes.

5.168 At the other six Viewpoints the proposed converter station and substation would remain less distinguishable due to a combination of more distant locations (beyond 4 km) where the extent of the view occupied by the proposed converter station and substation was seen alongside existing industrial complexes. The proposed DC cable route would be reinstated and would have no bearing on views. Visual effects from these six Viewpoints were predicted to be Minor Adverse or Negligible and therefore not significant. The detailed assessment of visual effects is contained within Appendix 05.B.

Significant Visual Effects from Residential Areas

5.169 Residential receptors at the western edge of Grain and along the B2001/ Grain Road are represented by Viewpoint 2- West Lane where overall visual sensitivity is considered to be Medium. At year 15 of operation once vegetation has established there would be a linear belt of low level scrub and woodland edge that would extend across part of the horizontal extent of the

view to the north-west the proposed converter station and substation. However the scale and extent of change would remain same as at year 1 and the magnitude of change would remain Medium. The magnitude of change, assessed alongside the sensitivity would result in a Moderate Adverse effect, which is considered significant.

Landscape and Visual Effects during Decommissioning

5.170 The scale and nature of activities undertaken during decommissioning would be similar to those described previously for construction. It is anticipated that below ground cables would remain in situ which would further limit the duration and extent of decommissioning activities. Following the removal of the structures and the reinstatement of the land there would be no long-term effects to the landscape and visual receptors.

Cumulative Effects

5.171 This section considers the potential for cumulative landscape and visual effects to occur as a result of the GB Onshore Scheme. Not all of the proposed cumulative developments contained within the long list set out in Chapter 12, Table 12.2 would result in significant landscape and visual cumulative effects. These developments have been excluded on the basis that they are not of the same type or similar scale or nature to the GB Onshore Scheme and do not have the potential to result in significant cumulative effects.

5.172 The following cumulative schemes are shown on Figure 12.1 and have been included in the assessment of inter-project cumulative landscape and visual effects:

- A new lattice tower (50 m tall) north of the proposed substation;
- Down leads from the tower direct to the substation;
- Down leads to the proposed cable sealing end compound (25 m x 25 m) via the proposed gantry (14 m tall); and
- Phase 1 of an outline planning application for the development of a business park management centre, Grain Road Rochester Kent ME3 0AE,

5.173 Potential cumulative effects during construction have been scoped out of the assessment as it is considered that there would be very little discernible difference between impacts associated with construction of the GB Onshore Scheme on its own and those associated with construction of the GB Onshore Scheme and the cumulative schemes together. The following inter-project cumulative assessment therefore focuses on potential inter-project cumulative landscape and visual effects at the operational stage only.

Cumulative Landscape Effects

5.174 The potential for significant cumulative landscape effects would be limited to the landscape fabric of the Project Area and the Allhallows to Stoke Marshes LCA. Overall the GB Onshore Scheme in combination with the cumulative schemes would result no distinguishable difference in intervisibility with the adjacent LCAs. The inclusion of the Phase 1 development of the business park management centre within this cumulative scenario in particular would reinforce the industrial setting of the Project Area. Given the existing context and the non-cumulative assessment, there would be no perceptible change to the key characteristics and would not result in significant cumulative effects. Therefore the cumulative landscape assessment has been limited to the Allhallows to Stoke Marshes LCA as detailed below.

Allhallows to Stoke Marshes LCA

5.175 This LCA is considered to be of Medium sensitivity as detailed in the non-cumulative assessment set out in Appendix 05.A Table 1.

5.176 The operational GB Onshore Scheme in combination with the cumulative schemes would very slightly increase the industrial influence within this LCA. The Phase 1 business park and management centre would further reinforce the industrial nature of the backdrop and setting of this LCA whereas the lattice tower and down leads would physically link the cumulative schemes to components of the GB Onshore Scheme, in particular the substation and cable sealing end compound. However, the majority of the more valued landscape elements of this LCA, in particular the balance of marshland features and creeks would remain unchanged. Overall the sense of place and distinctive qualities would remain largely intact. Therefore the cumulative magnitude of change is considered to be Very Low.

5.177 The magnitude of cumulative change, assessed alongside the sensitivity would result in a Negligible cumulative effect, which is not considered significant.

North Kent SLA

5.178 The cumulative developments are outside of the North Kent SLA and as such there would be no change to the fabric of the SLA or the majority of its setting and therefore no cumulative effects are predicted.

Cumulative Visual Effects

5.179 The cumulative schemes would be barely perceptible from more distant visual receptors where residual effects are predicted to be minor adverse and negligible as illustrated by viewpoints 1,5,6,7, and 9. These visual receptors (representative viewpoints) are unlikely to result in cumulative significant effects and are not considered for detailed cumulative assessment.

5.180 The potential for significant cumulative visual effects is limited to the visual receptors represented by:

- Viewpoint 2-West Lane;
- Viewpoint 3-Circular Walk 3-Allhallows Marshes; and
- Viewpoint 4-Stoke Road.

Viewpoint 2: West Lane

5.181 This viewpoint is representative of views experienced by residents at the western edge of Grain where overall visual sensitivity is considered to be Medium.

5.182 The introduction of the operational GB Onshore Scheme in combination with the cumulative schemes, in particular the 50m lattice tower and down leads would result in a very slightly greater influence of industrial development north beyond the existing OHL, physically linking the substation and cable sealing end compound. Together this cumulative scenario would appear as one development albeit oblique to the main focus of views. The upper portions of Phase 1 of the business park management centre may also be perceptible within a small proportion of the background of the view which is already occupied by existing industrial development. Overall the addition to the Proposed Development into this cumulative scenario would result in a slight change not dissimilar to the existing composition and balance of features within the view. Overall the cumulative magnitude of change is considered to be Low.

5.183 The cumulative magnitude of change, assessed alongside the sensitivity would result in a Minor Adverse cumulative effect, which is not considered significant.

Viewpoint 3-Circular Walk 3-Allhallows Marshes

5.184 This viewpoint is representative of views experienced by recreational receptors on this part of the circular walk and overall visual sensitivity is considered to be Medium.

5.185 The introduction of the GB Onshore Scheme in combination with the cumulative schemes, in particular Phase 1 of the business park and management centre would slightly extend the influence of industrial complexes across the backcloth of view north beyond the OHL. The lattice tower and down leads would physically link the substation and cable sealing end compound and would read as one development within the extent of the view occupied by the GB Onshore Scheme.

5.186 However this cumulative scenario would not detract from the overall composition and more scenic elements across the marshland and seaward views north. The cumulative magnitude of change is considered to be Low. The cumulative magnitude of change, assessed alongside the sensitivity would result in a Minor Adverse effect, which is not considered significant.

Viewpoint 4-Stoke Road

5.187 This viewpoint is representative of residential receptors and overall visual sensitivity is considered to be Medium.

5.188 The introduction of the operational GB Onshore Scheme in combination with the cumulative schemes would be perceptible where the lattice tower and down leads connect to the proposed substation and cable sealing end compound within a small part of the background view and would read as one development. The inclusion of the Phase 1 business park and management centre would further reinforce the industrial backdrop of the view. Overall the cumulative magnitude of change is considered to be Low. The cumulative magnitude of change, assessed alongside the sensitivity would result in a Minor Adverse effect, which is not considered significant.

Summary of Assessment

5.189 This LVIA was undertaken in accordance with current professional standards namely GLVIA 3 and has been informed by consultation with Medway Council. The LVIA considers the potential effects of the landscape and visual receptors at the construction phase, year 1 of operation and year 15 of operation of the GB Onshore Scheme. The LVIA also assesses the likely significant cumulative effects of the GB Onshore Scheme when considered in combination with the cumulative schemes.

5.190 The findings of the assessment are presented in Table 5.13 Assessment Summary Table.

5.191 In respect of effects on the landscape fabric and landscape character, the assessment found that significant effects during construction would be limited to the eastern edge of the Allhallows to Stoke Marshes LCA. Significant effects would arise from the loss of agricultural land as a result of construction activity at the proposed converter station and substation site as well as the DC cable route corridor. These effects would be short term during construction and there would be no physical change to the most distinctive landscape elements of the marshland. The landscape assessment concludes that there would be no significant effects at years 1 and 15 of operation. The assessment also concludes that the North Kent SLA would not be significantly affected.

5.192 In respect of visual amenity, of the nine viewpoints assessed during construction, visual receptors at three of the viewpoints would be significantly affected over the short term, with the furthest viewpoint located 3.9 km from the Project Area. The source of significant effects was due to receptors of medium sensitivity where the scale and extent of construction activity would be a prominent addition within the overall composition of the view. At year 1 of operation of the GB Onshore Scheme, the number of viewpoints significantly affected would be the same due to the scale and prominence of the proposed converter station and substation within close proximity views. At year 15 of operation of the GB Onshore Scheme, the number of viewpoints significantly affected would be reduced to one, at West lane. This finding relates to the establishment of landscape planting at the western edge of the Project Area which would reduce the prominence of the proposed converter station and substation over time.

5.193 The cumulative assessment concludes that there would be no significant cumulative effects on the landscape and visual receptors.

Table 5.13 Assessment Summary Table of Residual Effects

Landscape/ Visual Receptor	Sensitivity	Construction		Operation Year 1		Operation Year 15		Cumulative Assessment	
		Magnitude of Change	Significance of residual effect	Magnitude of Change	Significance of residual effect	Magnitude of Change	Significance of residual effect	Cumulative Magnitude of Change	Significance of residual effect
Allhallows to Stoke Marshes	Medium	Medium	**Moderate Adverse (significant)**	Low	Minor Adverse	Low	Minor Adverse	Very Low	Negligible
Hoo Peninsula Farmland	Low	Low	Minor Adverse	Very Low	Negligible	Very Low	Negligible	NA	NA
Lower Stoke Farmland	Low	Low	Minor Adverse	Very Low	Negligible	Very Low	Negligible	NA	NA
Industrial/ Urban Area	Low	Very Low	Negligible	Low	Negligible	Low	Negligible	NA	NA
Chetney and Greenborough Marshes	Medium	Very Low	Negligible	Very Low	Negligible	Very Low	Negligible	NA	NA
VP1 - Grain Coastal Park	Medium	Low	Minor Adverse	Very Low	Negligible	Very Low	Negligible	NA	NA
VP2 - West Lane	Medium	Medium	**Moderate Adverse (significant)**	Medium	**Moderate Adverse (significant)**	Medium	**Moderate Adverse (significant)**	Low	Minor Adverse
VP3 - Circular Walk 3- Allhallows Marshes	Medium	Medium	**Moderate Adverse (significant)**	Medium	**Moderate Adverse (significant)**	Low	Minor Adverse	Low	Minor Adverse
VP4 - Stoke Road	Medium	Medium	**Moderate Adverse (significant)**	Medium	**Moderate Adverse (significant)**	Low	Minor Adverse	Low	Minor Adverse
VP5 - Ratcliffe Highway	Medium	Low	Minor Adverse	Low	Minor Adverse	Low	Minor Adverse	NA	NA
VP6 - Saxon Shore Way	Medium	Very Low	Negligible	Very Low	Negligible	Very Low	Negligible	NA	NA
VP7 - Queenborough Coastal Path	Medium	Low	Minor Adverse	Low	Minor Adverse	Low	Minor Adverse	NA	NA
VP8 - Riverside Country Park	Medium	Very Low	Negligible	Very Low	Negligible	Very Low	Negligible	NA	NA
VP9 - Furze Hill	Low	Very Low	Negligible	Very Low	Negligible	Very Low	Negligible	NA	NA

References

Ref 5.1 Landscape Institute and Instituted of Environmental Management and Assessment, (2013). Guidelines for Landscape and Visual Impact Assessment, 3rd Edition, Oxon.

Ref 5.2 Landscape Institute, (2011). Landscape Institute Advice Note 01/11: Photography and photomontage in landscape and visual impact assessment.

Ref 5.3 Medway Council, (2003). Medway Local Plan.

Ref 5.4 Swale Borough Council, (2017). Bearing Fruits, The Swale Borough Local Plan.

Ref 5.5 Medway Council, (2011). Medway Landscape Character Assessment.

Ref 5.6 Natural England, (2013). National Character Area Profile: 81. Greater Thames Estuary.

Ref 5.7 Jacobs Babtie on behalf of Kent County Council, (2004). The Landscape Assessment of Kent.

Ref 5.8 Jacobs on behalf of Swale Borough Council, (2011). Swale Landscape Character and Biodiversity Appraisal, Supplementary Planning Document.

Ref 5.9 Medway Swale Estuary Partnership and Medway Council, (2008). Circular Walks on The Hoo Peninsula.

6. Ecology & Nature Conservation

Introduction

6.1 This chapter of the Environmental Impact Assessment (EIA) addresses potential effects associated with the NeuConnect GB Onshore Scheme on Ecology and Nature Conservation. It evaluates relevant ecological receptors (including nature conservation designations, priority habitats, protected species and invasive non-native species (INNS)) associated with the GB Onshore Scheme, with each being assigned a nature conservation value (sensitivity). Thereafter, the GB Onshore Scheme's potential impacts and effects on ecological receptor conservation status, inter-relationships, and their contribution to local (and if appropriate regional and national) biodiversity have been identified. The assessment takes into account impact avoidance design measures and management activities when determining the significance of potential effects. The requirement for any further mitigation measures is then described and mitigation measures are taken into account in the assessment of potential residual effects.

6.2 Consultation responses and scoping opinions have been taken into account during the preparation of this chapter. Consideration is also given, where appropriate to third-party projects and activities and specifically to the potential for interaction between the NeuConnect Scheme and other projects resulting in cumulative effects.

Study Areas

6.3 The Proposed Development area (the Site) (see Figure 6-1) is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south.

6.4 The study areas used in this assessment were defined with reference to the likely zones of influence (ZoIs) and relevant nature conservation features in relation to which the GB Onshore Scheme may have potential to result in significant effects, but also with regard to the precautionary principle to ensure sufficient data were gathered to meet any design iterations which may change the likely ZoI used to undertake the impact assessment.

6.5 It is important to recognise that the likely ZoI of the GB Onshore Scheme may vary over time (e.g. the construction zone of influence may differ from the operational zone of influence) and/ or depending on the individual sensitivities of different ecological features and this has been factored into the assessment, where relevant.

6.6 For the purpose of this assessment the following study areas have been used:

- up to 10 kilometres (km) from the Site boundary for all European statutory designated sites;
- up to 2 km from the Site boundary for all National statutory designated sites
- up to 2 km from the Site boundary for all non-statutory designated sites;
- up to 2 km from the Site boundary for records (within the last ten years) of protected/ notable species and, or habitats;
- up to 50 metres (m) from the Site boundary for notable habitats;
- up to 50 m from the Site boundary for terrestrial and aquatic invertebrates;
- up to 50 m from the Site boundary for Badger Meles meles;
- up to 500 m from the Site boundary for Great Crested Newt Triturus cristatus;
- up to 100 m from the Site boundary for reptiles, Water Vole Arvicola amphibius and Otter Lutra lutra;
- up to 100 m from the Site boundary for bat roosts and notable foraging and, or commuting habitat;
- up to 100 m from the Site boundary for breeding and wintering birds and their habitats (although habitats within the Site boundary are given greater emphasis); and
- up to 500 m from the Site boundary for waterbirds using the intertidal areas.

6.7 The study area for the intertidal benthic ecology baseline has been defined as the area encompassing the wider Thames Estuary. ZoIs for specific receptors are discussed in further detail throughout this assessment. This spatial extent was selected on the basis that it provides geographic context and encompasses the relevant functional habitats and range of movement for mobile benthic species found within the area of interest for the Project.

Planning Policy & Applicable Legislation

6.8 Legislation and policies relevant to the assessment of the impacts of the GB Onshore Scheme on ecology and nature conservation include:

International Legislation

6.9 European Union and global biodiversity targets are partly delivered through a range of legislative measures, which place obligations on Member States to protect biodiversity and the natural environment. In relation to wildlife and nature conservation, six key Directives have been adopted by the European Union, namely:

- Marine Strategy Framework Directive (2008/56/EC);
- Directive 2009/147/EC on the conservation of wild birds (the codified version of Council Directive 79/409/EEC as amended) (Birds Directive);
- Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive);
- The Oslo and Paris Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention') 1998; and
- Regulation (EU) 1143/2014 on the introduction and spread of invasive alien species (IAS).

6.10 These Directives provide for the protection of animal and plant species of European importance and the habitats which support them, particularly through the establishment of a network of protected sites, called Natura 2000.

6.11 Further relevant legislation includes Directive 2000/60/EC (Water Framework Directive), under which Member States are required to protect and improve their inland and coastal waters.

National Legislation

6.12 The main relevant legislative instruments relating to nature conservation in England are:

- Conservation of Habitats and Species Regulations 2017;
- Conservation of Habitats and Species and Planning (Various Amendments) (England and Wales) Regulations 2018;
- Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (WFD);
- The Marine Strategy Regulations 2010;
- Wildlife and Countryside Act (WCA), 1981 (as amended);
- Marine and Coastal Access Act 2009;
- Countryside and Rights of Way (CRoW) Act, 2000 (as amended);
- Natural Environment and Rural Communities (NERC) Act, 2006 (as amended);
- Protection of Badgers Act, 1992 (as amended);
- Hedgerow Regulations 1997 (as amended);
- Animal Welfare Act 2006; and
- Aquatic Animal Health (England and Wales) Regulations 2009 (as amended).

6.13 Key national and local plans and policy relevant to the assessment of the impacts of the GB Onshore Scheme on ecology and nature conservation include:

- UK Marine Policy Statement – Specific policies set out in the East Inshore Coast Marine Plan (Marine Management Organisation (MMO), 2014);

- Kent Biodiversity Action Plan - The Kent Biodiversity Action Plan (1997)[1] sets out Habitat Action Plans for 20 habitat types and 13 Species Action Plans within the county;
- Kent Biodiversity 2020 and beyond - A strategy for biodiversity in Kent and Medway, focussed on 33 priority habitats;
- Biodiversity 2020 - A strategy for England's Wildlife and Ecosystem Services with regards to marine habitats, ecosystems, and fisheries (Defra, 2011); and
- UK Post 2010 Biodiversity Framework: Revised Implementation Plan (2018 2020) - Succeeds the UK Biodiversity Action Plan (UK BAP) (Joint Nature Conservation Committee (JNCC) and Defra, 2018) (the UK BAP list of priority species and habitats remains an important reference material which has been considered within this EIA Report).

[1] The Kent Biodiversity Action Plan: A framework for the future of Kent's wildlife. Kent Biodiversity Action Plan Steering Group (1997)

Approach to Assessment

6.14 The Ecological Impact Assessment (EcIA) detailed in this chapter has been undertaken in accordance with best practice guidance issued by the Chartered Institute of Ecology and Environmental Management (CIEEM) entitled 'Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Costal and Marine' (CIEEM, 2018) as summarised below. The aims of the ecology assessment are to:

- identify relevant ecological features (i.e. designated sites, habitats, species or ecosystems) which may be impacted;
- provide a scientifically rigorous and transparent assessment of the likely ecological impacts and resultant effects of the GB Onshore Scheme. Impacts and effects may be beneficial (i.e. positive) or adverse (i.e. negative);
- facilitate scientifically rigorous and transparent determination of the consequences of the GB Onshore Scheme in terms of national, regional and local policies relevant to nature conservation and biodiversity, where the level of detail provided is proportionate to the scale of the development and the complexity of its potential impacts; and
- set out what steps will be taken to adhere to legal requirements relating to the relevant ecological features concerned.

6.15 The principal steps involved in the CIEEM approach can be summarised as:

- ecological features that are both present and might be affected by the GB Onshore Scheme are identified (both those likely to be present at the time works begin and those predicted to be present at a set time in the future) through a combination of targeted desk-based study and field survey work to determine the relevant baseline conditions;
- the importance of the identified ecological features are evaluated, placing their relative biodiversity and nature conservation value into geographic context, which is then used to define the relevant ecological features that need to be considered further within the EcIA process;
- the changes or perturbations predicted to result as a consequence of the Proposed Development (i.e. the potential impacts) and which could potentially affect relevant ecological features that are identified and their nature described. Established best-practice, legislative requirements or other incorporated design measures to minimise or avoid impacts are also described and are taken into account;
- the likely effects (beneficial or adverse) on relevant ecological features are then assessed, and where possible quantified;
- measures to avoid or reduce any predicted significant effects, if possible, are then developed in conjunction with other elements of the design (including mitigation for other environmental disciplines) and if necessary, measures to compensate for effects on features of nature conservation importance are also included;
- any residual effects of the GB Onshore Scheme are reported; and
- scope for ecological enhancement is considered.

6.16 It is not necessary in the assessment to address all habitats and species with potential to occur in the study area and instead the focus should be on those that are "relevant" i.e. ecological features that are considered to be important and potentially affected by the Proposed Development. CIEEM (2018) makes clear that there is no need to "carry out detailed assessment of ecological features that are sufficiently widespread, unthreatened and resilient to project impacts and will remain viable and sustainable". This does not mean that efforts should not be made to safeguard wider biodiversity and requirements for this have been considered. National policy documents emphasise the need to achieve net gains for nature and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution.

6.17 To support focussed EcIA, there is a need to determine the scale at which the relevant ecological features identified through the desk studies and field surveys undertaken for the GB Onshore

Scheme are of value. The value of each relevant ecological feature has been defined with reference to the geographical level at which it matters.

6.18 The frames of reference used for this assessment, based on CIEEM guidance are:

- international (generally this is within a European context, reflecting the general availability of good data to allow cross-comparison);
- national (Great Britain, but considering the potential for certain ecological features to be more notable (of higher value) in England, with context relative to Great Britain as a whole);
- regional (south-east England);
- county (Kent);
- district (Medway);
- local (biodiversity or geological features that do not meet criteria for valuation at a district or higher level, but that have sufficient value to merit retention or mitigation e.g. for purposes of ensuring no net loss of biodiversity); and
- negligible (common and widespread biodiversity or geological features of such low priority that they do not require retention or mitigation at the relevant location to otherwise maintain a favourable nature conservation status as defined in the Habitats Directive/ Regulations).

6.19 Species populations are valued on the basis of their size, recognised status (such as recognised through published lists of species of conservation concern and designation of Biodiversity Action Plan (BAP) status) and legal protection. For example, bird populations exceeding 1% of published information on biogeographic populations are considered to be of international importance, those exceeding 1% of published data for national populations are considered to be of national importance and so on.

6.20 In assigning values to species populations, it is important to take into account the status of the species in terms of any legal protection. However, it is also important to consider other factors such as its distribution, rarity, population trends and the size of the population which would be affected. For example, whilst the Great Crested Newt is protected under European law and therefore conservation of the species is of significance at the international level, this does not mean that every population of Great Crested Newt is internationally important. It is important to consider the particular population in its context. Therefore, in assigning values to species the geographic scale at which they are important has been considered. The assessments of value rely on the professional opinion and judgment of experienced ecologists.

6.21 Plant communities are assessed both in terms of their intrinsic value and as habitat for protected species whose habitat is also specifically protected and for species of nature conservation concern which are particularly associated with them.

6.22 Due regard will also be paid to the legal protection afforded to species during the development of mitigation and compensation measures to be implemented during the Proposed Scheme. For European protected species there is a requirement that the Proposed Scheme should not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

6.23 Assessing the value of features requires consideration of both existing and future predicted baseline conditions. Therefore, the description and valuation of ecological features takes account of any likely changes, such as trends in the population size or distribution of species, likely changes to the extent of habitats and the effects of other proposed developments or land use changes.

6.24 In line with the CIEEM guidelines, the terminology used within the EcIA draws a clear distinction between the terms ‘impact’ and ‘effect’. For the purposes of this EcIA these terms are defined as follows:

- impact – actions resulting in changes to an ecological feature. For example, construction activities of a development removing a hedgerow; and

- effect – outcome resulting from impact acting upon the conservation status or structure and function of an ecological feature, e.g. the effects on a population of bats as a result of the loss of a bat roost.

6.25 When describing potential impacts (and where relevant the resultant effects) consideration is given to the following characteristics likely to influence this:

- Positive or negative - i.e. is the change likely to be in accordance with nature conservation objectives and policy?:
  - positive - a change that improves the quality of the environment, or halts or slows an existing decline in quality e.g. increasing the extent of a habitat of conservation value; or
  - negative - a change that reduces the quality of the environment e.g. destruction of habitat.
- spatial extent - the spatial or geographical area or distance over which the impact or effect occurs;
- magnitude - the 'size', 'amount' or 'intensity' and 'volume' of an impact - this is described on a quantitative basis where possible;
- duration - the time over which an impact is expected to last prior to recovery or replacement of the resource or feature. Consideration has been given to how this duration relates to relevant ecological characteristics such as a species' lifecycle. However, it is not always appropriate to report the duration of impacts in these terms. The duration of an effect may be longer than the duration of an activity or impact;
- timing and frequency - i.e. consideration of the point at which the impact occurs in relation to critical life-stages or seasons; and
- reversibility - i.e. is the impact temporary or permanent. A temporary impact is one from which recovery is possible or for which effective mitigation is both possible and enforceable. A permanent effect is one from which recovery is either not possible, or cannot be achieved within a reasonable timescale (in the context of the feature being assessed).

6.26 Cumulative effects are those occurring from several sources (also known as inter-relationships) and, or the combined effects of other developments in the area.

6.27 For each ecological feature only those characteristics relevant to understanding the ecological effect and determining the significance are described. The determination of the significance of effects has been made based on the predicted effect on the structure and function, or conservation status, of relevant ecological features, as follows:

- not significant - no effect on structure and function, or conservation status; and
- significant - structure and function, or conservation status is affected.

6.28 CIEEM guidance states that effects should be determined as being significant when

> *"an effect either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national / local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local. A significant effect is an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project. In broad terms, significant effects encompass impacts on structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution)".*

6.29 Using this information and judgment, it is determined whether the effects will be significant or not on the structure and integrity (of site or ecosystems) or conservation status (of habitats and, or species) of each ecological feature and the impact significance is determined at the appropriate geographical scale.

6.30 In order to provide consistency of terminology, the findings of the CIEEM assessment have been translated into the classification of effects scale, as outlined in Table 6.1.

Table 6.1 Relating CIEEM Assessment Terms

Effect classification terminology		Equivalent CIEEM assessment
High	Major beneficial	Beneficial effect on structure/ function or conservation status at regional, national or international level.
Medium	Moderate beneficial	Beneficial effect on structure and, or function or conservation status at county level.
Low	Minor beneficial	Beneficial effect on structure/ function or conservation status at local and, or site level.
Negligible	Neutral	No effect on structure/ function or conservation status.
Low	Minor adverse	Adverse effect on structure/ function or conservation status at local and, or site level
Medium	Moderate adverse	Adverse effect on structure/ function or conservation status at county level.
High	Major adverse	Adverse effect on structure and, or function or conservation status at regional, national or international level.

Sources of Information/ Data

Desk Study

6.31 A desk study was carried out to identify ecological designations and protected and, or notable habitats and species and scheduled invasive non-native species potentially relevant to the GB Onshore Scheme.

6.32 The approach taken to defining the desk study areas was based on the likely ZoI of the GB Onshore Scheme on different ecological receptors and an understanding of the maximum distances that are typically expected to be considered by statutory consultees.

6.33 The desk study included a search for:

- European Sites within 10 km of the Site;
- statutorily designated sites of national nature conservation value, e.g. Sites of Special Scientific Interest (SSSIs) and Local Nature Reserves (LNRs) within 2 km of the Site; and
- non-statutorily designated sites of nature conservation value, e.g. Local Wildlife Sites (LWSs), within 2 km of the Site.

6.34 The Kent and Medway Biological Records Centre (KMBRC) was contacted in July 2018 to gain information on pre-existing ecological information (i.e. records of protected and notable species and habitats within 2 km of the Site as well as any invasive non-native species). The results of this desk study are reported in detail in the Preliminary Ecological Appraisal (PEA) report (AECOM, 2019) and included in Appendix 06.A.

6.35 In addition, online data resources were reviewed including:

- Multi-Agency Geographic Information Centre (MAGIC);
- The Joint Nature Conservation Committee (JNCC) website for details of Special Protection Areas (SPAs) including site information and designation details;
- The British Trust for Ornithology (BTO) website for site specific data from the Wetland Bird Survey (WeBS), a partnership between the BTO, the Royal Society for the Protection of Birds (RSPB) and JNCC (the last on behalf of Natural England (NE), Natural Resources

Wales (NRW), Scottish Natural Heritage (SNH) and the Department of the Environment Northern Ireland (DENI)) in association with the Wildfowl and Wetlands Trust (WWT); and

- National Biodiversity Network (NBN) Gateway.

6.36 Protected and notable habitats and species include those listed under Schedules 1, 5 and 8 of the WCA; Schedules 2, 4 and 5 of the Habitat Regulations; and species and habitats of principal importance for nature conservation in England listed under Section 41 (S41) of the NERC Act. Other habitats and species have also been considered and assessed on a case by case basis, e.g. those included in national, regional or local Red Data Books and Lists but not protected by legislation. This is consistent with the requirements of relevant planning policy.

6.37 Records of invasive non-native species, as listed under Schedule 9 of the WCA and as species of EU concern (EU IAS Regulation, 2014), were also collated and have been taken into account when assessing the potential ecological effects of the GB Onshore Scheme. It would not be appropriate to attribute the same weight to these invasive non-native species as has been applied to relevant ecological features when determining the likely significant effects of the GB Onshore Scheme, as the presence of such species is generally detrimental for ecology and the spread of such species may contravene legislation and the removal of such species may be desirable and beneficial for ecology. Requirements for control are also driven by the WCA and related legislation. Therefore, while the weed species concerned are not relevant ecological features for the purposes of EcIA, there is still a need to consider them in terms of their potential relevance to delivery of legislative compliance, for their potential to contribute to the amplification of any adverse effects arising from the GB Onshore Scheme, or their potential to conflict with objectives for ecological mitigation, compensation and enhancement.

6.38 The benthic ecology baseline has been described using a combination of information from a desk study and project-specific survey data to provide a robust and up to date characterisation of the benthic environment within the study area.

Field Survey

6.39 The requirement for ecological field surveys was determined following a review of the desk based study data and a PEA undertaken by AECOM in April and August 2018 (see Appendix 06.A).

6.40 The PEA from 2018 consisted of two components: a Phase 1 Habitat survey; and a scoping survey for protected species and other species of conservation concern.

6.41 The Phase 1 Habitat survey followed the standard methodology 'Handbook for Phase 1 habitat survey: A technique for environmental audit' (JNCC, 2010). In summary, this comprised walking over the Site and recording the habitat types and boundary features present. A protected species scoping survey was carried out in conjunction with the Phase 1 Habitat survey.

6.42 Subsequently, field surveys for protected or notable species were then undertaken, as identified in the PEA.

6.43 The field survey data obtained are reported in the following survey reports (included as technical appendices):

- Appendix 06. A. AECOM (2019) NeuConnect, Great Britain to Germany Interconnector, GB Onshore Scheme: Preliminary Ecological Appraisal Report;
- Appendix 06. B. AECOM (2019) NeuConnect, Great Britain to Germany Interconnector, GB Onshore Scheme: Report on Surveys for Breeding Birds;
- Appendix 06. C. AECOM (2019) NeuConnect, Great Britain to Germany Interconnector, GB Onshore Scheme: Report on Surveys for Wintering Birds;
- Appendix 06. D. AECOM (2019) NeuConnect, Great Britain to Germany Interconnector, GB Onshore Scheme: Report on Surveys for Intertidal Waterbirds;
- Appendix 06. E. AECOM (2019) NeuConnect, Great Britain to Germany Interconnector, GB Onshore Scheme: Report on Surveys for Reptiles;
- Appendix 06. F. AECOM (2019) NeuConnect, Great Britain to Germany Interconnector, GB Onshore Scheme: Report on Surveys for Great Crested Newt;

- Appendix 06. G. AECOM (2019) NeuConnect, Great Britain to Germany Interconnector, GB Onshore Scheme: Report on Surveys for Water Vole;
- Appendix 06. H. AECOM (2019) NeuConnect, Great Britain to Germany Interconnector, GB Onshore Scheme: Report on Aquatic Ecology;
- Appendix 06.I. AECOM (2019) NeuConnect, Great Britain to Germany Interconnector, GB Onshore Scheme: Report on surveys for bats; and
- Appendix 06. J. AECOM (2019) NeuConnect Interconnector: Benthic Characterisation and Habitat Assessment Survey (UK), Technical Report.

6.44 No further surveys were necessary in order to define the ecological baseline relevant to the GB Onshore Scheme. Information and rationale for surveys scoped out are provided in the PEA report included as Appendix 06.A.

6.45 Details of the survey methodologies, survey dates and guidance used for each survey are available in the reports as detailed above (and included as technical appendices (06.A to 06.J)) – a summary of survey findings is provided further on in this chapter.

Consultation

6.46 Consultation was undertaken with statutory and non-statutory consultees in 2018 as part of the EIA Scoping process. Stakeholder responses from Kent County Council and Natural England, relevant to Ecology, are included in Chapter 3.

6.47 The following stakeholders were consulted during the ecological impact assessment:

- Kent County Council (KCC);
- Environment Agency;
- Centre for Environment, Fisheries and Aquaculture Science (Cefas);
- Marine Management Organisation (MMO); and
- Natural England.

6.48 The key issues relating to ecology and nature conservation raised during consultation are outlined in Table 6.2 below, together with how these issues have been considered in the production of this assessment.

Table 6.2 Key issues raised in relation to ecology and nature conservation during consultation

Key issue raised	Response to issue raised and action taken where appropriate
KCC raised the following issues in relation to terrestrial ecology: *The Thames Estuary and Marshes SPA and Ramsar and the South Thames Estuary and Marshes SSSI is within 150m of the project area (where the substation will be located) and the cables will run directly through the designated sites. Therefore we advise that the proposed development is likely to have a significant impact on biodiversity (both direct and indirect) and based on the above conclusion we advise that for this development an EIA for Ecology is required. The submitted information has detailed that a range of ecological surveys are currently on going and the results of these surveys must inform the Environmental Statement. We highlight that there has been a number of projects within Kent which have resulted in direct impacts to the mud flats through the installation of cables – we recommend that the results of the ongoing monitoring from these projects are gathered to help inform the impact assessments and mitigation strategies.*	Consideration has been given to the impacts of the GB Onshore Scheme on designated sites and sensitive ecological receptors.

Key issue raised	Response to issue raised and action taken where appropriate
Cefas and the MMO raised concerns about the Screening Report conclusion of no expected significant impact on the Thames Estuary and Marshes SPA and advised that this hinges on whether 0.25% is considered a significant impact.	The GB Onshore Scheme will be installed by HDD cable conduits through the upper and mid-shore, therefore avoiding direct impact to upper and mid intertidal sediments and supported benthic communities. The cable will be installed through three separate trenches through the lower shore. At initial screening stage the quoted value of 0.25% assumed that the open cut trench and burial will be carried out using shore-based installation techniques. The preferred construction method would use a boat based technique which would further reduce the area of impact within the Thames Estuary and Marshes SPA.
The MMO disagreed with the conclusion to screen out intertidal impacts from boat or barge-based installation and cable burial.	Consideration has been given to this potential activity and, or receptor interactions within the impact assessment.
The MMO recommended that intertidal ecology should be included as a receptor with respect to the potential release of drilling fluids in the intertidal zone.	Consideration has been given to the potential effects of drilling fluids on benthic habitats and species within the impact assessment.

Baseline Conditions

6.49 The ecological baseline conditions for the Site are summarised below.

Statutory Sites

6.50 The Site, above the Mean High Water Spring (MHWS), is not located within any site statutorily designated for nature conservation. The intertidal area of the GB Onshore Scheme between MHWS and MLWS lies within the Thames Estuary and Marshes Ramsar/ SPA and South Thames Estuary and Marshes SSSI and Medway Estuary Marine Conservation Zone (MCZ). There are seven statutorily designated sites of international importance (Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar) designated for ecological reasons within 10 km of the Site and three sites of national importance (two SSSIs and one MCZ) designated for ecological reasons within 2 km of the Site. More information on these statutory sites is presented in Table 6.3 and Table 6.4 (see Figure 6-2).

Table 6.3: International Statutory Nature Conservation Designated sites within 10 km of the Site

Site Name and Designation	Reason(s) for Designation	Area (ha)	Approximate distance from the Site (km)	Connectivity to the Site
Thames Estuary and Marshes SPA and Ramsar	The site supports one endangered plant species and at least 14 nationally scarce plants of wetland habitats. The site also supports more than 20 British Red Data Book invertebrates and supports populations and an assemblage of waterbirds occurring at levels of international importance.	5,588.6	0.0	Ecological connections between interest features of the Ramsar / SPA and the Site.
Medway Estuary and Marshes SPA and Ramsar	The site holds several nationally scarce plants and a total of at least twelve British Red Data Book species of wetland invertebrates. The site also holds a significant number of non-wetland British Red Data Book species and supports populations and an assemblage of waterbirds occurring at levels of international importance.	4,696.7	1.1	Potential for ecological connections between interest features of the Ramsar and, or SPA and the Site.
Outer Thames Estuary SPA	The site qualifies for supporting breeding Common Tern *Sterna hirundo*, Little Tern *Sternula albifrons* and non-breeding Red-throated Diver *Gavia stellata*	392451.6	2.2	No connectivity between the SPA and the Site, although birds associated with the SPA may forage offshore from the Site.
Benfleet and Southend Marshes Ramsar / SPA	The site supports populations and an assemblage of waterbirds occurring at levels of international importance.	2,251.3	4.2	No connectivity between the Site and the Ramsar and, or SPA, although it is acknowledged that there is likely to be interchange of waterbirds between designated wetland sites in the region.
Essex Estuaries SAC	The site comprises of mainly Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*),	46,111.4	4.8	No connectivity between the Site and the SAC.

Site Name and Designation	Reason(s) for Designation	Area (ha)	Approximate distance from the Site (km)	Connectivity to the Site
	representing over 10% of the UK resource. The site also includes intertidal and subtidal sediment, mud, rock, sand and seagrass beds.			
Foulness (Mid-Essex Coast Phase 5) SPA and Ramsar	The site contains extensive saltmarsh habitat, with areas supporting full and representative sequences of saltmarsh plant communities covering the range of variation in Britain. The site also supports a number of nationally-rare and nationally-scarce plants species and British Red Data Book invertebrates. Furthermore, Foulness supports populations of waterbirds occurring at levels of international importance	10,932.9	4.9	No connectivity between the Site and the Ramsar and, or SPA, although it is acknowledged that there is likely to be interchange of waterbirds between designated wetland sites in the region.
The Swale SPA and Ramsar	The site supports nationally scarce plants and at least seven British Red Data book invertebrates. The site also supports populations of waterfowl occurring at levels of international importance.	6,514.7	7.1	No connectivity between the Site and the Ramsar and, or SPA, although it is acknowledged that there is likely to be interchange of waterbirds between designated wetland sites in the region.

Table 6.4: National Statutory Nature Conservation Designated sites within 10 km of the Site

Site Name and Designation	Reason(s) for Designation	Area (ha)	Approximate distance from the Site (km)	Connectivity to the Site
South Thames Estuary and Marshes SSSI	The site supports outstanding numbers of waterfowl with total counts regularly exceeding 20,000. Many species regularly occur in nationally important numbers and some species regularly use the site in internationally important numbers. The breeding bird community is also of particular interest and the diverse habitats support a number of nationally rare and scarce invertebrate species and an assemblage of nationally scarce plants.	5,449.1	0.0	Ecological connections between interest features of the SSSI and the Site.
Medway Estuary and Marshes SSSI	The site forms the largest area of intertidal habitats which have been identified as value for nature conservation in Kent. The area holds internationally important populations of wintering and passage birds and is also important for its breeding birds. An outstanding	6,840.1	0.5	Potential for ecological connections between interest features of the SSSI and the Site.

Site Name and Designation	Reason(s) for Designation	Area (ha)	Approximate distance from the Site (km)	Connectivity to the Site
	assemblage of plant species also occurs on site.			
Medway Estuary MCZ	An inshore site located on the Kent coast. It encompasses the Medway Estuary from Rochester down to its mouth, and extends seaward to include an area between Sheerness and the Isle of Grain. One species and eight different habitats and their associated wildlife are protected by the Medway Estuary MCZ. Such a range of habitats creates an environment that is capable of supporting some of the most diverse communities of animals in the South-East region.	6,000.0	0.0	Ecological connections between interest features of the MCA and the Site.

Non-Statutory Sites

6.51 The GB Onshore Scheme is immediately adjacent to the western boundary of a non-statutory site designated for nature conservation (ME16 Grain Pit LWS). More details of this non-statutory designated site are presented in Table 6.5 (see Figure 6.2).

Table 6.5: Site with Non-statutory Designation for Nature Conservation

Site Name and Designation	Reason(s) for Designation	Area (ha)	Approximate Distance from the Site (km)	Connectivity to the Site
ME16 Grain Pit LWS	Mosaic of habitats including neutral grassland and reedbed of local importance. Marsh Harrier breeds in the reedbed.	29.56	0.01	Immediately adjacent to the east of the Proposed DC cable corridor.

Species Records

6.52 Records of protected species were obtained in July 2018 from KMBRC using a 2 km search radius from the Site boundary and from the preceding 10 years. A number of notable species, including species of conservation importance, were recorded and these are presented in the PEA report provided as Appendix 06.A and summarised in Table 6.9.

Terrestrial Habitats

6.53 The habitats associated with the Site are summarised below and habitat descriptions are defined by broad habitat types (JNCC, 2010). Results from the Phase 1 Habitat survey, undertaken by AECOM in 2018, are provided in Appendix 06.A and shown on Figure 6-3 in this chapter.

6.54 The Site is 21.44 ha in area and the broad habitat types on the Site, together with area calculations (taken from digitised maps of the Site) and whether they are a priority habitat are presented in Table 6.6.

Table 6.6: Broad habitat types present on Site

Habitat	Area (ha)	% of Site Area	Priority Habitat
Scrub, Scattered	0.22	1.0	No
Scrub, Dense/continuous	1.76	8.1	No
Neutral grassland, Semi-improved	0.06	0.3	No
Improved Grassland	0.48	2.2	No
Maritime Cliffs and Slopes (Hard Cliff)	0.01	0.0	Maritime Cliffs are a priority habitat in the UK and Kent
Swamp / Reedbed	0.11	0.5	Swamps are a priority habitat in the UK, Reedbeds are a priority habitat in Kent
Cultivated/disturbed land, Arable	16.59	76.2	No
Cultivated/disturbed land, Ephemeral/short perennial	0.11	0.5	No
Other, Tall ruderal	1.37	6.3	No
Hardstanding	0.73	3.3	No

Intertidal Habitats and Communities

6.55 Table 6.7 outlines the intertidal broadscale habitats and biotope complexes identified during surveys of the cable corridor. The key characteristics of these habitats are outlined below.

Table 6.7 Summary of intertidal broad-scale habitats and biotope complexes identified during the surveys of the cable corridor.

Broad Scale Habitat	Biotope Complex
Littoral sand and muddy sand (A2.2)	Polychaetes in littoral fine sand (A2.231)
	Cerastoderma edule and polychaetes in littoral muddy sand (A2.242)
Littoral mud (A2.3)	*Nephtys hombergii* and *Streblospio shrubsolii* in littoral mud (A2.321)

Littoral sand and muddy sand (A2.2)

6.56 Habitats belonging to this broadscale habitat typically comprise of clean sands (no more than 25% silt and clay content) and can be found in areas of wave exposure ranging from 'exposed' to 'very sheltered'. Biological diversity is dependent upon the stability of substrates with mobile sands typically exhibiting lower biological diversity in comparison to stable sands.

6.57 Sediment associated with the biotope complex 'polychaetes in littoral fine sand' (A2.231) is known to be relatively stable. This biotope complex was only recorded within the GB Onshore Scheme Route Corridor at a single intertidal sampling station located in the mid shore region. The biotope complex 'Cerastoderma edule and polychaetes in littoral muddy sand' (A2.242) was recorded at four intertidal sampling stations located in the mid to upper shore region.

Littoral mud (A2.3)

6.58 Habitats belonging to this broadscale habitat are generally characterised by fine particulate sediment, mostly silt and clay, although sandy mud may contain up to 40% sand content. Wave exposure is normally very low in areas characterised by this habitat. Biotopes typically form extensive mudflats that support productive biological communities, consisting of predominately infaunal bivalves, polychaetes, and oligochaetes. The biotope complex 'Nephtys hombergii and

Streblospio shrubsolii in littoral mud' (A2.321) was recorded at the remaining two intertidal sampling stations located in the lower shore region.

Intertidal macrofauna

6.59 Intertidal macrofauna was found to be relatively homogenous across all sampling stations, being generally characterised by a dominance of polychaetes (e.g. marine catworms (Nephtys species) and to a lesser extent gastropod mollusc (e.g. Laver spire shell or mudsnail (Peringia ulvae)). A notable distinction was the abundance of the commercial Common Cockle (Cerastoderma edule) found within the mid shore region. Infaunal communities in the low shore region were found to be much less diverse, being dominated by the presence of polychaetes.

6.60 The Tentacled Lagoon-worm (Alkmaria romijni), which is a protected feature of the Medway Estuary MCZ, was not recorded at intertidal stations sampled within the Project Route Corridor.

Intertidal habitats and species of conservation importance

6.61 The two broadscale habitats identified within the intertidal area of the GB Onshore Scheme Route Corridor are representative of Annex I habitat 'mudflats and sandflats not covered by water at low tide'. Furthermore, intertidal sand and muddy sand is a designated feature of the Medway Estuary MCZ. These habitats are known to represent important feeding grounds for wildfowl and waders as a result of the macrofaunal communities and flora which they support.

6.62 No intertidal species of conservation importance were recorded from surveys of the GB Onshore Scheme Route Corridor.

Protected/ Notable Species

6.63 Protected or notable animal species have been identified as present, or potentially present within the surveyed areas (as defined in section 6.2.4) and are summarised in Table 6.8.

Table 6.8: Summary of Baseline Details for Protected/ Notable species on Site

Species	Baseline Detail
Plants	Desk study: The data search returned records of 34 protected or notable plant species recorded within the last ten years and within 2 km from the Site. Field survey: No legally protected plant species recorded on the Site. Divided Sedge *Carex divisa* and Sea Buckthorn *Hippophae rhamnoides,* both Kent Rare Plant Register (RPR) species, were recorded outside of the Site boundary, but were not noted within the Site boundary and habitats with the potential to support either species are restricted.
Terrestrial invertebrates	Desk study: A large number of notable terrestrial invertebrate species, including moths, butterflies, beetles and bees recorded within the last ten years and within 2 km from the Site. Field survey: The habitats on site were assessed during the PEA to have limited potential to support a diverse community of terrestrial invertebrates, including notable species. Although, better quality habitats were identified outside of the Site boundary.
Freshwater invertebrates	Desk study: Records of protected/ notable aquatic invertebrates recorded within the last ten years and within 2 km from the Site. Field survey: No aquatic macroinvertebrate species were recorded that receive specific legal protection via Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), or that are listed on Section 41 of the NERC Act as being of principal importance for nature conservation in England. A number of notable beetle taxa recorded in the Ditch adjacent to the proposed DC cable, including the diving beetles, *Hygrotus parallelogrammus,* Wasp Diving Water Beetle (*Dytiscus circumflexus*), *Agabus conspersus* and the water scavenger beetles *Helophorus alternans, Limnoxenus niger, Berosus affinis, Berosus signaticollis* and the Great Silver Water Beetle, *Hydrophilus piceus.* The River Habitat Survey classed the ditch adjacent to the proposed DC cable corridor as severely modified which is a consequence of being an artificial drainage channel. Despite its artificial nature, the watercourse provided habitat for a variety of notable and protected species including the near threatened Great Silver Diving Water Beetle and aquatic invertebrate assemblage of very high conservation value.
Marine invertebrates	Desk study: Tentacled Lagoon worm is found in the Medway Estuary. This species is likely to be found in narrow upstream channels which are absent from the GB Onshore Scheme. No records of any other protected or notable species. Field survey: Intertidal macrofauna characterised by a dominance of *polychaetes* and to a lesser extent gastropod molluscs, the exception being the abundance of the Common Cockle (*Cerastoderma edule*) in the mid-shore region in the low-shore region infaunal communities were found to be much less diverse, being dominated by *polychaetes*. No occurrence of Tentacled Lagoon worm.

Species	Baseline Detail
Breeding birds	Desk study: The data search returned records of 148 notable species recorded within the last ten years and within 2 km of the Site. Field survey: 61 bird species were recorded within the survey area during surveys for breeding birds with 44 species representing confirmed, probable or possible breeding within the survey area. Single territories of two WCA Schedule 1 species (Marsh Harrier *Circus aeruginosus* and Cetti's Warbler *Cettia cetti*) confirmed breeding within the survey area. Cetti's Warbler also confirmed breeding outside of the Site boundary, within 100 m.
Non-breeding (wintering and passage) birds	Desk study: The data search returned records of 148 notable species recorded within the last ten years and within 2 km of the Site. Field survey: 43 bird species were recorded within the terrestrial survey area during surveys for wintering birds, with 18 notable species recorded. A total of 24 waterbird species were recorded using the intertidal survey area between January 2018 and December 2018. Of these 24 species, 17 species of waterbird were recorded using the survey area in winter; 9 species of waterbirds were recorded using the survey area in spring and 14 species were recorded using the survey area in autumn. No waterbird species recorded within the intertidal survey area in 2018 represented 1% or more of the international or national population estimates used for assessing populations. A significant proportion (>5%) of the wintering population of Black-tailed Godwit (*Limosa limosa*), cited on The Thames Estuary and Marshes Ramsar/ SPA was recorded within the survey area in 2018. However, when evaluating the peak count of Black-tailed Godwit recorded in the survey area in 2018 against the recent five-year peak mean for the whole estuary, taken from the Wetland Bird Survey (WeBS) data, the peak count represents just over 1% of the population using the estuary. The peak count of three species (Dark-bellied Brent Goose *Branta bernicla*, Oystercatcher (*Haematopus ostralegus*) and Black-tailed Godwit) recorded during the Site surveys represented over 5% of the cited SPA populations for the Medway Estuary and Marshes Ramsar/ SPA.
Reptiles	Desk study: The data search returned records of three species of reptile (Adder (*Vipera berus*), Grass Snake (*Natrix helvetica*) and Common Lizard (*Zootoca vivipara*)) recorded within 2 km of the Site and within the last ten years. Field survey: Habitats on site identified during the PEA as being potentially suitable for reptiles were surveyed in September - October 2018 using refugia felt mats, following techniques detailed in Gent and Gibson (2003) and JNCC (2014). These mats were surveyed in suitable weather conditions for reptiles to be basking to establish reptile presence. The reptile surveys in 2018 identified three species of reptile present on Site: Common Lizard, Slow-worm (*Anguis fragilis*) and Grass Snake. The maximum counts, recorded on the Site in a single survey were 17 Common Lizard, three Slow-worm and one Grass Snake were of 17, 3. Estimating population sizes of these species using guidance within Froglife's Advice Sheet Number 10 (Froglife, 1999), places the population of Common Lizard at 'good' and the populations of Slow-worm and Grass Snake at 'low'.

Species	Baseline Detail
Badger *Meles meles*	Desk study No recent records (within the last ten years) of Badger were identified during the data search from within 2 km of the Site. Field survey Badger latrines and snuffle holes were recorded on the Site during the PEA but no Badger setts were found on the Site.
Amphibians	Desk study: The desk study identified eight waterbodies (not including rivers and, or swamps) within 500 m of the Site, using aerial mapping. The data search returned three records of Great Crested Newts from within 2 km of the Site in 2009. Great Crested Newt is also known to be widespread across much of the Isle of Grain (Max Wade, personal communication). Field survey: No Great Crested Newt recorded during surveys of five accessible waterbodies outside of the Site boundary in 2018. No Great Crested Newt recorded within terrestrial habitat within the Site boundary. The terrestrial habitat on Site has the potential to support foraging and commuting Great Crested Newt and Common Toad (*Bufo bufo*).
Water Vole	Desk study: The data search returned 12 records of Water Vole within 2 km of the Site, with five records located within 1 km from the Site in 2012 and 2014. Water Vole is known to be widespread across much of the Isle of Grain (Max Wade, personal communication). Field survey: Water Vole was recorded in three lagoons outside of the Site boundary. Water Vole was recorded within the ditch adjacent to the proposed DC cable corridor. Based on presence and quality of habitat on site, Water Vole is likely to be present in low numbers in all un-surveyed waterbodies within the vicinity of the Site.
Bats	Desk study: A data search undertaken through Kent Bat Group returned three records of flying, grounded or dead bat from within 2 km of the Site and within the last ten years. These records were: a dead Pipistrelle species in 2015,1.5 km to the south-south-west of the proposed converter station; a grounded Nathusius's Pipistrelle (*Pipistrellus nathusii*) in 2016, 1.5 km to the south-south-west of the proposed converter station; and an unidentified bat, in 2014, approximately 500 m to the east of the proposed DC cable corridor. Field survey: There were no features of interest such as mature trees and buildings to support roosting bats within the Site boundary. The mosaic of scrub and wetland habitats around and across the Site provides foraging resources for bats. Seasonal transect surveys to record bat activity (based on the habitat quality of the Site being 'low' suitability for commuting and foraging bats) recorded very low numbers of three bat species (Common Pipistrelle (*Pipistrellus pipistrellus*) and Soprano Pipistrelle (*Pipistrellus pygmaeus*)) and a single Nathusius' Pipistrelle (*Pipistrellus nathusii*) using the Site for foraging and commuting. One species group (*Myotis* sp.) was also recorded during transect surveys.

Species	Baseline Detail
	Seasonal static monitoring surveys from two locations along the proposed DC cable corridor recorded three species of bat (Common Pipistrelle, Soprano Pipistrelle and Noctule (*Nyctalus noctula*)) using the Site for foraging and commuting. Soprano Pipistrelle was the most numerously recorded bat species. Overall, a small (<100) number of contacts (calls) of Common Pipistrelle and Soprano Pipistrelle were recorded each night during the monitoring periods, but for one night when 367 Soprano Pipistrelle contacts were recorded. A very small (<6) number of Noctule contacts were recorded, but not recorded every night.
Invasive non-native species	Desk study: The data search returned six records of invasive non-native plant species within 2 km of the Site and within the last ten years. These (along with their distances from the Site) were: hybrid Bluebell-Spanish Bluebell cross (*Hyacinthoides non-scripta* x *hispanica* = *H.* x *massartiana*) (1.9 km), Curly Waterweed (*Lagarosiphon major*) (0.2 km), New Zealand Pigmyweed (*Crassula helmsii*) (0.3 km), Japanese Rose (*Rosa rugosa*) (1.2 km), American Slipper Limpet (*Crepidula fornicate*) (0.5 km) and Portuguese Oyster (*Crassostrea gigas*) (0.5 km). Field survey: No invasive non-native species were recorded on the terrestrial areas of the Site. Marsh Frog (*Pelophylax ridibundus*) was recorded within all off-site waterbodies, including the ditch running adjacent to the proposed DC cable corridor. Marsh Frog is listed on Schedule 9 of the Wildlife and Countryside Act, which makes it illegal to distribute or allow the release of Marsh Frog into the wild. Two individuals of the non-native barnacle species (*Austrominius modestus)* which competes with British species, in particular, (*Semibalanus balanoides*) were identified during surveys at a single intertidal station. *A. modestus* occurs naturally in Australasia and is now widespread throughout Britain and the North West coasts of Europe (Avant, 2007). It is most common from mid shore to shallow subtidal areas of estuarine and sheltered marine habitats. A number of other INNS have been identified by other surveys undertaken within the study area in recent years (Limpenny *et al.,* 2011). These include the American slipper limpet, amphipod (*Monocorophium sextonae*) and the cryptogenic amphipod species (*Photis pollex*). Whilst these INNS have not been confirmed to be present within the Project Route Corridor, it remains a possibility that they may be present in areas outwith the survey sampling stations.
West European Hedgehog *Erinaceus europaeus*	Desk study: The data search did not return any recent (within the last ten years) records of Hedgehog from within 2 km from the Site. Field survey: An assessment of the habitat present on the Site and likelihood for Hedgehog to occur on Site concluded that Hedgehog is likely to be present on Site.
Brown Hare *Lepus europaeus*	Desk study: The data search did not return any recent (within the last ten years) records of Brown Hare from within 2 km from the Site. Field survey: An assessment of the habitat present on the Site and likelihood for Brown Hare to occur on the Site concluded that this species is likely to be present.

Future Baseline

6.64 This section considers changes to the baseline conditions as described above, which might occur in the future in the absence of the GB Onshore Scheme being constructed.

6.65 If the GB Onshore Scheme did not proceed, the majority of existing habitats are likely to continue being present. For the intertidal area, whilst the proportion of habitats may alter due to changes in currents and sedimentation, they will remain unchanged. For the terrestrial habitats there will be some changes in habitat extent, composition and structure. These will occur as a result of ecological succession e.g. the gradual establishment of tree and shrub seedlings increasing the amount of scrub habitat and its progression to woodland.

6.66 The Site is largely undisturbed and the habitats present are suitable for a wide range of biodiversity present within the ZoI. In the short to medium term, in the absence of the GB Onshore Scheme, the terrestrial habitat has and will continue to provide a number of species with potential to be colonised from the wider ZoI, such as Great Crested Newt and Badger. In the long term, in the absence of the GB Onshore Scheme, habitats on site, the terrestrial habitat will mature and develop, which will change the distribution and assemblage of some species.

Important Ecological Features

6.67 For each ecological feature identified within a respective ZoI, a biodiversity value has been assigned according to the geographical scale at which it is important in accordance with Section 6.4. This value is the result of professional judgement, taking into account the intrinsic value of the receptor type in the UK and the actual area of a habitat or population of a species present within or in the vicinity of the Site. The rationale for assigning value to each ecological receptor is discussed in this section.

6.68 In addition, some ecological features are protected by legislation, such that their presence on or near the Site must be taken into account when assessing the likely effects of the GB Onshore Scheme, regardless of the biodiversity value assigned to these. For these features, a discussion of legal considerations is also provided.

6.69 Table 6.9 summarises the sensitive ecological receptors identified in the relevant study areas (as identified in Section 6.4) and the nature conservation value assigned to each receptor.

6.70 No protected or notable plant, terrestrial invertebrates or marine invertebrates, were recorded on site and neither were Great Crested Newt or Badger. These are not included as ecological receptors in Table 6.9. However, given the presence of these species, or species groups in the wider area, the potential for these species or species groups to occur on site should be considered in relation to the legal status of any given species.

6.71 There are considered to be no ecological connections between the Site and other designated sites, beyond 2 km from the Site (as listed in Table 6.3) and therefore these have been coped out of further assessment and are not included in Table 6.9.

Table 6.9: Nature Conservation Value of Each Ecological Receptor

Designated/ Non-Designated Site/ Habitat/ Species	Nature Conservation Receptor	Driver	Biodiversity Value	Rationale
Statutorily Designated Site	Thames Estuary and Marshes SPA	Habitats and Birds Directives	International	Statutory site of nature conservation importance
	Thames Estuary and Marshes Ramsar	Designated under the Convention on Wetlands of International Importance	International	Statutory site of nature conservation importance
	Medway Estuary and Marshes SPA	Habitats and Birds Directives	International	Statutory site of nature conservation importance
	Medway Estuary and Marshes Ramsar	Designated under the Convention on Wetlands of International Importance	International	Statutory site of nature conservation importance
	South Thames Estuary and Marshes SSSI	WCA 1981	National	Statutory site of nature conservation importance
	Medway Estuary and Marshes SSSI	WCA 1981	National	Statutory site of nature conservation importance
Non-statutory Designated Site	ME16 Grain Pit LWS	Local authority declaration	County	Site of nature conservation importance in Kent
Habitats	Maritime Cliffs and Slopes (Hard Cliff)	NERC Act (2006) UK BAP, LBAP	Local	Both Maritime Cliffs and Slopes (Hard Cliff) and Swamp/reedbed are priority habitats, however neither of the habitat areas recorded within the Site were of either sufficient quality or extent to qualify under the relevant national or county criteria for priority habitats. All other habitats found within the survey area were common and widespread.
	Swamp / Reedbed	NERC Act (2006) UK BAP, LBAP		
	Intertidal Habitats	Habitats Directive Annex I, UK BAP.	County	All intertidal habitats identified within the Project Route Corridor were representative of the Annex I habitat 'mudflats and sandflats not covered by seawater at low tide' and UK BAP Priority Habitat 'intertidal mudflats'. Intertidal sand and muddy sands which approximate to the broadscale habitat 'littoral sand and muddy sand' (A2.2) is a qualifying feature of the Medway Estuary MCZ although is known to be widespread throughout the study area.
Legally Protected and Notable Species				

Designated/ Non-Designated Site/ Habitat/ Species	Nature Conservation Receptor	Driver	Biodiversity Value	Rationale
Freshwater invertebrates	A range of notable and uncommon species were recorded within the ditch. The most notable was the Great Silver Water Beetle *Hydrophilus piceus*, which is Near Threatened. However none of the species recorded are rare, threatened or legally protected.	Red Data Book 3, Rare	District	Many of the notable species recorded are species of coastal wetlands and as such they can reasonably be expected to occur wherever there are comparable habitats, which are fairly common in the wider landscape, most notably in the nearby statutorily designated sites. Therefore, there are no individual species present that are of any more than Local value. The criteria established to allow the identification of habitats and sites of county nature conservation value does not define specific thresholds for the identification of Local Wildlife Sites on the basis of invertebrate communities. However, given the diverse assemblage and the large number of notable species, it is possible that the ditch adjacent to the proposed DC cable may be of District value, especially given its close proximity to statutorily designated sites of similar habitats and the likely dispersal of species between the ditch and those sites. The ditch is assessed as being of District value.
Breeding birds	A single Marsh Harrier territory within the survey area	All birds, their nests and eggs are afforded protection under the WCA 1981, as amended.	District	Single Marsh Harrier territory represents 1% of the Kent breeding population (based on population reported in the Kent Breeding Bird Atlas 2008-2011).
Breeding birds	A small assemblage of notable birds breeding on Site.	All birds, their nests and eggs are afforded protection under the WCA 1981, as amended. Species of principal importance within Section 41 of the NERC Act (2006).	Local	The habitat on the Site supports a very low number of notable bird species during the breeding season. Breeding assemblage common and widespread nationally, regionally and locally. A single territory of Cetti's Warbler (a Schedule 1 breeding species on the WCA), overlapped with the DC cable corridor. This does not represent >1% of the population in Kent and the nesting location is likely to be outside of the DC cable corridor. This species was also recorded breeding outside of the Site boundary.
	Common nesting bird species throughout the Site.	All nesting birds are protected under the Wildlife and Countryside Act 1981 (as amended).	Local	Habitat present across the extent of the Site supports a very low assemblage of common nesting birds.
Non-breeding (wintering) birds (terrestrial)	A small assemblage of wintering birds present on Site	NERC, 2006, LBAP	Local	Habitat present across the Site supports a low assemblage of notable wintering birds.

Designated/ Non-Designated Site/ Habitat/ Species	Nature Conservation Receptor	Driver	Biodiversity Value	Rationale
Non-breeding Birds (intertidal)	Assemblage of waterbirds present with the intertidal area, adjacent to the DC cable landfall.	Natura 2000	International	A significant proportion (>5%) of the wintering population of Black-tailed Godwit, cited on The Thames Estuary and Marshes Ramsar / SPA was recorded within the survey area in 2018.
Reptiles	Good population of Common Lizard and low populations of Grass Snake and Slow-worm	Protected from injury or killing under the Wildlife and Countryside Act 1981 (as amended). Species of principal importance within Section 41 of the NERC Act (2006).	Local	Common Lizard, Grass Snake and Slow-worm are nationally widespread in abundance and can be found in suitable habitat across the county. Relatively low numbers of reptiles recorded and an abundance of available habitat for reptiles in the wider area. Reptile population and assemblage scores do not meet criteria for selection of County Wildlife Sites in Kent.
Water Vole	Population of Water Vole recorded within the ditch, adjacent to the DC cable corridor and in three waterbodies within 100 m of the Site.	Protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and is afforded protection under Section 9 parts 9 (1), (2), (4) and (5) of the Act. Priority Species under Section 41 of the NERC Act 2006 and is also included as a UK and Local Biodiversity Action Plan (LBAP) priority species.	Local	Low population size recorded in the ditch immediately adjacent to the proposed DC cable corridor and likely (based on habitat quality and presence in the wider area) to be present within Lagoon 5, within the proposed DC cable corridor. Impacts on these wetland habitats will be avoided, or minimised. Species is declining in a national and county context, but the criteria for selection of a County Wildlife Site in Kent, for Water Vole, are not met.
Bats	Foraging and commuting bats – records of Noctule, Nathusius' Pipistrelle and the *Myotis* genus – all are uncommon / rarer species in the UK.	Wildlife and Countryside Act 1981 (as amended). Noctule is a species of principal importance in the UK. Noctule is classed as a rarer species nationally (Wray, 2010).	Local	Low levels of Noctule, Nathusius' Pipistrelle and the *Myotis* genus activity were recorded on the Site. Low numbers (1-2 bats) of all three species on site are unlikely to represent a significant (*i.e*. >1%) proportion of the county population.
	Foraging and commuting bats – populations of 'common' species (Common Pipistrelle Soprano Pipistrelle) on site.	Wildlife and Countryside Act 1981 (as amended). Soprano Pipistrelle is a species of principal importance in the UK.	Local	On average, low levels of commuting and foraging activity of Common Pipistrelle and Soprano Pipistrelle recorded during transect and static monitoring surveys in 2018 / 2019. Both species are common and widespread in Kent.
West European Hedgehog	Likely to be present on the Site, on the basis of local records in the wider area and habitat on site.	Priority species in England	Local	On the basis of suitable available habitat, this species is likely to occur on Site. Hedgehog is widespread and abundant in the UK and Kent.

Designated/ Non-Designated Site/ Habitat/ Species	Nature Conservation Receptor	Driver	Biodiversity Value	Rationale
Brown Hare	Likely to be present on Site, on the basis of local records in the wider area and habitat on Site.	Priority species in England	Local	On the basis of suitable available habitat, this species is likely to occur on the Site. Hedgehog is widespread and abundant in the UK and Kent.
Invasive non-native species	No records of any terrestrial invasive non-native species from within the Site. Two individuals of the non-native barnacle species *Austrominius modestus* were identified during surveys at a single intertidal station. Further terrestrial and inter-tidal invasive non-native species have been recorded within the 2 km search area. Marsh Frog recorded in waterbodies outside the Site boundary.	Wildlife and Countryside Act 1981 (as amended) Schedule 9	Marine INNS – National All terrestrial INNS – Local	The non-native barnacle *Austrominius modestus* recorded within the intertidal area of the Cable Route. Marsh Frog was recorded outside of the Site. No invasive non-native species on the Site.

6.72 Features of less than district importance are not considered further in the assessment process due to the scale and type of the GB Onshore Scheme, potential impacts and context of the wider area, unless legislation requires their consideration.

Avoidance Measures/ Mitigation by Design

6.73 The design process for the GB Onshore Scheme includes consideration of ecological constraints and has incorporated, where possible, measures to reduce the potential for adverse ecological effects in accordance with the mitigation hierarchy and relevant planning policy. The measures identified and adopted include those that can realistically be expected to be applied as part of construction environmental best practice, or as a result of legislative requirements. The expectation is that the Proposed Scheme will be constructed and will operate in accordance with the plans detailed on the consent, incorporating the measures identified below.

6.74 The development design, impact avoidance and reduction measures that have been, or will be, adopted are:

- the design of the GB Onshore Scheme will deliver compliance with industry good practice and environmental protection legislation during both construction and operation e.g. prevention of surface and ground water pollution, fugitive dust management, noise prevention or amelioration;
- the use of an HDD cable installation method to minimise habitat loss and disturbance within the intertidal zone. HDD conduits will be drilled at sufficient depth to ensure disturbance to surface habitats and species as a result of drilling vibrations will not occur.
- drilling fluids required for HDD operations will be carefully managed to minimise the risk of breakouts into the marine environment. Specific avoidance measures would include:
  - The use of biodegradable drilling fluids that Pose little or no risk (PLONOR substances) where practicable;
  - Drilling fluids will be tested for contamination to determine possible reuse or disposal; and
  - If disposal is required, drilling fluids would be transported by a licensed courier to a licensed waste disposal site; and
  - The end of the ducts would be bundled in order to capture discharges from the breakout points.
- the preparation and implementation of a Construction and Environmental Management Plan (CEMP) to manage the environmental effects of the GB Onshore Scheme and to demonstrate compliance with environmental legislation, which will then be implemented by the selected construction contractor. The CEMP, Emergency Spill Response Plan and a Waste Management Plan shall be developed and implemented for the installation phase of the Project in accordance with in the coastal and marine environmental site guide (John et al., 2015);
- the latest guidance from the GB non-native species secretariat (2015) will be followed and a Biosecurity Plan produced to cover cable installation and any maintenance or cable repair works;
- all project vessels shall adhere to the International Convention for the Control and Management of Ships' Ballast Water and Sediments with the aim of preventing the spread of INNS;
- all Project vessels will be required to comply with the International Regulations for Preventing Collisions at Sea (1972) and regulations relating to International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) with the aim of preventing and minimising pollution from ships. Most critically, all vessels shall have a contingency plan for marine oil pollution (Shipboard Oil Pollution Emergency Plan);
- where practicable, the cable route will be micro routed around sensitive benthic ecology receptors as identified from surveys of the Project Route Corridor.

- dredge spoil will be deposited adjacent to the cable route to minimise the footprint of disturbance effects;
- cable installation will be carried out on a 24-hour basis in order to reduce the overall installation time and associated disturbance of benthic ecological receptors;
- an outline landscape design as detailed in Chapter 5: Landscape and Visual Amenity which includes boundary planting incorporating tree and shrub planting;
- a Sustainable Drainage System (SUDS) detention basin, attenuation pond and swale each planted with marginal wetland species;
- further development of the landscape design to support the application and detailed design, in particular any ecological mitigation requirements as detailed herein;
- implementation of standard environmental best practice and mitigation to ensure construction and operation of the GB Onshore Scheme complies with legislation relating to protected species and does not compromise the local conservation status of ecological receptors present within or in the vicinity of the GB Onshore Scheme;
- obtaining, where required, protected species licences from Natural England sufficiently in advance of the works to meet with the optimum time for mitigation and to minimise any changes to the construction programme;
- production of mitigation strategies for protected species and application for species licences for translocation of animals away from construction areas where required;
- site vegetation clearance undertaken in advance of construction and at an appropriate time of year so as to avoid incidental injuring or killing of reptiles;
- avoidance where possible of lagoons and ditch with potential to support Water Vole (a legally protected species) and where avoidance is not possible, mitigation measures will be implemented in consideration of the legal status of the species.;
- post-construction restoration of any habitat removed from within the DC cable corridor;
- retention of the lagoons outside of the Site boundary;
- soft landscaping on site to create diverse habitats for locally important species, using trees and shrubs of local provenance; and
- avoidance of the nesting bird period i.e. March to August (inclusive) for site vegetation clearance and for any vegetation clearance proposed outside of this time to be checked for the presence of any nest by a suitably qualified ornithologist, prior to removal, and if active nests are found, then appropriate buffer zones would be put in place and the area monitored until the young birds have fledged.

Potential Impacts

6.75 This section describes the impacts and potential effects of the GB Onshore Scheme on relevant ecological features in the absence of any mitigation over and above that which is inherent to the design (as described above).

6.76 Relevant ecological features are those that are considered to be important and have the potential to be affected by the GB Onshore Scheme.

6.77 Decommissioning and demolition impacts have been scoped out of detailed assessment but are likely to be similar to those during construction. It is anticipated that the existing protected species legislation would remain in place.

Converter Station and Substation

6.78 An initial screening of potential impacts and effects arising from the construction and operation phases of the proposed converter station and substation is provided in Table 6.10.

Table 6.10: Determination of Relevant Ecological Features for the Proposed Converter Station and Substation

Ecological feature	Value	Screening for Potential impacts / effects	Scoped into EcIA?
Thames Estuary and Marshes SPA / Ramsar	International	**Construction**: The construction of the proposed converter station and substation will not impact on habitat within the SPA and Ramsar sites. Preparation of the Site and the construction of the proposed converter station and substation will result in dust generation, along with noise and visual disturbance. Noise and visual disturbance will not impact on the integrity or the functioning of the SPA and Ramsar sites owing to the distance between the SPA and Ramsar and the construction of the proposed converter station and substation. Furthermore, the construction of the proposed converter station and substation will be screened by existing vegetation and the topography. The implementation of standard environmental protection measures during construction, such as dust suppression and pollution prevention, will be adopted and these measures will be formalised into a CEMP. Consequently, dust generation during construction is unlikely to affect the integrity of the SPA and Ramsar, providing the environmental protection measures are implemented and owing to the distance between the SPA and Ramsar and the proposed converter station and substation.	No
		Operation: There are no pathways (*e.g.* habitat loss, disturbance to SPA and Ramsar features such as noise, lighting or visual, due to distance to qualifying receptors and visual screening from existing vegetation and topography) which could affect the SPA and Ramsar sites during operation of the proposed converter station and substation.	No
Medway Estuary and Marshes SPA / Ramsar	International	**Construction**: The construction of the proposed converter station and substation will not impact on habitat within the SPA and Ramsar sites, which is >1 km from the Site. Preparation of the Site and the construction of the proposed converter station and substation will result in dust generation, along with noise and visual disturbance. The SPA and Ramsar sites are more than 1 km from the Site and therefore there will be no impacts on the SPA and Ramsar sites from dust, noise or visual disturbance as pollution controls will be in place to supress dust and vectors for noise and visual disturbance will be both a sufficient distance and sufficiently screened by existing urban/landscape features.	No
		Operation: The SPA and Ramsar are more than 1 km from the Site and therefore, there are no pathways (*e.g.* disturbance to SPA and Ramsar features such as noise, lighting or visual) which could affect the SPA and Ramsar sites during operation of the proposed converter station and substation.	No
South Thames Estuary and Marshes SSSI	National	**Construction**: The construction of the proposed converter station and substation will not impact on habitat within the SSSI. Preparation of the Site and the construction of the proposed converter station and substation will result in dust generation, along with noise and visual disturbance. Noise and visual disturbance will not impact on the integrity or the	No

Ecological feature	Value	Screening for Potential impacts / effects	Scoped into EcIA?
		functioning of the SSSI due to distance to qualifying receptors and visual screening from existing vegetation and topography. The implementation of standard environmental protection measures during construction, such as dust suppression and pollution prevention, will be adopted and these measures will be formalised into a CEMP. Consequently, dust generation during construction is unlikely to affect the integrity of the SSSI, providing the environmental protection measures are implemented.	
		Operation: There are no pathways (e.g. habitat loss, disturbance to SPA and Ramsar features such as noise, lighting or visual, due to distance to qualifying receptors and visual screening from existing vegetation and topography) which could affect the SSSI during operation of the proposed converter station and substation.	No
Medway Estuary and Marshes SSSI	National	**Construction**: The construction of the proposed converter station and substation will not impact on habitat within the SSSI, which is more than 1 km from the Site. Preparation of the Site and the construction of the proposed converter station and substation will result in dust generation, along with noise and visual disturbance. The SSSI is more than 1 km from the Site and therefore there will be no impacts on the SSSI from dust, noise or visual disturbance as pollution controls will be in place to supress dust and vectors for noise and visual disturbance will be both a sufficient distance and sufficiently screened by existing urban/landscape features.	No
		Operation: The SSSI is more than 1 km from the Site and therefore, there are no pathways (*e.g.* disturbance to SSSI features such as through noise, lighting or visual) which could affect the SSSI during operation of the proposed converter station and substation.	No
ME16 Grain Pit LWS	County	**Construction**: The construction of the proposed converter station and substation will not impact on habitat within the LWS. With the implementation of standard environmental protection measures during construction, such as dust suppression and pollution prevention, there are no likely pathways by which the construction of the proposed converter station and substation could adversely affect the LWS. Therefore, there is no reasonable likelihood of impacts during construction.	No
		Operation: There are no pathways (*e.g.* habitat loss, disturbance from noise, lighting or visual) which could affect the LWS during operation of the proposed converter station and substation.	No
Aquatic Invertebrates	District	**Construction**: The construction of the proposed converter station and substation will not directly impact on any waterbodies or watercourses. The implementation of standard environmental protection measures during construction, such as dust	No

Ecological feature	Value	Screening for Potential impacts / effects	Scoped into EcIA?
		suppression and pollution prevention measures such as temporary silt fencing, Sustainable Drainage System features, will be adopted to prevent any indirect impacts and these measures will be formalised into a CEMP.	
		Operation: There are no pathways (*e.g.* habitat loss, disturbance from noise, lighting or visual) which could affect aquatic invertebrates during operation of the proposed converter station and substation.	No
Breeding Birds (Marsh Harrier)	District	**Construction**: The construction of the proposed converter station and substation will be a sufficient (>500 m) distance from Marsh Harrier breeding locations to ensure that there will be no disturbance from noise or visual disturbance which would affect breeding Marsh Harrier. There will be no loss of habitat used by breeding Marsh Harrier during construction of the proposed converter station and substation.	No
		Operation: There are no pathways (*e.g.* habitat loss, disturbance from noise, lighting or visual) which could affect breeding birds during operation of the proposed converter station and substation.	No
Non-breeding (intertidal) birds	International	**Construction**: The construction of the proposed converter station and substation will generate noise, dust and will create visual disturbance. However, the converter station and substation are >500 m from the intertidal areas used by waterbirds. It is unlikely that there will be any effects on waterbirds using the intertidal areas at this distance and therefore there are no pathways for effects on intertidal waterbirds during construction of the proposed converter station and substation.	No
		Operation: There are no pathways (*e.g.* habitat loss, disturbance from noise, lighting or visual) which could affect intertidal waterbirds during operation of the proposed converter station and substation, given the distance between the converter station and substation and the intertidal areas used by waterbirds (>500 m distance).	No

Proposed DC Cable Route

6.79 An initial screening of potential impacts and effects arising from the construction and operation phases of the proposed DC cable is provided in Table 6.11.

Table 6.11: Determination of Relevant Ecological Features for the Proposed DC Cable Route

Ecological feature	Value	Screening for Potential impacts/ effects	Scoped into EcIA ?
Thames Estuary and Marshes SPA and Ramsar	International	**Construction**: The construction of the proposed DC cable corridor, above the MHWS, will not directly impact on habitat within the SPA and Ramsar sites. Preparation of the Site and the installation of the proposed DC cable corridor will result in dust generation, along with noise and visual disturbance. The implementation of standard environmental protection measures during construction, such as dust suppression and pollution prevention, will be adopted and these measures will be formalised into a CEMP. Consequently, dust generation during construction is unlikely to affect the integrity of the SPA and Ramsar sites, providing the environmental protection measures are implemented. The effects of noise and visual disturbance on the interest features of the SPA and Ramsar sites are considered further on in this Table.	No
		Operation: There are no pathways which could affect the SPA and Ramsar sites during operation of the proposed DC cables.	No
Medway Estuary and Marshes SPA and Ramsar	International	**Construction**: The construction of the proposed DC cable corridor, above the MHWS, will not impact on habitat within the SPA and Ramsar sites, which are more than 1 km from the Site. Preparation of the Site and the installation of the proposed DC cables will result in dust generation, along with noise and visual disturbance. The SPA and Ramsar sites are more than 1 km from the Site and therefore there will be no impacts on the SPA and Ramsar sites from dust, noise or visual disturbance as pollution controls will be in place to supress dust and vectors for noise and visual disturbance will be both a sufficient distance and sufficiently screened by existing urban/landscape features.	No
		Operation: The SPA and Ramsar are more than 1 km from the Site and therefore, there are no pathways (*e.g.* disturbance to SPA and Ramsar features such as noise, lighting or visual) which could affect the SPA and Ramsar sites during operation of the proposed DC cables.	No
South Thames Estuary and Marshes SSSI	National	**Construction**: The construction of the proposed DC cable corridor, above the MHWS, will not impact on habitat within the SSSI. Preparation of the Site and the installation of the proposed DC cables will result in dust generation, along with noise and visual disturbance. The implementation of standard environmental protection measures during construction, such as dust suppression and pollution prevention, will be adopted and these measures will be formalised into a CEMP. Consequently, dust generation during construction is unlikely to affect the integrity of the SSSI, providing the environmental protection measures are implemented. The effects of noise and visual disturbance on the interest features of the SSSI are considered further on in this Table.	No

Ecological feature	Value	Screening for Potential impacts/ effects	Scoped into EcIA ?
		Operation: There are no pathways which could affect the SSSI during operation of the proposed DC cables.	No
Medway Estuary and Marshes SSSI	National	**Construction**: The construction of the proposed DC cable corridor, above the MHWS, will not impact on habitat within the SSSI, which is more than 1 km from the Site. Preparation of the Site and the installation of the proposed DC cables will result in dust generation, along with noise and visual disturbance. The SSSI is more than 1 km from the Site and therefore there will be no impacts on the SSSI from dust, noise or visual disturbance as these pollutants are unlikely to travel that far.	No
		Operation: The SSSI is more than 1 km from the Site and therefore, there are no pathways (*e.g.* disturbance to SSSI features such as through noise, lighting or visual) which could affect the SSSI during operation of the proposed DC cables.	No
ME16 Grain Pit LWS	County	**Construction**: The construction of the proposed DC cable corridor will not impact on habitat within the LWS, which is adjacent (on the eastern side) to the DC cable corridor. With the implementation of standard environmental protection measures during construction, such as dust suppression and pollution prevention, there are no likely pathways by which the construction of the proposed DC cable corridor could adversely affect the LWS. Therefore, there is no reasonable likelihood of impacts during construction. The CEMP for the Site will include measures to avoid the temporary effects of artificial lighting pollution on fauna and habitats associated with the LWS and to avoid accidental ingress (through fencing) of plant machinery and personnel into the LWS.	No
		Operation: There are no pathways (*e.g.* habitat loss, disturbance from noise, lighting or visual) which could affect the LWS during operation of the proposed DC cables.	No
Intertidal Habitats	County	**Construction:** Construction activities associated with route preparation and cable installation can lead to direct physical disturbance (*i.e*. reworking) of substrate which may lead to disturbance and/or loss of benthic habitats and species within the footprint and immediate vicinity of the intertidal works. The construction activities can also lead to a temporary increase in suspended sediment concentrations (SSC), sediment deposition and re-deposition leading to turbidity and smothering effects. Changes to marine water quality from the use of drilling fluids and accidental leaks and spills from vessels, including loss of fuel oils during installation.	Yes
Aquatic Invertebrates	District	**Construction:**	No

Ecological feature	Value	Screening for Potential impacts/ effects	Scoped into EcIA ?
		Providing the construction of the DC cable avoids the direct loss of habitat within the ditch at crossing points, or along the length of the ditch, there will be no direct impacts (through habitat loss) on aquatic invertebrates during construction. The implementation of standard environmental protection measures during construction, such as dust suppression and pollution prevention, will be adopted to prevent any indirect impacts and these measures will be formalised into a CEMP. If possible, works should be limited to the western side of the Ditch and access track, including excavation, spoil storage, vehicle movements etc., and thereby direct and indirect impacts to the Ditch avoided. Due to the high biological water quality and value of the Ditch, pollution prevention measures such as temporary silt fencing, Sustainable Drainage System features and attenuation ponds (as detailed in Chapter 5) are recommended for construction works.	
		Operation: There are no pathways (*e.g.* habitat loss, disturbance from noise, lighting or visual) which could affect aquatic invertebrates during operation of the proposed DC cables.	No
Invasive Non-native Species (Marine)	National	**Construction:** Introduction and spread of INNS from biofouling on marine vessels - In light of the avoidance measures outlined in Section 6.10, the risk of INNS being introduced and spread by biofouling on marine vessels and subsequently effecting benthic habitats and species is considered to be negligible. Thus, this environmental issue has been scoped from further consideration within the impact assessment.	No
Breeding Birds (Marsh Harrier)	District	**Construction**: The construction of the proposed DC cable corridor, if undertaken within the bird breeding season (March to August inclusive) has the potential to affect Marsh Harrier breeding in off-site habitats within 100 m of the proposed DC cable corridor, through noise and visual disturbance. There will be no loss of habitat used by breeding Marsh Harrier during construction of the proposed DC cable corridor.	Yes
		Operation: There are no pathways (*e.g.* habitat loss, disturbance from noise, lighting or visual) which could affect breeding birds during operation of the proposed DC cables.	No
Non-breeding (intertidal) birds	International	**Construction**: There will be no permanent loss of intertidal habitat used by waterbirds to the MHWS. The movement of people and plant during the construction phase of the proposed DC cable route, at the MHWS mark, may be visible to a small proportion of the SPA cited bird species using the intertidal areas of the SPA and Ramsar during low tide and recorded during intertidal waterbird surveys. However, at low tide, from the MHWS landwards there is limited potential for temporary disturbance of birds using the intertidal areas caused by visual disturbance and that there is sufficient exposed intertidal habitat that any temporary disturbance to waterbirds during installation of the proposed DC cables at low tide is mitigated for through the abundance of available habitat elsewhere.	No

Ecological feature	Value	Screening for Potential impacts/ effects	Scoped into EcIA ?
		At high tide, the majority of waterbirds congregate at high tide roosts >600 m from the landfall area. This is a sufficient distance from the landfall area at which any temporary disturbance from installation of the proposed DC cables at landfall, generated through noise, should not affect the integrity of the high tide roost. The curvature of the coastline will screen the construction areas at landfall from the high tide roost >600 m from the landfall area. Therefore, there will be no temporary affects from visual disturbance during installation of the DC cable corridor at landfall.	
		Operation: There are no pathways (*e.g.* habitat loss, disturbance from noise, lighting or visual) which could affect waterbirds using the intertidal areas during operation of the proposed DC cables.	No

Significance of effects

6.80 Taking into account the committed avoidance and mitigation measures as detailed in section 6.10, the potential for the GB Onshore Scheme to generate effects on ecological receptors was evaluated using the methodology as detailed in section 6.5. The aim of the evaluation was to identify potentially significant effects and determine the need for bespoke mitigation measures additional to those detailed in section 6.10.

Intertidal Benthic Habitats

6.81 The evaluation highlighted that the GB Onshore Scheme has the potential to generate a negative effect on intertidal habitats during construction and operation of the DC cable (refer to Table 6.11 for details) and this is discussed further.

Construction - Temporary physical disturbance to and/or loss of intertidal benthic habitats

6.82 Various activities associated with the route preparation and cable installation phases of the Project may result in temporary physical disturbance to and/or loss of intertidal benthic habitats and species. These include:

- Horizontal direction drilling (HDD);
- Cable burial by ploughing, trenching or excavating; and
- Vessel anchors.

6.83 Effects would occur at the four breakout points for the HDD conduits in the mid shore area (i.e. approximately 800 m from the MHWS mark) and would continue down to MLWS where the cable would be installed within an open cut trench created using either a plough, mechanical trencher or excavator.

6.84 It is highly likely that a boat-based method (i.e. anchored barge) would be used to carry out the cable installation works within the low intertidal zone. Consequently, marine vessels would be required; the associated anchorage is estimated to have a ZoI of 500 m from the marine vessel whilst the cable barge would also have a footprint on the foreshore. Should cable installation works be completed using small jack up barges, the ZoI would be limited to the legs and spudcans which would have an approximate diameter of 2 m.

6.85 In the event that the intertidal trench is installed using shore based open cut techniques, it is anticipated to have a footprint measuring approximately 800 m long, 3 m wide and 1 – 1.5 m deep. Including a cable access corridor of 10 m, the total ZoI for this activity equates to an area of approximately 0.06 km2. This area would include the area which may be impacted should there be a requirement for a temporary cofferdam and/or for the cable to be pulled along the beach for installation within the HDD ducts.

6.86 All intertidal habitats identified within the Project Route Corridor are representative of Annex I habitat ('mudflats and sandflats not covered by seawater at low tide') and the UK BAP Priority Habitat 'intertidal mudflats'. 'Intertidal sand and muddy sands' which approximates to the broadscale habitat 'littoral sand and muddy sand' (A2.2) is also a qualifying feature of the Medway Estuary MCZ. The Project Route Corridor overlaps with this designated site covering an area of 0.08 km2.

6.87 Physical disturbance and loss of intertidal habitats and species due to the cable installation works would be temporary, with excavated substrates being returned to the trench following cable laying. Intertidal environments are highly dynamic and therefore habitats and species have adapted to variable conditions; for example, natural community changes are often observed between summer and winter due to sediment erosion from storm events (Connor et al., 2004). As a result, the sensitivity of intertidal habitats and species to temporary physical disturbance to and/or loss is considered to be low. More sensitive nearshore habitats such as saltmarshes have demonstrated recovery to pre burial condition after five years, with some recovery within two years (Linders et al., 2003). The recovery rate for mudflats would be expected to be more rapid than this with sediment reworking and natural recruitment or migration of species from similar habitats adjacent to the ZoI. Considering the sensitivity, recoverability and conservation importance of intertidal benthic habitats, the overall value of this receptor is considered to be of county value.

6.88 Overall, effects to intertidal habitats and species from temporary physical disturbance to and/or loss of substrates during the cable installation phase of the Project is predicted to be of low magnitude. Combined with the county value of this receptor, the effect is predicted to be **minor adverse** and **not significant**.

Construction - Temporary increase in suspended sediment concentrations (SSC), sediment deposition and re-deposition leading to turbidity and smothering effects

6.89 Within the intertidal zone, activities likely to cause disturbance to sediment, and therefore increased suspended sediment and depositional loads, would be limited to the lower 800 m of the foreshore, as HDD will be used for cable installation across the upper 800 m of the intertidal zone. Trenching, barge anchor points and foreshore-based works may cause increased SSC and deposition however, the duration of these effects would be short-term.

6.90 Owing to the prevalence of fine sediments within the intertidal zone, the ZoI for increased SSC is likely to extend across the intertidal area through which the Project Route Corridor passes and may extend into the surrounding Thames and Medway estuaries, depending on prevailing currents at the time of sediment disturbance.

6.91 Sediment chemistry analysis has shown there to be some low level and localised contamination of intertidal substrates with concentrations of several Polycyclic Aromatic Hydrocarbons (PAHs) exceeding the Cefas Action Level 1 (AL1). This is not unexpected given the heavily industrialised nature and history of the area. Despite this, all concentrations of heavy and trace metals, polychlorinated biphenyls (PCBs), organotins and organochlorines fell below AL1 and are therefore not considered to be of concern and are unlikely to influence any licensing decision for dredging.

6.92 Several PAHs are highly toxic to aquatic organisms and a number are known to be carcinogenic and mutagenic. Threshold Effect Levels (TEL) and Probable Effect Levels (PEL) are defined by the Canadian sediment quality guidelines (CCME, 2001). These are referred to in the absence of equivalent UK guidelines. The TEL of a substance is the concentration below which sediment associated chemicals are not considered to represent significant hazards to aquatic organisms. The PEL represents the lowest concentration of a substance that is known to have an adverse effect on aquatic organisms. Exceedances of the TEL for several PAHs were also prevalent where observed within the intertidal zone although no exceedance of the PEL was observed. Thus, there is considered to be no potential for effects to intertidal habitats and species from the release and re-deposition of sediment bound contaminants and thus, this effect has not been considered further.

6.93 Intertidal environments are highly dynamic and subject to constant physical disturbance and exposure to wave and tidal action which can lead to natural increases to SSC and deposition. Intertidal habitats known to be present within the Project Route Corridor are characterised by muddy substrates, which are likely to easily become suspended by natural current and wave action. In addition, these habitats occur at the mouth of the River Thames where discharges of suspended sediment are high (i.e. near-bed levels typically in the region of 100 mg/l (HR Wallingford, 2002)). Thus, it expected that the intertidal habitats and associated species within the ZoI of the route preparation and cable installation works would be relatively insensitive to increases in SCC and deposition related to the Project.

6.94 Increases in SSC and deposition associated with the intertidal installation activities are not predicted to greatly exceed natural variations. Furthermore, no significant alteration of water quality due to the mobilisation of sediment bound contaminants is anticipated.

6.95 Although temporary increases in SCC and deposition may occur within the intertidal zone as a result of the Project, in comparison to the high and variable background levels, any increase is unlikely to be detectable above natural variation. Owing to the short-term nature and small scale of change related to any increase in SSC and deposition, photosynthesis of marine flora is unlikely to be affected.

6.96 Given the conservation importance of intertidal habitats and species the value of this receptor has been assessed as county importance. However, due to the already high background levels of SSC and the low sensitivity of intertidal habitats and species to increases in SSC and

deposition, the magnitude of impact is predicted to be negligible and turbidity and smothering effects is predicted to be negligible and not significant.

Construction - Changes to marine water quality from the use of drilling fluids and accidental leaks and spills from vessels, including loss of fuel oils

6.97 Changes to marine water quality arising from the use of drilling fluids and additives, accidental leaks and spills from vessels has the potential to harm benthic habitats and species through toxicity and bacteriological contamination.

6.98 Most drilling fluids and additives such as bentonite which would be required during the HDD operations are biodegradable and have no harmful effect on the marine environment. For example, bentonite which consists predominately of clay minerals and is generated frequently from the alteration of volcanic ash, is considered to be a clean, inert and non-polluting substance. As such it is included on the OSPAR List of Substances Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (Cefas, 2018). Furthermore, bentonite is not listed under the Environmental Quality Standards Directive (EQSD). As outlined in section 6.10 several mitigation measures shall be implemented to avoid and/or minimise the risk of drilling fluid breakouts from the end of the ducts.

6.99 Construction vessels produce the following types of wastes and discharges each requiring appropriate handling and disposal; these include:

- Black water (i.e. sewage) which can contain harmful microorganisms, organic material with a chemical and biological oxygen demand, nutrients etc.;
- Grey water (i.e. from sinks and showers); and
- Deck drainage and bilge water there is potential for contamination with oils and lubricants.

6.100 All effluent from construction vessels will be discharged in accordance with the applicable MARPOL Convention Regulations. The potential for accidental leaks or spills of fuel, oils and any other hazardous construction materials which would also be addressed through control and response measures in the project Environmental Management Plans.

6.101 Despite the prevalence of marine traffic in the outer Thames Estuary and southern North Sea, historically few pollution events have occurred in this area. Considering this and the mitigation measures outlined above, the likelihood of accidental release occurring in relation to this Project is thought to be extremely low. Should an accidental spill or leak occur, it would be subject to immediate dilution and rapid dispersal within the marine environment.

6.102 Overall, intertidal habitats and species could potentially be affected by the changes in water quality associated with the route preparation and cable installation works however, any effect would be temporary and largely restricted to the vicinity of the works. Furthermore, the mitigation measures outlined in Section 6.10 are considered to significantly reduce the likelihood of changes in water quality occurring as a result of accidental release of substances. Thus, the overall magnitude of impact is predicted to be negligible. Combined with the county value of intertidal benthic receptors, the overall effect is predicted to be **negligible** and **not significant**.

Operation - Disturbance to benthic habitats and species due to subsea cable thermal emissions

6.103 Operation of the subsea HVDC cables generates heat due to resistance in the conductor components which can warm the cable surface and adjacent environment (i.e. sediments). The rate of heat loss, and magnitude of environmental heating is dependent on several factors; most notably the amount of power passing through the cables; the design of the cables; and the thermal properties of the surrounding substrates which in turn is influenced by sediment grain size. Coarser sediments such as gravel and sand have lower thermal resistivity than clays and mud and can therefore lead to greater transfer of heat (OSPAR Commission, 2009).

6.104 Temperature increases near the cable can modify chemical and physical properties of the substratum, such as the oxygen concentration profile (redox interface depth) and, indirectly, the development of microorganism communities and/ or bacterial activity. Physiological changes in benthic organisms living at the water-sediment interface and in the top sediment layers can also potentially occur (OSPAR Commission, 2008; Rhoads and Boyer, 1982). Temperature radiation can also cause small spatial changes in benthic community structure by way of migratory

behaviour modification with species which prefer lower temperature being excluded from the cable route in favour of other, more tolerant species.

6.105 Whilst sediments may be exposed to temperature increases, the cable has negligible capacity to heat the overlying water column due to the high heat capacity of water (OSPAR, 2008). Thus, there is considered to be no interaction between benthic organisms which live in contact with the water column with potential effects being limited to infaunal species.

6.106 Temperature emissions have been modelled for a range of different possible cable systems in order to identify systems that would meet the limit described (Fichtner, 2018). All assumptions used for modelling are believed to be conservative. Modelling assumes an ambient seabed temperature of no more than 15°C, a seabed thermal resistivity of 0.7 Km/W and an average burial depth of 1500 mm. Calculations also assume a steady-state electricity transmission, which would enable heating to achieve equilibrium. In reality electricity transmission will fluctuate, leading to lower heating effects, and so this assumption is considered to be very conservative.

6.107 Sediments within the intertidal zone experience extreme natural temperature variations due to immersion and emersion during tidal cycles. As such, many intertidal species are considered to have wide tolerances for temperature and can also alter metabolic activity or burrow deeper or migrate upwards in the sediment to adjust to temperature changes (Brown, 1982).

6.108 Based on the temperature emissions predicted for the HVDC cable design, it is unlikely that any increase in temperatures within intertidal sediments would lead to notable changes in benthic species richness and abundance, or microbial activity and microphytobenthic primary production (Blanchard and Guarini, 1996).

6.109 Whilst thermal emissions would represent a permanent effect lasting for the operational lifetime of the subsea cables, the scale of change and spatial extent of effects is expected to be small and limited to a very narrow region above the cables. Thus, the overall magnitude of impacts to intertidal benthic habitats and species is predicted to be negligible. Combined with the county value of this receptor, the effect is predicted to be **negligible** and **not significant**.

Marsh Harrier

6.110 This evaluation highlighted that the GB Onshore Scheme has the potential to generate a negative effect on breeding Marsh Harrier during construction of the DC cable (refer to Table 6.11 for details) and this is discussed further.

6.111 The potential effects of construction relating to breeding Marsh Harrier, which are subject to further assessment in this chapter, are summarised below:

- temporary loss of natural or semi-natural habitats; and
- temporary disturbance from noise or light pollution, human activity and vehicular movement.

6.112 As identified in Table 6.11 there are no pathways for effects on species or designated sites during operation of the proposed DC cables and therefore will not be further assessed within this EcIA.

Temporary loss of habitat for Marsh Harrier

6.113 There will be no loss of reedbed habitat used by breeding Marsh Harrier, during installation of the proposed DC cables. Therefore, there will be **no effects** of habitat loss on Marsh Harrier.

Temporary disturbance from noise or light pollution, human activity and vehicular movement

6.114 Construction lighting, if night working is required during construction of the DC cable corridor, has the potential to disrupt breeding Marsh Harrier through light spill and glare if this falls onto reedbed habitat outside of the Site boundary. However, construction lighting will be temporary. Task-specific lighting may be used during darkness hours that occur within regular working hours (i.e. in the winter months), or during periods of low levels of natural light, but these will be outside of the breeding season for Marsh Harrier (typically March to August inclusive).

6.115 Therefore, the effects from lighting associated with construction of the proposed DC cable corridor on breeding Marsh Harrier would be negligible.

6.116 A study from Dos Reinos Lake in Spain (Fernandez and Azkona, 1993) on the effects of human disturbance on parental care by Marsh Harrier and the nutritional condition of nestlings considered that whilst the effects of human disturbance limited Marsh Harrier parental care, the behaviour of male Marsh Harrier was only affected during the incubation stage. Overall, the breeding success of Marsh Harrier was unaffected between disturbed and undisturbed pairs.

6.117 This study would suggest that the effects of disturbance on Marsh Harrier, a receptor of district value, during construction are unlikely to be significant.

6.118 Human activity, through the movement of people and vehicles during the operational phase has potential to cause temporary visual disturbance to breeding Marsh Harrier. However, this is likely to be a significant impact only immediately adjacent to the main works areas, where these works are visible to the reedbed habitat. The majority of the reedbed habitat will be screened from construction activities by vegetation, including trees and scrub. The vegetation screening will reduce the visibility of movement of people and vehicles during the breeding season (March to August inclusive).

6.119 Therefore, the magnitude of the impacts of disturbance during construction on Marsh Harrier would be low, resulting in a short-term temporary minor adverse effect which is not significant.

6.120 No predictions for noise disturbance have been performed (see Chapter 7: Noise) and therefore the significance of any construction noise effects on Marsh Harrier, without mitigation, cannot be stated. Whilst the construction of the DC cable is likely to result in short-term temporary disturbance only (if undertaken during the breeding season), there is the potential for high construction noise levels to occur whilst works are undertaken in close (<200 m) proximity to the reedbed area, east of the DC cable.

6.121 Therefore, in the absence of mitigation, the magnitude of the impacts of disturbance during construction of the GB Onshore Scheme on Marsh Harrier could lead to a short-term temporary moderate adverse effect which is significant.

Mitigation

6.122 This section only includes mitigation that is not already accounted for within the upfront inherent scheme design, as detailed in section 6.10. Any measures identified here are where significant effects on ecology and nature conservation (i.e. major or moderate adverse effects) or otherwise are predicted and mitigation is required for specific protection afforded to relevant protected species.

6.123 Good practice precautionary mitigation measures are required on the grounds of animal welfare and to ensure works are undertaken in a manner that provides certainty of compliance with relevant legislation and these will be implemented as detailed within the relevant mitigation strategies. This will be adopted and implemented through the CEMP adopted prior to and throughout the construction phase of the GB Onshore Scheme.

6.124 Noise disturbance, during construction of the DC cable, has the potential to directly impact breeding Marsh Harrier, if such works are undertaken during the breeding season (typically March to August inclusive). Therefore, to avoid any such impacts, the mitigation will be adopted and formalised into the CEMP such that construction of the DC cable, within 200 m of the Marsh Harrier territory, will not be undertaken between March and August, inclusive.

6.125 The lighting for the GB Onshore Scheme, during construction and operation, would be appropriately designed to minimise impacts on bats and off-site habitats (details to be confirmed). Brightness would be as low as legally possible and the times during which the lighting is to be used limited to provide some dark periods, if possible subject to safety requirements. Lighting would be directed to where it is needed to avoid any horizontal light spillage. Any upward lighting would be minimal to avoid light pollution and disturbance to foraging and commuting bats. Limiting the height of lighting columns and directing light at a low level would reduce the ecological impact of lighting on bats and off-site habitats. An outline Lighting Strategy will be prepared. Any lighting that is required for the construction and operation of the GB Onshore Scheme will be directed away from surrounding habitat to minimise light disturbance to off Site habitats.

6.126 In addition to the avoidance measures and mitigation by design described in Section 6.10, the following project specific mitigation is proposed to address potential significant effects to intertidal benthic ecology:

- deployment of anchors/anchor chains on the seabed will be kept to a minimum in order to reduce disturbance to seabed within the intertidal zone; and
- the preferred method of cable installation in the intertidal would be boat-based, as whilst there is potential for small non-significant effects to intertidal habitats and species from beaching of the barge and vessel anchorage, the alternative shore based option would be associated with a much larger potential ZoI and magnitude of effect although the significance is predicted to remain as minor adverse.

6.127 No further mitigation is required for the construction of the proposed GB Onshore Scheme.

6.128 No other pathways to effects on ecology are predicted during operation of the GB Onshore Scheme.

Enhancement

6.129 An Indicative Landscape Design (see Chapter 5: Landscape and Visual Amenity) has been prepared to support this application. The design includes biodiversity mitigation measures, enhancement proposals and habitat management prescriptions. The proposed biodiversity enhancements are summarised below:

- management of retained areas of scrub and trees to enhance their landscape and biodiversity value, including infill tree planting, understorey scrub planting, ground flora planting, provision of dead wood habitat piles;
- provision of bat and bird boxes within retained areas of scrub and trees;

- biodiversity enhancements through the provision of species rich grassland and scrub in surrounding areas;
- retention and enhancement of existing boundary vegetation;
- hedgerow planting and diversification along the Site boundary;
- screen planting, with trees and scrub, around the proposed converter and substation;
- creation of an attenuation SUDS basin with standing water;
- creation of a dry attenuation area immediately west of the proposed converter station; and
- creation of a dry swale, leading to the attenuation pond.

Residual Impacts

6.130 The residual effects are those that will remain after the implementation of mitigation measures. Requirements for mitigation relating to potential significant effects are minimal and relate primarily to requirements to comply with good practice and relevant legislation. Accordingly, no significant residual effects on ecological features are predicted during construction or operation of the GB Onshore Scheme.

Cumulative Effects

6.131 This section presents the assessment of cumulative effects between the GB Onshore Scheme and other proposed and committed plans and projects including other developments.

6.132 This cumulative effect assessment identifies for each receptor those areas where the predicted effects of the GB Onshore Scheme could interact with effects arising from other plans and, or projects on the same receptor based on a spatial and, or temporal basis. The approach adopted within this report follows the principles and guidelines as set out by the Planning Inspectorate. This follows a four-stage approach to assessment, initially identifying a long list of other plans and projects (Stage 1) followed by a shortlisting exercise and information gathering (Stage 2), before any potential cumulative effects are assessed (Stage 3). Further information on this methodology can be found in Chapter 12: Cumulative Assessment.

6.133 Where relevant, transboundary effects have also been considered, as per the obligations set out in the Convention on Environmental Impact Assessment in a Transboundary Context' (United Nations 1991).

Stage 1: Long list of other plans and projects

6.134 A long list of plans and projects known for the survey area and the wider area was drawn up. This list is presented in Chapter 12 and the locations are shown in Figure 12.1.

Stage 2: Shortlist of cumulative assessment developments relevant to Ornithology

6.135 The shortlisting of projects involved taking into consideration spatial and temporal overlaps between the GB Onshore Scheme and the long list of developments as outlined in Chapter 12. Where potential spatial and, or temporal overlap was thought to occur, the area of overlap was reviewed to identify any specific ecological receptors. If the ecological receptors identified were considered to be sensitive, the overlapping development was taken forward into the cumulative assessment (Stages 3 and 4).

6.136 From review of the projects identified in Chapter 12, those which are regarded as having a temporal and/ or spatial overlap with the GB Onshore Scheme, that may result in cumulative impact(s) on ecological receptors are the proposed NGET OHL Works, and the GB Offshore Scheme. From review of these proposed projects and their overlap to the GB Onshore Scheme the only ecological receptors considered to be sensitive, thereby requiring assessment, are the Thames Estuary & Marshes SPA and Ramsar, and Lower Thames Estuary & Marshes SSSI, and the Marsh Harrier.

6.137 In reviewing the long-list of projects it has been assumed that any maintenance and repair work associated with the operation of the GB Onshore Scheme would be temporary and highly localised such that any disturbance (e.g. visual, noise and, or lighting) would not combine with similar effects during either the construction or maintenance works associated with any of the projects listed above to result in a cumulative effect. As such no cumulative effects are likely during operation.

6.138 Further to the projects identified in Chapter 12, the Britned development – located 1.5 km to the south-east of the Project Area – was also screened out as this development is operational and therefore there are unlikely to be any cumulative effects arising from any maintenance and repair to this development and the construction of the GB Onshore Scheme (where these are coincident).

6.139 The remaining plan and projects including developments have also been screened out on the basis of distance from the GB Onshore Scheme.

Stages 3 and 4: Information gathering and assessment

6.140 The works associated with the installation of the GB Offshore Scheme subsea cables, may result in the cumulative impact on the Thames and Lower Thames Estuary & Marshes SPA, Ramsar and SSSI sites. However the installation activities of the subsea cable on either side of MLWS

would be undertaken as part of the same activity and not undertaken simultaneously. Therefore whilst the impacts may persist for slightly longer the GB Offshore Scheme, beyond the GB Onshore Scheme application boundary, installation will be out of the boundary of the protected areas. Any disturbance to bird populations would also be negligible as whether these activities are undertaken at high tide or low tide, there will either be no mudflats exposed for feeding, or maximum feeding grounds exposed.

6.141 From review of the location of the Marsh Harrier nesting site and the proposed projects there are no spatial overlaps. Due to the nature of the works associated with the NGET OHL Works and the GB Offshore subsea cable installation activities being minor and undertaken in line with the GB Onshore Scheme construction, it is concluded that in combination impacts on the Marsh Harrier would be negligible.

6.142 In terms of assessment, no plans or projects including other developments, as detailed in Chapter 12, have been identified which may result in cumulative effects on Ecology within the GB Onshore Scheme. Therefore, the main potential for ecological impacts during construction and operation of the GB Onshore Scheme is within the Site itself. Other schemes do not contribute to the effects on protected species identified in this chapter and therefore the effects are likely to be **not significant**.

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7. Noise & Vibration

Introduction

7.1 This chapter of the Environmental Statement reports the findings of an assessment of the effects associated with noise and vibration occurring as a result of the construction, operation and maintenance and decommissioning of the GB Onshore Scheme. Described within this chapter are:

- The methods used to assess the likely significant noise and vibration effects associated with the GB Onshore Scheme;
- The baseline sound environment at noise sensitive receptor (NSR) locations surrounding the Project Area (the area in which the GB Onshore Scheme is located) based upon a long-term sound survey;
- Mitigation measures required to prevent, reduce or offset any likely significant adverse noise and vibration effects arising as a result of the construction, operation and maintenance and decommissioning of the GB Onshore Scheme; and
- The likely residual noise and vibration effects of the GB Onshore Scheme after these mitigation measures have been adopted and a statement on the significance of the residual effects.

7.2 Effects are considered during the construction, operation and maintenance and decommissioning phases of the GB Onshore Scheme. The scope of this assessment is to identify the potential for effects to occur at NSRs due to the following:

- Noise and vibration impacts from construction and/or decommissioning works;
- Noise impacts from the operation of the converter station and substation; and
- Noise impacts associated with road traffic movements attributable to the construction activities.

7.3 No sources of significant vibration are associated with the operation and maintenance of the GB Onshore Scheme. DC cables do not typically emit high levels of sound and, according to Chapter 03 Proposed GB Onshore Scheme, the DC cable will be buried in a 1.5 m deep trench which would absorb any sound emissions. Any sound emissions from the buried DC cable are anticipated to be imperceptible. Therefore, assessments of operational vibration, operational noise from the proposed DC cables have been scoped out of the assessment.

7.4 Regular maintenance activities are not anticipated to generate perceptible levels of noise or vibration at nearby receptors. Unplanned maintenance activities may result in perceptible noise levels at NSRs, in particular due to the requirement for night-time access when NSRs are more sensitive. However, these would be extremely infrequent events. Therefore, noise and vibration impacts due to maintenance activities have been scoped out.

7.5 Road traffic flows due to the operation and maintenance of the GB Onshore Scheme are anticipated to have a negligible impact on baseline flows on the surrounding roads. Therefore, operational impacts due to road traffic noise have been scoped out. This Chapter is supported by the following Technical Appendices:

- Appendix 7.A: Baseline Sound Survey Report
- Appendix 7.B: Modelling Information

Approach to Assessment

Overview

7.6 This section of this ES Chapter presents the following:

- Information sources that have been consulted throughout the preparation of this chapter;
- Details of consultation undertaken with respect to noise and vibration;
- The methods used to assess magnitude of noise level change from the existing or 'baseline' condition and the potential future baseline; and
- The significance criteria and terminology for the assessment of noise and vibration effects.

7.7 The assessment has been based on the development description in Chapter 3: Proposed GB Onshore Scheme. The following sources of information that define the GB Onshore Scheme have been reviewed and form the basis of the assessment of potential noise and vibration effects:

- Site layout plans:
  - Figure 2.2: Proposed GB Onshore Scheme;
  - Figure 2.3: Indicative Converter Station Layout.
- Development traffic: 24-hour AADT base and development traffic flows provided as part of the Transport Assessment (refer to Chapter 5: Transport).

7.8 Operational plant and sound source levels: based on information from the Environmental Statement submitted in support of the planning application for the "NSN Link" project by National Grid dated July 2014. The proposed converter station is of a similar design and plant and sound source levels are therefore considered representative of the GB Onshore Scheme.

Study Area

7.9 The extent of the study area has been defined to include the nearest NSRs in each direction from the Project Area and alongside the transport corridors that may be affected by changes in road traffic flows during the construction of the GB Onshore Scheme.

Consultation

7.10 An EIA Screening Opinion request was submitted to Medway Council (MC) on 23rd November 2018. The MC Environmental Health department provided the following comment in relation to noise and vibration:

> *"I am happy with the proposed scope of the EIA with respect to air quality and noise.*
>
> *There are likely to be construction and operational phase noise. Due to the long duration of the project I recommend that a construction phase noise assessment is carried out, and this should inform the scope of a Construction Environmental Management Plan (CEMP) and so set construction noise limits at representative noise sensitive receptors. The most appropriate standard for assessing the construction phase noise, and setting suitable noise limits and best practice controls and mitigation measures for this phase is BS5228.*
>
> *The operational phase noise assessment should refer to applicable standards and guidelines (for example BS4142:2014) and particular attention needs to be taken to the consideration of low frequency sound. It may be beneficial to seek the advice of UK Power Networks on the suitable assessment of low frequency sound from these types of installations."*

7.11 MC have been further consulted by telephone call between Tim Britton (Principal Acoustic Consultant, AECOM) and Stuart Steed (Environmental Protection Officer, MC). During this phone call it was agreed that:

7.12 Due to the absence of available information on the construction activities, assessment of construction noise and vibration would be qualitative, focussing on determining suitable limits and potential best practice measures;

7.13 Predictions of operational sound levels at receptors will be based on similar alternative projects to determine likelihood of requiring additional mitigation measures. However impacts will be controlled via the detailed design process and conditions in planning consent; and

7.14 In terms of an operational noise assessment using BS 4142: 2014, MC have a general preference of applying a criterion that the rating level should be at least 10 dB below the background sound level, subject to a demonstration that the internal noise level criteria in BS 8233:2014 are met. However it was agreed that BS 8233:2014 is not applicable to this type of sound and that alternative internal noise level criterion should be identified, preferably by applying guidance from UK Power Networks (UKPN).

Assessment Method

Guidance

7.15 The following guidance has been applied in this assessment as required.

British Standard 7445-1:2003 and 7445-2:1991

7.16 BS 7445 'Description and measurement of environmental noise' (BSi 2003 & 1991) (Ref 7-1) defines parameters, procedures and instrumentation required for noise measurement and analysis.

British Standard 5228:2009+A1:2014

7.17 BS 5228-1 'Code of practice for noise and vibration control on construction and open sites. Noise' (BSi 2014a) (Ref 7-2) provides a 'best practice' guide for noise control, and includes Sound Power Level (Lw) data for individual plant as well as a calculation method for noise from construction activities. BS 5228-2 'Code of practice for noise and vibration control on construction and open sites. Vibration' (BSi 2014b) provides comparable 'best practice' for vibration control, including guidance on the human response to vibration.

British Standard 4142:2014

7.18 BS 4142 'Methods for rating and assessing industrial and commercial sound' (BSi 2014) (Ref 7-3) can be used for assessing the effect of noise of an industrial nature, including mechanical services plant noise. The method compares the difference between the 'rating level' of the industrial noise with the 'background sound level' at the NSR position.

British Standard 8233:2014

7.19 BS 8233:2014 Guidance on sound insulation and noise reduction for buildings (Ref 7-4) provides criteria for the assessment of internal noise levels for various uses including dwellings and commercial properties.

Department of Transport: Calculation of Road Traffic Noise

7.20 Department of Transport (DfT)/ Welsh Office Memorandum 'Calculation of Road Traffic Noise' (CRTN) (1998)' (Ref 7-5) describes procedures for traffic noise calculation, and is suitable for environmental assessments of schemes where road traffic noise may have an effect.

Highways Agency: Design Manual for Road and Bridges

7.21 The Highways England 'Design Manual for Road and Bridges Volume 11 Section 3 Part 7 HD213/11 (Revision 1) Traffic Noise and Vibration' (DMRB) (Highways Agency, 2011) (Ref 7-6) provides guidance on the appropriate level of assessment to be used when assessing the noise and vibration effects arising from all road projects, including new construction, improvements and maintenance. The guidance can also be used for assessing changes in traffic noise levels as a result of non-road projects such as this.

ISO 9613-2:1996: Attenuation of Sound during Propagation Outdoors

7.22 International Standards Organisation (ISO) 9613-2:1996 'Attenuation of Sound during Propagation Outdoors, Part 2: General Method of Calculation' (ISO 9613-2) (Ref 7-7) specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources.

Assessment Method

7.23 Applicable planning policy is discussed in the following section; however it is necessary at this stage to describe the requirements of the Noise Policy Statement for England (NPSE) (Ref 7-8) in relation to the proposed assessment method. The Explanatory Note to the NPSE refers to the following concepts:

- No Observed Effect Level (NOEL) - the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established.
- Lowest Observable Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected.

- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

7.24 It is recognised that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL may be different for different noise sources, for different NSRs and at different times.

7.25 The aims of the NPSE are interpreted to be as follows (within the context of Government policy on sustainable development):

- To avoid noise levels above the SOAEL.
- To consider situations where noise levels are between the LOAEL and SOAEL. In such circumstances, all reasonable steps should be taken to mitigate and minimise the effects. However, this does not mean that such adverse effects cannot occur.

7.26 To demonstrate compliance with the NPSE, the adopted assessment methodology identifies the LOAEL and SOAEL for each potential impact under consideration.

Construction and Decommissioning Noise

7.27 Annex E of BS 5228-1 provides example criteria for the assessment of potential significance of construction noise effects. 'Example Method 1 – The ABC Method' has been adopted for the purposes of this assessment, as it takes into consideration the context of existing noise levels experienced at a NSR, and the method for defining construction noise limits is outlined in Table 7.1.

Table 7.1 BS 5228-1:2009+A1:2014 ABC Method

Assessment Category and Threshold Value Period	Threshold Value, in decibels (dB) ($L_{Aeq,T}$)		
	Category A [A)]	Category B [B)]	Category C [C)]
Night-time (23.00−07.00)	45	50	55
Evenings and weekends [D)]	55	60	65
Daytime (07.00−19.00) and Saturdays (07.00−13.00)	65	70	75

NOTE 1 A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the application site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3dB due to site noise.

NOTE 3 Applied to residential receptors only.

[A)] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

[B)] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

[C)] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

[D)] 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

7.28 For the appropriate period (day, evening, night, weekend etc.), the ambient noise level is determined and rounded to the nearest 5 dB and the appropriate Threshold Value is then derived. The predicted construction noise level is then compared with this Threshold Value. The criterion adopted in this assessment for the onset of potentially significant effects is the exceedance of the $L_{Aeq,T}$ threshold level for the category appropriate to the ambient noise level at each NSR. This is considered to be potentially equivalent to the SOAEL, although as stated in BS 5228, other project-specific factors are also considered by the assessor when determining if there is a potentially significant effect, such as the number of NSRs affected and the duration and character of the impact. The criterion for the LOAEL for this assessment is a predicted construction noise

level equal to the existing ambient noise level at each NSR, *i.e.* resulting in a 3 dB increase in noise level when combined with the ambient noise level. Note that these criteria relate to residential NSRs only, in line with the ABC method.

7.29 With consideration of the above and the information presented in Table 7.1, Table 7.2 presents the construction noise magnitude of impact criteria for residential NSRs.

Table 7.2 Construction noise magnitude of impact criteria for residential NSRs

Magnitude of Impact	Construction Noise Level $L_{Aeq,T}$ (dB)
High	Exceedance of ABC Threshold Value by ≥5 dB
Medium	Exceedance of ABC Threshold Value by up to 5 dB
Low	Equal to or below the ABC Threshold Value by up to 5 dB
Very low	Below the ABC Threshold Value by ≥5 dB

7.30 As details of the proposed construction and decommissioning schedule and plant to be used are not available at this stage, a quantitative construction noise assessment has not been carried out. Instead a qualitative assessment focussing on best practicable means has been completed.

Construction Vibration

7.31 BS 5228 indicates that construction activities (particularly piling) usually only generate significant vibration effects when they are located within 20 metres (m) from sensitive locations. The effect depends on the construction activity, ground conditions and receptor distance.

7.32 Table 7.3 details Peak Particle Velocity (PPV) vibration levels and provides a semantic scale for description of demolition and construction vibration impacts on human receptors based on guidance contained in BS 5228-2.

Table 7.3 Guidance on the Impacts of Vibration (PPV) Levels

Peak Particle Velocity Level	Description	Magnitude of Impact
0.14 mm/s to <0.3 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	Very Low
0.3 mm/s to <1.0 mm/s	Vibration might be just perceptible in residential environments.	Low
1.0mm/s to <10 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.	Medium
>=10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	High

7.33 As with the construction noise assessment, a quantitative construction vibration assessment has not been carried out. Instead a qualitative assessment focussing on best practicable means has been completed.

Construction Traffic Noise

7.34 Construction traffic noise impacts due to increases in traffic flows on existing roads have been estimated based on the CRTN methodology for the calculation of the Basic Noise Level (BNL) at

a reference distance of 10 m from the nearside carriageway. Predictions have been undertaken for both the “with” and “without” construction traffic scenarios.

7.35 The criteria for the assessment of traffic noise level changes have been taken from Table 3.1 of DMRB and are provided in Table 7.4 below.

Table 7.4 Road Traffic Noise Assessment Criteria (Temporary Changes)

Magnitude of Impact	Change in Road Traffic Noise Level $L_{A10,18h}$ (dB)
High	≥ 5
Medium	3 to <5
Low	1 to <3
Very low	<1

7.36 DMRB advises that an increase in road traffic flows of 25% (where the traffic speed and composition remain consistent) equates to an increase in road traffic noise of 1 dB LA10,18h. A doubling in traffic flow would be required for an increase in 3 dB LA10.

7.37 It is generally accepted that changes in noise levels of 1 dB or less are imperceptible, and changes of 1 to 3 dB are not widely perceptible. The SOAEL is set at a change in traffic noise of +3 dB LA10 and the LOAEL at +1 dB LA10.

Operational Noise

7.38 The layout of the buildings in the converter station and substation are subject to detailed design approval; however the sites have been zoned to demonstrate where buildings will be located. It is understood that there will be no transformers or other external plant associated with the substation, therefore no significant impacts are anticipated due to operational noise from the substation. The assessment has been based on the worst-case scenario for converter station orientation in regards to predicted noise levels and surrounding NSR locations. The indicative layout identified in Figure 3.3 shows the layout assumed for the worst-case noise level with the transformers – the main noise source during operation – located to the north of the site.

7.39 Predicted operational sound levels from the converter station have been calculated using the SoundPLAN sound prediction software (version 8.0), which predicts the L_{Aeq} at NSR locations in accordance with the methodology in ISO 9613-2. The model includes sound breakout from buildings where internal levels are anticipated to be high and sound from external plant. Predictions have been performed in octave bands using individual frequency spectra for each sound source, allowing determination of the likely frequency spectra of operational sound levels at NSRs. The predictions have incorporated 15 m high blast walls separating each combined transformer and transformer cooler location and at either end of the transformer area. Further details are provided in Appendix 7.2.

7.40 BS 4142 provides a means of assessing the significance of industrial noise. A key aspect of the BS 4142 assessment procedure is a comparison between the background sound level in the vicinity of residential locations and the rating level of the sound source under consideration. The relevant parameters in this instance are as follows:

- Background Sound Level, $L_{A90,T}$, defined in the Standard as the 'A-weighted sound pressure level that is exceeded by the residual sound for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels';
- Specific Sound Level, $L_{Aeq,Tr}$,the 'equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr'; and
- Rating Level, $L_{Ar,Tr}$, the specific sound level plus any adjustment made for the characteristic features of the sound'.

7.41 BS 4142 allows for, as an absolute worst case, a cumulative +15 dB correction to be applied to the specific sound level based upon the presence or expected presence of the following:

- Tonality - up to +6 dB penalty;
- Impulsivity - up to +9 dB penalty (this can be summed with tonality penalty); and
- Other sound characteristics (neither tonal nor impulsive but still distinctive) - +3 dB penalty.

7.42 When considering the difference between the rating level and the background sound level, the following guidance is provided in the standard:

- "*Typically, the greater this difference, the greater the magnitude of the impact."*
- *"A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context."*
- *"A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context."*
- *"Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

7.43 Any consideration of the significance of effect should also take into account other factors including:

- the absolute level of the sound;
- the character and level of the residual sound compared to the character and level of the specific sound; and
- the sensitivity of the NSR.

7.44 The criteria for determining the magnitude of operational noise impacts at NSRs, based on guidance within BS 4142, are presented in Table 7.5.

Table 7.5 BS 4142:2014 Noise Ratings

Difference Between *Rating Level* and *Background Sound Level*	Magnitude of Impact
-10dB(A) or less	Very low
Between -10dB(A) and 0dB(A)	Low
Between 0 and +10 dB(A)	Medium
+10dB(A) or more	High

7.45 For indicative assessment purposes the LOAEL is set at a rating level equal to the background noise level and the SOAEL is set at a rating level of +10 dB above background, although it should be remembered that the context assessment can vary the overall significance of effects.

7.46 To provide further context to the assessment, the ingress of operational noise into residential properties has also been assessed. As proposed by MC in the Screening Opinion and subsequent consultation, these assessment criteria have been established based on the opinion of UK Power Networks (UKPN). UKPN have published a response to 'The London Plan' (The Spatial Development Strategy for Greater London) dated March 2018 , which stated the following in regard to noise which is relevant to this assessment:

"we note your reference to BS8223:2014 in respect of providing guidance on good acoustic design inside buildings. Whilst this is a widely used standard it is not always appropriate for low frequency noise associated with electricity transformer hum. When buildings are in close proximity to our substations consideration should also be given to…..:…

Considering the use of noise reduction curves within the planning conditions – the NR20 would be the appropriate curve to use. However, a robust process would need to be put in place to ensure that planning conditions are achieved post construction."

7.47 It is understood from the above that UKPN are satisfied that internal electricity transformer hum sound levels are likely to be considered acceptable as long as the criterion of NR20 is not exceeded.

7.48 There are no available significance of effect criteria allowing assessment of internal operational noise impacts for this type of low frequency hum sound in the context of Environmental Impact Assessment (EIA) or to identify a LOAEL or SOAEL. The calculated internal noise levels are therefore compared to the limit of NR20, the effect is classified as not significant or significant depending on whether the limit is exceeded.

7.49 It is assumed that occupants of surrounding NSRs will keep their windows partially open during both daytime (07:00 – 23:00) and night-time (23:00 – 07:00) periods; a partially open window provides up to 15 dB attenuation of external free-field to internal noise.

7.50 Backup diesel generators will be present on the proposed site. These will only be operated in the event of a fault with the converter station's power supply; however, they will require to be regularly tested during daytime hours only. Given the likely infrequency of the operational noise impacts, the effect of these generators is not significant and therefore has not been assessed further.

Significance Criteria

7.51 Sensitive NSRs have been classed depending on their use and subsequent sensitivity to noise and vibration. The sensitivity of NSRs to noise and vibration has been defined in Table 7.6.

Table 7.6 Criteria Used to Define Sensitivity of Receptors

Sensitivity	Description	Examples of Receptor Usage
High	Receptors where noise will significantly affect the function of a receptor	• Auditoria/ studios; • Specialist medical/ teaching centres; and • Libraries.
Medium	Receptors where people or operations are particularly susceptible to noise	• Residential and student accommodation; • Places of worship; • Conference facilities; • Schools in daytime; and • Hospitals/ residential care homes.
Low	Receptors of low sensitivity to noise, where it may cause some distraction or disturbance	• Offices; • Restaurants; and • Sports grounds when spectator or noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf).
Very low	Receptors where distraction or disturbance from noise is minimal	• Residences and other buildings not occupied during working hours; • Factories and working environments with existing high noise levels; and • Sports grounds when spectator or noise is a normal part of the event.

7.52 The following terminology has been used to define noise and vibration effects:

- **Adverse** – detrimental or negative effects to an environmental resource or receptor;

- **Negligible** – imperceptible effects to an environmental resource or receptor; or
- **Beneficial** – advantageous or positive effects to an environmental resource or receptor.

7.53 Where adverse or beneficial noise and vibration effects have been identified, these are described using the following scale:

- **Minor** – slight, very short or highly localised effect;
- **Moderate** – limited effect (by extent, duration or magnitude), which may be important at a local scale; or
- **Major** – considerable effect (by extent, duration or magnitude) of more than local significance or in breach of recognised acceptability, legislation, policy or standards.

7.54 The duration of noise and vibration effects is defined as follows:

- **Short term** – period lasting for no longer than 3 months;
- **Medium term** – period lasting for no longer than 2 years; or
- **Long term** – period lasting for longer than 2 year.

7.55 Table 7.7 provides a matrix showing the classification of effects depending on the sensitivity of receptors and magnitude of impact.

Table 7.7 Classification of Effects Matrix

Sensitivity of Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Very Low	Minor	Negligible	Negligible	Negligible

7.56 Generally, effects classed from negligible to minor are considered to be not significant, whereas effects classed from moderate to major are considered to be significant. However, in line with best practice this initial decision on the significance of an effect is then combined with professional judgement which takes into account a range of other factors. Where relevant to specific potential impacts these have already been discussed however other potential generic factors include:

- the absolute sound levels e.g. if sound levels are already very high then small sound level changes may be considered significant. Conversely if sound levels are very low then a larger change may be required to be considered significant;
- where the predicted level lies relative to the boundaries between the bands, e.g. in some circumstances a change of road traffic noise level e.g. 2.9 dB, which just falls into the minor category, may be considered significant;
- the circumstances of the NSR, e.g. a NSR may contain areas which are more or less sensitive than others, e.g. office spaces or kitchens in a school, would be considered less sensitive than classrooms. Alternatively, if a receptor is particularly vulnerable, such as a school for hearing impaired children;
- the acoustic character of an area, e.g. if a scheme introduces a sound source into an area where that type of sound is not currently a major source; and
- the proportion of a designated site that is affected (e.g. comparing the proportion of a designated site within the noise study area, such as a Site of Special Scientific Interest (SSSI)), that is above the LOAEL or SOAEL.

Assumptions and Limitations

7.57 Predictions of sound levels have an associated degree of uncertainty. Modelling and measurement processes have been carried out in such a way to reduce such uncertainty; however, it is unavoidable that some degree of prediction uncertainty remains. In particular, the following sources of uncertainty have been noted:

- The layout of the converter station and construction materials to be used for the buildings are all subject to detailed design approval and have been based on other similar projects. The modelling has assumed a potential worst-case in terms of the building and plant layout which would generate highest operational sound levels at NSRs.
- Sound source levels of operational plant have been based on data from other similar projects. The precise methodology by which these data were gathered, and hence the uncertainty associated with these is not known, however the plant modelled is based on models currently adopted within the industry and regarded to be a reasonable prediction of chosen equipment. The plant that will be installed and thus the associated operational sound emissions are also subject to detailed design.
- Predictions of operational plant and activities sound pressure levels according to ISO 9613-2 are based on an assumption of moderate downwind propagation, and hence could be considered as a worst-case calculation. However, the standard also indicates an estimated accuracy of ±3 dB(A) in predicted levels.
- Sound insulation data, used to calculate the break-out of sound from within buildings have been estimated from the details of the construction from the North Sea Link project due to its similarity with the proposed GB Onshore Scheme, using industry standard methods and software, but a degree of uncertainty in sound breakout from the building will result from the use of these estimates.
- An external free-field to internal noise level difference of 15 dB has been assumed for residential properties with a partially open window (per BS 8233 guidance).

7.58 To assess the potential noise and vibration effects of the GB Onshore Scheme, it was necessary to determine the baseline conditions. It is considered that the baseline sound measurements, which were undertaken at locations surrounding the application site in March to April 2019, as agreed with MC Environmental Health, are representative of the baseline sound climate in the vicinity. The potential for changes in baseline sound levels over the project duration has been considered but this is limited to available information about potential future changes in the observed sources contributing to the baseline sound climate.

7.59 In addition, any measurement of existing ambient or background sound levels will be subject to a degree of uncertainty. Environmental sound levels vary between days, weeks, and throughout the year due to variations in source levels and conditions, meteorological effects on sound propagation and other factors. Hence, any measurement survey can only provide a sample of the ambient levels. Every effort was made to undertake measurements as to provide a representative sample of conditions, such as avoiding periods of adverse weather conditions, and school holiday periods (which are often considered to result in atypical sound levels). However, a small degree of uncertainty will always remain in the values taken from such a measurement survey.

7.60 It is the contractor's responsibility to ensure that the noise from the proposed converter station operating at full load will not exceed the required specification (noise limits at NSRs) achieved through mitigation by design. Therefore it is assumed that this will be the case.

Planning Policy & Applicable Legislation

National Legislation

7.61 Relevant national legislation to noise and vibration include:

- The Control of Pollution Act 1974 (CoPA)
- The Environmental Protection Act 1990 (EPA)

Control of Pollution Act 1974

7.62 Section 72 of CoPA requires that Best Practicable Means (BPM) are adopted to control demolition and construction noise on any given site. CoPA makes reference to BS 5228 Noise and Vibration Control on Construction and Open Sites as BPM.

7.63 Sections 60 and 61 of the CoPA provide the main legislation regarding enabling works and demolition and construction site noise and vibration. If noise complaints are received, a Section 60 notice may be issued by the Local Authority with instructions to cease work until specific conditions to reduce noise have been adopted. Section 61 of the CoPA provides a means to apply for prior consent to carry out noise generating activities during demolition and construction. Once prior consent has been agreed under Section 61, a Section 60 notice cannot be served provided the agreed conditions are maintained on- site.

Environmental Protection Act 1990

7.64 The EPA prescribes noise (and vibration) emitted from premises (including land) so as to be prejudicial to health or a nuisance as a statutory nuisance.

7.65 Local Authorities are required to investigate any public complaints of noise and if they are satisfied that a statutory nuisance exists, or is likely to occur or recur, they must serve a noise abatement notice. A notice is served to the person responsible for the nuisance. It requires either the abatement of the nuisance, works to abate it, prohibition or restriction of the activity. Contravention of a notice without reasonable excuse is an offence. Right of appeal to the Magistrates Court is permitted within 21 days of a noise abatement notice being served.

7.66 In determining if a noise complaint amounts to a statutory nuisance the Local Authority can take account of various guidance documents and existing case law as no statutory noise limits exist. Demonstrating the use of best practicable means to minimise noise levels is an accepted defence against a noise abatement notice.

National Planning Policy

7.67 Relevant national planning policy and related guidance include:

- National Planning Policy Framework (NPPF);
- Noise Policy Statement for England (NPSE);
- Planning Practice Guidance: Noise (PPGN);
- UK 25 Year Environment Plan ('A Green Future: Our 25 Year Plan to Improve the Environment').

National Planning Policy Framework (2018)

7.68 The NPPF was published in July 2018 and sets out the Government's planning policies for England how these are expected to be applied.

7.69 In respect of noise and vibration the NPPF states to the following:

- Paragraph 170. *"Planning policies and decisions should contribute to and enhance the natural and local environment by: […] e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans."*

- Paragraph 180. *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should: a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development - and avoid noise giving rise to significant adverse impacts on health and the quality of life; b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."*

Noise Policy Statement for England (2010)

7.70 The NPSE seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. The statement applies to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise.

7.71 The statement sets out the long-term vision of the government's noise policy, which is to "promote good health and a good quality of life through the effective management of noise within the context of policy on sustainable development".

7.72 This long-term vision is supported by three aims:

- *"avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvements of health and quality of life."*

7.73 The long-term policy vision and aims are designed to enable decisions to be made regarding what is an acceptable noise burden to place on society.

Planning Practice Guidance: Noise (2014)

7.74 The PPGN is a web-based resource that was launched on 6 March 2014 and includes guidance which "*advises on how planning can manage potential noise impacts in new development*" in line with the 2012 NPPF. At the time of writing, the PPGN has not yet been updated to reflect the updated NPPF.

7.75 The PPGN states that local planning authorities should take account of the acoustic environment and in doing so consider:

- *"whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved."*

7.76 This guidance introduced the additional concepts of NOAEL (No Observed Adverse Effect Level), and UAEL (Unacceptable Adverse Effect Level). Further details are provided in Table 7.8. Factors to be considered in determining whether noise is of concern are identified including the absolute noise level of the source, the existing ambient noise climate, time of day, frequency of occurrence, duration, character of the noise and cumulative effects.

Table 7.8 Planning Practice Guidance Noise Observed Effect Levels

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid through use of appropriate mitigation whilst taking into account the social and economic benefit
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent through use of appropriate mitigation

Green Future: Our 25 Year Plan to Improve the Environment

7.77 The 25 Year Environment Plan, published in January 2018, sets out the actions the UK Government will take to help the natural world regain and retain good health.

7.78 The Plan states that "over the next 25 years, we must significantly cut all forms of pollution and ease the pressure on the environment. We must ensure that noise and light pollution are managed effectively."

Local Planning Policy

Medway Local Plan

7.79 The 2003 Medway Local Plan (MLP) (Ref 7-14) is due to be replaced by the Medway Local Plan 2018 – 2035 in 2020, subject to the outcomes of an independent examination by a planning inspector. However at the time of writing the 2003 document is applicable.

7.80 The MLP contains the following relevant policies to noise and vibration in the context of the GB Onshore Scheme:

- Policy BNE2: Amenity Protection *"All development should secure the amenities of its future occupants, and protect those amenities enjoyed by nearby and adjacent properties. The design of development, should have regard to:*
  - *(i) privacy, daylight, and sunlight; and*
  - *(ii) noise, vibration, light, heat, smell and airborne emissions consisting of fumes, smoke, soot, ash, dust and grit; and*
  - *(iii) activity levels and traffic generation."*

- Policy BNE3: Noise Standards "*Noise-generating development should be located and designed so as not to have a significant adverse noise impact on any nearby noise sensitive uses (including offices, hospitals, schools and, in respect of noise emanating from non-transport related sources, housing).*"

Baseline Conditions

Site Location

7.81 The Project Area is situated within the centre of the Isle of Grain to the west of Grain, the main settlement in the vicinity. The land surrounding the Project Area is either in agricultural use or is brownfield. In addition to Grain there are a number of scattered residential properties to the north and east of the Project Area.

Baseline Monitoring Methodology

7.82 Long-term surveys were undertaken from 27th March 2019 to 3rd April 2019 at three locations (LT1 to LT3) to establish the baseline sound environment around the Project Area. Details of the monitoring methodology and equipment specifications are provided in Appendix 7.1 Baseline Sound Survey Report.

7.83 Sound monitoring locations were selected based on professional experience to provide suitability representative information on sound levels at the NSRs and in agreement with MC Environmental Health. The baseline sound surveys were undertaken in accordance with guidance specified in BS 7445. The sound level meters logged environmental sound measurement parameters including average ambient (L_{Aeq}), and background (L_{A90}) sound levels, and all measurements were undertaken in free-field conditions (i.e. greater than 3 m from a reflecting surface other than the ground.

7.84 BS 7445 and BS 4142 include requirements on suitable weather conditions for sound measurements, for example maximum wind speeds to avoid wind-induced noise on the microphone. Therefore, the weather conditions were recorded throughout the monitoring period to exclude data gathered during periods of adverse weather conditions.

Sensitive Receptors

7.85 The identified NSRs are those nearest the Project Area i.e. the NSRs that will experience the highest level of sound from the GB Onshore Scheme. Although sound may be perceivable at other NSRs in the area, effects will not be significant if they are suitability controlled at the identified NSRs. The nearest NSRs to the Project Area have been selected for assessment, where the intention is to apply appropriate sound level data at each NSR location for assessment purposes. Sensitive NSRs that have been considered in the assessment are illustrated in Figure 7.1 (ES Volume III) and described in Table 7.9. Monitoring locations are shown in Figure 7.2 (ES Volume III).

Table 7.9 Noise Sensitive Receptor Locations

Receptor	Receptor Address	Corresponding Monitoring Location	Receptor Type	Distance to redline boundary (m)
R1	Dallekko, Grain Road	LT3	Residential	18
R2	Perry's Farm	N/a	Residential	89
R3	Police Cottages	LT2	Residential	546
R4	Rosecourt Farm	LT1	Residential	189
R5	Westbere	LT3	Residential	34

7.86 Measurements were not performed at a representative location to R2 Perry's Farm it will not be inhabited during construction or operation of the GB Onshore Scheme. However the property is included within the assessment to illustrate all potential impacts representative to the existing baseline. In order to identify the potential worst-case impacts, baseline sound levels at this location have been assumed to be the lowest of those measured at the three monitoring locations.

Baseline Monitoring Results

7.87 The results of baseline sound monitoring undertaken are summarised in Table 7.10. No periods of adverse weather conditions occurred, therefore no data have been excluded from the analysis.

7.88 At LT1 during set up of the monitoring equipment, the dominant sound source was aircraft movements from a combination of helicopters and planes. Other sound sources included birds tweeting and intermittent vehicle's driving through West Lane. At the time of collection, another sound which could be heard was from a school playground to the south during their dinner hour.

7.89 At LT2, the dominant sound sources were noted as birds tweeting/ intermittent aircraft movements. Other sound sources included a constant low lying background hum from factories to the south west.

7.90 At LT3, the dominant sound source was noted as fairly constant traffic along Grain Road. Other sound sources included birds tweeting and upon collection a group of workers setting up a temporary mobile generator approximately 80 m to the north.

Table 7.10 Baseline Sound Survey Results Summary

Location	Daytime			Night-time		
	dB $L_{Aeq,16h}$	dB $L_{A90,15min}$ Mode	dB $L_{A90,15min}$ 10th Percentile	dB $L_{Aeq,8h}$	dB $L_{A90,15min}$ Mode	dB $L_{A90,15min}$ 10th Percentile
LT1	55	36	32	51	34	32
LT2	51	37	32	46	35	33
LT3	55	39	36	52	36	35

Future Baseline

7.91 At the majority of the measurement locations the dominant source contributing to the baseline sound climate is aircraft, potential changes to the baseline sound levels in the future will primarily depend on the changes in aircraft sound levels. There is insufficient information available to predict the potential changes in aircraft sound levels, or the changes in sound from birds or the factories to the south-west. The anticipated increase in baseline road traffic flows in the vicinity is included within the assessment of construction road traffic noise impacts.

Potential Impacts

Introduction

7.92 Mitigation measures which have been incorporated in the design and construction of the GB Onshore Scheme are set out in Chapter 3: Proposed GB Onshore Scheme. These measures are included within this assessment of potential noise effects. If additional mitigation measures are required beyond those incorporated into the design, these are discussed in the Mitigation section of this Chapter.

7.93 The prediction of noise and vibration impacts associated with the construction and operation of the GB Onshore Scheme reflects the description presented in Chapter 3: Proposed GB Onshore Scheme**.**

Construction

7.94 The construction activities have the potential to result in temporary noise and vibration impacts at the closest NSRs to the works. The main construction activities are:

- Preliminary works;
- Site establishment;
- Earthworks;
- Civil engineering works;
- Building works;
- Cable installation;
- Provision/installation of permanent services;
- Mechanical and electrical works;
- Commissioning; and
- Site reinstatement and landscape works.

Construction Noise

7.95 Based upon the analysis and summary of the results of the baseline sound survey, the relevant LOAELs and SOAELs (SOAEL is equal to the BS 5228 'ABC' noise threshold category) at each NSR are provided in Table 7.11, along with the relevant ambient sound level. Note that the ambient sound levels presented below have been calculated based on the measurements during the relevant time period defined in BS 5228 which differs from those presented in Table 7.9.

Table 7.11 Measured free-field $L_{Aeq,T}$ noise levels and associated 'ABC' assessment category.

Receptor	Ambient Sound Level dB $L_{Aeq,T}$			LOAEL dB $L_{Aeq,T}$			SOAEL dB $L_{Aeq,T}$		
	Daytime	Evening	Night time	Daytime	Evening	Night time	Daytime	Evening	Night time
R1	56	53	52	56	53	52	65	60	55
R2	52	42	46	52	42	46	65	55	50
R3	52	42	46	52	42	46	65	55	50
R4	55	48	51	55	48	51	65	55	55
R5	56	53	52	56	53	52	65	60	50

7.96 As no predictions have been performed, the significance of the construction noise effect on NSRs without mitigation cannot be conclusively stated. Typically, earthworks cause the greatest noise impacts at NSRs due to the requirement for large numbers of noisy plant for a relatively long duration. The earthworks associated with the construction of the proposed substation and converter station are likely to have the greatest impacts on the residential property at Perry's Farm due to its proximity to these locations.

7.97 Given the proximity of the proposed DC cable route to residential properties on Grain Road (18 m to the site boundary) there is the potential for high construction noise levels to occur at these properties whilst works are undertaken in close proximity; however these works are likely to be of relatively short duration.

7.98 Prior to mitigation, the noise of the construction works has the potential to result in significant effects at NSRs.

Construction Vibration

7.99 The potential for temporary construction vibration impacts is dependent on the need for construction activities which are a potentially significant source of vibration, such as piling, ground improvement or compaction works.

7.100 Mobile plant is unlikely to give rise to high levels of ground borne vibration. Typically the levels of ground borne vibration from tracked earth moving equipment (such as a bulldozer or excavator) are imperceptible to humans at a distance of approximately 20 m, and those generated by vehicles with rubber tyres (e.g. a heavy lorry or dump truck) would be imperceptible at more than 10 m from the haul road[2]. Mobile plant may occasionally come within 10 or 20 m of an identified sensitive NSR; hence vibration may be perceptible but is highly unlikely to be of a magnitude that would cause complaint. Worst-case effects from vibration caused by mobile plant are therefore anticipated to be not significant.

Construction Traffic Noise

7.101 Construction traffic can have a temporary noise impact on sensitive NSRs located along existing roads used by these vehicles. The potential for such impacts is dependent on the volume and route of construction traffic.

7.102 During the construction phase there would be additional vehicle movements from staff and delivery HGVs accessing the site from the surrounding road network. These vehicles have the potential to increase noise levels at nearby NSRs. The routes these vehicles would take will be included within the outline CEMP and will be restricted to the major roads in the vicinity, which would help minimise the potential for significant adverse effects at NSRs. Implementation of a CEMP will be secured by planning condition.

7.103 Construction is anticipated to be undertaken between 2021 and 2023. Chapter 10 Traffic presents the 24-hour AADT for the road links which construction traffic are anticipated to use both 'with' and 'without' the construction traffic, for each of these years. The 18-hour AAWT was not available for majority of the identified links, therefore the 24-hour AADT has been assumed to be equal to the 18-hour AAWT and this information has been used to calculate the BNL for each of these scenarios. Based on this information, the additional construction traffic would result in a predicted increase in noise levels of up to 0.3 dB $L_{A10,18h}$, which is a negligible increase. The 18-hour AAWT flow is typically slightly lower than the 24-hour AADT but the construction traffic is the same whichever parameter is used. Therefore the construction traffic will result in slightly larger changes in the 18-hour AAWT baseline flow and therefore slightly higher increases in noise levels than calculated. However, given the small increases in noise levels that are anticipated due to the construction traffic, use of the actual 18-hour AAWT in the calculations would not result in changes greater than 1 dB $L_{A10,18h}$. Therefore, the magnitude of the worst-case construction traffic noise impacts is anticipated to be very low hence effects will be not significant.

[2] D.J.Martin (1977). Ground Vibrations Caused by Road Construction Operations. Transport and Road Research Laboratory.

Operation

7.104 Table 7.12 presents the BS4142 assessment of predicted operational noise levels from the converter station at NSRs. A +6 dB acoustic feature correction has been applied for the highly tonal nature of the operational sound emissions. The predicted operational sound level is the same irrespective of the time period being assessed.

Table 7.12 Operational Noise - BS4142 Assessment

Receptor	Predicted Free-Field *Specific Sound Level* $L_{Aeq,T}$ dB	Predicted *Rating Level* $L_{Ar,Tr}$ dB	Daytime *Background Sound Level* $L_{A90,T}$ dB	Daytime Difference, dB	Night-time *Background Sound Level* $L_{A90,T}$ dB	Night-time Difference, dB
R1	28	34	36	-2	35	-1
R2	32	38	32	6	29	9
R3	30	36	32	4	29	7
R4	26	32	32	0	32	0
R5	28	34	36	-2	35	-1

7.105 Predicted *rating levels* at R1 and R5 are 2 dB and 1 dB below the day and night-time *background sound levels* respectively (below the LOAEL threshold level), equivalent to an impact of low magnitude. For receptors of medium sensitivity this is an effect of minor significance and therefore not significant, depending on the context.

7.106 Predicted *rating levels* at R2 are 6 and 9 dB above the day and night-time *background sound levels* respectively (between the LOAEL and SOAEL), equivalent to an impact of medium magnitude. For receptors of medium sensitivity, this is an effect of moderate significance and therefore significant, depending on the context.

7.107 Predicted *rating levels* at R3 are 4 and 7 dB above the day and night-time *background sound levels* respectively (between the LOAEL and SOAEL), equivalent to impacts of low (daytime) and medium (night-time) magnitude. For receptors of medium sensitivity this effect is minor during the day and moderate during the night and therefore significant, depending on the context.

7.108 Predicted *rating levels* at R4 are equal to the day and night-time *background sound levels* (equal to the LOAEL), equivalent to an impact of low magnitude. For receptors of medium sensitivity this is an effect of minor significance and therefore not significant, depending on the context.

7.109 To add further context to the operational noise assessment, the impact of the internal operational sound levels in residential properties has been assessed. The worst-affected property is R2 Perry's Farm; internal operational sound levels in this property are anticipated to be around 17 dB L_{Aeq} with the windows partially open. Using the predicted operational sound frequency spectrum at this receptor, the internal operational sound level is expected to be around NR 11 which is below the criterion of NR20; therefore the effect is not significant.

7.110 In line with the guidance in BS 4142: 2014, it is considered that the contextual assessment has shown that the effect of the operational noise impacts will be not significant irrespective of the initial conclusion of the BS 4142 assessment.

Decommissioning

7.111 Decommissioning noise and vibration effects are anticipated to be similar to those during construction. These should be assessed at the time when the works are proposed.

Mitigation

Construction

7.112 A CEMP will be prepared and implemented by the construction contractors. The final CEMP will include the relevant noise and vibration criteria, giving regard to the criteria presented in Table 7.11 (noise) and Table 7.3 (vibration), proposed surveys and a range of BPM which are likely to include the following:

- Implementing processes to minimise noise before works begin and ensuring that BPM are being achieved throughout the construction programme, including the use of localised screening around significant noise producing plant and activities where appropriate;
- Ensuring that modern plant is used, complying with the latest European noise emission requirements. Selection of inherently quiet plant where possible;
- Use of lower noise piling (such as rotary bored or hydraulic jacking) rather than driven piling techniques if any piling is required, where possible;
- Off-site pre-fabrication, where practical;
- All plant and equipment being used for the works to be properly maintained, silenced where appropriate, operated to prevent excessive noise and switched off when not in use;
- Ensuring contractors are made familiar with current legislation and the guidance in BS 5228 which should form a prerequisite of their appointment;
- Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials around the Project Area to be conducted in such a manner as to minimise noise generation;
- Consultation with MC and local residents as appropriate to advise of potential noisy works that are due to take place; and
- Monitoring of any noise complaints, and reporting to the contractor for immediate investigation.

7.113 Consultation and communication with the local community throughout construction periods will also serve to publicise the works schedule, giving notification to residents regarding periods when higher levels of noise may occur during specific operations, and providing lines of communication where complaints can be addressed.

7.114 A detailed construction noise and vibration assessment may be required once the contractor is appointed and further details of construction methods are known, in order to identify specific mitigation measures (including construction traffic).

7.115 In addition, it is anticipated that the appointed contractor would be a member of the 'Considerate Constructors Scheme' which is an initiative open to all contractors undertaking building work.

7.116 A Construction Traffic Management Plan (CTMP) will be implemented, which will present the haul routes and road management procedures used to manage traffic movements within the works areas, the construction compound and on the local road network in the vicinity of the closest NSRs.

7.117 Preparation and implementation of the CEMP will be a secured by planning condition. Specific BPM can be further secured if required by an agreement under Section 60 or Section 61 of CoPA between the contractor and the Local Authority.

Operation

7.118 The best available operational methods should be employed at all times, having regard to the principles of BPM to minimise noise and vibration from the development.

7.119 The assessment has shown that pre-mitigation noise impacts due to operation of the converter station are not anticipated to be significant; therefore no further mitigation is required. However at the time of the assessment, the detailed acoustic specification of the equipment to be installed

within the converter station is not known and has been assumed as described in the approach to assessment section.

7.120 Operational noise impacts will be controlled by detailed design and mitigation measures, if required, will be determined by the appointed contractor. The specification of the detailed design will require that internal operational sound levels in nearby residential properties do not exceed NR 20. This limit applies to the cumulative operational sound of the converter station and the substation.

7.121 Although the noise of the proposed backup generator is not anticipated to be significant, it may be a requirement of the Local Authority that this is assessed. Such an assessment would be performed at detailed design stage when the actual generator has been selected. If required, potential options may include:

- Minimising the running of the generator i.e. keeping testing times as short as possible;
- Positioning the generator such that line of sight to nearby receptors is blocked as much as possible to provide the maximum acoustic screening thereby minimising potential operational noise impacts; and
- Providing an acoustic enclosure to the generator if required.

7.122 Inclusion and implementation of noise limits within the project specification will be secured by planning condition.

Decommissioning

7.123 Any measures required to mitigate the impacts of decommissioning noise will be identified at the time. These are anticipated to be similar to those required for the construction activities.

Residual Impacts

Construction

7.124 Implementation of the final CEMP will ensure that construction noise and vibration impacts on NSRs are controlled to acceptable levels. High noise levels may occur whilst works are undertaken close to residential properties however these would be of short duration, therefore residual effects will be not significant.

7.125 Implementation of a CTMP will minimise potential adverse effects of construction traffic noise on NSRs. Residual effects are anticipated to be not significant.

7.126 The noise effects during decommissioning are anticipated to be no worse than during construction, they will also be temporary and no specific mitigation is required with regard to decommissioning noise. These effects are therefore predicted to be not significant.

Operation

7.127 With appropriate consideration of the airborne sound emissions during the detailed design phase the operational sound levels are anticipated to comply with the limit of an internal level not exceeding NR 20. Hence residual operational noise effects will be not significant.

Decommissioning

7.128 These are anticipated to be similar to the residual impacts during construction.

Cumulative Effects

7.129 No developments have been identified which may result in cumulative noise effects with the GB Onshore Scheme are as follows:

- The GB Offshore Scheme – the construction period will overlap with the onshore DC cable as it is laid through the intertidal area. However there are no receptors in the vicinity of the intertidal area that would experience cumulative construction noise impacts. These works will all be boat-based so there would be no construction traffic.
- The OHL works will likely directly overlap with the GB Onshore Scheme construction programme but will be a lot shorter in duration. The potential for cumulative impacts will be considered within the CEMPs for each development and mitigation measures to avoid significant cumulative effects will be identified if required.

7.130 Therefore cumulative effects are anticipated to be not significant.

7.131 Noise is an amenity issue and other impacts, such as air quality and landscape and visual, can also affect residential amenity. As the GB Onshore Scheme will inevitably result in impacts in a variety of areas which can influence residential amenity inter-relationship effects may occur. Cumulative impacts are further assessed in Chapter 12.

Summary of Assessment

7.132 A summary of residual effects due to noise and vibration and their significance is provided in Table 7.13.

Table 7.13 Summary of Residual Effects

Description of Effect	Description of Receptor (Sensitivity)	Summary of Mitigation	Residual Effect (Adverse or Beneficial)	Duration	Significant/ Not Significant
Construction and Decommissioning					
Construction works noise	Existing residential properties (medium)	Mitigation measures advised to employ 'best practicable means' to control noise, measures to be documented within CEMP.	Negligible to Minor (adverse)	Short to long term	Not significant (temporary)
Construction works vibration	Existing residential properties (medium)	Mitigation measures advised to employ 'best practicable means' to control vibration.	Negligible to Minor (adverse)	Short to long term	Not Significant (temporary)
Construction traffic noise	Existing residential properties (medium)	Contractors will issue project route map and delivery schedule to control construction traffic. Onsite management of access points.	Negligible (adverse)	Short to long term	Not Significant (temporary)
Operation					
Noise from the converter station	Existing residential properties (medium)	Noise emissions from operational activities will be considered during the detailed design in order to achieve appropriate operational noise limits.	Negligible to Minor (adverse)	Long term	Not Significant (permanent)

References

Ref 7-1 British Standards Institute (2003); BS 7445 – Description and measurement of environmental noise. Part 1: Guide to quantities and procedures, BSi, London.

Ref 7-2 British Standards Institute (2014) BS 5228:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites. Noise, BSi, London.

Ref 7-3 British Standards Institute (2014); BS 4142 – Methods for rating and assessing industrial and commercial sound, BSi, London.

Ref 7-4 British Standards Institute, (2014); BS 8233 – Guidance on sound insulation and noise reduction for buildings, BSI, London.

Ref 7-5 Department of Transport/Welsh Office (1988); Calculation of Road Traffic Noise.

Ref 7-6 Highways Agency (2011) Design Manual for Road and Bridges Volume 11 Section 3 Part 7 HD213/11 (Revision 1) Traffic Noise and Vibration

Ref 7-7 International Standards Organisation (1996) ISO 9613 Acoustics - Attenuation of sound during propagation outdoors

Ref 7-8 Department for Environment Food and Rural Affairs (Defra) (2010); Noise Policy Statement for England.

Ref 7-9 Her Majesty's Stationery Office (1974); Control of Pollution Act.

Ref 7-10 Her Majesty’s Stationary Office (1990); Environmental Protection Act 1990.

Ref 7-11 Ministry of Housing, Communities & Local Government (MHCLG) (2018) National Planning Policy Framework.

Ref 7-12 Department for Communities and Local Government; Planning Practice Guidance.

Ref 7-13 Department for Environment, Food and Rural Affairs (2018). 'A Green Future: Our 25 Year Plan to Improve the Environment

Ref 7-14 Medway Council (2003). Medway Local Plan

8. Archaeology & Cultural Heritage

Introduction

8.1 This chapter of the Environmental Statement (ES) reports the findings of an assessment of the likely significant effects on Cultural Heritage as a result of the components of NeuConnect proposed on the Isle of Grain, Kent, (hereafter referred to as the 'GB Onshore Scheme') described in Chapter 2, Proposed GB Onshore Scheme, of this ES.

8.2 This chapter describes the cultural heritage assets within the GB Onshore Scheme application boundary (hereafter referred to as 'the Site') and the Study Area defined in the 'Approach to assessment' section below, including their heritage value, and assesses the potential impacts of the GB Onshore Scheme on those assets.

8.3 The potential for combined effect interactions (Type 1 effects) is discussed in Chapter 12: Cumulative Assessment. The potential for combined cumulative cultural heritage effects (Type 2 effects) of the GB Onshore Scheme with other development schemes is discussed at the end of this chapter.

8.4 Baseline information is provided in the Cultural Heritage Desk-based Assessment (DBA) produced by AECOM which appears in Volume II, Appendix 8-1 of this ES. This chapter is supported by Figures 8-1: Location of archaeological assets and 8-2: Location of built heritage assets.

Approach to Assessment

Introduction

8.5 This section presents the following:

- identification of the information sources that have been consulted throughout the preparation of this chapter;
- the methodology behind the baseline assessment including the definition of an appropriate Study Area;
- the methodology and terminology used in the assessment of effects; and
- details of the consultation undertaken during the preparation of this chapter.

Sources of information/ data

8.6 The following sources of information have been reviewed in order to establish the baseline conditions for the Cultural Heritage resource:

- Kent Historic Environment Record (KHER);
- National Heritage List for England (NHLE);
- Historic mapping data;
- Local Authority data;
- Kent archives at the Kent History & Library Centre;
- Geotechnical data; and,
- online sources.

Extent of Study Areas

8.7 For designated assets (World Heritage Sites, Scheduled Monuments, Listed Buildings, Conservation Areas, Registered Parks and Gardens, Registered Battlefields), a 1 km Study Area around the Site has been applied. This size of study area has been chosen using professional judgement and with reference to experience of working on comparable developments in comparable landscapes. The Study Area ensures that designated heritage assets are identified to a sufficient distance to anticipate or identify any likely changes to their setting. Given the low lying location of the Site, the Study Area was extended to the west to take in the villages of Allhallows and Lower Stoke, which are located on higher ground.

8.8 For non-designated assets (archaeological sites, findspots, locally Listed Buildings and other non-designated buildings) a search of 3 km was used to obtain data from the KHER and the Kent Archives. This distance has been agreed with Kent County Council as appropriate to provide the context of, and potential for, surviving archaeological remains within the Site. The 3 km Study Area is specifically targeted to include key Palaeolithic sites on the peninsula, a number of archaeological interventions that have been carried out in the southeast of the Isle of Grain, and the high ground on which the village of Grain is located (known as the Head and River Terrace Gravels geological deposits and margins). Kent County Council were concerned that a smaller Study Area would not adequately reflect the potential for archaeological remains of the Site due to the low number of archaeological studies undertaken in its immediate vicinity.

8.9 Intertidal heritage assets located within the application boundary between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS) have been identified in a cultural heritage DBA intended for the offshore aspect of the Scheme (GB Offshore Scheme ES Chapter 16)). These assets are referred to and cross referenced in this chapter where relevant but are assessed as part of the GB Offshore Scheme.

8.10 Assets identified within the Site and Study Area have been given unique reference numbers. These are pre-fixed with [A] for archaeological assets and [BH] for built heritage assets. Each asset can be cross-referenced to the gazetteers appended to the cultural heritage DBA (Appendix

8-1) and located on Figures 8-1, archaeological assets and 8-2, built heritage assets within this ES chapter.

Methodology for Determining Baseline Conditions

8.11 The cultural heritage baseline conditions have been set out in the accompanying DBA (Appendix 8-1). This assessment established the existing conditions of the cultural heritage resource within the Site and Study Area. The baseline section of this ES chapter draws on the results of the DBA.

8.12 The methodology for establishing the baseline followed guidelines of the Chartered Institute for Archaeologists (CIfA), the Standard and Guidance for Historic Environment Desk-based Assessment (CIfA 2017) and the Code of Conduct (CIfA 2014), and is set out in Section 3 of Appendix 8-1.

Methodology for Determining Construction Effects

8.13 The construction phase impacts will be permanent for archaeological remains within the Site and temporary (medium term) in nature for built heritage assets and Scheduled Monuments within the Study Area across the three year indicative construction programme (as defined in Chapter 2: Project Description and Chapter 3: Approach to Assessment of this ES), and will cease when the GB Onshore Scheme becomes fully operational.

8.14 Once the baseline conditions for the Site and surrounding Study Area were characterised, the following method was used to assess the likely significant effects of the GB Onshore Scheme upon cultural heritage:

- The significance (heritage value) of cultural heritage assets affected by the GB Onshore Scheme was first determined. This assessment draws on existing designations and for non-designated assets professional judgment guided by policy and research agendas set out in the DBA (Volume II, Appendix 8-1 of this ES) and the criteria set out in Table 8.1;
- The impacts (magnitude of change) arising from the GB Onshore Scheme upon the significance (heritage value) of known or potential cultural heritage assets were then assessed using the criteria set out in Table 8.2, which takes into account any environmental design and management measures (i.e. measures that offer mitigation but are inherent in the design and construction of the GB Onshore Scheme). This determines the significance of effect as set out in Table 8.3;
- Once the significance of the effect has been established, appropriate additional mitigation measures were proposed to compensate for any unavoidable significant effects;
- The final stage of the assessment established any residual effects that may remain following the implementation of the additional mitigation measures.

8.15 The construction effects of the GB Onshore Scheme on cultural heritage resources are presented in three sections covering three distinct locations of the GB Onshore Scheme which would be subject to distinct development works. All aspects of the construction phase will be assessed for all three areas. The three areas are:

- the proposed converter station and access track;
- the proposed substation and cable sealing end compound; and
- the proposed DC cable route.

8.16 The archaeological and built heritage assets presented below will be assessed slightly differently due to the nature of the potential impacts of the GB Onshore Scheme.

8.17 The effects of the construction phase on the archaeological resource have been assessed as resulting from each intrusive activity separately in order to design appropriate mitigation strategies in line with the individual construction effects.

8.18 The effects on the built heritage resource have been assessed separately for each individual asset. This is because each asset has the potential to be uniquely impacted by the GB Onshore

Scheme's construction phase based on its location and setting and may require a tailored mitigation strategy.

Methodology for Determining Operational Effects

8.19 Effects during operation are those effects associated with the GB Onshore Scheme once construction has been completed and the GB Onshore Scheme is fully operational.

8.20 The impacts on archaeological assets within the Site will occur during construction only; the operation of the GB Onshore Scheme will not have any additional impact on archaeological assets within the Site as any required maintenance or upkeep will likely be limited to the areas evaluated and mitigated prior to the construction phase.

8.21 With regard to built heritage assets and Scheduled Monuments within the Study Area, construction phase impacts are generally temporary in nature and will cease when the buildings become operational. Impacts during the operational phase of the GB Onshore Scheme are likely to result from changes to setting and are considered to be permanent.

8.22 Similarly to the methodology used for the construction phase, the assessment of operational effects is presented according to the three areas of the GB Onshore Scheme discussed above. All impacts resulting from the operational phase will be assessed in each section.

8.23 The operational effects of the GB Onshore scheme on archaeological and built heritage resources will be assessed following the same method as outlined for the construction phase. While the archaeological assessment is carried out for each intrusive activity, the built heritage assessment is undertaken for each asset individually.

Methodology for Determining Decommissioning Effects

8.24 The scale and nature of activities undertaken during decommissioning would be similar to those described previously for the construction phase, however they would only be temporary over the period of activities on site and would not extend beyond the footprint and depth of the existing structures. This would result in no additional impacts on the archaeological resource beyond those assessed and mitigated against for the construction phase, but may result in some changes to the settings of built heritage assets.

Value of Heritage Assets (Heritage Significance)

8.25 The value (heritage significance) of a heritage asset is derived from its heritage interest which may be archaeological, architectural, artistic or historic (NPPF Annex 2). The value of an asset is defined by the sum of its heritage interests. Taking these criteria into account, each identified heritage asset can be assigned a level of value in accordance with a four-point scale as set out in Table 8.1.

Table 8.1: Criteria for determining the value of heritage assets

Value (significance)	Asset categories
High	• World Heritage Sites • Scheduled Monuments • Grade I and II* Listed Buildings • Registered battlefields • Grade I and II* Registered Parks and Gardens • Conservation Areas of demonstrable high value • Non-designated heritage assets (archaeological sites, historic buildings, monuments, parks, gardens or landscapes) that can be shown to have demonstrable national or international importance • Well preserved historic landscape character areas, exhibiting considerable coherence, time-depth or other critical factor(s)
Medium	• Grade II Listed Buildings • Conservation areas

Value (significance)	Asset categories
	• Grade II Registered Parks and Gardens • Conservation Areas • Non-designated heritage assets (archaeological sites, historic buildings, monuments, park, gardens or landscapes) that can be shown to have demonstrable regional importance • Averagely preserved historic landscape character areas, exhibiting reasonable coherence, time-depth or other critical factor(s) • Historic townscapes with historic integrity in that the assets that constitute their make-up are clearly legible
Low	• Locally Listed Buildings • Non-designated heritage assets (archaeological sites, historic buildings, monuments, park, gardens or landscapes) that can be shown to have demonstrable local importance • Assets whose values are compromised by poor preservation or survival of contextual associations to justify inclusion into a higher grade • Historic landscape character areas whose value is limited by poor preservation and/ or poor survival of contextual associations
Negligible	• Assets identified on national or regional databases, but which have no archaeological, architectural, artistic or historic value • Assets whose values are compromised by poor preservation or survival of contextual associations to justify inclusion into a higher grade • Landscape with no or little significant historical merit

8.26 When professional judgement is taken into account, some assets may not fit into the specified category in Table 8.1. Each heritage asset was therefore assessed on an individual basis and the assessment takes into account regional variations and individual qualities of these assets.

8.27 Having identified the value of the heritage asset, the next stage in the assessment is to identify the level and degree of impact to an asset arising as a result of the GB Onshore Scheme. Impacts may arise during construction or operation and can be temporary or permanent. Impacts can occur to the physical fabric of the asset or affect its setting.

8.28 The level and degree of impact (impact rating) is assigned with reference to a four-point scale as set out within Table 8.2. In respect of cultural heritage, an assessment of the level and degree of impact was made in consideration of any design mitigation (environmental design and management measures) within the GB Onshore Scheme.

Table 8.2: Criteria for determining the magnitude of impact on heritage assets

Magnitude of Impact	Description of Impact
High	Change such that the value of the asset is totally altered or destroyed. Comprehensive change to setting affecting significance, resulting in a serious loss in our ability to understand and appreciate the asset.
Medium	Change such that the value of the asset is affected. Noticeably different change to setting affecting significance, resulting in erosion in our ability to understand and appreciate the asset.
Low	Change such that the value of the asset is slightly affected. Slight change to setting affecting significance resulting in a change in our ability to understand and appreciate the asset.
Very Low	Changes to the asset that hardly affect value. Minimal change to the setting of an asset that have little effect on significance resulting in no real change in our ability to understand and appreciate the asset.

8.29 An assessment of the level of effect, having taken into consideration any environmental design and management measures, was determined by cross-referencing the value of the asset (Table 8.1) and the magnitude of impact (Table 8.2). The resultant level of effect (Table 8.3) can be neutral, adverse or beneficial.

Table 8.3: Classification of effects

Heritage Value	Magnitude of Impact			
	High	**Medium**	**Low**	**Very Low**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

8.30 In accordance with the methodology set out within Chapter 3 – Approach to Assessment, of this ES, the following criteria is applied for determining the significance of effect:

- 'Moderate' or 'major' are deemed to be 'significant'.
- 'Minor' are considered to be 'not significant', although they may be a matter of local concern; and
- 'Negligible' effects are considered to be 'not significant'.

8.31 Within the NPPF, impacts affecting the value of heritage assets are considered in terms of harm and there is a requirement to determine whether the level of harm amounts to 'substantial harm' or 'less than substantial harm'. There is no direct correlation between the significance of effect as reported in this ES and the level of harm caused to heritage significance. A major (significant) effect on a heritage asset would, however, more often be the basis by which to determine that the level of harm to the significance of the asset would be substantial. A moderate (significant) effect is unlikely to meet the test of substantial harm and would therefore more often be the basis by which to determine that the level of harm to the significance of the asset would be less than substantial. A minor or negligible (not significant) effect would still amount to a less than substantial harm, which triggers the statutory presumptions against development within s.66 of the Listed Buildings Act 1990; however, a neutral effect is classified as no harm. In all cases determining the level of harm to the significance of the asset arising from development impact is one of professional judgement.

Consultation

8.32 Direct consultation with statutory bodies of Kent County Council and Historic England was carried out by AECOM's heritage team in February 2019. A response from Kent County Council's Archaeological Officer's was received on 12th February 2019 and a response from Historic England's Inspector of Ancient Monuments for Kent and Sussex was received on 1st March 2019, both of which are provided in Appendix 8-1.

8.33 Comments raised as part of this statutory consultation are set out in Table 8.4 below including a statement identifying how these comments have been addressed as part of this chapter and assessment.

Table 8.4: Comments raised by statutory and further consultation

Comments Raised	Response Provided in the ES / Planning Application
Kent County Council (KCC): The archaeology officer for KCC advised that the study area take in the higher ground, i.e. the area of Head and River Terrace Gravels and margins, so that the character of the archaeological resource could be better understood.	Following further discussion with the Kent Historic Environment Record prior to conducting the search, it was decided that a 3km on-shore buffer from the centre of the proposed development would adequately encompass the geomorphological landform of the terrace gravels as well as include relevant investigations on the south and south-east coast of the Isle of Grain.
KCC: It was advised that although major excavations were undertaken by the Kent Archaeological Rescue Unit (KARU) from the late 1970s over a period of some 16+years around Rose Court Farm (J. Clubb Ltd site), this information had not been published and would form a significant gap in our understanding of the archaeology of the area.	This has been considered in the Desk-based Assessment appended and the possible presence of significant Iron Age and Roman remains within the GB Onshore Scheme footprint has been considered for this Environmental Impact Assessment. Furthermore, contact was made with former staff of KARU in an effort to obtain some of the missing data. However, despite repeated attempts, no further information was obtained.
KCC: Requested that the assessment consider Historic England's study of the Hoo Peninsula and its landscapes.	This research project has been considered and is referenced within the appended cultural heritage desk-based assessment.
KCC: The officer requested that should borehole logs produced during ground investigation works, they should be assessed and appended to the DBA. Furthermore, it was requested that future test pitting be archaeologically monitored with potential inputs from a Palaeolithic/Pleistocene specialist.	Borehole logs of initial GI works are discussed and the data incorporated in the appended Desk-Based Assessment. All ongoing and future trial pits are to be archaeologically monitored.
HE: It was requested that the DBA consider the potential for the remains of the Second World War heavy anti-aircraft batteries, a Roman cemetery and an Iron Age settlement north of Rose Court farm.	These have been considered and impacts of the GB Onshore Scheme on these assets is included in this chapter.
HE: It was requested that information regarding intertidal cultural heritage assets be integrated between onshore and offshore EIAs. HE also advised that KCC should be consulted with regard to these intertidal assets and that project design for the cable route should take the location of cultural heritage assets into consideration.	The offshore aspect of the GB Onshore Scheme has produced a desk-based assessment which will have identified heritage assets within the intertidal zone. These assets will be considered as part of this ES chapter following KCC's directions. Impacts of the cable route on cultural heritage will be considered and the route may be micro-sited to avoid known assets.

Limitations and Assumptions

8.34 This assessment has been produced within the limitations of the data available at the time of writing. As this is an outline planning application, detailed construction methodology as well as detailed piling design was not available at the time of writing this ES chapter.

8.35 For the purpose of this assessment a worst-case scenario of topsoil removal across the entirety of the GB Onshore Scheme has been assumed. Furthermore, since the location of the Direct Current DC cable trench has not yet been determined, it has been assumed that it will be located in areas with the highest archaeological potential.

8.36 It is further assumed that topsoil stripping will extend to a depth of approximately 0.4 m below ground surface based experience and discussions with engineers familiar with the project.

Planning Policy & Applicable Legislation

Introduction

8.37 This assessment has been undertaken taking into account relevant legislation and guidance set out in national, regional and local planning policy. A detailed review of legislation and policy is set out in Section 2 of the cultural heritage DBA (ES Vol II, Appendix 8-1), with a summary presented in the sections below. The legislation and policy requirements have informed the preparation of this ES chapter.

Legislation

The Ancient Monuments and Archaeological Areas Act 1979

8.38 The Ancient Monuments and Archaeological Areas Act (Ref 8-2) imposes a requirement for Scheduled Monument consent for any works of demolition, removal, repair, and alteration that might affect a Scheduled Monument and any flooding or tipping operations on land in, on or under which there is a Scheduled Monument. For non-designated archaeological assets, protection is afforded through the development management process as established both by the Town and Country Planning Act 1990 (Ref 8-3) and the NPPF (Ref 8-1).

The Planning (Listed Buildings and Conservations Areas) Act 1990

8.39 The Planning (Listed Buildings and Conservation Areas) Act 1990 (Ref 8-3) sets out the principal statutory provisions which must be considered in the determination of any planning application affecting Listed Buildings or Conservation Areas.

8.40 Section 66 of the Act states that in considering whether to grant planning permission for development which affects a Listed Building or its setting, the LPA or, as the case may be, the Secretary of State, shall have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses. By virtue of Section 1(5) of the Act a Listed Building includes any object or structure within its curtilage. Section 72 of The Act establishes a general duty for planning authorities with respect to buildings and land within a Conservation Area that special attention shall also be paid to the desirability of preserving or enhancing the character or appearance of a Conservation Area. Control of development that may be considered to be within the setting of a Conservation Area is afforded through policy within the NPPF.

8.41 Recent case law makes it clear that the duty imposed in the Act means that in considering whether to grant permission for development that may cause harm (substantial or less than substantial) to a designated asset (Listed Building or Conservation Area) or its setting, the decision maker should give considerable importance and weight to the desirability of avoiding that harm. There is still a requirement to seek a planning balance, but it must be informed by the need to give appropriate weight to the desirability of preserving the asset and its setting.

National Planning Policy and Guidance

National Planning Policy Framework (2019)

8.42 The National Planning Policy Framework (NPPF) (Ref 8-1) outlines the Government's environmental, economic and social policies for England. The NPPF sets out a presumption in favour of sustainable development which should be delivered with three main dimensions: economic; social and environmental (Paragraphs 8 and 15). The NPPF aims to enable local people and their councils to produce their own distinctive local and neighbourhood plans, which should be interpreted and applied in order to meet the needs and priorities of their communities.

8.43 The NPPF requires plans, both strategic and non-strategic to make provision for the conservation and enhancement of the built and historic environment (Paragraphs 20d and 28). Section 16 of the NPPF sets out a series of policies that are a material consideration to be taken into account in development management decisions in relation to the heritage consent regimes established in the Ancient Monuments and Archaeological Areas Act 1979 (Ref 8-2) and the Planning (Listed Buildings and Conservation Areas) Act 1990 (Ref 8-3).

8.44 The NPPF sets out the importance of being able to assess the significance of heritage assets that may be affected by a development proposal. Significance is defined in Annex 2 as the value

of an asset because of its heritage interest. This interest may be archaeological, architectural, artistic or historic and can extend to its setting. The setting of a heritage asset is defined in Annex 2 as "the surroundings in which a heritage asset is experienced". In determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the asset's importance and no more than is sufficient to understand the potential impact of the proposal on their significance (paragraph 189). Similarly, there is a requirement on local planning authorities to identify and assess the particular significance of any heritage asset that may be affected by a proposal; and that they should take this assessment into account when considering the impact of a proposal on a heritage asset (paragraph 190).

8.45 In determining planning applications, local planning authorities should take account of the following three points:

- “The desirability of sustaining and enhancing the significance of heritage assets and putting them to viable uses consistent with their conservation;
- The positive contribution that conservation of heritage assets can make to sustainable communities including their economic vitality; and
- The desirability of new development making a positive contribution to local character and distinctiveness” (paragraph 192).

8.46 Paragraphs 193 to 196 of the NPPF introduce the concept that heritage assets can be harmed or lost through alteration or destruction or development within their setting. This harm ranges from less than substantial through to substantial. With regard to designated assets, paragraph 193 states that great weight should be given to an asset's conservation and the more important the asset, the greater the weight should be. Distinction is drawn between those assets of exceptional interest (e.g. grade I and grade II* Listed Buildings), and those of special interest (e.g. grade II Listed Buildings). Any harm or loss of heritage significance requires clear and convincing justification, and substantial harm or loss should be wholly exceptional with regard to those assets of greatest interest (paragraph 194).

8.47 In instances where development would cause substantial harm to or total loss of significance of a designated asset consent should be refused unless that harm or loss is 'necessary to achieve substantial public benefits that outweigh that harm or loss' (paragraph 195). In instances where development would cause less than substantial harm to the significance of a designated asset the harm should be weighed against the public benefits of the proposal including its optimum viable use (paragraph 196). In relation to non-designated assets a balanced judgment is required taking into account the scale of harm or loss and the significance of the asset (paragraph 197). Distinction is made between those non-designated assets of archaeological interest which are demonstrably of equivalent significance to Scheduled Monuments they should be considered against polices for designated heritage assets, as it outline within footnote 63.

8.48 Paragraph 199 states that the ability to record evidence of our past should not be a factor in deciding whether such loss should be permitted. Accordingly, whilst it is noted that there is potential to uncover remains of our past and generate records through proposed development, the benefit or otherwise of this would not been considered as a factor that either mitigates or reduces any identified harm. Similarly, it would not be treated as a benefit of the proposed development.

8.49 Guidance on the application of heritage policy within the NPPF is provided by on-line Planning Practice Guidance (Ref 8-4) and in a series of Good Practice Advice notes published by Historic England, as discussed below.

National Planning Policy Guidance (2019)

8.50 The Planning Practice Guidance (PPG; MCHLG 2019; Ref 8.4) is a government produced interactive on-line document that provides further advice and guidance that expands the policy outlined in the NPPF. It expands on terms such as ‘significance’ and its importance in decision making. The PPG clarifies that being able to properly assess the nature, extent and the importance of the significance of the heritage asset and the contribution of its setting, is very important to understanding the potential impact and acceptability of development proposals (paragraph 009).

8.51 The PPG states that in relation to setting a thorough assessment of the impact on setting needs to take in to account, and be proportionate to, the significance of the heritage asset under consideration and the degree to which proposed changes enhance or detract from that significance and the ability to appreciate it (paragraph 013).

8.52 The PPG discusses how to assess if there is substantial harm. It states that what matters in assessing if a proposal causes substantial harm is the impact on the significance of the asset. It is the degree of harm to the asset's significance rather than the scale of the development that is to be assessed (paragraph 017). Generally, harm to heritage assets can be avoided or minimised if proposals are based on a clear understanding of the heritage asset and its setting (paragraph 019).

8.53 The NPPF indicates that the degree of harm should be considered alongside any public benefits that can be delivered by development. The PPG states that these benefits should flow from the proposed development and should be of a nature and scale to be of benefit to the public and not just a private benefit and would include securing the optimum viable use of an asset in support of its long term conservation (paragraph 020).

Historic England Good Practice Advice Notes (2015 and 2017)

8.54 Historic England has published a series of Good Practice Advice (GPA) of which those of most relevance to this appraisal are GPA2 Managing Significance in Decision-taking (Ref 8.5) and GPA3 The Setting of Heritage Assets (Ref 8.6).

8.55 GPA2 emphasises the importance of having a knowledge and understanding of the significance of heritage assets likely to be affected by the development and that the 'first step for all applicants is to understand the significance of any affected heritage asset and, if relevant the contribution of its setting to its significance' (para 4). Early knowledge of this information is also useful to a local planning authority in pre-application engagement with an applicant and ultimately in decision making (paragraph 7).

8.56 GPA3 (Second Edition) provides detail on the setting of heritage assets provides general advice on understanding setting, and how it may contribute to the significance of heritage assets and allow that significance to be appreciated. The document also provides advice on how views contribute to setting.

8.57 Paragraph 8 of the advice note confirms that the extent of the setting, as defined in the NPPF, is not fixed and may change as the asset and its surroundings evolve.

8.58 Paragraph 9 states that although the setting is not itself a heritage asset, nor a heritage designation, land comprising a setting may itself be designated. The concept of a 'core', 'wider' and 'extended' setting is introduced in the same paragraph (under the section on Designated Views); however, it is acknowledged that there is no formal meaning for these terms and they will only apply in certain cases.

Local Planning Policy and Guidance

Medway Local Plan

8.59 Local policy is defined by the Medway Local Plan (Ref 8.7) adopted by Medway Council on 14th May 2003. Medway Council is currently working on an emerging Local Plan, Future Medway, which will cover the period up to 2035.

8.60 The Medway Local Plan makes several provisions for the protection and enhancement of the heritage environment. Relevant to this study are the following policies:

8.61 Policy BNE18: Setting of Listed Buildings. 'Development which would adversely affect the setting of a Listed Building will not be permitted.'

8.62 Policy BNE21: Development affecting potentially important archaeological sites will not be permitted, unless:

- the developer, after consultation with the archaeological officer, has arranged for an archaeological field evaluation to be carried out by an approved archaeological body before any decision on the planning application is made; and

- it would not lead to the damage or destruction of important archaeological remains. There will be a preference for the preservation of important archaeological remains in situ.
- where development would be damaging to archaeological remains, sufficient time and resources are made available for an appropriate archaeological investigation undertaken by an approved archaeological body. Such investigations should be in advance of development and in accordance with a specification and programme of work approved by the council. Resources should also be made available for the publication of the results of the investigation.

8.63 The emerging Local Plan is will use two heritage documents as their evidence base, the Medway Heritage Asset Review 2017 and the Medway Heritage Strategy 2018.

8.64 The Medway Heritage Asset Review 2017 highlights the designated and non-designated heritage assets considered to be of particular value, significance, or considered at risk. It also reinforces the historic and heritage character of the Medway's landscapes and various localities.

8.65 The Medway Heritage Strategy 2018 sets out the future approach to preserving and enhancing the historic environment. It's three objective are:

- Conserve and enhance the Medway's heritage assets;
- Work with Medway's heritage assets to help deliver sustainable development;
- Increase the understanding and community involvement with Medway's heritage assets.

8.66 The current draft of the emerging Local Plan's Development Strategy includes several policies aimed at fulfilling the objectives set out by the Medway Heritage Strategy which are relevant to the proposed development:

- BE1: Promoting High Quality Design
- BE2: Sustainable Design
- BE5: Historic Environment
- BE6: Managing Development in the Historic Environment

8.67 Together, these policies are largely in-line with the NPPF, specifying the need for sustainable development and for minimising impacts to cultural heritage assets, both designated and non-designated. The emerging plan is not expected to result in any significant changes to the LPA's approach to cultural heritage.

Baseline Conditions

Introduction

8.68 In order to assess the potential effects of the GB Onshore Scheme, it is necessary to determine the environmental conditions, resources and sensitive receptors that currently exist on the Site and in the surrounding area. These are known as 'baseline conditions' and should be considered in the context of each assessment.

8.69 A baseline summary is provided below. A full and detailed description of the baseline conditions within the Site and surrounding Study Area is provided in the cultural heritage DBA (Appendix 8-1). The baseline assets considered:

- the topography and geology of the Site (Cultural Heritage DBA section 4.1);
- the designated and non-designated heritage assets within the Site and Study Area (Cultural Heritage DBA sections 4.2, 4.3, and 4.4);
- the historic development of the Site and Study Area (Cultural Heritage DBA section 4.4);
- the historic landscape character within the wider area and features of the historic landscape within the Site (Cultural Heritage DBA section 4.5);
- the significance of the known designated and non-designated heritage assets within the Site and Study Area (Cultural Heritage DBA section 5.1 and 5.2);
- the potential for the survival of previously unknown archaeological remains within the Site and their heritage significance (value) (Cultural Heritage DBA section 5.3); and
- the character of the historic landscape and its sensitivity to change within the Site (Cultural Heritage DBA section 5.4).

8.70 There are no World Heritage Sites, Scheduled Monuments, Registered Battlefield or Registered Parks and Gardens within the Site. Two Scheduled Monuments, one grade I listed and two grade II Listed Buildings (Figure 8-2) are located in the Study Area. A further two Listed Buildings, one grade I and one grade II, are located within the village of Allhallows approximately 4 km to the west of the Site.

8.71 Five non-designated archaeological assets have been identified within the application boundary, in addition to two Areas of Archaeological Potential (AAP) as shown on Figure 8-1. These non-designated assets are archaeological in nature and date from the Iron Age to the post-medieval periods. The AAPs date to the Palaeolithic and the Iron Age and Roman periods respectively.

8.72 A further 143 non-designated assets lie within the Study Area, eleven of which are built heritage assets, while the remainder are archaeological (Figures 8-1 and 8-2).

Heritage Baseline

Scheduled Monuments

8.73 Coastal artillery Defences on the Isle of Grain, Immediately East and South East of Grain Village – BH5 (Scheduled Monument, NHLE 1019955)

8.74 The scheduled coastal defences commence to the southeast of the Church of St James [**BH2**] and continue south, with a break for the road to Grain Tower, for approximately 1.25 km in six separate areas of protection. The monument includes a gun tower (Grain Tower, outside the study area), a fort and three batteries together with later, 20th century additions including two searchlight emplacements. Grain Tower was built in response to the perceived threat from French invasion in the mid-19th century and was supported from the 1860s by Grain Fort which was built on the recommendation of the 1859 Royal Commission into the Defences of the United Kingdom Fortifications. The fort was formed of a semi-circular keep with a central parade and accommodation for 250 men, the whole being surrounded by inner and outer ditches and defended by bastions and caponiers. The fort's armaments were upgraded up until the Second World War and the fort was decommissioned in 1956.The keep and caponiers were demolished and the ditch partially filled in in the 1960s. Visible remains today comprise earth banks and platforms but the subterranean passages that linked the keep, caponiers and magazines remain.

8.75 A series of open batteries were built to the south of the fort. The first, Grain Battery (renamed Dummy Battery in 1901) was built approximately 1 km south of the fort in the 1860s and was linked to it by a communications road on an earthen bank. In 1895 Wing Battery was built immediately to the south of Grain Fort and in 1900 Grain Battery was built to the west of Wing Battery. Finally, two searchlight emplacements were built on the esplanade to the east of Grain Fort. The upstanding parts of these fortifications were similarly demolished in the 1960s.

8.76 The asset has historic interest as part of Britain's coastal defences for almost 100 years after the middle of the 19th century and archaeological interest in its surface and subterranean features which have the ability to provide information on construction, use and adaptation of the defences. The asset's setting is the estuary of the River Thames and River Medway and the coastal strip behind. Despite the development of the petro-chemical plant to the east of the southern end of the asset the setting has not changed substantially and contributes to the asset's significance.

Second World War QF P-Series Oil Bombing Decoy – BH13 (Scheduled Monument, NHLE 1425319)

8.77 The asset is located in two areas of protection approximately 1.78 km west-northwest of the application boundary at its nearest point in a wide bend of Yantlet Creek. The asset is one of eleven QF (diversionary fire) P (petroleum division) oil bombing decoy sites developed in Britain in the early years of the Second World War. This example was designed to draw enemy bombing away from the oil storage depot to the south. Aerial photographs and archaeological surveys have found that the asset retains all its above and below ground features. The decoy was designed to burn fuel oil in brick or clay-lined pools to simulate burning oil storage tanks, ignition being controlled from a control building and associated generator building approximately 200 m to the west of the pools.

8.78 The asset has considerable historic interest as one of only 11 such sites to be built and only two remaining. It has archaeological interest in the complete survival of its original above and below ground features.

8.79 The asset's setting is the flat floodplain of Yantlet Creek situated between the higher ground on which Allhallows is located to the west and Grain is located to the east. This extends to the site of the oil depots the asset was designed to protect on the south coast of the island. The post-war development of the petro-chemical site approximately 1 km south-east of the asset is within the asset's setting and can be seen as an expansion of the earlier oil depot. The asset's setting therefore continues to contribute to its significance.

Listed Buildings

World War II Anti-Tank Obstacles on the Foreshore – BH1 (Grade II, NHLE 1393145)

8.80 The asset comprises a line of concrete anti-tank obstacles erected c. 1940 and running for approximately 570 m from north-west to south-east along the north coast of the Isle of Grain. The main type of obstacle is formed by truncated square pyramids known as dragons teeth attached to a concrete grid. The teeth are arranged in rows four deep but every other row is offset so in effect the rows are eight deep. At the north-west end of the line is s double row of anti-tank concrete cubes while at the south-eastern end of the line is a pile of concrete caltrops, designed like medieval caltrops with four arms so that however they are placed one arm will always point upwards.

8.81 The asset has historic interest as part of Britain's coastal defences during the Second World War and archaeological interest for its strategic positioning.

8.82 Historic aerial photographs show that the obstacles were originally deployed inland some 50 m from the beach but coastal erosion means that the dragon's teeth are now on the beach and are being undermined by the tides, uncovering the concrete grids below. The asset's setting is now the coastline rather than the coastal strip but the setting still contributes to the significance of the asset by demonstrating its purpose of defending the land from seaborne attack.

Church of St James – BH2 (Grade I, NHLE 1085755)

8.83 The church has its origins in the 12th century with additions in the 13th and 15th centuries and a southwest tower added in 1903-05. Construction is ragstone rubble and the plan is simple with a

nave, chancel, south-west tower, northeast sacristy and south porch. The chancel retains 13th century windows in the Early English style. The aisles have been removed but the remains of the arcade can still be seen with the early 20th century replacement windows inside the blocked-up spaces. Brick buttresses were added after the aisles were taken away.

8.84 The asset's setting is the village of Grain but is not extensive, being restricted to the less developed part of the village to the north. Due to the flatness of the topography and the asset's short, squat tower the asset cannot be seen from a wide area. The asset retains a relationship with the school to the south-west (although its 19th century buildings have been removed) and, to a lesser degree with the old rectory to the west of the school. The presence of the modern school buildings does nothing to enhance the church's setting and the chimney of the power station is a presence as it is in most parts of the village and the island. Apart from these incursions modernity has not encroached unduly and the open nature of the setting around the church contributes to its significance.

The Hogarth Inn – BH3 (Grade II, NHLE 1336496)

8.85 The Hogarth Inn is a rendered, timber-framed public house dating to the late 16th century. The two-storey building has a hipped, tiled roof and sliding sash windows to the first floor. The canted bay windows on the ground floor are a 20th century addition. The asset was built as a house and was later the Cock Inn and then the Post Office and stores before being reinstated as a public house in 1975. The Hogarth name is a reference to William Hogarth who visited the Cock Inn in 1732 during a visit to the Hoo peninsula. The brick outbuilding to the north-west of the asset is shown on the First Edition Ordnance Survey map of 1870 while a further building between the two shown on subsequent Ordnance Survey maps and labelled PO is no longer in place.

8.86 The asset has historic interest as the oldest domestic building on the island and historical interest and community value as the village's pub, Post Office and store since at least the early 18th century. The asset's setting is the centre of the village of Grain but has changed considerably in the last century. In the early 20th century the pub was the first building encountered on entering the village from the west. Over time the asset has become surrounded by modern development and now stands roughly in the centre of the developed part of High Street. The provision of a large area of hard standing immediately to the north-west of the asset has also been detrimental to the asset. In common with many parts of the village the chimney of Grain Power Station is visible to the south of the village as are examples of the electricity pylons that carry the overhead power lines from the power station to the south and west of the village and west across the Hoo peninsula. This combination of changes to the asset's setting means that it no longer contributes to its significance.

White House Farmhouse – BH4 (Grade II, NHLE 1204482)

8.87 White House Farmhouse is a two-storey, three-bay 18th century weatherboarded farmhouse with timber sash windows with glazing bars and a panelled front door with a fanlight above. The hipped roof is tiled, with brick stacks to the rear elevation. There is a triple-pile back addition to the rear of the main range.

8.88 The asset has historic interest as the last remaining example of what was a number of farmhouses present on the Isle of Grain in the 18th century. Although a small outbuilding shown on the 1898 Ordnance Survey map is extant, all the farm's other buildings have been removed and the surrounding land has been developed on all sides. Although much of the asset's former land remains in agricultural use to the south and west these considerable changes to the asset's setting mean it contributes only slightly to its significance.

Church of All Saints – BH14 (Grade I, NHLE 1085758)

8.89 The Church of All Saints is the parish church of Allhallows and dates from the 12th to 15th centuries with restoration in the late 19th century. Construction is of uncoursed rubble and slate roof. The plan of the building is of aisled nave with cupola, chancel and south porch. The asset has historic and architectural interest as Allhallows' parish church. The asset is located in a raised churchyard surrounded by a brick wall. It retains a village setting but, with the exception of the former Rose & Crown public house to the west with which the asset forms a group the majority of the historic buildings that once stood around the churchyard, including two farms, are no longer

extant. The predominantly modern buildings within the setting have weakened the sense of place and the setting only contributes moderately to its significance.

Rose and Crown Public House – BH15 (Grade II, NHLE 1086504)

8.90 The asset is an 18th century house, formerly the Rose and Crown public house and now a dwelling house again. The two storey building is in painted brick with a hipped, tiled roof with two dormers to the front elevation. Both the roof and timber framed windows are said (list description) to have been replaced in the 20th century. The asset retains a village setting but one that has been largely changed, with only the Church of All Saints remaining from the 19th century and earlier. While the asset retains its important relationship with the church the setting only contributes moderately to its significance.

Archaeological and Historical Development

Early Prehistoric

8.91 Although only a single flint artefact [**A1**] and environmental remains [**A2**] of Palaeolithic date have been uncovered within the Study Area, the superficial Thames terrace gravel deposits on which the Site is located have been dated to Marine Isotope Stage (MIS) 6, roughly 200,000 years ago. These gravel deposits, on which the Site is located and which are the target of an Area of Archaeological Potential, may contain further unknown Lower Palaeolithic remains.

8.92 No Mesolithic remains have been identified within the Study Area.

Late prehistoric

8.93 Areas of peat recorded off the south-east coast of the Isle of Grain and alluvium deposits on the Isle itself have all been dated to the Holocene period and as such have the potential to contain remains from any period since the last glaciation. These deposits are, however, restricted to the low-lying areas and as such they are unlikely to be present within the GB Onshore Scheme.

8.94 The only Neolithic material recorded within the study area consists of a single Neolithic handaxe [**A3**] of insecure provenance.

8.95 No Bronze Age remains have been identified within the Study Area, although some evidence of Bronze Age salt production and occupation has been recorded on the Hoo Peninsula west of the Isle of Grain.

8.96 A large Iron Age settlement complex [**A6**] has been excavated somewhere north of Rose Court Farm. These extensive remains included a number of ditched enclosures and post-hole structures extending over an area of well over 10 ha dating to the first centuries BC and AD. The excavations reports have not been published and the exact location and extent of the settlement remains unknown. While it is highly likely that these deposits have been largely removed by gravel extraction, features may have survived within the access road on which the proposed cable route is situated. Iron Age remains, consisting of burnt material [**A7**] that may indicate the presence of kiln, have been recorded at Wallend 700 m south-east of the Site. Lastly, two Iron Age gold coins [**A4** and **A5**] have been recorded by the Portable Antiquities Scheme in the area of Grain, although their exact provenance is not known.

Roman

8.97 The most significant Roman remains within the Study Area consist of an enclosure, field ditches, and cemetery containing at least two cremation and 47 inhumation burials uncovered during salvage excavations in 1978-81 [**A11**] north of Rose Court Farm. The presence of a dense cluster of funerary remains suggests that a significant Roman settlement was present on the Isle of Grain, although it has yet to be identified. The exact location and extent of these features is not currently known as the results of the excavations have not been published. This site may extend to the GB Onshore Scheme's cable route north of West Lane, and although gravel extraction is likely to have destroyed much of the archaeology, there is a possibility that Roman remains have survived within the access road on which the cable route is centred.

8.98 A possible Roman pottery kiln [**A10**] is reported 1.2 km south of the Site, and Roman burnt material [**A7**] is reported 700 m south of the Site. Lastly, two isolated Roman cordoned flasks [**A8** and **A9**] have also been recorded within the Study Area south of the Site.

Medieval

8.99 Archaeological remains dating to the early medieval period identified within the Study Area are limited to four isolated findspots. These consist of two copper alloy fittings [**A12** and **A13**] and two Anglo-Saxon silver pennies (sceats) [**A14** and **A15**].

8.100 The parish church of St James [**BH2**] is the only building on the Isle of Grain with extant features dating to the medieval period. Archaeological remains within the Study Area dating to this period include a midden [**A16**], and a scatter of medieval pottery [**A10**]. Within the Site itself, a large area of ridge and furrow [**A70**], suggestive of medieval agricultural practices, have been identified through aerial photographs.

Post-medieval

8.101 The natural and built-up landscape of the Isle of Grain underwent significant changes throughout the post-medieval period, largely driven first by efforts to reclaim land lost to periodic saltwater inundation in the low-lying tidal marshes and then by the strategic military position of the Isle to the defence of both the Medway and Thames estuaries.

8.102 The village of Grain itself is first shown on 18th century historical maps as a dispersed settlement centred on the largely post-medieval parish church of St James [**BH2**] and the Cock Inn [**BH3**], surrounded by the dispersed farmsteads of Red House Farm [**A36**], Wallend [**A40** to **A43**], Perry's and Wilford's farms [**A48** and **BH11**], West Bear [**A49**], White House Farm [**A51** and **BH4**], St James' Farm [**A52**], a farm located on the later Lee's Cottages [**A56**], and first labelled as Brick House but likely to be White Hall Farm [**A47**].

8.103 Nineteenth century maps show the gradual expansion of the village of Grain, including Bethel Chapel [**A61**], the Grain United Reformed Church [**BH7**], the National School [A59], church Rectory [**A60** and **BH6**], Parsonage Barn [**A53**] and a row plan farm [**A54**]. The maps also show the construction of several new farms on the high ground surrounding Grain such as Baytree Farm [**A58**] and Rose Court Farm [**A44**, **A45**, and **BH10**]. Developments in the low-lying areas include the erection of Grain Bridge [**A67**], saltpans with associated windmills [**A17** to **A20**], Redhouse Farm [**A36**], and eight unnamed farms [**A35, A37, A38, A39, A46, A50, A55**, and **A57**].

8.104 Military remains dating to the 19th century include a number of batteries associated with the Scheduled Monument of Grain defences [**BH5**].

8.105 Industrial developments around the Isle of Grain include the Hoo Railway [**A63, A65**, and **A66**] linking the late 19th century pleasure port of Port Victoria [**A64**] to the rest of the Hoo Peninsula.

8.106 The post-medieval maritime heritage of the Isle of Grain is well attested archaeologically both onshore and offshore. They comprise a wide range of features, including buried features such as jetties and sea wall defences along former channels in the marshes [**A23** to **A27**], former wharves [**A28** and **A29**], a coastguard station [**A30**], and the sites of former signal beacons [**A31** to **A34**]. In addition, a place called 'Blackstakes' [**A62**] on the southern coast of the Isle of Grain is shown on a 17th century chart and on Ordnance Survey maps, but no information is available on the origins of the name.

8.107 Features of lesser importance are also recorded in the KHER throughout the Study Area. These include two post-medieval enclosures of unknown purpose [**A69** and **A70**] near the Yantlet Creek, a burial mound or ground [**A71**] marked on 19th century Ordnance Survey maps, a circular embanked feature [**A72**], flint foundations and scatters of red brick [**A73**], and water management features or pounds [**A74**], and a sewer outfall [**A68**]. Isolated finds dating to the post-medieval period include a rudder [**A75**] likely forming part of a wrecked vessel in the Yantlet, and a post-medieval silver coin [**A76**] registered by the portable antiquities scheme.

Modern

8.108 The Isle of Grain underwent drastic changes in the 20th century, in part due to the strategic importance of the area to the defence of the Thames and Medway estuaries during the First and Second World Wars, and in part due to the shift from a coal powered to an oil powered navy. These government-led military and industrial developments largely dictated the evolution of the Isle of Grain until the end of the Second World War, after which the military complex quickly declined while the petroleum industry and port facilities established on the southern half of the peninsula during the Second World War continued to thrive, developing into a power station complex and culminating in the landscape present there today.

8.109 The earliest modern military development within the Study Area is the Coastguard Station [**BH9**] built in 1900 for the Admiralty and comprising of a row of terraced cottages and watch room to the northeast of Whitehouse Farm. Soon afterwards, the Royal Navy began to use the Isle of Grain as a storage and resupply point for its oil powered ships, as evidenced by rows of oil tanks [**A94**] shown on early 20th century Ordnance Survey maps.

8.110 In 1912, a naval seaplane base was established at Port Victoria and in 1915 a Marine Experimental Aircraft Depot was added, the two being known collectively as RNAS Grain [**A96**]. This effectively converted the original pleasure port into a military asset. The earlier 19th century defences of Grain [**BH5**] were enhanced during the First World War and included several new anti-aircraft, batteries, and other features.

8.111 During the interwar period, the Admiralty built firing point buildings and structures on the Grain Range Line (also known as Yantlet Battery) on Yantlet Creek [**A86** and **BH12**]. The site was used as a firing point for the velocity testing of artillery from the 1920s to the 1950s. The remains consist of a number of structures [**A87**] including concrete bases and platforms; a workshop complex; powerhouse; mess building; guardhouse and cottages. Artillery was brought on and off-site via a wharf [**A88**] and slipway [**A89**] from Yantlet Creek and a purpose built railway [**A90**].

8.112 Aside from these military developments and the continued growth of the village of Grain, the only noteworthy change affecting the Site during the interwar period was the construction of a cluster of farm buildings [**A131**] south of White Hall Farm. Although this was destroyed in the latter half of the 20th century, remains of these buildings may survive within the Site.

8.113 Further enhancements were made to the Grain defences [**BH4**] and new defences were erected during the Second World War. Remains from this period that lie within the GB Onshore Scheme include dragon's teeth anti-tank defences on the northern coast of the Isle of Grain [**BH1**] as well as military barracks [**A91**] and batteries [**A97**] immediately west of White Hall Farm. Within the Study Area, Second World War military remains comprise bombing decoys [**BH13**], oil storage tanks [**A92** and **A93**], pillboxes [**A95**], radio masts [**A98** and **A99**], and the sites of three German airplane crashes [**A101**, **A102**, and **A103**].

8.114 Gravel extraction was a significant factor in the changing modern landscape of the Isle of Grain. Although mostly reinstated, large scale quarrying was carried out north of West Lane, and east of Perry's Farm. The earliest phases of extraction took place northwest of the village of Grain and included a tramway [**A104**] linking the extraction pit to a pier off the north coast of the Isle, both of which had been removed by the 1930s. By the 1990s roughly 46 hectares (ha) had been removed around White Hall Farm and Rose Court Farm and a small complex of farm buildings south of White Hall Farm had been demolished. While Rose Court Farm was left intact following the land reinstatement, the remaining buildings of White Hall Farm were ultimately demolished between 2007 and 2010. A mound [**A105**] to the east of the village of Grain may relate to small-scale extraction activities.

8.115 The extent of 20th century development on the Isle of Grain is reflected in the large number of modern assets reported in the KHER. Although maritime remains were not included in the study area, 11 archaeological assets have been recorded along the shore above the MHW, consisting of wharves, beacons, groynes, and hards [**A77** to **A87**].

8.116 The remaining KHER archaeological asset within the study dating to the modern period consists of a former sewage outfall [**A106**] south-east of Grain marked on 20th century Ordnance Survey maps.

8.117 A single non-designated archaeological asset [**7134**] of unknown date has been identified by the marine survey of the GB Offshore Scheme within the intertidal zone of the application site. This consists of a small dipole anomaly that is interpreted as a possible buried ferrous object.

Archaeological Potential

8.118 A full assessment of the archaeological potential within the Site is presented in section 5.3 of the cultural heritage DBA (Appendix 8-1). In summary the archaeological potential within the Site is considered to be:

- Palaeoenvironmental – Low potential given the lack of alluvial or peat deposits likely to contain such environmental remains within the Site.
- Early Prehistoric – Moderate potential for Lower Palaeolithic remains situated within the Grain Gravel deposits of Pleistocene origins which are known to contain such material. An AAP covers the geological deposits of relevance and highlights this potential.
- Late Prehistoric – High potential for Iron Age occupation and agricultural remains associated with a large settlement excavated north of Rose Court Farm. This potential is targeted by an AAP which overlies the northern part of the proposed cable route.
- Roman – High potential for settlement, funerary, or agricultural remains relating to the Roman era enclosures and cemetery uncovered north of Rose Court Farm. This potential is targeted by an AAP which overlies the northern part of the proposed cable route. There is also a possibility of industrial remains relating to salt production to exist on the edge of the low-lying marshland in the south-west section of the GB Onshore Scheme application site.
- Early medieval – Low potential given the general scarcity of such sites on the Isle of Grain;
- Medieval – Moderate potential given the medieval origins of an area of ridge and furrow agriculture beneath the proposed converter station. Remains are likely to relate to agricultural activities;
- Post-medieval – High potential based on the identification of several assets dating to the post-medieval period through HER and map analysis including several scattered farmsteads, military remains, and industrial activities.
- Modern – High potential due to the presence of extensive military remains dating to the First and Second World Wars throughout the Isle of Grain, and due to the presence of several dispersed farmsteads within and in close proximity to the GB Onshore Scheme Site.

Historic Landscape

8.119 The Cultural Heritage DBA (Appendix 8-1) sets out the Historic Landscape Character of the Site, drawing on the Natural England National Character, the Kent Historic Landscape Character, the results of the Hoo Peninsula Project, as well as the results of a site walkover and map regression. The landscape within the Site can be broadly categorised as formed of disused gravel workings and reinstated farmland in use by Rose Court Farm and Perry's Farm, and by 19th century medium fields with straight boundaries. These are set within a patchwork of industrial, military, urban, and agricultural landscapes that define the character of the Study Area and the Isle of Grain as a whole.

8.120 The disused gravel extraction workings are common throughout the country and considered of no historical or aesthetic interest.

8.121 Despite the abundance of 19th century field systems in England as a whole, this landscape is currently at risk of disappearing on the Isle of Grain. This landscape has lost much of its 19th century and earlier relationship to the rural village of Grain and the saltmarshes to the south due to 20th century urban and industrial developments. Nevertheless, this landscape is rapidly disappearing and as such our ability to understand the historical landscape of the Isle of Grain is at risk. On measure, it has been assessed as being of low sensitivity to change based on its local historical interest.

Summary of Receptors and Associated Value

8.122 Based on a review of the baseline conditions, the following assets have been identified in Table 8.5 as potentially affected by the GB Onshore Scheme, taking into consideration the location of

the receptor and its relationship with the Site. These receptors have been attributed with a value based on the significance of each receptor in accordance with the criteria set out in Table 8.1.

Table 8.5: Resource / Receptor value

Asset/Receptor	Value of Asset / Receptor
World War II Anti-Tank Obstacles on the Foreshore (Scheduled Monument) [**BH1**]	Medium
Church of St James (Grade I Listed Building) [**BH2**]	High
The Hogarth Inn (Grade II Listed Building) [**BH3**]	Medium
White House Farm (Grade II Listed Building) [**BH4**]	Medium
Coastal artillery Defences on the Isle of Grain, Immediately East and South East of Grain Village (Scheduled Monument) [**BH5**]	High
The Old Vicarage, High Street, Grain Village (non-designated building) [**BH6**]	Low
Grain United Reformed Church (non-designated building) [**BH7**]	Low
Grain Village Hall (non-designated building) [**BH8**]	Low
Former Coastguard Station (Medtha House and Coastguard Cottages) (non-designated building) [**BH9**]	Low
Rose Court Farm (non-designated building) [**BH10**]	Low
Perry's Farm and Wilford's Farm (non-designated building) [**BH11**]	Low
Grain Range Line on Yantlet Creek (non-designated building) [**BH12**]	Low
Second World War QF P-Series Oil Bombing Decoy (Scheduled Monument) [**BH13**]	High
Church of All Saints (Grade I Listed Building) [**BH14**]	High
Rose and Crown Public House (Grade II Listed Building) [**BH15**]	Medium
Site of White Hall Farm [**A47**]	Low
Area of Ridge and Furrow [**A70**] and potential associated medieval agricultural remains	Low
Site of Second World War Camp west of White Hall Farm [**A91**]	Medium
Site of 20th Century Outfarm South of White Hall Farm [**A132**]	Negligible
Potential Palaeolithic remains	High
Potential Iron Age settlement remains	High
Potential Roman settlement and/or funerary remains	Medium
Potential post-medieval field systems or farmstead remains	Negligible
Potential post-medieval military remains	Medium
Potential modern field systems or farmstead remains	Negligible
Potential modern military remains	Medium
Landscape of 19th century fields	Low

Future Baseline

8.123 This section considers changes to the baseline conditions, described above, which might occur during the time period over which the GB Onshore Scheme will be in place. It considers changes that might occur in the absence of the GB Onshore Scheme being constructed.

8.124 Changes to the archaeological baseline which might occur during the lifespan of the GB Onshore Scheme and which might occur in the absence of the GB Onshore Scheme are virtually identical. They would be limited to typical taphonomic processes on buried archaeological assemblages,

which may be very slightly altered by changes to the land drainage. Aside from issues of preservation, the future baseline would evolve according to new discoveries and the removal of archaeological assets through unrelated developments in the area. However these would occur regardless of the presence of the GB Onshore Scheme.

8.125 The Built Heritage baseline is unlikely to undergo significant change given the presence or absence of the GB Onshore Scheme other than through gradual industrial and rural development of the Isle of Grain. Of note, however, is that the World War II Anti-Tank Obstacles on the Foreshore [**BH1**] are being systematically lost to the gradual erosion of the northern shoreline of the Isle of Grain. Based on historical aerial photographs, the rate of erosion is significant and much of the current extent structures are likely to absent following the 40 year lifespan of the GB Onshore Scheme. However, the DC cable is expected to be directionally drilled beneath the asset and buried below MHWS, and as such the rate of erosion would not be materially altered by the GB Onshore Scheme.

Potential Impacts

Archaeological Effects during Construction

Proposed Converter Station & Access Track

8.126 Construction of the converter station will entail the following activities which may impact the cultural heritage resource outlined above:

- the construction of access roads, which are expected to be topsoil stripped to a depth of 0.4 m below surface;
- the establishment of temporary facilities including site offices, lay down and storage areas and welfare facilities, development of electricity and water supplies, erection of security fencing or hoarding and implementation of external lighting for security. Approximately 1.5 ha will be required for the construction compound, laydown, and storage areas, which are expected to be stripped of topsoil to a depth of approximately 0.4 m below surface;
- the levelling and land re-profiling in order to establish a level platform on which the proposed converter station will be constructed. The areas are expected to be levelled to a depth of approximately 5.8 m above Ordnance Datum (AOD);
- the construction of a converter station approximately 250 m by 250 m (or up to 5 ha) with a maximum height of approximately 26 m. The layout of this zone is still in the design stages but is expected to include a DC switch hall, valve halls, a control building, cooling fans, transformers, Alternating Current (AC) switchyard, diesel backup generator, and a spare parts building. Some of these structures will be placed on piled foundations;
- the installation of an AC cable route from the substation to the converter station, which may be either above or below ground. For this assessment it is assumed to be underground and laid within a trench 1 m wide and 1.5 m deep; and
- the excavation of an attenuation pond approximately 1.1 ha in size and a smaller overflow pond approximately 0.3 ha in size connected by a swale/ channel. The larger pond is expected to extend to a depth of approximately 2 m below surface.

8.127 Archaeological assets that may be affected by these works include an area of medieval ridge and furrow [**A70**], and previously unrecorded remains dating to the Palaeolithic, Iron Age, Roman, medieval, post-medieval, and modern periods ranging in value from low to high.

8.128 Topsoil stripping relating to the construction of compounds, lay down areas, and access road could result in the disturbance and/ or removal of archaeological deposits that may immediately underlie the topsoil.

8.129 This would result in the value of medieval ridge and furrow [**A70**] in this section of the Site, being totally altered or destroyed and as such is assessed to represent a high magnitude of impact in accordance with the criteria set out in Table 8.2. The asset is considered to be of low value, and as such topsoil stripping would result in a moderate adverse effect, which is significant. Planned levelling works to 5.8 m AOD would be limited to the footprints of the proposed converter station and substation. Due to the natural topography sloping down towards the south-west, soil removal of up to 4 m is anticipated in the eastern half of the converter station site and the addition of up to approximately 1.5 m of soil is anticipated in the south-west corner.

8.130 This would result in the value of the area of ridge and furrow [A70] being totally altered or destroyed and as such is assessed to represent a high magnitude of impact in accordance with the criteria set out in Table 8.2. Levelling activities would therefore result in a moderate adverse effect, which is significant, on this asset considered of low value.

8.131 Gravel deposits that may contain Palaeolithic remains, considered to be of high value, have been recorded in two boreholes within the converter station footprint at depths of between 6.95 m AOD and 8.35 m AOD. Consequently, levelling works would result in the complete removal of the asset resulting in its value being totally altered or destroyed. The magnitude of the impact is assessed to be high, resulting in a major adverse effect.

8.132 Construction of the proposed converter station will require the driving of piled foundations. However, previously unknown archaeological remains will have been entirely removed by earlier topsoil removal and levelling works and will therefore not cause further impacts to the archaeological resource.

8.133 The installation of attenuation ponds and swale, down to a maximum depth of 2 m below surface, would result in the removal of portions of medieval ridge and furrow [A70] which is of low value. This would result in the value of the asset in this part of the site being totally altered or destroyed and is therefore assessed to be a high magnitude of impact. The significance of effect is assessed to be moderate adverse.

8.134 Construction of the AC cable linking the converter station to the substation would take place within the area of proposed levelling, which would have already removed any archaeological remains present. As such, any open-cut trench required for the AC cable will result in no additional impacts to the archaeological resource.

8.135 There is a potential for previously unrecorded archaeological remains to be present within this section of the Site. These remains are likely to be associated with medieval, post-medieval, and modern farming practices and are assessed as being of low to negligible value. The construction of the proposed converter station would entail the removal of topsoil and superficial deposits through topsoil stripping and levelling works which would completely remove any such archaeological remains present, resulting in the value of any such asset being totally altered or destroyed. These works are therefore assessed to represent a high magnitude of impact in accordance with the criteria set out in Table 8.2, resulting in a moderate adverse effect.

8.136 This section of the GB Onshore Scheme would result in the loss of approximately a fifth of a landscape composed of 19th century field systems considered to be of low value. This would result in change in both to the asset itself and changes to its setting resulting in erosion in our ability to understand and appreciate the asset. The magnitude of change is therefore considered to be medium, resulting in minor adverse effect.

Proposed Substation and Cable Sealing End Compound

8.137 Construction of the substation would entail the following activities which may impact the cultural heritage resource outlined above:

- preliminary works, which would include utilities diversions as necessary;
- the establishment of a lay down and storage areas of approximately 0.64 ha would be required, which is expected to be stripped of topsoil to a depth of approximately 0.4 m below surface;
- the levelling and land re-profiling in order to establish a level platform on which the proposed substation would be constructed. The areas are expected to be levelled to a depth of approximately 5.8 m AOD;
- the construction of a new substation approximately 80 metres (m) by 80 m (or up to 0.64 ha) with a maximum height of approximately 14 m and which may be placed on piled foundations.

8.138 Receptors that may be affected by these works include previously unrecorded archaeological remains from the surficial deposits with the potential to contain archaeological remains dating to the Palaeolithic, medieval, post-medieval, and modern periods ranging in value from negligible to high.

8.139 Topsoil stripping relating to the establishment of the lay down area would result in the disturbance and/ or removal of archaeological deposits that may immediately underlie the topsoil. As a result, impact will be limited to previously unrecorded archaeological remains of medieval, post-medieval, and modern date.

8.140 Planned levelling works, which would level the ground to approximately 5.8 m AOD, would only occur within the footprint of the substation in this area of the GB Onshore Scheme. Based on the present ground surface being approximately 7.2 m AOD, it is anticipated that the levelling works would remove as much as 1.4 m of topsoil and subsoil deposits. No ground investigation works have been carried out in this area, but a single borehole sited 60 m south suggests that there are

no Pleistocene gravel deposits of archaeological interest within the substation footprint. Impacts from levelling works would be limited to previously unrecorded assets of medieval, post-medieval, and modern date.

8.141 Although there are no known archaeological assets within the proposed substation section of the Site, there is a potential for previously unrecorded archaeological remains to be present. These remains are likely to be associated with medieval, post-medieval, and modern farming practices and are assessed as being of low to negligible value. The construction of the proposed substation would entail the removal of topsoil and superficial deposits which would completely remove any such archaeological remains present. The impact is therefore assessed to be high, resulting in a moderate adverse effect.

Proposed DC Cable Route

8.142 Construction of the proposed DC cable route would entail the following activities which may impact the cultural heritage resource outlined above:

- an underground DC cable route from the converter station to the landfall point, and through the intertidal area to MLWS (overlapping with the subsea DC cable between MHWS and MLWS). The 30 m easement is expected to be topsoil stripped to approximately 0.4 m depth and the cable is expected to be placed in an open cut trench 1 m wide and 1.5 m deep;
- the construction of a concrete pad (TJP) of 15 m by 5 m where the subsea cable and onshore underground cables meet, which will be excavated to a depth yet to be determined;
- the laying of buried concrete pads 15 m by 5 m placed every 800 m to connect the cables. These areas will be excavated to a depth of 1.5 m;
- three open-cut trenches approximately 800 m in length to carry the subsea DC cables and optic cable from the last breakout point in the mid-intertidal area to MHWS.

8.143 Despite the extensive mineral extraction that has taken place in Clubb Pit north of West Lane throughout the 20th century, which is likely to have removed most of the archaeological evidence, the access road present today and the area surrounding the former White Hall Farm appear to have been left largely intact. The 30 m easement and indicative trench location are sited over the former quarry access road and quarry working area, where there is the potential for survival of archaeological remains dating to the Palaeolithic, Iron Age, Roman, post-medieval and modern periods.

8.144 Topsoil stripping across the 30 m easement would result in the disturbance and/ or removal of archaeological deposits that may immediately underlie the topsoil. This would result in the value of the remains of the 20th century outfarm south of White Hall Farm [**A132**], the remains of White Hall Farm [**A91**], and the remains of the Second World War camp [**A91**], Iron Age settlement remains near Rose Court Farm and Roman funerary remains near Rose Court Farm being totally altered or destroyed and as such is assessed to represent a high magnitude of impact in accordance with the criteria set out in Table 8.2. As a result, there is anticipated to be a high impact on archaeological remains ranging from negligible to high value.

8.145 For the site of the 20th century outfarm south of White Hall Farm [**A132**], considered to be of negligible value, this would result in a minor adverse effect.

8.146 For the site of the post-medieval White Hall Farm [**A47**], considered to be of low value, this would result in a moderate adverse effect.

8.147 For assets of medium value, which includes potential Roman settlement and/ or funerary remains and the site of a Second World War camp [**A91**], this would result in a major adverse effect.

8.148 The significance of effect on possible Iron Age settlement remains of high value that may be located within the easement would be major adverse.

8.149 The open-cut trench for the proposed DC cable route, which is expected to be excavated to a depth of 1.5 m, would result in the localised removal or truncation of archaeological deposits below the topsoil. Given that the impact will be limited to a narrow trench within the easement and would therefore likely only affect a small proportion of the archaeological resource means that the open-cut trench would result in an impact of low magnitude on the remains of the 20th

century outfarm south of White Hall Farm [**A132**], the remains of White Hall Farm [**A91**], the remains of the Second World War camp [**A91**], Iron Age settlement remains near Rose Court Farm and Roman funerary remains near Rose Court Farm.

8.150 For the site of the 20th century outfarm south of White Hall Farm [**A132**], considered to be of negligible value, and for the site of the post-medieval white Hall Farm [**A47**], considered of low value, the open-cut trench would result in a negligible effect.

8.151 For assets of medium value, which includes potential Roman settlement and/ or funerary remains and the site of a Second World War camp [**A91**], this would result in a major adverse effect.

8.152 The significance of effect on possible Iron Age settlement remains of high value that may be located within the easement would be minor adverse.

8.153 Similarly, the excavation of open areas in order to lay 15 m by 5 m concrete pads at cable joints is expected to be excavated to a depth of 1.5 m, and would result in the removal or truncation of archaeological deposits below the topsoil. Consequently, this would result in an impact of medium magnitude on archaeological remains of the 20th century outfarm south of White Hall Farm [**A132**], the remains of White Hall Farm [**A91**], the remains of the Second World War camp [**A91**], Iron Age settlement remains near Rose Court Farm and Roman funerary remains near Rose Court Farm.

8.154 For the site of the 20th century outfarm south of White Hall Farm [**A132**], considered to be of negligible value, this would result in a negligible effect.

8.155 For the site of the post-medieval White Hall Farm [**A47**], considered to be of low value, this would result in a minor adverse effect.

8.156 For assets of medium value, which includes potential Roman settlement and/or funerary remains and the site of a Second World War camp [**A91**], this would result in a moderate adverse effect.

8.157 The significance of effect on possible Iron Age settlement remains of high value that may be located within the easement would be major adverse.

8.158 The DC Cable is planned to be directionally drilled beneath much of the intertidal zone, which is expected to result in no impacts to the buried archaeological resource. However, the installation of four breakout points at unknown locations every 800 m within the intertidal zone to facilitate the directional drilling, and the excavation of open-cut trenches in the last 800 m to the MLWS have the potential to impact on archaeological remains within their footprints. A single geophysical anomaly [**7134**] has been identified within the intertidal zone and is assessed as a possible feature of anthropogenic origin (A2) within the GB Offshore Scheme (Chapter 16). There is a potential for previously unrecorded archaeological remains to be present within this section of the scheme. These remains are likely to be associated with post-medieval and modern farming practices and are assessed as being of negligible value, or to relate to post-medieval and modern military defences, considered of medium value. The construction of the proposed DC cable route would entail the removal of topsoil deposits across the 30 m easement and removal of subsoil deposits within the open cut trench and concrete pads, which would completely remove any previously unrecorded archaeological remains present. The impact is therefore assessed to be high, resulting in a minor adverse impact on assets of negligible value and moderate adverse on assets of medium value.

8.159 This section of the GB Onshore Scheme would result in the loss of approximately a tenth of a landscape composed of 19th century field systems considered to be of low value. This would result in change in both to the asset itself and changes to its setting resulting in erosion in our ability to understand and appreciate the asset. The magnitude of change is therefore considered to be medium, resulting in minor adverse effect.

Archaeological Effects During Operation

8.160 Effects once the GB Onshore Scheme is complete and occupied comprise operational effects arising from the presence of permanent structures, enclosing security palisade, maintenance activities, road traffic, and lighting. The Site is expected to be in operation for approximately 40 years prior to decommissioning.

8.161 All physical impacts on the archaeological resource will occur during the construction stage of the GB Onshore Scheme. The nature and extent of archaeological assets within the Site will have been established during evaluation works that would form part of the mitigation strategy outlined below. All identified archaeological remains will therefore have been recorded to a level commensurate with their significance. Any archaeological resource that may be impacted during the operational phase, through maintenance work or emergency intrusive excavations, will therefore have been previously evaluated and recorded. As such, it is considered that there would be no additional impacts to the archaeological resource once the GB Onshore Scheme is operational.

Potential Built Heritage Impacts During Construction and Operation

*World War II Anti-Tank Obstacles on the Foreshore [**BH1**]*

Construction

8.162 The Grade II listed World War II Anti-Tank Obstacles are assessed to be of medium value. The proposed DC cable route would pass underneath the asset via Horizontal Directional Drilling within a 30 m corridor centred approximately at NGR 588552, 177354. Construction of the cable route beneath the asset would be to a design by the appointed contractor and would represent a temporary change to the setting of the asset which will cease when the land is returned to its previous state. The temporary impact is assessed to be low, resulting in a minor adverse effect.

Operation

8.163 There will be no impact on the asset as a result of the operation of the GB Onshore Scheme and no change to its setting. When viewed from the beach the proposed converter station and other elements of the GB Onshore Scheme will not be visible above the cliff that runs immediately behind the asset. The effect from the operational Development is neutral.

*Church of St James [**BH2**]*

Construction

8.164 The Church of St. James is a Grade 1 Listed Building and is of high value. The setting of the church does not extend into the GB Onshore Scheme application site, therefore there will be no impact on the asset during the construction phase of the GB Onshore Scheme. No element of the GB Onshore Scheme Site would be visible from the asset or elsewhere in its setting including Grain Fort.

Operation

8.165 While the GB Onshore Scheme will not be visible from the asset or the churchyard surrounding it, it would be visible in views to the west from the ramparts of Grain Fort which include the asset to the right hand side of the view. The convertor station will be visible in these views above the roofs of the houses to the west of Green Lane and to the north of High Street. The converter station building will form a low backdrop to these buildings, taking up a very small proportion of the view and not providing a distraction from the asset within the view. The asset's setting is the historic core of the village and it is not considered that this slight visibility of the GB Onshore Scheme within the same view as the asset will change its setting sufficiently to be assessed as an impact. The effect from the operational Development is assessed to be neutral.

*The Hogarth Inn [**BH3**]*

8.166 There will be no impact on the asset during either the construction or operation phases of the GB Onshore Scheme. No element of the site would be visible from the asset or anywhere within its setting. The effect arising from the construction and operation of the GB Onshore Scheme is assessed to be neutral.

*White House Farm [**BH4**]*

Construction

8.167 There will be no impact on the asset during the construction phase of the GB Onshore Scheme. No element of the Site will be visible from the asset or elsewhere in its setting and the effect is assessed to be neutral.

Operation

8.168 The asset is screened from the Site by houses on the north side of Rivendell Close and the south and east sides of Lapwing Road so that there is no view of the Site from the asset itself. However, the flat landscape between the asset and the Site means that the GB Onshore Scheme would be visible from some parts of the asset's setting to the east, albeit at a distance of over 1 km from the eastern corner of the proposed convertor station. At this distance the GB Onshore Scheme would not be as great an influence on the asset's setting as the superstructure (as opposed to the chimney) of Grain Power Station. It would however be apparent within the asset's setting, adding to the already significant changes it has undergone throughout the 20th century. The effect of the scheme would be minor adverse, derived from a low magnitude of impact on a medium value asset.

*Coastal artillery Defences on the Isle of Grain, Immediately East and South East of Grain Village [**BH5**]*

Construction

8.169 Construction activity within the Site will not change the asset's setting and would not impact upon the asset. The effect is assessed to be neutral.

Operation

8.170 The GB Onshore Scheme would be visible in the view to the west from the ramparts of Grain Fort, the northernmost part of the group of coastal artillery defences. The asset is approx. 1.2 km distant from the eastern corner of the proposed convertor station at this point and the GB Onshore Scheme would be visible from the asset above the roofs of the houses to the west of Green Lane and to the north of High Street. The GB Onshore Scheme would form a low backdrop to these buildings, taking up a very small proportion of the view. The asset's setting is the coastal strip on the east of the Isle of Grain and it is not considered that this slight visibility of the GB Onshore Scheme from the asset would change this setting sufficiently to be assessed as an impact. It is assessed therefore that there would be no impact arising from the operational Development and the effect is assessed to be neutral.

The Old Vicarage, High Street, Grain Village [BH6]

Construction

8.171 There would be no impact on the asset during the construction phase of the GB Onshore Scheme. No element of the site would be visible from the asset or elsewhere in its setting including Grain Fort. The effect is assessed to be neutral.

Operation

8.172 While the GB Onshore Scheme would not be visible from the asset it would be visible in views looking west from the ramparts of Grain Fort which include the asset to the right of the centre of the view. The convertor station would be visible in these views above the roofs of the houses to the west of Green Lane and to the north of High Street. The building would form a low backdrop to these buildings, taking up a very small proportion of the view and not providing a distraction from the asset within the view. The asset's setting is the Church of St James [**BH2**] and the historic core of the village and it is not considered that this slight visibility of the GB Onshore Scheme within the same view as the asset will change its setting sufficiently to be assessed as an impact. It is assessed therefore that there would be no impact arising from the operational Development and the effect is assessed to be neutral.

*Grain United Reformed Church [**BH7**]*

Construction

8.173 There would be no impact on the asset during the construction phase of the GB Onshore Scheme. No element of the site would be visible from the asset or elsewhere in its setting.

Operation

8.174 The view from the asset to the north is terminated by the cottages on the northwest side of Grain Road. The electricity pylon to the north of Perry's Farm and Wilford's Farm [**BH11**] is visible

behind the cottages but only the upper two pairs of arms can be seen meaning that the convertor station would not be visible from this location or from anywhere else in the asset's setting. There would therefore be no impact on the asset as a result of the operation phase of the GB Onshore Scheme and the effect is assessed to be neutral.

*Grain Village Hall [**BH8**]*

8.175 There would be no impact on the asset during either the construction or operation phases of the GB Onshore Scheme. No element of the site would be visible from the asset or anywhere within its setting. The effect of the construction and operation of the GB Onshore Scheme is assessed to be neutral.

*Former Coastguard Station (Medtha House and Coastguard Cottages) [**BH9**]*

8.176 There would will be no impact on the asset during either the construction or operation phases of the GB Onshore Scheme. No element of the site would be visible from the asset or anywhere within its setting. The effect of the construction and operation of the GB Onshore Scheme is assessed to be neutral.

*Rosecourt Farm [**BH10**]*

Construction

8.177 Given the proximity of the asset to the GB Onshore Scheme, approx. 200 m at its closest point, there would be impact on the asset during the construction phase. The asset is screened from the Site by a strip of scrub on the south side of West Lane. The scrub extends south along the southeast edge of the pond to the south of the road and continues around the southwest side of the pond. This screening is however sparse and construction activity including preparatory works and civil construction works would be visible and audible from the asset and from various locations within the setting of the asset. These changes will be temporary and would not result in a change in our ability to understand and appreciate the asset as a late 19th century farmstead. The impact is assessed to be very low on an asset of low value, resulting in a negligible effect.

Operation

8.178 The asset is located approx. 490 m from the proposed substation (80 m x 80 m x 14 m high) and approx. 570 m from the proposed convertor station (250 m x 250 m x 26 m high). Although there is some screening in place between the asset and the GB Onshore Scheme it is sparse and will not function efficiently as screening during the winter months. Some mitigation in the form of scrub and woodland edge planting is embedded in the scheme design to the north of the proposed attenuation pond but the GB Onshore Scheme would be visible above this when viewed from the asset. The GB Onshore Scheme would also be visible when approaching the asset from the northwest and southeast along West Lane. The asset's setting would change as a result of the GB Onshore Scheme, resulting in some change in our ability to understand and appreciate the asset. This change is assessed to represent a low magnitude of impact on an asset of low heritage value. The effect is assessed to be negligible.

*Perry's Farm and Wilford's Farm [**BH11**]*

Construction

8.179 The asset is located very close to the application boundary of the GB Onshore Scheme and would experience impact from activity during the construction phase including preparatory works and civil construction works. The majority of the asset's setting would experience change as a result of construction activity resulting in a change in our ability to understand and appreciate the asset. This change is assessed to represent a low magnitude of impact on an asset of low heritage value. The effect is assessed to be negligible.

Operation

8.180 The asset is located approx. 40 m from both the proposed substation (80 m x 80 m x 14 m high) and approx. 570 m from the proposed convertor station (250 m x 250 m x 26 m high) at its closest point. The proposed buildings would dominate the asset's setting, bringing the existing industrial landscape very much closer to it than the existing approx. 850 m. All parts of the asset's setting would be changed by the GB Onshore Scheme, resulting in an erosion of our ability to understand

and appreciate the asset. This change is assessed to represent a medium magnitude of impact on an asset of low heritage value. The effect is assessed to be minor adverse.

*Second World War QF P-Series Oil Bombing Decoy [**BH13**]*

Construction

8.181 The asset is located in two areas of protection approximately 1.6 km west-northwest of the application boundary at its nearest point, in a wide bend of Yantlet Creek. At this distance, although construction activity may be apparent from the asset and from locations within its setting it would not change that setting. There would therefore be no impact as a result of construction activity and the effect is assessed as neutral.

Operation

8.182 The GB Onshore Scheme would be visible from the asset and from locations within the asset's setting as a continuation of the existing industrial landscape to the southeast of the asset and southwest of the GB Onshore Scheme. However, the presence of the GB Onshore Scheme in the landscape would not change the asset's setting, the flat floodplain of Yantlet Creek, and would not alter the asset's relationship with the petro-chemical development to the south which is the successor to the oil storage facility the asset was built to protect. There would therefore be no impact on the asset and no loss of significance as a result of the proposed Development. The effect is assessed as neutral.

*Church of All Saints [**BH14**]*

Construction

8.183 At just under 4 km distant to the west, construction activity on the Site would not have any impact on the asset. The effect is assessed as neutral.

Operation

8.184 The GB Onshore Scheme would not be visible from the asset or its immediate context but would be visible in views to the east when entering the village on Stoke Road from the south or on Ratcliffe Highway from the west. In these views the GB Onshore Scheme would be seen as an extension of the existing industrial landscape to the south. The change in setting would be minimal and would not alter appreciation of the asset. This change represents a very low magnitude of impact on an asset of high heritage value and would result in a minor adverse effect.

*Rose and Crown Public House [**BH15**]*

8.185 The asset is located to the west of the Church of All Saints [**BH14**] and the GB Onshore Scheme would not have an impact on it or change its setting during either the construction or operation phases. The effect is assessed as neutral.

Archaeological and Built Heritage Effects during Decommissioning

8.186 The decommissioning of the Development would likely be limited to the removal of existing structures and the reinstatement of land to agricultural use. Impacts to the archaeological resource would likely be limited to the footprints and depths of existing structures within the GB Onshore Scheme, and as such would not result in any additional effects on the archaeological resource.

8.187 Impacts on built heritage assets at decommissioning would be at a similar scale and nature as for construction and would be similarly temporary. Impacts on built heritage assets during refurbishment would be at a smaller scale and would be temporary.

8.188 Following the removal of the structures and the reinstatement of the land to agricultural use, there would be no further potential effects to the historic landscape or built heritage resource.

Mitigation

8.189 Archaeological assessment is unlike most other EIA topics in so far as the presence of an asset is frequently not known with certainty. Unless records are extensive or archaeological investigation has been undertaken as part of the EIA, it remains the function of pre-construction investigation to ascertain whether any detailed mitigation measures may be required.

8.190 Archaeological fieldwork does not reduce the overall effect to an asset. Fieldwork is designed to offset an impact and inform the planning balance. Furthermore, it is not considered as a 'benefit' of the scheme given that the loss of an asset remains. The NPPF is clear on this point, stating that 'the ability to record evidence of our past should not be a factor in deciding whether such loss should be permitted' (paragraph 199).

8.191 The results of the Archaeological DBA (Appendix 8-1) has identified that there is the potential for archaeological remains to survive within the Site. Mitigation measures, in the form of a staged programme of archaeological investigation, recording and dissemination, if deemed appropriate by Kent County Council, could be employed to establish the presence and significance of archaeological remains within the Site.

8.192 Typical appropriate measures that may be employed to achieve preservation by record of any surviving archaeological remains are summarised in Table 8.6 below. An outline programme of initial investigations is detailed below based on the results of the desk-based assessment and impact assessment and in consultation with Kent County Council. It is anticipated that the requirements for archaeological mitigation will be secured by a planning condition post-determination.

Table 8.6: Possible archaeological investigation measures

Mitigation Method	Description
Geoarchaeological Investigation	A programme of sample recovery and analysis undertaken to investigate palaeoenvironmental conditions and soil sediment development that may be relevant to the research of archaeological remains recovered within the vicinity. Achieved through trial pit excavations or other geotechnical soil sample retrieval methods (such as soil cores or boreholes).
Targeted Watching Brief	A programme of observation, investigation and recording of archaeological remains during or alongside construction activities in which the contractor's preferred method of working would be controlled as necessary to allow archaeological recording to take place to the required standard. Targeted watching briefs can be undertaken in specific cases where the presence of potential remains has been demonstrated, but where detailed investigation prior to the main construction programme is unjustified, unfeasible due to safety or logistical considerations, or undesirable due to environmental or engineering constraints.
General Watching Brief	A programme of observation, investigation and recording of archaeological remains during or alongside construction activities in which the contractor's preferred method of working would be controlled as necessary to allow archaeological recording to take place to the required standard.
Strip Map and Sample Investigation	A flexible programme of fieldwork, which is of particular value where the presence of archaeological remains is known but the extent of areas requiring archaeological excavation, is unclear. Topsoil and overburden would be stripped under archaeological control, over a defined area, in order carefully to expose archaeological remains. This work will be undertaken prior to the main construction programme in order to allow sufficient time for archaeological recording. A scope of work appropriate to record any archaeological remains exposed would be agreed on site during consultation with KCC archaeological officer and implemented immediately.
Trial Trench Evaluation	Either targeted or sample-based investigation in which mechanical excavated trenches are excavated in order to establish the presence/absence, location, extent, and character of archaeological deposits or activity foci identified by non-intrusive baseline survey methods. Trial trenching would also inform the need for any further appropriate mitigation strategy. Trial trenching would also be applied to areas where

Mitigation Method	Description
	no significant archaeological remains have been identified to control the risk to the construction programme and the risk for disturbing 'unforeseeable' finds.
Detailed Excavation	Detailed Excavation would be undertaken where significant archaeological remains are either known previously or discovered during the course of the works. This may be targeted at specific area locations such as the sites of archaeological interest identified during the baseline assessment or identified as the result of a programme of trial trench evaluation or watching brief monitoring.

8.193 The first stage of investigation would be archaeological monitoring of any new geotechnical investigations in order to understand the nature of the made ground and magnitude of previous ground disturbance. This would be particularly relevant along the proposed DC cable route to clarify the extent of gravel extraction activities and determine whether there is any potential for undisturbed archaeological deposits to have survived. The result of this monitoring would be used to inform the need for further archaeological evaluation in the form of targeted trial trenching evaluation within the area of impact.

8.194 Archaeological trial trench evaluation would be targeted to investigate areas of proposed ground disturbance resulting from topsoil stripping and areas of intrusive excavation of the underlying surficial deposits. Areas of topsoil stripping would be investigated to determine the presence/ absence and extent of any surviving archaeological remains dating to the Iron Age, Roman, medieval, post-medieval, or modern periods cutting into the underlying superficial deposits, whereas areas of deeper excavation would be investigated to determine the presence/ absence of Palaeolithic material.

8.195 Any appropriate archaeological investigation or mitigation measures would be undertaken in accordance with an Archaeological Project Design and Written Scheme of Investigation (WSI) prepared and approved in advance with Kent County Council and Medway Council. All archaeological investigations will be undertaken by suitably qualified archaeologists who will be monitored as necessary by Kent County Council to ensure compliance with both the agreed project design and professional standards.

Residual Impacts

8.196 Table 8.7 below summarise the residual effects of the GB Onshore Scheme on the cultural heritage resource and any changes resulting from the implementation of the suggested additional mitigation measures.

8.197 Despite a comprehensive assessment of baseline archaeological conditions there remains the potential risk that construction works could reveal as yet unidentified or unexpected archaeological remains within the application site. This possibility is inherent in archaeological investigation and developments which require assessment against the guidance given in the NPPF. Any such remains would likely be revealed during the evaluation work secured by a post-determination planning condition.

Table 8.7: Summary of residual effects

Description of effect	Sensitivity of Receptor (heritage significance/ value)	Nature of Effect and Geographic Scale	Magnitude of Impact	Classification of Effect and Statement of Significance	Mitigation and monitoring	Residual effect
Effects during the construction phase of the converter station and substation						
Removal of remains of Ridge and Furrow [**A70**] and potential associated medieval agricultural remains from topsoil stripping, levelling works, and excavation of attenuation ponds.	Low	Permanent Local Negative	high	Moderate adverse	Programme of archaeological recording	Moderate adverse
Truncation of potential post-medieval field systems or farmstead remains from topsoil stripping, levelling works, and excavation of attenuation ponds.	Negligible	Permanent Local Negative	high	Minor adverse	Programme of archaeological recording	Minor adverse
Removal of potential post-medieval field systems or farmstead remains from topsoil stripping, levelling works and excavation of attenuation ponds.	Negligible	Permanent Local Negative	High	Minor adverse	Programme of archaeological recording	Minor adverse
Removal of potential Palaeolithic remains within gravel terrace deposits from levelling works.	High	Permanent Local Negative	High	Major adverse	Programme of archaeological recording	Major adverse
Rosecourt Farm [**BH10**]	Low	Temporary Local Negative	Very Low	Negligible	Additional mitigation is not required	Negligible
Perry's Farm and Wilford's Farm [**BH11**]	Low	Temporary Local Negative	Low	Negligible	Additional mitigation is not required	Negligible
Loss of 19th century landscape of straight field boundaries as a result of the construction of the converter and substation.	Low	Permanent Local Negative	Medium	Minor adverse	Embedded in scheme	Minor adverse

Description of effect	Sensitivity of Receptor (heritage significance/ value)	Nature of Effect and Geographic Scale	Magnitude of Impact	Classification of Effect and Statement of Significance	Mitigation and monitoring	Residual effect
Effects during the construction phase of the DC cable						
Truncation of remains of Site of White Hall Farm **[A47]** from topsoil stripping and DC cable route's open-cut trench.	Low	Permanent Local Negative	Low	Negligible	Programme of archaeological recording	Negligible
Truncation of remains of Site of White Hall Farm **[A47]** from excavations to place concrete pads at cable joints.	Low	Permanent Local Negative	Medium	Minor adverse	Programme of archaeological recording	Minor adverse
Truncation of remains of the Second World War Camp west of White Hall Farm [**A91**] from topsoil stripping and DC cable route's open-cut trench.	Medium	Permanent Local Negative	Low	Negligible	Programme of archaeological recording	Negligible
Truncation of remains of the Second World War Camp west of White Hall Farm [**A91**] from excavations to place concrete pads at cable joints.	Medium	Permanent Local Negative	Medium	Moderate adverse	Programme of archaeological recording	Moderate adverse
Truncation of remains of the 20th Century Outfarm South of White Hall Farm [**A132**] from topsoil stripping and DC cable route's open-cut trench.	Negligible	Permanent Local Negative	Low	Negligible	No mitigation required	Negligible
Localised truncation or removal of remains of the 20th Century Outfarm South of White Hall Farm [**A132**] from excavations to place concrete pads at cable joints.	Negligible	Permanent Local Negative	Medium	Negligible	No mitigation required	Negligible
Truncation of potential Palaeolithic remains from DC cable route's open cut trench.	High	Permanent Local Negative	Low	Moderate adverse	Programme of archaeological recording	Moderate adverse
Localised truncation or removal of potential Palaeolithic remains from	High	Permanent Local	Medium	Major adverse	Programme of archaeological recording	Major adverse

Description of effect	Sensitivity of Receptor (heritage significance/ value)	Nature of Effect and Geographic Scale	Magnitude of Impact	Classification of Effect and Statement of Significance	Mitigation and monitoring	Residual effect
excavations to place concrete pads at cable joints.		Negative				
Truncation of potential Iron Age settlement remains from topsoil stripping and DC cable route's open-cut trench.	High	Permanent Local Negative	Low	Moderate adverse	Programme of archaeological recording	Moderate adverse
Localised truncation or removal of potential Iron Age settlement remains from excavations to place concrete pads at cable joints.	High	Permanent Local Negative	Medium	Major adverse	Programme of archaeological recording	Major adverse
Truncation of potential Roman settlement and/or -funerary remains from topsoil stripping and DC cable route's open-cut trench.	Medium	Permanent Local Negative	Low	Minor adverse	Programme of archaeological recording	Minor adverse
Localised truncation or removal of potential Roman settlement and/or -funerary remains from excavations to place concrete pads at cable joints.	Medium	Permanent Local Negative	Medium	Moderate adverse	Programme of archaeological recording	Moderate adverse
Removal of potential post-medieval field systems or farmstead remains from topsoil stripping, DC cable route's open-cut trench, and concrete pads at cable joints.	Negligible	Permanent Local Negative	High	Minor adverse	Programme of archaeological recording	Minor Adverse
Removal of potential post-medieval military remains from topsoil stripping, DC cable route's open-cut trench, and concrete pads at cable joints.	Medium	Permanent Local Negative	High	Moderate adverse	Programme of archaeological recording	Moderate adverse
Removal of potential modern field systems or farmstead remains from topsoil stripping, DC cable route's open-cut trench, and concrete pads at cable joints.	Negligible	Permanent Local Negative	High	Minor adverse	Programme of archaeological recording	Minor adverse

Description of effect	Sensitivity of Receptor (heritage significance/ value)	Nature of Effect and Geographic Scale	Magnitude of Impact	Classification of Effect and Statement of Significance	Mitigation and monitoring	Residual effect
Removal of potential modern military remains from topsoil stripping, DC cable route's open-cut trench, and concrete pads at cable joints.	Medium	Permanent Local Negative	High	Major adverse	Programme of archaeological recording	Major adverse
World War II Anti-Tank Obstacles on the Foreshore [**BH1**]	Medium	Temporary Local	Medium	Minor adverse	Embedded in scheme	Minor adverse
Effects during the operational phase of the GB Onshore Scheme						
White House Farm [**BH4**]	Medium	Permanent Local Negative	Low	Minor adverse	Embedded in scheme	Minor adverse
Rosecourt Farm [**BH10**]	Low	Permanent Local Negative	Low	Negligible	Embedded in scheme	Negligible
Church of All Saints [**BH14**]	High	Permanent Local Negative	Very Low	Minor adverse	Embedded in scheme	Minor adverse

Cumulative Impacts

8.198 The wider archaeological resource of the Study Area comprises buried archaeological remains which have accumulated as a result of human activity since the prehistoric period and industrial and military development of the area since the late 19th century.

8.199 It is reasonably assumed that the determination of planning approval for each cumulative development will have been made in accordance with national, regional and local planning policy and guidance, within which archaeological assets would be a material consideration and would have included the provision of appropriate archaeological mitigation measures, including the requirement for investigation and recording.

8.200 The erection of the OHL north of the substation and the installation of the cable below MLWS have the potential to impact on archaeological assets that extend beneath both the GB Onshore Scheme and the respective developments. However, each scheme will be addressed separately and will therefore be subject to planning conditions that require archaeological investigation and recording. Nevertheless, the GB Onshore Scheme has been assessed as resulting in major adverse effects on potential archaeological resources of medium to high significance in both areas. As such, the additional impact of these schemes would not result in an increase in the effect for the GB Onshore Scheme, and as such the mitigation strategy remains suitable.

8.201 With regard to built heritage it is considered that the remaining four short listed development schemes are sufficiently distant from the Site so that any impact caused by them will not have a cumulative effect over and above the impacts caused by the propose development.

8.202 As a result, the likely cumulative effects of other development schemes in conjunction with the GB Onshore Scheme are considered to be negligible.

Summary of Assessment

8.203 The GB Onshore Scheme would not affect any World Heritage Sites, Registered Battlefields, Registered Parks and Gardens or Scheduled Monuments. It will cause change to the settings of two Listed Buildings, and two non-designated built heritage assets. Furthermore, the GB Onshore Scheme would directly impact on five non-designated archaeological assets located within Site, and may impact on potential archaeological remains dating to the Palaeolithic, Iron Age, Roman, medieval, post-medieval, and modern periods.

8.204 The construction phase of the GB Onshore Scheme would have a temporary Minor adverse effect on the grade II listed World War II Anti-Tank Obstacles on the foreshore [**BH1**]. The operational phase of the GB Onshore Scheme would have a Minor adverse effect on the Church of All Saints, Allhallows [**BH14**]. Convention and professional judgement dictate that neither effect is significant.

8.205 The construction and operational phases of the GB Onshore Scheme would have Negligible to Minor adverse effects on the non-designated built heritage assets of Rosecourt Farm [**BH10**] and Perry's Farm and Wilford's Farm [**BH11**]. Convention and professional judgement dictate that these effects are not significant.

8.206 Five archaeological assets have been identified within the Site consisting of the remains of the post-medieval White Hall Farm [**A47**], the remains of medieval ridge and furrow [**A70**], the remains of a Second World War camp [**A91**], and the remains of the a modern outfarm south of White Hall Farm [**A132**]. The fifth asset consists of a dipole anomaly of possible anthropogenic origin [**7134**] which is assessed in the GB Offshore Scheme ES Chapter 16. It has also been determined that the Site holds a potential to contain Palaeolithic, Iron Age, Roman, medieval, post-medieval and modern remains ranging in value from negligible to high.

8.207 It has been established that the GB Onshore Scheme would result in the truncation and/ or removal of archaeological assets, resulting in, at most, a permanent major adverse effect to the archaeological resource. It has been recommended that a staged program of archaeological investigations is undertaken to identify the extent and further assess the significance of known and potential archaeological remains within the Site and that a programme of excavation and recording of archaeological remains commensurate with their significance be carried out to mitigate the impacts of the GB Onshore Scheme.

References

Ref 8-1.MHCLG 2019 Revised National Planning Policy Framework (NPPF). Section 16: Conserving and enhancing the historic environment. Ministry of Housing, Communities and Local Government. https://www.gov.uk/government/publications/national-planning-policy-framework--2

Ref 8-2.The Ancient Monuments and Archaeological Areas Act 1979 and subsequent amendments http://www.legislation.gov.uk/ukpga/1979/46/pdfs/ukpga_19790046_en.pdf

Ref 8-3.Planning (Listed Buildings and Conservation Areas) Act 1990. The Stationery Office, London http://www.legislation.gov.uk/ukpga/1990/9/contents

Ref 8-4.MHCLG 2019 National Planning Policy Framework (NPPF) Planning Practice Guidance (PPG). Conserving and enhancing the historic environment. Ministry of Housing, Communities and Local Government. https://www.gov.uk/guidance/conserving-and-enhancing-the-historic-environment

Ref 8-5.EH 2015 Historic Environment Good Practice Advice in Planning Note 2. Managing Significance in Decision Taking in the Historic Environment. English Heritage, Swindon http://historicengland.org.uk/images-books/publications/gpa2-managing-significance-in-decision-taking/

Ref 8-6.HE 2017 Historic Environment Good Practice Advice in Planning Note 3. 2nd edition. The Setting of Heritage Assets. English Heritage, Swindon http://historicengland.org.uk/images-books/publications/gpa3-setting-of-heritage-assets/

Ref 8-7.Medway Council (2003). Medway Local Plan

9. Water Resources & Flood Risk

Introduction

9.1 This Chapter describes the existing water environment and identifies and assesses the potential effects of the GB Onshore Scheme on water resources and flood risk. It identifies the likely impact risks and describes the mitigation measures and/ or best practice measures that will be incorporated into the construction and operational phases of the GB Onshore Scheme to avoid, reduce or offset potential adverse effects, or enhance potential beneficial effects. Following this, residual effects will then be assessed, and any necessary mitigation for these effects identified.

9.2 The potential impacts considered in this Chapter include those on hydrology and surface water resources that form part of the onshore environment to mean low water (MLW). Impacts on hydrogeology and groundwater are considered in Chapter 11: Ground Conditions. Impacts on receptors within the coastal and offshore waters are assessed within the GB Offshore Scheme Environmental Appraisal.

Approach to Assessment

Overview

9.3 Hydrology has been assessed in terms of natural drainage patterns, base flows and volumes, runoff rates, geomorphology and water quality. Potential effects resulting from the GB Onshore Scheme on water resources and flood risk both during construction and operation have been assessed having regard to the mitigation measures already integrated into the design.

9.4 In accordance with the NPPF (Ref 9.1) a Flood Risk Assessment (FRA) has been undertaken which establishes the risk of flooding to and from the GB Onshore Scheme and proposes suitable mitigation where required to avoid or reduce the risk to a more acceptable level. The FRA is included in Appendix 9A and is supported by the outline surface water Drainage Strategy included in Appendix 9B. Conclusions from the FRA and Drainage Strategy are summarised in this Chapter.

Consultation

9.5 Two key stakeholders were consulted during the preparation of this Chapter and the supporting FRA (Appendix 9A) and Drainage Strategy (Appendix 9B).

9.6 North Kent Marshes Internal Drainage Board (IDB) which is managed by Medway Council in their role as Lead Local Flood Authority (LLFA) was consulted on the approach for surface water management for the site. The IDB advised that sustainable drainage systems (SuDS) should be incorporated and should be designed in accordance with SuDS Management Train principles. This advice has been applied in the development of the Drainage Strategy (Appendix 9B).

9.7 The Environment Agency was consulted to obtain flood risk information and modelling datasets of relevance to the Project Area (shown in Figure 9.1). The Environment Agency were contacted to obtain agreement regarding the parameters for future site planning and design in this location. This information was used to determine the finished floor levels for the proposed converter station and substation, and the levels for a suitable place of safe refuge for occupants of the site, which are further described in the FRA (Appendix 9A).

Data and Information

9.8 The following sources of information that define the GB Onshore Scheme have been reviewed and form the basis of the assessment of likely significant effects on water resources and flood risk:

- LiDAR topographic survey of existing Project Area (Environment Agency);
- GB Onshore Scheme layout plan drawings (Chapter 3);
- AECOM Outline Surface Water Drainage Strategy (Appendix 9B); and
- GB Onshore Scheme operation and construction description (Chapter 3).

9.9 Water environment and flood risk baseline conditions have been established through a desk based review of data and correspondence with the Environment Agency and LLFA. Data has been collected from the following sources:

- Envirocheck Report (Ref 9.2);
- AECOM Flood Risk Assessment Report (Appendix 9A);
- AECOM Outline Surface Water Drainage Strategy (Appendix 9B);
- Environment Agency online flood risk mapping (Ref 9.3);
- Environment Agency ‘Product 4’ data request including outputs from the Kent Coastal Modelling Study (2015) (Ref 9.4);
- Medway Council Strategic Flood Risk Assessment (Ref 9.5); and,
- Medway Council Local Flood Risk Management Strategy (Ref 9.6).

9.10 Analysis of receptors was based on the source-pathway-receptor mode whereby a potential pathway for an impact sources to reach a receptor was analysed. Where a pathway to a receptor was identified, this receptor has been included in this Chapter, regardless of the distance from the Project Area boundary.

Assessment Method

Introduction

9.11 Tables 9.1, 9.2 and 9.3 provide details of the criteria that have been used within the assessment methodology to define the importance of a receptor or attribute, the magnitude of potential impacts, and the classification of significance of potential effects. These are based on the Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 (Ref 9.7).

Importance of Receptors

9.12 The importance of receptors is identified from a review of Project Area and land uses within the surrounding area with respect to the vulnerability classifications as set out in the Planning Policy Guidance (PPG) (Ref 9.8). With respect to flood defence and flood storage features, the value of the receptor is based on the scale and type of development that is being protected.

Table 9.1 Importance of receptor/attribute

Value	Criteria	Examples
Very High	Attribute with a high quality and rarity, regional or national scale.	Watercourse having a Water Framework Directive (WFD) classification as shown in a River Basin Management Plan (RBMP) and Q95 ≥ 1.0 m^3/s; development defined within the PPG as Essential Infrastructure or Highly Vulnerable; Floodplain or defence protecting more than 100 residential properties from flooding
High	Attribute with a high quality and rarity, local scale.	Watercourse having a WFD classification as shown in a RBMP, and Q95 < 1.0m^3/s; development defined within the PPG as More Vulnerable; Water Resource Zone (WRZ) at serious stress; Floodplain or defence protecting between 1 and 100 residential properties from flooding.
Medium	Attribute with a medium quality and rarity, local scale.	Watercourse detailed in the Digital River Network[3] (DRN) but not having a WFD classification as shown in a RBMP; development defined within the PPG as Less Vulnerable; WRZ at moderate stress; Floodplain or defence protecting 10 or fewer industrial properties from flooding.
Low	Attribute with a low quality and rarity, local scale.	Surface water sewer, agricultural drainage ditch; development defined within the PPG as Water Compatible; WRZ at low stress; Floodplain with limited constraints and a low probability of flooding of residential and industrial properties.

Magnitude of Impacts

9.13 The magnitude of the potential impacts is estimated based on the likely effects and is independent of the importance of the feature. Table 2 provides examples of the potential impacts; it is intended to provide a guide rather than an exhaustive list.

[3] The Detailed River Network (DRN) is the only large-scale, accurate and fully attributed digital river centreline covering England and Wales. The DRN is captured from the water features theme of the OS MasterMap topographic layer and built into a network using automated rules. Other input datasets and extensive local Environment Agency staff knowledge has been used to augment the core geometry to incorporate critical spatial detail and attribution, such as flow direction and path, not available from the OS mapping and to verify the accuracy of the centreline itself.

Table 9.2 Magnitude of potential impacts

Magnitude	Criteria	Examples
Major Adverse	Results in loss of a feature.	Major loss of flood storage; increase in peak flood levels (>200 mm); major increase in surface water flood risk; decrease in surface water ecological or chemical WFD status.
Moderate Adverse	Results in adverse impact on integrity of feature or loss of part of feature.	Moderate loss of flood storage; increase in peak flood levels (>100 mm); moderate increase in surface water flood risk; measurable decrease in surface water ecological or chemical quality, or flow, such that existing users are affected, but not changing any WFD status.
Minor Adverse	Results in minor adverse impact of feature.	Minor loss of flood storage; increase in peak flood levels (>100 mm); minor increase in surface water flood risk; measurable decrease in surface water ecological or chemical quality, or flow, not affecting existing users or changing any WFD status.
Negligible	Results in an impact on feature but of insufficient magnitude to affect the use/integrity.	No change to flood storage, no increase in peak flood levels or surface water flood risk. Discharge to watercourse which does not lead to a change in the attribute's integrity.
Minor Beneficial	Results in minor beneficial impact on feature or a reduced risk of adverse effect occurring.	Measurable changes in feature, but of limited size and/or proportion; measurable increase in surface water ecological or chemical quality, or flow, not affecting existing users or changing any WFD status.
Moderate Beneficial	Results in moderate improvement of feature.	Moderate creation of flood storage; decrease in peak flood levels (>100 mm); moderate reduction in surface water flood risk; measurable increase in surface water ecological or chemical quality, or flow, such that existing users are affected, but not changing any WFD status.
Major Beneficial	Results in major improvement in feature.	Major creation of flood storage; decrease in peak flood levels (>200 mm); major reduction in surface water flood risk; increase in surface water ecological or chemical WFD status.

Significance of Potential Effects

9.14 The appraisal of the importance of the receptors (Table 9.1) is then combined with the appraisal of the magnitude of the potential impacts (Table 9.2) to establish the significance of these impacts, as detailed in Table 9.3. Both the DMRB and Environmental Statement terminology has been included.

9.15 Where a potential impact has a significance of Major or Moderate, this is considered Significant, and measures have been identified to mitigate the effect.

Table 9.3 Classification of significance of potential effects

Magnitude of potential effects	Important / sensitivity of receptor			
	Very High	High	Medium	Low
Major	Very Highly Significant (DRMB) Major (ES)	Highly Significant (DRMB) Major (ES)	Significant (DRMB) Major (ES)	Low Significance (DRMB) Moderate (ES)
Moderate	Highly Significant (DMRB) Major (ES)	Significant (DRMB) Moderate (ES)	Low Significance (DRMB) Moderate (ES)	Insignificant (DRMB) Minor (ES)

Magnitude of potential effects	Important / sensitivity of receptor			
	Very High	High	Medium	Low
Minor	Significant (DRMB) Moderate (ES)	Low Significance (DRMB) Moderate (ES)	Insignificant (DRMB) Minor (ES)	Insignificant (DRMB) Negligible (ES)
Negligible	Low Significance (DRMB) Moderate (ES)	Insignificant (DRMB) Minor (ES)	Insignificant (DRMB) Negligible (ES)	Insignificant (DRMB) Negligible (ES)

Planning Policy & Applicable Legislation

European Legislation

9.16 The European Union (EU) Water Framework Directive (WFD) (2000/60/EC) (Ref 9.9) is the primary European Directive setting the context for the requirements of this Chapter. The purpose of the Directive is to establish a framework for the protection and improvement of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater.

9.17 The Directive requires the UK to classify the current condition of key waterbodies (giving a 'Status' or 'Potential') and set objectives to either maintain the condition or improve it where a waterbody is failing minimum targets. Any activities or developments that could cause deterioration within a nearby waterbody or prevent the future ability of a waterbody to reach its target Status, must be mitigated so as to reduce the potential for harm and allow the aims of the WFD to be realised.

9.18 A water body is assessed for ecological status and chemical status as part of the WFD. The methodology for determining status has been set out by the United Kingdom Technical Advisory Group (UKTAG) on the WFD (Ref 9.10). The Environment Agency is responsible for monitoring and ensuring that the targets are met. Water bodies are classed as either: high, good, moderate, poor or bad status.

National Legislation

9.19 The Water Resources Act 1991 as amended (Ref 9.11) is the key element of national legislation setting out requirements specific to this Chapter, as it sets out the relevant regulatory controls that provide protection to waterbodies and water resources (from abstraction pressures and pollution), as well as drainage and flood risk management related to main rivers.

9.20 Other relevant national legislation setting out requirements related to control and protection of water resources and provision of flood risk management includes:

- The Water Act 2003 (Ref 9.12) and 2014 (Ref 9.13) governing the control of water abstraction, discharge to water bodies, water impoundment, conservation and drought provision.
- The Environment Act 1995 (Ref 9.14), which established the Environment Agency and its statutory role in water resource protection and flood risk management;
- The Environmental Protection Act 1990 (Ref 9.15), which provides for integrated pollution control;
- The Land Drainage Act (1991) (Ref 9.16), which provides for drainage and flood risk management related to non-main rivers; and,
- The Flood and Water Management Act 2010 (Ref 9.17), which introduces requirements for managing 'local' sources of flood risk such as groundwater and surface water flooding and introduces statutory roles for some tiers of local authority in managing local flood risk.

9.21 A number of specific regulations have been made to implement European legislation into national law and to implement details and practical measures into law under primary legislation. These regulations include:

- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (Ref 9.18). The Regulations are key to the assessment within this Chapter as they set the WFD environment quality standards that need to be met and maintained in UK waterbodies;
- The Anti-Pollution Works Regulations 1999 (Ref 9.19);
- The Control of Pollution (Oil Storage) (England) Regulations 2001 (Ref 9.20);
- The Groundwater Regulations (England and Wales) (2009) (Ref 9.21) which transposed the EU Groundwater Directive 2006 (2006/118/EC) (Ref 9.22) into UK law;
- The Environmental Damage Regulations 2009 (Ref 9.23);

- The Water Resources Act (Amendment) (England and Wales) Regulations 2009 (Ref 9.24),
- The Environmental Permitting (England and Wales) Regulations 2010 (Ref 9.25) which control discharge of water to surface water and groundwater; and,
- Water Supply (Water Quality) Regulations 2010 (Ref 9.26).

National Planning Policy

National Planning Policy Framework

9.22 The National Planning Policy Framework (NPPF) (Ref 9.1) and associated Planning Policy Guidance (PPG) (Ref 9.8) set out the national planning policy and guidance with respect to flood risk. Paragraph 103 of the NPPF requires local planning authorities to ensure when determining planning applications:

9.23 "that flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

- *within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and*
- *development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems".*

9.24 The government published a ministerial statement (HCWS161) on sustainable drainage systems on 18th December 2014 (Ref 9.27) whereby decisions on planning applications relating to major development must ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate. The ministerial statement is currently referenced by Defra as Sustainable Drainage Systems Policy to be used in conjunction with the NPPF.

9.25 The PPG also contains guidance in relation to water supply, wastewater and water quality and provides advice and information on how planning can and should protect water quality and ensure the delivery of adequate water and wastewater infrastructure for new development.

Local Planning Policy & Guidance

Local Plan 'Future Medway' 2018-2037

9.26 Medway Council are currently working on a new Local Plan, Future Medway, which will cover the period up to 2037.

9.27 As part of the preparations of the new Local Plan the Council prepared a Development Strategy technical report along with the Medway 2035 document (Ref 9.28). The report set out the ambitions for the plan, options for how Medway could grow and draft policies for managing development, building on work carried out at previous stages of consultation on Medway's emerging Local Plan. These are described further below.

Consultation Development Strategy: Policy NE7: Flood and Water Management

9.28 The Local Plan will seek to reduce flood risk, promote water efficiency measures, and protect and enhance water quality through the following mechanisms:

Flood Risk Management

- Ensuring that development has a positive or nil impact on flood risk management interests
- Development that would harm the effectiveness of existing flood defences or prejudice their maintenance or management will not be permitted.
- Where development benefits from an existing or proposed flood infrastructure, the development should contribute towards the capital costs and/ or maintenance of these defences over the lifetime of the development.

Sustainable Urban Drainage

- Development should enable or replicate natural ground and surface water flows and decreased surface water runoff, via the use of Sustainable urban Drainage systems (SUDS), utilising green infrastructure where possible and as guided by relevant national (and/ or local standards) and guidance.
- Where SuDS are provided, arrangements must be put in place for their management and maintenance over their full lifetime.

Water Supply

- Development within groundwater Source Protection Zones[4] (SPZ) and principal aquifers will only be permitted provided that it has no adverse impact on the quality of the groundwater resource, and it does not put at risk the ability to maintain a public water supply.

Water Quality

- All new development should have regard to the actions and objectives of appropriate River Basin Management Plans (in Medway, this is the Thames River Basin District) in striving to protect and improve the quality of water bodies in and adjacent to the district, as well as ecology, geomorphology, and water quantity. Developers shall undertake thorough risk assessments of the impact of proposals on surface and groundwater systems and incorporate appropriate mitigation measures where necessary.

Adaptation to Climate Change

- Development will be required to be designed to be resilient to, and adapt to the future impacts of, climate change through the inclusion of adaptation measures. These include:
  - Incorporating water efficiency measures, such as the use of grey water and rainwater recycling, low water-use sanitary equipment.
  - Minimising vulnerability to flood risk by locating development in areas of low flood risk and including mitigation measures including SuDS in accordance with (SuDS policy above).
  - Optimising the use of multi-functional green infrastructure, including tree planting for urban cooling, local flood risk management and shading.
  - Seeking opportunities to make space for water and develop new blue infrastructure to accommodate climate change.
  - Where possible watercourses and wetland features will be adequately buffered from development commensurate with the designation and/or ecological value of those features so that they can be safeguarded and managed sustainably in perpetuity.
  - Provision for buffering, mitigating and extending habitats and green corridors to ensure that wildlife populations are more resilient for a changing climate.

Local Flood Risk Management Strategy for Medway

9.29 As the Lead Local Flood Authority (LLFA) Medway Council has developed the Local Flood Risk Management Strategy (LFRMS) (Ref 9.6) to increase the understanding of local flood risk posed to the area and take the lead in effectively implementing measures to manage the risk where appropriate. The following objectives from the LFRMS are of relevance to the proposed Scheme;

- 2b: Medway Council will promote the use of SuDS:
- 2c: Medway Council will take account of the cumulative effect of developments and climate change on the risk of flooding throughout Medway; and,
- 2d: Medway Council will seek to ensure that development has a positive or nil effect on the risk of flooding to and arising from proposed development.

[4] Defined by the Environment Agency for groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk.

Thames Estuary 2100

9.30 The Thames Estuary 2100 Plan (Ref 9.29) is a long-term strategy for managing tidal flood risk in the Thames Estuary. The Plan divides the Estuary into policy units and sets out the policy for managing tidal flood risk in that area. The Isle of Grain forms one of the policy units within the Thames Estuary 2100 Plan. The selected policy for the Isle of Grain policy unit is P4: "*to maintain and improve the level of flood defences to keep up with climate change*".

9.31 The Plan states:

> *"The Isle of Grain forms one of the policy units within the Thames Estuary 2100 Plan. The Isle of Grain policy unit has two distinct parts: an area of freshwater marshes to the west (Allhallows and Grain Marshes) and an industrial area to the south and east. The village of Grain lies on higher ground at the north-eastern extremity of the policy unit.*
>
> *Large parts of the grazing marshes are designated (as a SPA), and the area also provides an open rural landscape. The adjacent intertidal areas to the north and south west of this policy unit are also designated (as a SPA). No new development should therefore be permitted in these areas. However, the marshes themselves do not justify the current level of tidal flood protection along the Thames and Yantlet Creek and this must be examined as part of the implementation of the TE2100 Plan – possibly as part of the TE2100 habitat creation strategy.*
>
> *The eastern part of the policy unit will continue to be developed for industry and commerce in the foreseeable future. This is an important industrial and port area with large installations, and flood risk management must continue to be provided, keeping pace with climate change."*

Other Relevant Standards and Guidance

Environment Agency Pollution Prevention Guidance Notes

9.32 The Environment Agency PPG Notes provide advice on statutory responsibilities and good environmental practice. The PPGs were withdrawn in December 2015 as the Environment Agency is no longer a provider of 'good practice' guidance. However, they are still relevant and a useful reference. The guidance notes of relevance to the Proposed Development include:

- PPG 1: General Guide to the Prevention of Pollution (Ref 9.30);
- PPG 2: Above Ground Oil Storage Tanks (Ref 9.31) which provides guidance to those responsible for the storage of oil on construction sites;
- PPG 3: Use and Design of Oil Separators in Surface Water Drainage Systems (Ref 9.32);
- PPG 5: Works and maintenance in or near water (Ref 9.33);
- PPG 6: Working at Construction or Demolition Sites (Ref 9.34) is a document that mirrors much of PPG 5 but with emphasis on the situations likely to occur at demolition and construction Sites;
- PPG 7: Refuelling Activities (Ref 9.35), which provides information on the correct delivery, storage and dispensing of fuel to help reduce the risk of pollution; and,
- PPG 21: Pollution Incident Response Planning (Ref 9.36) assists those developing Site-specific pollution incident response plans to prevent and mitigate damage to the environment caused by accidents such as spillages and fires.

Construction Industry Research and Information Association (CIRIA) Guidance

9.33 The CIRIA guidance of relevance to the Proposed Development includes:

- Guidance C532 – Control of Water Pollution from Construction Sites (Ref 9.37) brings together the Environment Agency guidance but goes into greater detail regarding sources of water on construction sites, pollutants and pathways. In addition, it provides guidance on planning for the type and location of suitable control measures; and
- Guidance C753 – The SuDS Manual (Ref 9.38) provides best practice guidance on the planning, design, construction, operation and maintenance of SuDS to facilitate their best effective implementation within developments.

Baseline Conditions

Water Resources

Surface Water Features

9.34 There are several land drains and unnamed ponds within the Project Area, and a number of tidal creeks, ponds and ordinary watercourse to the west of the site within the Grain Marsh, including the Hamshill Fleet (ordinary watercourse) and Millmarsh Fleet (Main River). These waterbodies are identified in Table 9.4 and 9.5.

9.35 These waterbodies are within the Medway Lower operational area. The Environment Agency Catchment Data Explorer[5] identifies that none of these waterbodies have a designated WFD status. The Grain Marsh is a designated Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and RAMSAR site.

9.36 The importance of these receptors is identified in Tables 9.4 and 9.5.

Table 9.4 Waterbodies within Project Area

Name	Classification	Importance of receptor*	Location
Unnamed pond	Pond	Low	TQ 87885 76850
Unnamed pond	Pond	Low	TQ 88292 77283
Unnamed pond	Pond	Low	TQ 87956 76465
Unnamed drain	Drain (appears to be land drain on OS mapping)	Low	TQ 87670 76245
Unnamed drain	Drain (appears to be land drain on OS mapping)	Low	TQ 88330 76935
Unnamed drain	Drain (appears to be land drain on OS mapping)	Low	TQ 88171 77003
Unnamed pond	Pond	Low	TQ 88511 77123
Unnamed watercourse system	Drain (appears to be land drain on OS mapping)	Low	TQ 88701 76933
Unnamed pond	Pond	Low	TQ 88606 76854

Table 9.5 Waterbodies close to the Project Area

Name	Classification	Importance of receptor*	Location
Thames Estuary	Tidal estuary	High	TQ 89353 78730
Hamshill Fleet	Ordinary Watercourse	Medium	TQ 87365 76998
Millmarsh Fleet	Main River	Medium	TQ 86937 76745
Unnamed tidal creeks (Grain Marsh)	Tidal Creeks	Medium	TQ 87622 77067
Unnamed tidal marsh/ ditches		Low	TQ 87557 76657
Unnamed pond	Pond	Low	TQ 87885 76850
Unnamed pond	Pond	Low	TQ 88292 77283
Unnamed pond	Pond	Low	TQ 87856 76110

* as defined in Table 9.1.

[5] The Catchment Data Explorer helps explore and download information about the water environment. It supports and builds upon the data in the river basin management plans. http://environment.data.gov.uk/catchment-planning/

Water Supply Source

9.37 The Project Area is located within Southern Water's Kent Medway WRZ. Within this WRZ 75% of the water supply comes from groundwater and 25% from rivers. Medway is an area of serious water stress as identified by the Environment Agency (Ref 9.39). In accordance with the criteria in Table 9.1. the water resources used to supply the Kent Medway WRZ are of **High** importance.

Flood Risk

Tidal Flooding

9.38 The Environment Agency's Flood Map for Planning (Rivers and Sea) (Figure 9.1) (Ref 9.3) shows that the western fringe of the Project Area is located within Flood Zone 3. Flood Zone 3 is defined as land assessed as having a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. This area is shown to benefit from flood defences, which are located along the frontage of the Thames Estuary. The risk of tidal flooding to this part of the Project Area is therefore **residual**, in the event of a breach or failure of these flood defences.

9.39 The majority of the Project Area, and the settlement of Grain itself, are located at a slightly higher elevation (7-12 m Above Ordnance Datum (AOD)) and are therefore within an area defined as Flood Zone 1 Low Probability of tidal flooding (less than 1 in 1000 annual probability, or 0.1% AEP).

Fluvial Flooding

9.40 The closest watercourses to the Project Area are the network of ditches adjacent to the south western edge of the Project Area which connect to the Hamshill Fleet, located approximately 0.5 km to the west of the Project Area. The LiDAR topographic survey identified that the Project Area is located above 3m AOD, and the marshland is below 2 m AOD. The risk of flooding from this watercourse is therefore considered to be **Low**.

Surface Water Flooding

9.41 The Environment Agency mapping 'Risk of Flooding from Surface Water' (Ref 9.3) identifies the main risks of surface water flooding close to the Project Area are associated with the drainage ditches in the lower lying areas to the west of the Project Area. The higher elevation of the Project Area itself means that it is not at risk of surface water flows from adjacent land. The risk of surface water flooding is therefore **Low**.

Groundwater Flooding

9.42 The Project Area is situated on superficial deposits of sand and gravel, which are classified as a 'Secondary A' aquifer. The bedrock is the London Clay Formation, which is typically impermeable and has no aquifer classification/ designation. Therefore, there is a significant risk of the groundwater level being close to the ground level in this area. Further ground investigation work will be required to determine more accurately the risk to the Project Area. The risk of groundwater flooding to the site is **Medium** prior to further investigation.

Sewer Flooding

9.43 No details regarding the sewer network local to the site have been provided. The risk of flooding on the site associated with surcharging sewers is therefore unknown.

Reservoir Flooding

9.44 The Environment Agency Flood Risk from Reservoirs mapping does not identify the Project Area to be at risk of flooding in the event of uncontrolled release of water associated with the failure of a reservoir. The risk is **Negligible**.

Flood Risk Receptor Value

9.45 The importance of receptors in the context of flood risk relates to the NPPF vulnerability classification for land uses potentially affected by changes in flood risk as a result of the GB Onshore Scheme. Potential receptors can therefore be the future users of the GB Onshore Scheme itself, as well as users or occupiers of land outside of the Project Area that could be affected by changes to flood risk resulting from the GB Onshore Scheme. The receptor importance is therefore defined independently of the sources of flood risk.

9.46 The GB Onshore Scheme includes a converter station and substation which are classified as 'Essential Infrastructure' in accordance with the NPPF (Ref 9.1) and PPG (Ref 9.8). The GB

Onshore Scheme is therefore defined as of **Very High** importance, in accordance with Table 1. However, it should be noted that much of the Project Area will be open land and therefore the vulnerability should not be considered uniform throughout the whole area.

9.47 The FRA for the GB Onshore Scheme identifies that the GB Onshore Scheme has the potential to influence surface water flow paths across the site, and discharge to the network of watercourses to the west of the Project Area. The importance of these receptors is defined as **Medium** and **Low,** as detailed in Tables 9.3 and 9.4.

Future Baseline

9.48 This section considers changes to the baseline conditions, described above, which might occur during the time period over which the GB Onshore Scheme will be in place. It considers changes that might occur in the absence of the GB Onshore Scheme being constructed.

9.49 Climate change over the coming decades is anticipated to result in hotter drier summers, milder wetter winters, rising sea levels and more extreme weather events including heavy rainfall events. This change in climate is anticipated to increase the likelihood of flooding.

9.50 The selected policy for the Isle of Grain under the Thames Estuary 2100 Plan (Ref 9.29) is Policy P4, whereby it is planned to maintain and improve the level of flood defences around the Isle of Grain to keep up with the anticipated changes in tidal flood levels that arise from the impact of climate change. The risk of tidal flooding to the area is therefore anticipated to remain a residual risk, in the event of a failure or breach of these flood defences.

9.51 The risk of surface water flooding is likely to increase in the future as a result of more extreme rainfall events.

Potential Impacts

Introduction

9.52 The potential impacts of the proposed converter station, substation and Direct Current (DC) cable are very similar and affect the same receptors. To avoid duplication and ensure a thorough assessment, the potential impacts from each elements of the development have been assessed collectively. For each potential impact, the significance of the effects has been assessed, based on the importance of the receptor or attribute and the likely magnitude of the potential impacts, as described in the 'Approach to assessment' section of this Chapter. These impacts are assessed prior to the consideration of the mitigation measures presented in the 'Mitigation' section of this Chapter.

Construction Phase

9.53 The following potential impacts on water resources and flood risk during the construction phase have been identified, based on the assessment approach above:

- The proposed works include the installation of a cable beneath the natural embankment that forms the existing tidal flood defence line. The works may have the potential to increase the risk of tidal flooding.
- Processes during the construction phase may require significant volumes of water supply.
- Processes during the construction phase may generate significant volumes of wastewater.
- There is potential for machinery and construction works on the site to cause a disturbance of the ground leading to an increase in sediment runoff to surrounding surface water resources.
- Leakages and spillages from machinery during construction have the potential to result in pollutant pathways that may impact surrounding groundwater and surface water resources.
- Increased areas of hard standing across the site may alter surface water runoff rates and patterns to the Project Area and receiving Grain Marsh during the construction phase.
- Uncontrolled surface water runoff may lead to surface water flooding on the Project Area and surrounding area.
- There is a risk of flooding to the Project Area should significant amounts of groundwater be encountered during construction.
- The Project Area is partially located within an area that is at residual risk of tidal flooding; there is residual risk of tidal flooding to the GB Onshore Scheme.

Table 9.6 Potential impacts during construction

Potential impact during construction	Importance of receptors	Magnitude of impacts	Significance of potential effects
Increase in tidal flood risk as a result of works under the tidal embankment	Residential areas on fringe of All Hallows – High	Major adverse	Highly significant (Major)
	Project Area – Medium	Major adverse	Significant (Major)
	Grain Marsh – Low	Major adverse	Low significance (Moderate)
Increase in water demand	Kent Medway WRZ – High	Moderate adverse	Significant (Moderate)
Increase in wastewater generation	Southern Water network - Low	Moderate adverse	Insignificant (Minor)
Increased sediment runoff	Land drains - Low	Moderate adverse	Insignificant (Minor)
	Watercourses - Medium	Moderate adverse	Low significance (Moderate)

Potential impact during construction	Importance of receptors	Magnitude of impacts	Significance of potential effects
Pollutants from leakages and spillages	Land drains - Low Watercourses – Medium Groundwater – Medium	Moderate adverse Moderate adverse Moderate adverse	Insignificant (Minor) Low significance (Moderate) Low significance (Moderate)
Change in surface water runoff rates and patterns	Land drains - Low Watercourses – Medium Project Area - Medium	Moderate adverse Moderate adverse Moderate adverse	Insignificant (Minor) Low significance (Moderate) Low significance (Moderate)
Surface water flooding	Land drains - Low Watercourses – Medium Project Area – Medium Scheme – Very High	Moderate adverse Moderate adverse Moderate adverse Moderate adverse	Insignificant (Minor) Low significance (Moderate) Low significance (Moderate) Highly significant (Major)
Groundwater flooding	Land drains - Low Watercourses – Medium Project Area – Medium Scheme – Very High	Negligible Negligible Minor adverse Minor adverse	Insignificant (Negligible) Insignificant (Negligible) Insignificant (Minor) Low significance (Moderate)
Scheme partially within an area at residual tidal flood risk	Scheme - Very High	Moderate adverse	Highly significant (Major)

Operational Phase

9.54 The following potential impacts on water resources and flood risk during the operational phase have been identified based on the assessment approach above:

- The operation of the GB Onshore Scheme will not require the use of significant volumes of water, nor will it generate significant volumes of wastewater on account of the limited staff required for operation, therefore the site is unlikely to have significant impacts on water supply and wastewater generation.
- Increased areas of hard standing and modifications to land drains within the Project Area may alter surface water runoff rates and patterns to the Project Area and surrounding area.
- Uncontrolled surface water runoff may lead to surface water flooding on the Project Area and surrounding area.
- The GB Onshore Scheme is partially located within an area that is at residual risk of tidal flooding.

Table 9.7 Potential impacts during operation

Potential impact during operation	Importance of receptors	Magnitude of impacts	Significance of potential effects
Increase in water demand	Kent Medway WRZ – High	Negligible	Insignificant (Minor)
Increase in wastewater generation	Southern Water network – Low	Negligible	Insignificant (Negligible)
Change in surface water runoff rates and patterns	Land drains - Low Watercourses – Medium	Moderate adverse Moderate adverse	Insignificant (Minor) Low significance (Moderate)

Potential impact during operation	Importance of receptors	Magnitude of impacts	Significance of potential effects
	Project Area – Medium	Moderate adverse	Low significance (Moderate)
Surface water flooding	Land drains - Low	Moderate adverse	Insignificant (Minor)
	Watercourses – Medium	Moderate adverse	Low significance (Moderate)
	Project Area – Medium	Moderate adverse	Low significance (Moderate)
	Scheme – Very High	Moderate adverse	Highly significant (Major)
Scheme partially within an area at residual tidal flood risk	Scheme – Very High	Moderate adverse	Highly significant (Major)

Decommissioning and demolition

9.55 Potential effects on water resources and flood risk during decommissioning and demolition are expected to be the same as those identified during construction, and are identified as follows:

- Works to decommission the cable beneath the natural embankment that forms the existing tidal flood defence line. may have the potential to increase the risk of tidal flooding.
- Processes during the demolition phase may require significant volumes of water supply.
- Processes during the demolition phase may generate significant volumes of wastewater.
- There is potential for machinery and demolition works on the site to cause a disturbance of the ground leading to an increase in sediment runoff to surrounding surface water resources.
- Leakages and spillages from machinery during decommissioning and demolition have the potential to result in pollutant pathways that may impact surrounding groundwater and surface water resources.
- Increased areas of hard standing across the site may alter surface water runoff rates and patterns to the Project Area and receiving Grain Marsh during the construction phase.
- Uncontrolled surface water runoff may lead to surface water flooding on the Project Area and surrounding area.
- There is a risk of flooding to the Project Area should significant amounts of groundwater be encountered during demolition.
- The Project Area is partially located within an area that is at residual risk of tidal flooding; there is residual risk of tidal flooding during the demolition phase.

9.56 Table 9.6 identifies the significance of these potential effects.

Mitigation

Introduction

9.57 Through the adoption of best practice construction methods, operational management, and design of the GB Onshore Scheme, there are several measures that will reduce the risk and hence likelihood that some potential impacts on water resources or flood risk would occur. Mitigation measures for the proposed converter station, substation and DC cable have been assessed collectively.

9.58 For construction related impacts, these measures will be developed, detailed and implemented via a Construction and Environmental Management Plan (CEMP).

Construction Phase

Works Adjacent to Flood Defences

9.59 The installation of the cable beneath the coastal embankment, which forms the existing tidal flood defence line, will require a Flood Risk Activity Permit from the Environment Agency.

9.60 Modifications to the embankment along the coastline will be avoided by using horizontal directional drilling (HDD) construction methods (as opposed to trenching or cut and cover techniques) to drill underneath the defences. The depth of the defences and appropriate standoff distances will be agreed in consultation with the Environment Agency prior to works being undertaken.

Water Demand During Construction

9.61 Processes during the construction phase that may require significant volumes of water supply include supply for washing down and potable water for sanitary facilities for site staff. The most intensive use of water, for the mixing of concrete, will be done off-site where possible and therefore will not affect water supply to the Project Area.

9.62 Water supply to the site during construction phase will be provided from the existing Southern Water sources, via an application to use an existing water supply for building purposes.

Waste Water Generation During Construction

9.63 Wastewater generation on construction sites includes effluent from sanitary facilities provided on-site and from washing down and wheel wash facilities. It is expected that foul water generated at the Project Area will be drained via the existing combined sewers in the surrounding area, following treatment if required. If dewatering is required during excavations, then abstracted water may be discharged to the Southern Water network, following sediment removal.

Surface Water Management During Construction

9.64 As detailed in Appendix 9B, suitable construction phasing should be used to enable the SuDS features to be constructed at the beginning of the works. This would ensure that any rainfall events during construction of the substation and converter building would be intersected and attenuated by the SuDS before being discharged at a restricted rate into the agreed receiving waterbodies, in agreement with the North Kent Marshes IDB.

Sediment in Runoff During Construction

9.65 It is proposed that surface water quality monitoring of the receiving waterbodies should be undertaken throughout construction to ensure any discharges from the works are not adversely impacting these waterbodies.

9.66 Should any negative impacts be identified such as water pollution, site drainage pathways will be immediately reviewed.

9.67 The following mitigation measures will be put in place and embedded within the CEMP:

- Development of an Erosion and Sediment Control Plan prior to execution of the Proposed Scheme;
- Sufficient rumble pads will be provided at site access points to prevent tracking of sediments onto public roads;

- Sediment traps will be provided at downstream edges of site to treat runoff prior to it leaving site; and,
- Where possible, all runoff will be directed to the onsite sediment basin for treatment.

Leaks and Spillages of Contaminants During Construction

9.68 There is potential for hydraulic leaks from plant and machinery, as well as spills from chemical storages and sources such as concrete mixing to result in pollutant pathways to surrounding water resources.

9.69 In relation to leaks and spillages of contaminants, the following mitigation measures will be embedded within a CEMP to reduce the risk of leaks and spills:

- An emergency spillage action plan will be produced and included within the CEMP, which site staff will have read and understood, and will have been trained in its implementation on site;
- Any damage to the drainage network will be repaired as soon as practical;
- Any maintenance of plant and machinery will take place in a bunded impermeable area a minimum 20 m from any external drainage lines and the onsite waterbodies and those adjacent to the boundary;
- The majority of concrete used will be pre-mixed and delivered from an off-site source, thereby negating the need to mix concrete on-site and reducing the creation of alkaline wastewater. Any mixing and handling of wet concrete on-site will be undertaken in designated impermeable areas, away from any drainage channels or surface water; and,
- A designated impermeable area will be used for any washing down or equipment cleaning associated with concrete or cementing processes and wastewater will be discharged to the foul drainage system (with approval from Southern Water) or contained and removed by tanker to a suitable discharge location via a licensed waste operator.

Operational Phase

Water Demand and Wastewater Generation During Operation

9.70 Water requirements and wastewater generation during operation will be minimal; and will entail provision of sanitary facilities for a small team of onsite staff.

9.71 Should larger teams of site personnel be needed for periods of maintenance, temporary welfare facilities will be provided, and suitable arrangements made at that time.

Surface Water Management During Operation

9.72 The proposed Drainage Strategy for the site is described in Appendix 9B and summarised below.

9.73 During operation, the GB Onshore Scheme will generate several storm and wastewater sources including process waste, foul waste from sanitary facilities and surface water runoff from buildings, car parks and landscaped areas. Process and foul water management will be addressed as information about the sources of these flows becomes available and the design progresses.

9.74 All surface water will be collected by rainwater pipes, gullies and linear drainage channels from all areas of hardstanding including building roofs, carparks and access roads. As defined in Appendix 9B, runoff will be attenuated onsite by the proposed SuDS features, prior to being conveyed via swales to discharge at greenfield runoff rates to the defined receiving waterbodies, in agreement with the North Kent Marshes IDB.

9.75 The total volume of storage required, to attenuate surface water runoff arising from the 100 year plus 20% climate change storm event, is approximately 6000 m^3.

Surface Water Quality During Operation

9.76 Silt traps will be incorporated into the surface water pipe networks to intersect silt and sediment before runoff is attenuated within the SuDS features. Silt traps will require periodic maintenance to ensure they remain operational throughout the design life of the GB Onshore Scheme.

9.77 There is a residual risk of silts and sediments entering the SuDS features. However, the nature of the proposed SuDS will provide a treatment train and will trap potentially contaminated sediments within the vegetation, thus preventing the conveyance of silts and sediments into the receiving waterbodies.

9.78 Oil separator units will be installed upstream of all attenuation systems on all drainage serving roads and yard areas, where potential hydrocarbon contamination could occur.

Tidal Flood Risk - Finished Floor Levels

9.79 The proposed converter station and substation are located in the southwestern part of the Project Area, located away from the settlement of Grain and towards the existing industrial developments in the vicinity.

9.80 Correspondence with the Environment Agency included in the FRA Report has confirmed that proposed infrastructure associated with the convertor station and substation should be set above the flood level for the defended 0.5% AEP flood event, including climate change over the lifetime of the development. In this location, this corresponds to a flood level of 3.1 m AOD.

9.81 The platform for the converter station and substation will be set above this level including a suitable freeboard.

Decommissioning and Demolition Phase

9.82 The potential effects during the decommissioning and demolition phase are very similar to those identified during the construction phase. The same mitigation measures will therefore be applied during the decommissioning and demolition phase.

Residual Impacts

Introduction

9.83 The following sections identify the residual effects of the Project during the construction and operational phases, following the implementation of the mitigation described previously.

Construction Phase

Water Demand During Construction

9.84 Water demand for construction processes may represent a short-term, temporary increase in supply volumes to the site. This is assessed as having potentially an adverse, low magnitude impact on Southern Water's available water resources due to the overall demand from this supply being minimal with respect to all supply within the WRZ. On this basis and the designation of the Kent Medway WRZ as being of High importance, the impact would be localised, short-term and would therefore result in a minor adverse effect. This effect is considered not significant.

Waste Water Generation During Construction

9.85 The construction activities may result in an increase in the volumes of wastewater generated. An increase in wastewater volumes generated can increase pressure on the capacity of the Wastewater Treatment Works. It can also lead to a potential increase in the volume of water spilled into the watercourses, via Combined Sewer Overflows (CSOs) in the Southern Water network.

9.86 The rate at which the Project Area can discharge to the Southern Water sewer network is restricted by the size of the existing sewer connections (for which automatic connection is accepted). New connections would, however, be subject to an agreement, prior to construction under the Water Industry Act. If no additional connections to the sewer network are obtained, then the maximum discharge into the sewer network will not exceed the existing situation. If Southern Water determine that there is not capacity within the local sewer network or existing connections, it will be necessary to upgrade the network prior to any works taking place. As a result, any impact on flood risk (via CSO discharges) will therefore be very low. Due to the Thames Estuary having High importance and the impact magnitude on the flood risk being allocated low, the overall effect for wastewater generation throughout construction would be minor. This effect is considered not significant.

9.87 Due to the dilution provided within the sewer network and the Thames Estuary itself, it is considered that there would be a very low impact on the water quality, water supply or fisheries via CSO discharges and the Thames Estuary being allocated a High importance, the overall effect would be minor. This effect is considered not significant.

Residual Tidal Flood Risk – Flood Warning and Response During Construction

9.88 The Environment Agency issue flood warnings to alert to the potential risk of flooding during tidal surge conditions. Those managing the construction phase will subscribe to the Environment Agency's Flood Warning Service.

9.89 A Flood Warning and Response Plan should be prepared detailing the planned response in the event of receiving a flood warning, and in the event of a breach or overtopping of the flood defences. This is likely to be a part of a health and safety planning prepared for the construction phase.

9.90 Access for site personnel to the proposed converter station will be via the B2001/ Grain Road via the development of a new access point and internal road; this will be the primary point of access during both the construction and operation of the GB Onshore Scheme. Temporary access for construction of the proposed DC cable route will also be taken from West Lane further to the north which provides access to Rose Court Farm and Peat Way.

9.91 Both of these routes enable safe dry access away from the site to an area in Flood Zone 1 low probability of tidal flooding.

Operational Phase

Residual Tidal Flood Risk - Flood Warning and Response

9.92 The operating company for the GB Onshore Scheme will subscribe to the Environment Agency's Flood Warning Service.

9.93 A Flood Warning and Response Plan will be prepared detailing the planned response in the event of receiving a flood warning, and in the event of a breach or overtopping of the flood defences. This is likely to be a part of a wider business continuity and health and safety planning for the operation of the GB Onshore Scheme.

9.94 As during the construction phase, access to the proposed converter station will be via the B2001/ Grain Road from the development of a new access point and internal road. This route provides safe dry access to an area in Flood Zone 1 low probability of tidal flooding.

Residual Tidal Flood Risk - Safe Refuge

9.95 During ordinary operation the proposed converter station will be staffed by a small team on site with a minimum of two operators present. During normal operation there will be approximately six personnel on site, divided between three shifts over a 24-hour period. During regular maintenance and/ or repairs the number of personnel present on site would increase with the number of staff proportionate to the nature of the maintenance or repair works being undertaken.

9.96 The residual risk is the risk that remains after flood defence measures have been taken into consideration. In order to manage this residual risk a place of safe refuge should be provided on the site.

9.97 The safe refuge should be set above the flood level for the undefended 0.5% AEP flood event including an allowance for climate change over the lifetime of the development. Reference to the Environment Agency's Kent Coastal Modelling Study (Ref 9.4) sets this level at 5.2 m AOD.

Table 9.8 Summary of Potential Effects and Incorporated Mitigation

Potential impact	Importance of receptors	Magnitude of impacts	Significance of potential effects	Mitigation	Residual effect
CONSTRUCTION					
Reduced integrity of tidal flood defences and increase in tidal flood risk	Residential areas on fringe of All Hallows – High Project Area – Medium Grain Marsh – Low	Major adverse Major adverse Major adverse	Highly significant (Major) Significant (Major) Low significance (Moderate)	Flood Risk Activity Permit to ensure suitable construction approach	Insignificant (Minor)
Increase in water demand	Kent Medway WRZ – High	Moderate adverse	Significant (Moderate)	Managed through the CEMP	Insignificant (Minor)
Increase in wastewater generation	Southern Water network - Low	Moderate adverse	Insignificant (Minor)	Managed through the CEMP	Insignificant (Minor)
Increased sediment runoff	Land drains - Low Watercourses - Medium	Moderate adverse Moderate adverse	Insignificant (Minor) Low significance (Moderate)	Managed through the CEMP	Insignificant (Minor)
Pollutants from leakages and spillages	Land drains - Low	Moderate adverse	Insignificant (Minor)	Managed through the CEMP	Insignificant (Minor)

Potential impact	Importance of receptors	Magnitude of impacts	Significance of potential effects	Mitigation	Residual effect
	Watercourses – Medium Groundwater – Medium	Moderate adverse Moderate adverse	Low significance (Moderate) Low significance (Moderate)		
Change in surface water runoff rates and patterns	Land drains - Low Watercourses – Medium Project Area - Medium	Moderate adverse Moderate adverse Moderate adverse	Insignificant (Minor) Low significance (Moderate) Low significance (Moderate)	Managed through the CEMP	Insignificant (Minor)
Surface water flooding	Land drains - Low Watercourses – Medium Project Area – Medium Scheme – Very High	Moderate adverse Moderate adverse Moderate adverse Moderate adverse	Insignificant (Minor) Low significance (Moderate) Low significance (Moderate) Highly significant (Major)	Managed through the CEMP	Insignificant (Minor)
Groundwater flooding	Land drains - Low Watercourses – Medium Project Area – Medium Scheme – Very High	Negligible Negligible Minor adverse Minor adverse	Insignificant (Negligible) Insignificant (Negligible) Insignificant (Minor) Low significance (Moderate)	Managed through the CEMP	Insignificant (Minor)
Scheme partially within an area at residual tidal flood risk	Scheme - Very High	Moderate adverse	Highly significant (Major)	Flood Warning and Evacuation Plan. Safe access to area of low flood risk available.	Insignificant (Minor)
OPERATION					
Increase in water demand	Kent Medway WRZ – High	Negligible	Insignificant (Minor)	NA	Insignificant (Minor)
Increase in wastewater generation	Southern Water network – Low	Negligible	Insignificant (Negligible)	NA	Insignificant (Negligible)
Change in surface water runoff rates and patterns	Land drains - Low Watercourses – Medium	Moderate adverse Moderate adverse	Insignificant (Minor) Low significance (Moderate)	Drainage strategy demonstrates suitable surface water	Insignificant (Minor)

Potential impact	Importance of receptors	Magnitude of impacts	Significance of potential effects	Mitigation	Residual effect
	Project Area – Medium	Moderate adverse	Low significance (Moderate)	management approach	
Surface water flooding	Land drains - Low Watercourses – Medium Project Area – Medium Scheme – Very High	Moderate adverse Moderate adverse Moderate adverse Moderate adverse	Insignificant (Minor) Low significance (Moderate) Low significance (Moderate) Highly significant (Major)	Drainage strategy demonstrates suitable surface water management approach	Insignificant (Minor)
Scheme partially within an area at residual tidal flood risk	Scheme – Very High	Moderate adverse	Highly significant (Major)	FRA demonstrates suitable measures to mitigate residual tidal flood risk, including requirements for finished flood levels for converter station; Flood Warning and Evacuation Plan; safe access to area of low flood risk; place of safe refuge.	Insignificant (Minor)

Decommissioning and Demolition Phase

9.98 The residual effects during the decommissioning and demolition phase are the same as those identified during the construction phase.

Cumulative Effects

9.99 As described in Chapter 12, the following schemes have been considered in the assessment of inter-project cumulative effects with respect to flooding and water resources:

- NGET OHL Works – facilitating the connection of the GB Onshore Scheme to the National Electricity Transmission System.
- GB Offshore Scheme – installation of the subsea cable beyond MLW.
- Six residential properties; Port Victoria Road, Isle of Grain, Rochester, ME3 0EN.
- Outline planning application for the development of up to 464,685 m2 of built employment floorspace and up to 245 m2 of floorspace for a business park management centre; Grain Road Isle Of Grain Rochester Kent ME3 0AE.
- Construction and operation of a cementitious grinding facility and associated development; Grain Road, Isle of Grain, ME3 0DW.
- Cement Plant; Thamesport Isle of Grain Rochester Medway ME3 0AP.
- Proposed development of a new cement plant at London Thamesport.

Cumulative effects during demolition and construction

9.100 Cumulative effects to water resources during demolition and construction processes are associated with the generation of sediments and the release into the sewer drainage network; spillage and leakage of oils and fuels; leakage of wet concrete; cement and disturbance of contaminated land; suspended sediments; disturbance to groundwater and foul drainage.

9.101 Measures exist to manage and control these effects and reduce the magnitude and significance of effects to a minimum as outlined within this chapter. These measures should also be adopted at other local construction sites as a matter of standard practice. Therefore, as a result of these control measures, the cumulative effect is **negligible**.

9.102 Cumulative effects on flood risk during demolition and construction processes are associated with alterations to the ground surface and drainage patterns, and alterations to the flood defence infrastructure. The NGET OHL Works may include the development of a new tower located directly north of the proposed substation location. This area of potential additional hardstanding has been accounted for within the FRA and the drainage strategy and storage area volumes include these works. The remaining schemes identified above do not intersect the same surface water flow paths as the GB Onshore Scheme. Therefore, there are not considered to be any cumulative effects with respect to flood risk during construction and demolition.

Cumulative effects during operation

9.103 As described above, the schemes identified above are not located within proximity to the GB Onshore Scheme. There are not considered to be any cumulative effects with respect to flood risk during operation.

Summary of Assessment

9.104 No significant effects to water resources and flood risk are expected during the construction or operation of the Scheme assuming mitigation measures outlined in Section 9.6 are undertaken in accordance with the FRA and a suitable CEMP and Flood Warning and Evacuation Plan, secured by a planning condition.

9.105 There will be no significant residual effects during construction assuming mitigation measures outlined in Section 9.6 are undertaken in accordance with the CEMP, secured by a planning condition.

9.106 Whilst the residual tidal flood risk remains, the flood warning and evacuation plan, as well as the provision of safe access and a place of safe refuge, secured by planning conditions, will reduce the impact magnitude as no long- term damage or risk to life would result.

9.107 The cumulative assessment concludes that there would be no significant cumulative effects with respect to water resources and flood risk.

References

Ref 9.1 MHCLG, 2012, National Planning Policy Framework https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/733637/National_Planning_Policy_Framework_web_accessible_version.pdf, accessed 30th May 2019.

Ref 9.2 Envirocheck Report

Ref 9.3 Environment Agency online flood risk mapping https://flood-map-for-planning.service.gov.uk/

Ref 9.4 Kent Coastal Modelling Study, Environment Agency, 2015.

Ref 9.5 Medway Council Strategic Flood Risk Assessment,

Ref 9.6 Medway Council Local Flood Risk Management Strategy,

Ref 9.7 Highways Agency, 2009 – Design Manual for Road and Bridges. Volume 11 Section. Road Drainage and the Water Environment.

Ref 9.8 MHCLG, 2014, Planning Practice Guidance https://www.gov.uk/government/collections/planning-practice-guidance

Ref 9.9 Commission of the European Communities, (2000); Directive 2000/60/EC 'The Water Framework Directive'

Ref 9.10 UK Technical Advisory Group Water Framework Directive Site, Available at: http://www.wfduk.org/

Ref 9.11 HMSO (1991); Water Resources Act 1991

Ref 9.12 HMSO (2003); Water Act 2003

Ref 9.13 HMSO (2014); Water Act 2014

Ref 9.14 HMSO (1995); Environment Act 1995

Ref 9.15 HMSO (1990); Environmental Protection Act 1990

Ref 9.16 HMSO (1991); Land Drainage Act 1991

Ref 9.17 HMSO (2010); Flood and Water Management Act 2010

Ref 9.18 HMSO (2003); 'The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003'

Ref 9.19 HMSO (1999); The Anti-Pollution Works Regulations

Ref 9.20 HMSO (2001); The Control of Pollution (Oil Storage) (England) Regulations

Ref 9.21 HMSO (2009); 'The Groundwater (England and Wales) Regulations

Ref 9.22 European Commission (2006); Directive 2006/118/EC, on the protection of groundwater against pollution and deterioration, PE-CONS 3639/1/100 Rev 1 Luxembourg

Ref 9.23 HMSO (2009); 'The Environmental Damage Regulations'

Ref 9.24 HMSO (2009); 'The Water Resources Act (Amendment) (England & Wales) Regulations'

Ref 9.25 HMSO (2010); 'The Environmental Permitting (England and Wales) Regulations'

Ref 9.26 HMSO (2000); 'The Water Supply (Water Quality) Regulations 2000'

Ref 9.27 Ministerial Statement, 18 December 2014, Sustainable drainage systems: Written statement - HCWS161

Ref 9.28 Medway Council, Report on Development Options Consultation 2017

Ref 9.29 Environment Agency, 2008, Thames Estuary 2100 Plan

Ref 9.30 Environment Agency; 'Pollution Prevention Guidelines 01: Understanding Your Environmental Responsibilities – Good Environmental Practices'

Ref 9.31 Environment Agency; 'Pollution Prevention Guidelines 02: Above Ground Oil Storage Tanks'.

Ref 9.32 Environment Agency; 'Pollution Prevention Guidance 03: Use and Design on Oil Separators in Surface Water Drainage Systems'

Ref 9.33 Environment Agency; 'Pollution Prevention Guidance 05: Works and maintenance in or near water'

Ref 9.34 Environment Agency; 'Pollution Prevention Guidelines 06: Working at construction or demolition Sites'

Ref 9.35 Environment Agency; 'Pollution Prevention Guidelines 07: Refuelling Activities

Ref 9.36 Environment Agency; 'Pollution Prevention Guidelines 21: Pollution Incident Response Planning'

Ref 9.37 CIRIA (2001); Control of water pollution from construction Sites: Guidance for consultants and constructors. C532

Ref 9.38 CIRIA (2015); The SuDS Manual. C753

Ref 9.39 Department for Environment, Food & Rural affairs, 'Environment Agency, Water Stressed Areas (2013)', Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244333/waterstressed-classification-2013.pdf

10. Transport & Access

Introduction

10.1 This chapter has been prepared by AECOM. It reports the results of baseline studies and the assessment of the potential impacts of the GB Onshore Scheme as described in Chapter 3.

10.2 Traffic and transport impacts are interrelated with Noise and Vibration impacts, and therefore reference should also be made to Chapter 07 Noise & Vibration.

Chapter Structure

10.3 The remainder of this chapter is structured as follows:

- **Approach to Assessment**. Sets out the discipline specific approach to the assessment in accordance with relevant guidance;
- **Basis of Assessment**. Sets out the key assumptions which have been made in undertaking the impact assessment;
- **Planning Policy & Applicable Legislation**. Provides a summary of the key points of planning policy and legislation which have been considered as part of the assessment;
- **Baseline Conditions**. Reports the results of desktop and field studies undertaken to establish existing conditions;
- **Potential Impacts**. Identifies the potential impacts on traffic and transport which may occur as result of construction and operation;
- **Mitigation**. Identifies the mitigation which is proposed including measures which are incorporated into the siting, design and construction of the underground cable;
- **Residual Impacts**. Reports the residual effects which remain taking into account proposed mitigation and identifies whether these are significant or not;
- **Cumulative Effects**. Identifies the inter-project cumulative effects which may occur in combination with other developments; and
- **Summary of Assessment**. Provides a summary of the key findings of the impact assessment.

Approach to Assessment

10.4 This section describes the approach to the identification and assessment of traffic and transport impacts resulting from the construction and operation of the GB Onshore Scheme.

Consultation

10.5 Whilst no formal scoping opinion was received for the proposed development, Medway Council Highways have been consulted when developing the methodology and deliberating data collection requirements, as a result of the data collected and assumptions made have been discussed with Medway and officers have been kept informed throughout the process. Advice regarding baseline traffic surveys, collision data analysis and abnormal load routing has been provided by Medway Council and taken on board during the production of this chapter of the Environmental Statement.

Scope of Assessment

10.6 The geographical boundary of the assessment has been determined by the estimated percentage increases in traffic on the local road network as a result of the construction phase of the proposed development. Traffic volumes during the construction phase rather than the operational phase has been chosen because the traffic levels associated with the operation and maintenance of the site is anticipated to be low.

10.7 Potential effects on human health are considered as far as the potential for the proposed GB Onshore Scheme to result in an increased frequency of road traffic accidents. Effects to human health beyond this are not considered applicable to the assessment and have been scoped out.

Assessment Guidance

10.8 The methodology for assessing the impact of development-generated traffic has been based on that outlined in Institute of Environmental Assessment's (IEA) 'Guidelines for the Environmental Assessment of Road Traffic' (January 1993). IEA is now known as the Institute for Environmental Management and Assessment. The IEA guidelines state that a link on the highway network should be included within the study if one of the following criteria is met:

- Traffic flows increase by more than 30% (or HGV flows increase by more than 30%);
- Traffic flows in sensitive areas increase by more than 10%.

Assessment Criteria

10.9 The significance of effect is determined by both the sensitivity of the receptors on the link affected and the magnitude of the impact exerted on it.

Receptor Sensitivity

10.10 Table 10.1 lists examples of receptors and their sensitivity based on guidance provided within National Policy Statements (NPS); National Planning Policy Framework (NPPF); and Department for Transport (DfT) Circular 02/13, The Strategic Road Network and The Delivery of Sustainable Development, 2013.

Table 10.1: Receptor Sensitivity Criteria (Transport & Access)

Sensitivity	Description
Very High	Schools, colleges, playgrounds, hospitals, retirement homes.
High	Heavily congested junctions, residential properties very close to carriageway.
Medium	Congested junctions, shops/businesses, areas of heavy pedestrian / cycling use, areas of ecological/nature conservation, residential properties close to carriageway.

Sensitivity	Description
Low	Tourist/visitor sites, places of worship, residential areas set back from the highway with screening.
Negligible	Those people and places located away from the affected highway link.

Magnitude of Impact

10.11 Table 10.2 provides general criteria for defining the magnitude of impact. Magnitude is determined by the scale, duration frequency and reversibility of the effect.

Table 10.2: Magnitude of Impact Criteria (Transport & Access)

Magnitude	Description	Illustrative Criteria
High	HGV Construction Traffic	High number of construction vehicles using roads over a protracted period of time. More than a 40% increase for more than 6 months.
	Pedestrians/Cyclists	Limited or no facilities for pedestrians and cyclists with limited crossing facilities and low-quality linkages to the local facilities.
	Severance	Increase in total traffic flows of 90% and above (or increase in HGV flows over 10% based on the sensitivity of the receptors).
	Road Safety	High increase in traffic at known collision locations.:
Medium	HGV Construction Traffic	Moderate number of construction vehicles using roads over a protracted time period. • 16-39% increase for more than 6 months; or • More than 40% increase for 3-6 months.
	Pedestrians/Cyclists	Few facilities for pedestrians and cyclists with limited crossing facilities and linkages to the local facilities.
	Severance	Increase in total traffic flows of 60-89% (or increase in HGV flows over 10% based on the sensitivity of the receptors).
	Road Safety	Moderate increase in traffic at known collision locations.
Low	HGV Construction Traffic	Small number of construction vehicles using roads over a short period of time. • 6-15% increase for more than 6 months; • 31-39% for 3-6 months; or • >40% increase for less than 3 months.
	Pedestrians/Cyclists	Facilities for pedestrians and cyclists with safe and convenient crossing facilities and good linkages to the local facilities.
	Severance	Increase in total traffic flows of 30-59% (or increase in HGV flows over 10% based on the sensitivity of the receptors).
	Road Safety	Minor increase in traffic at known collision locations.
Negligible	HGV Construction Traffic	Occasional construction vehicles using roads over a short period of time. • Less than 5% Increase for more than 6 months; or • Between 6-30% increase for 3- 6 months; or • Between 31-40% for less than 3 months.
	Pedestrians/Cyclists	Dedicated facilities for pedestrians and cyclists with safe and convenient crossing facilities and good linkages to the local facilities.
	Severance	Increase in total traffic flows of 29% or under (or increase in HGV flows under 10%).
	Road Safety	Negligible increase in traffic at known collision locations.

Significance of Effects

10.12 The significance of effects are evaluated using the table below. The IEA guidelines require that significant effects are identified. An effect is considered significant when they are predicted to be either 'major' or 'moderate' within the matrix.

Table 10.3: Significance of Effects Matrix

Magnitude of Impact	Sensitivity of Receptor				
	Very High	High	Medium	Low	Negligible
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Minor	Negligible	Negligible	Negligible

Assessment Method

10.13 Reference should be made to Chapter 03 Proposed GB Onshore Scheme of the Environmental Statement, which provides a full description of the construction and operation of the GB Onshore Scheme.

10.14 The remainder of this section, which forms the basis of the assessment is structured as follows:

- Construction traffic volumes;
- Construction programme;
- Construction traffic distribution and assessment;
- Construction assumptions; and
- Decommissioning and demolition traffic activity.

Construction Traffic Volumes

10.15 Information regarding the likely number and types of vehicular trips that will be necessary to construct the proposed converter station, proposed DC cable route and permanent access road has been primarily based on numbers derived and benchmarked against comparable projects in the UK, namely the Interconnexion France-Angleterre 2 (IFA2) electricity interconnector project.

10.16 Based on the fact the proposed converter station and permanent access road will be raised, in parts, above the existing ground level, the related additional fill volumes required have been converted into additional vehicles required. This provides a robust indication of the number of vehicle movements that would be expected.

10.17 The traffic volumes for the proposed substation have been based on the similar Littlebrook 400 kV Gas Insulated Switchgear (GIS) Substation assessment.

10.18 This assessment provides an estimate of the number of vehicular movements that will occur during the construction period. The construction traffic has been allocated across the duration of the construction period. The construction traffic volumes provided are based on realistic worst-case estimates, as the finalised numbers are subject to the appointment of a Contractor.

10.19 Construction trips generated by the proposed converter station have been split into worker trips (assumed as 1 car per worker, which is considered as a worst-case scenario as some would be expected to travel using other modes such as car share, public transport etc.) and HGV trips (assuming 1 HGV = 16 tonne Max Articulated vehicle). Some of the generated trips will be larger vehicles such as cranes and the delivery of transformers to site, however these will be infrequent events.

10.20 The breakdown of total two-way vehicle movements expected as part of the construction phase, along with those expected in the peak month is summarised in Table 10.4. Construction traffic was provided as a monthly profile, which has then been converted into an average weekly profile by dividing by four (average of four weeks per month). An average daily total has then been assumed by dividing the weekly total by six (assuming a six-day working week, Monday to Saturday).

Table 10.4: Converter Station Estimated Construction Traffic (Two-Way Movements)

Vehicle Type	Construction Phase Total Number	Peak Month – Monthly Total	Peak Month – Daily Total
Cars	31,140	216	39
Max. Articulated HGV	25,057	1,220	55
Large Equipment Vehicle	147	33	1

Vehicle Type	Construction Phase Total Number	Peak Month – Monthly Total	Peak Month – Daily Total
Transformer Vehicle	10	4	Not accounted for
25ft Crane	2	1	Not accounted for
100ft Crane	2	1	Not accounted for
Mobile Platform	2	1	Not accounted for
Total	**56,360**	**1,476**	**95**

10.21 Whilst it is accepted that there will be movements of larger construction vehicles in addition to the HGVs, such as cranes and transformer vehicles, the number of daily movements for vehicles of those types is expected to be small, therefore has not been considered as part of the assessment.

10.22 Some works may be required to be carried out overnight where there is an engineering need, such as the pouring of concrete which must be continuous or jointing work for the DC cable which must maintain a stable environment. These activities would be limited and would result in only a small number of associated vehicle movements. As this number would be low, further assessment of traffic outside of the current daytime periods was not considered necessary.

10.23 For robustness, it is assumed that construction of the proposed substation would take place at the same time as the proposed converter station.

Table 10.5: Substation Estimated Construction Traffic (Two-Way Movements)

Phase	Period	Peak LVs/Day	Peak HGVs/day
Peak Period			
Civil Engineering	2021-2022	40	40
Electrical	2022-2023	40	16
Average Period			
Civil Engineering	2021-2022	40	8
Electrical	2022-2023	40	3

Table 10.6: Combined Estimated Construction Traffic (Two-Way Movements) (Peak)

Phase	Peak Cars & LVs/day	Peak HGVs/day	Total
Converter	39	55	94
Substation	40	40	80
Total	**79**	**95**	**174**

Construction Programme

10.24 Construction of the proposed converter station and substation is planned to begin in 2021 and is anticipated to last approximately three years.

10.25 Construction works across this period will include the below activities, in descending order:

- Preparatory works including access road construction and site establishment;
- Civil construction works including earthworks, foundations and erection of buildings;
- Mechanical and electrical works including installation of AC and DC cables;

- Testing, commissioning and site reinstatement including landscape planting.

10.26 A summary of the various elements of the construction phase is provided in Table 10.7.

Table 10.7: Estimated Construction Programme

Construction Phase Element	Start Date	Completion Date	Construction Duration
Proposed Permanent Access Road	2021	2021	4 months
Proposed Converter Station Site & DC Underground Cable Route	2021	2023	36 months
Proposed Substation	2021	2023	36 months

10.27 Whilst traffic would be expected throughout the construction period, only the peak month for traffic has been assessed. This ensures that a robust realistic worst-case traffic scenario is considered.

10.28 The daily trips to and from the Project Area have been considered in terms of their overall percentage impact on the roads within the Zone of Influence (ZoI).

Construction Traffic Distribution Methodology

10.29 The construction traffic detailed in the above sections has been distributed onto the local road network within the ZoI to facilitate the assessment work.

10.30 Traffic distribution diagrams have been produced to aid the process of assignment onto the local road network within the ZoI.

10.31 In order to calculate traffic distribution of workers travelling to and from the Project Area each day a simple gravity model has been developed.

10.32 It is currently unknown where workers or construction materials may originate, therefore following discussions with officers at Medway Council it was concluded that in order to predict the distribution of traffic origin has been based on the approximate populations of large settlements (>6,000 people) within a 60 minute drive time of the Project Area.

10.33 For those settlements towards the maximum journey time of 60 minutes, a weighting of 0.7 has been applied to reflect the additional distance needed to travel, hence the reduced likelihood of people or goods travelling from that area.

10.34 Table 10.8 indicates the distribution based on each settlement identified.

Table 10.8: Worker Location Distribution

Settlement	Population	Distance Weighting	Weighted Population	Distribution %
Hoo	8,945	1	8,945	1.1%
Gillingham	104,157	1	104,157	12.3%
Chatham	76,792	1	76,792	9.1%
Rochester	62,982	1	62,982	7.4%
Snodland	10,211	1	10,211	1.2%
Gravesend	74,000	1	74,000	8.7%
Aylesford	10,660	1	10,660	1.3%

Settlement	Population	Distance Weighting	Weighted Population	Distribution %
Swanscombe	6,300	1	6,300	0.7%
Dartford	97,365	0.7	68,156	8.0%
Bexley	246,100	0.7	172,270	20.3%
Sittingbourne	62,500	0.7	43,750	5.2%
Maidstone	113,137	0.7	79,196	9.3%
Grays	36,601	0.7	25,621	3.0%
Faversham	19,316	0.7	13,521	1.6%
Cantebury	55,240	0.7	38,668	4.6%
Ashford	74,204	0.7	51,943	6.1%
Total	**1,058,510**	**N/A**	**847,171**	**100%**

10.35 The above distribution percentages were then applied to the relevant road links within the ZoI in order to carry out the impact assessment. The assessment and identification of specific links was identified and agreed during scoping discussions with the Local Highway Agency (LHA) and identifies all the current traffic data available to this assessment. The links represent the local and strategic network providing vehicular access to the site for Construction, operational and maintenance activity. This is summarised in Table 10.9.

Table 10.9: Worker Distribution Percentage by Road Link

Site No.	ATC No. / DfT Count Point.	Road Link	Distribution %
ATC 1	ATC 1	B2001 East of Access	0%
ATC 2	ATC 2	A228 Grain Rd at Stoke	100.0%
ATC 3	ATC 3	B2001 West of Access	100.0%
DfT 1	56776	A228 Grain Road	100.0%
DfT 2	56827	A228 Four Elms Hill Beacon Hill	99.0%
DfT 3	70385	A289 Wainscott Primary School	16.8%
DfT 4	56816	A228 Frindsbury Road	4.9%
DfT 5	70384	A2 Chatham Docks	16.8%
DfT 6	70386	A2 opposite Featherby Rd	16.8%
DfT 7	70381	A289 between A226 and B2000	39.3%
DfT 8	56415	A228 Gun Lane	0.0%
DfT 9	6099	Rochester Bridge	15.9%
DfT 10	56008	M2 btwn J1 & J2	22.0%
DfT 11	6010	M2 btwn J2 & J3	22.0%
DfT 12	73645	M2 btwn J4 & J5	11.8%
DfT 13	78142	A287 btwn A2 & M2	0.0%
DfT 14	36100	A2 w of J1 of M2	39.3%
DfT 15	16092	A2 btwn M25 & B255	30.2%
DfT16	38792	A227 Dartford Crossing	2.9%

Site No.	ATC No. / DfT Count Point.	Road Link	Distribution %
DfT 17	7824	M25 S of A2	0.0%
DfT 18	36099	A2 W of M25	19.6%

Construction Traffic Assessment

10.36 Construction traffic associated with the proposed GB Onshore Scheme has been distributed onto the local highway network to calculate the resultant percentage increase on each link within the ZoI.

10.37 The average daily construction traffic for the peak month generated by the proposed converter station has been subsequently added to the 2021 and 2023 Base two-way traffic flows, which represent the start and finish years of the construction period.

Construction Assumptions

10.38 A number of assumptions relating to traffic and transport have also been included as part of the assessment which formed part of the agreement of scope with the LHA. These include operational hours of construction activity for vehicles on the local and strategic network. These assumptions are described below.

- The period of 07:00-19:00, Monday to Saturday (6-day assessment period) has been assessed. Whilst the operation of the site may be less, in terms of hours, activity to and from the site will commence and end long after the site closes as it has been agreed that distribution will be within a 60-minute drive time from the site. Furthermore, in order to understand the peak activity associated with construction traffic over the network a much wider period of assessment has been undertaken encompassing a 12-hour day. Using 12-hour data is considered as 'best practice' as referred to in the Institute of Highways and Transportation guidance for Transport Assessments (1994);
- The impacts of construction traffic have been assessed using traffic count data collected during a neutral month, November 2018 over a 6-day period on Grain Road;
- For the impact on the wider SRN (Strategic Road Network) and other notable routes in the wider area, DfT AADT data from 2017 has been used;
- All baseline traffic data has been factored up to 2021 and 2023 levels using TEMPRO v7.2 software.

10.39 The A228/ B2001 Grain Road is the only road access to the Isle of Grain. Access to the proposed converter station will be via the B2001 Grain Road from the development of a new access point and internal road, this will be the primary point of access during construction and operation of the GB Onshore Scheme.

10.40 Temporary access for construction of the proposed DC cable route will also be taken from West Lane further to the north which provides access to Rose Court Farm and Peat Way which may also be used for access to the DC cable route and landfall location.

Design Mitigation

10.41 The permanent access road will provide access during the construction of the proposed development.

10.42 Highway improvements would also be included on the B2001 itself, with a right turn ghost island and acceleration/ deceleration lanes incorporated, designed in accordance with Design Manual for Road and Bridges (DMRB) (Ref 25-4) standards. These improvements will be subject to approval with the local Highway Authority and as such will form part of the planning conditions associated with these proposals.

Planning Policy & Applicable Legislation

10.43 The proposed development has been considered in the context of a number of national and local planning and transport guidelines and policies. The following are summarised in the following sections:

- The National Planning Policy Framework (NPPF);
- Medway Local Transport Plan 3 (2011-2026); and
- Emerging Medway Local Plan (2018-2035).

National Planning Policy Framework (NPPF)

10.44 The NPPF provides a framework for local communities and Authorities to development relevant local development plans and strategies. A revised version of the NPPF was released in July 2018.

10.45 The NPPF has two key themes:

- Providing a greater level of integration and simplification of the planning policies governing new development nationally;
- Contribute to the achievement of sustainable development from an economic, social and environmental perspective.

10.46 The NPPF is in favour of sustainable development, which should be reflected in local development plans and frameworks to ensure that sustainable development and the needs of an area are identified and subsequently approved without delay.

10.47 The NPPF is based on a range of core planning principles, which are aimed at supporting the focus on sustainable plan-led development.

10.48 Transport specific policies play a key role in supporting and achieving the core planning principles and are intrinsically linked to the objective of sustainable development. The NPPF specifically states that development should only be prevented or refused on transport grounds if there would be an unacceptable impact on highway safety or where the residual cumulative impacts of development are severe.

10.49 Paragraph 108 of the NPPF states that whilst assessing applications for development, it should be ensured that:

- appropriate opportunities to promote sustainable transport modes can be – or have been – taken up, given the type of development and its location;
- safe and suitable access to the Project Area can be achieved for all users; and
- any significant impacts from the development on the transport network (in terms of capacity and congestion), or on highway safety, can be cost effectively mitigated to an acceptable degree.

10.50 In terms of parking, paragraph 106 states that maximum parking standards for residential and non-residential developments should only be set if there is a clear and compelling justification that they are necessary for managing the local road network.

10.51 The core planning principles above provide a framework to provide inclusive, accessible, well connected and sustainable development.

Medway Local Transport Plan 3 (LTP3 2011-2026)

10.52 This document is the long-term Transport Strategy that will help place-shape Medway for the 15-year period of the plan. The strategy will be delivered by short term Implementation Plans, which will set out a three-year rolling programme of actions. Medway's three-year Implementation Plans will link the plan priorities and transport objectives with available financial resources for delivery including the LTP funding allocation from government.

10.53 It is the overarching strategy for Medway, setting the ambitions for Medway with the key aim for Medway to have a thriving, diverse and sustainable economy matched by an appropriately skilled workforce supported by a Higher Education Centre of Excellence. Collaborative working has taken place in developing the Sustainable Community Strategy and LTP3.

10.54 The Thames Gateway Kent Business Plan sets out for Medway to focus on the evolution of a regional riverside city, with cultural, educational, tourism and hi-tech facilities. Grain on the Hoo Peninsula is identified as a national hub for port-related activities, energy production, environmental technology and a value added industry. The transport objectives developed for LTP3 need to address the development ambitions in the Thames Gateway Kent Business Plan.

10.55 The Medway's LTP3 will significantly contribute to the delivery of the strategy through the following transport objectives:

- **Transport objective 1** - Highway maintenance. To undertake enhanced maintenance of the highway network in the most sustainable way practical;
- **Transport objective 2** - Improving infrastructure capacity. To respond to regeneration by efficiently and safely managing and improving Medway's road network, including improving road freight movements through Medway;
- Medway Council will work with key strategic partners including Kent County Council and Network Rail to seek to:
  - Continue to improve the A228 to Grain;
  - Improve the Thamesport freight line, including Hoo junction;
  - Improve the efficiency of road-based freight movements through Medway, with HGV traffic being directed away from unsuitable roads;
  - Ensure major freight traffic generating developments provide access to the rail network for freight movements;
  - Encourage freight movements to use rail and river transport;
  - Monitor growth in freight movements originating from International Gateways throughout Kent and work sub-regionally to mitigate negative consequences; and
  - Investigate the provision of faster and more reliable highway linkages from business, storage and distribution sites to the strategic highway network supporting wider connectivity.
- **Transport objective 3** - Improving public transport. Principle of objective: To respond to the regeneration of Medway by encouraging travel by public transport including improving the quality, reliability, punctuality and efficiency of services;
- **Transport objective 4** – Encouraging active travel and improving health. To contribute to improving health by promoting and developing transport corridors that encourage personal movement and by improving air quality;
- **Transport objective 5** - Improving travel safety. To reduce casualties on Medway's roads and to encourage changes to travel habits by the implementation of Safer Routes to School projects.

Emerging Medway Local Plan Pre-Consultation Draft (2018-2035)

10.56 Medway Council is preparing a new Local Plan to provide direction for future growth, and growth for all. A Development Strategy technical report has been prepared for the new Local Plan for Medway along with our Medway 2035 document. The report set out the ambitions for the plan, options for how Medway could grow and draft policies for managing development.

10.57 The transport polices within the emerging Local Plan have been prepared in accordance with national planning policy and the Medway policy framework, including the Local Transport Plan (2011-2026). Relevant sections to this application are as follows:

Policy T1: Promoting Sustainable Transport

- Support the Medway Local Transport Plan (2011-26) and subsequent iterations during the plan period, along with the associated three-year Implementation Plans and strategies.
- Ensure development is located and designed to enable sustainable transport.
- Mitigate the impacts of new development according to Transport Assessments and Transport Statements, or refuse development where its residual cumulative impacts are severe.
- Require a Travel Plan for development which will generate significant amounts of movement.
- Plan for strategic road network and rail improvements.
- Improve public transport provision and the walking and cycling network.
- Develop an integrated transport strategy for Medway to deliver sustainable growth.
- Identify the need for and if required define the location for park and ride facilities.
- Engage with the relevant authorities to address the impacts of the proposed Lower Thames Crossing.
- Undertake any necessary revisions to the adopted Parking Standards.
- Improve air quality as a result of vehicular emissions.

Policy T11: Cycle parking and storage

- Development proposals will be expected to comply with the cycle parking standards in accordance with the council's adopted Parking Standards.
- Long term cycle parking facilities for residents, visitors and/ or employees of the development must be conveniently located; safe to use; secure; weatherproof; and be well integrated into the building and/ or layout of the GB Onshore Scheme.
- Short term cycle parking facilities should be conveniently located in relation to the public realm, provide effective security for cycles and be safe to use.

Policy T12: Managing the transport impact of development Transport Assessments

- The council expects proposals that will generate a significant amount of movement to be supported by a Transport Assessment. Applicants are encouraged to refer to the adopted Guidance Note for Transport Assessments. Travel Plans Travel Plans will also be required for developments above threshold sizes, specified by the council.

Other Guidance Documents

10.58 In addition to the above policies and documents, the following guidance documents have been taken into account in the production of the chapter. These have provided guidance for the methodology and design guidelines on which the permanent access road designs have been based.

- Travel Plans, Transport Assessments and Statements – Planning Practice Guidance
- (Department for Communities and Local Government, March 2014);
- Institute of Environmental Management and Assessment's (IEMA) 'Guidelines for the Environmental Assessment of Road Traffic' – January 1993;
- Design Manual for Road and Bridges (DMRB); and
- DMRB Volume 11, Section 2, Part 5 – HA 205/08 Assessment and Management of Environmental Effects.

Baseline Conditions

10.59 Access to the proposed converter station and substation will be via the B2001 Grain Road. An existing unnamed road runs west/ northwest from Grain Road along the southern boundary of the site, which is the preferred point of access during construction and operation of the GB Onshore Scheme.

10.60 There are also access points from Grain Road to Perry's Farm through part of the Project Area, as well as from West Lane further to the north which provides access to Rose Court Farm and Peat Way which may also be used for temporary and/ or permanent access.

10.61 Prediction of construction effects has focused on activities that could directly and indirectly impact on receptors within the defined study area. The ZoI includes those roads which may be utilised during construction, and upon which there is the potential for a significant impact.

Surrounding Highway Network (ZoI)

10.62 The southern boundary lies adjacent to the B2001 Grain Road. The B2001 heads west, continuing into the A228 and is the only route along the along the Hoo Peninsula to the Isle of Grain, linking the site with Rochester, Chatham Docks and the A2/ M2 for onwards destinations. The following roads on the surrounding highway network will be described in this subsection:

- The B2001 Grain Road/ High Street;
- The A228;
- Chapel Road;
- Power Station Road;
- The A289; and
- The M2/ A2.

The B2001 Grain Road / High Street

10.63 The B2001 is a 3.5 km stretch of road that extends west from the eastern shore of the Hoo Peninsula, through the village of Grain and past the proposed development site before ending west of London Thamesport where the A228 begins. The B2001 is known as High Street through Grain village and is subject to a 30 mph speed limit. Through the village the road is mostly fronted by residential properties which have direct vehicular access via private driveways. There is a convenience store and post office on the High Street with on-street parking. There are bollards along the footpath of the southern boundary to prevent vehicles being parked on both sides of the carriageway that would otherwise block traffic.

10.64 The B2001 High Street, B2001 Grain Road and Chapel Road form a T-junction west of Grain. Heading west, Grain Road leaves the village as a single-carriageway with a speed limit of 40 mph. Power Station Road connects with Grain Road before the access to Perry's Farm (application site). Continuing west, Grain Road passes the access to London Thamesport before reaching the A228.

The A228

10.65 The A228 takes over from the B2001, heading west passing Strood and connecting with Junction 2 of the M2, 16 km and 19 km away, respectively. The A228 ends in Royal Tunbridge Wells in south-west Kent. It is the only route off the Hoo Peninsula from the site. Up until the roundabout junction at High Halstow the A228 is an unlit single-carriageway road subject to a 40 mph speed limit enforced by average speed cameras. Other than passing through the village of Stoke, the road is bound by fields. West of the High Halstow roundabout the national speed limit applies.

10.66 1.2 km west of High Halstow the A228 is known as Peninsula Way and becomes dual-carriageway subject to the national speed limit. Upon entering the suburban fringes of Strood the A228 returns to single-carriageway and a 30 mph speed limit at the change occurs at a roundabout with the A289, which heads south towards the Medway Tunnel and Chatham Docks.

10.67 The A228 passes through Strood before joining the M2 at Junction 2 via a grade-separated dumbbell junction.

Chapel Road

10.68 Chapel Road heads south-east through Grain from a T-junction with the B2001. It is subject to a 30 mph speed limit, fronted for the most part by residential properties with footpaths and street lighting along its length. Bus stops and a few commercial properties are also located adjacent to the carriageway. Minor residential streets connect with Chapel Road at priority junctions.

Power Station Road

10.69 Power Station Road is the access road to Grain Power Station. It is single-carriageway and approximately 750 m from the priority junction to the wider extent of the power station. 500 m east of the proposed site access. The larger oil-fired plant closed in 2012 however there is now a CCGT plant operating on site which means Power Station Road is still used albeit to a lesser extent.

A289

10.70 The A289 forms a 15 km north-eastern bypass of the Medway Towns of Chatham, Rochester and Strood. From Junction 1 of the M2, the A289 heads in a north-east direction towards the A228/ A289/ B2108 roundabout on the Hoo Peninsula, with the A228 continuing east towards Grain. Between these junctions, the A289 is known as Hasted Road and is a dual-carriageway and subject to the national speed limit. There is a central reservation with street lighting throughout.

10.71 The A289 continues south of the A228 roundabout, remaining a dual-carriageway. After 1 km a 50 mph speed limit is introduced and the A228 passes through the Medway Tunnel. 1 km east of the Medway Tunnel, the A289 form a large signalised junction with the B2004 and the access to Chatham Docks

10.72 The A289 continues south-east, the surroundings becoming more residential. The road becomes subject to a 40 mph speed limit and remains dual carriageway until a four-arm roundabout with the A2.

M2

10.73 The M2 is subject to the national speed limit and stretches 40 km south of Junction 1, the grade-separated junction with the A2 and A289. The route bypasses the Medway towns to the south-west. The carriageway is four-lanes wide in both directions up until Junction 4 south of Gillingham, where it reduces to two. The M2 ends at Junction 7 where it reconnects with the A2 and A299.

A2

10.74 The A2 runs from London to Dover and forms part of the Primary Route Network. Whilst the M2 bypasses the Medway Towns the A2 passes through the centre of Rochester and Chatham.

10.75 North of Junction 1 of the M2, the A2 is four lanes wide, subject to the national speed limit and heads west towards London. 15 km west of Junction 1, the A2 forms a grade-separated junction with the M25 to the south and the A282 to the north. The A282 heads north over the Dartford Crossing before re-joining the M25.

Baseline Traffic

10.76 Baseline traffic levels have been established in order to quantify the magnitude of impact of the development traffic. Automatic Traffic Counters (ATC) and data obtained from the DfT has been used to derive the baseline. Table 10.10 and Table 10.11 list the baseline flows on each of the links.

Automatic Traffic Counters

10.77 ATCs were placed on the B2001 Grain Road near the proposed Project Area access and recorded 24-hour traffic flows over a seven-day period. The surveys were initially conducted from the 1st November 2018 – 7th November 2018. ATC 1 and 3 were found to be faulty and were subsequently re-surveyed from the 9th November to the 15th November. Table 10.10 shows the seven-day average 24-hour flows at each of the ATC sites.

Table 10.10: ATC Surveys

Site No.	Road Link	All Traffic	HGV	HGV %
ATC 1	B2001 East of Access	2,946	390	13.2%
ATC 2	B2001 West of Access	2,947	312	10.6%
ATC 3	A228 Grain Rd at Stoke	4,241	818	19.3%

DfT Traffic Counters

10.78 DfT record AADT flows for every junction-to-junction link on the 'A' road and motorway network in Great Britain. Table 10.11 shows the data recorded during the most recent count at each link.

Table 10.11: DfT Traffic Counters

Site No.	DfT Count Point	Road Link	All Traffic	HGV	HGV %
DfT 1	56776	A228 Grain Road	8582	1584	18.5%
DfT 2	56827	A228 Four Elms Hill Beacon Hill	33024	1355	4.1%
DfT 3	70385	A289 Wainscott Primary School	43021	2169	5.0%
DfT 4	56816	A228 Frindsbury Road	15904	376	2.4%
DfT 5	70384	A2 Chatham Docks	34242	686	2.0%
DfT 6	70386	A2 opposite Featherby Rd	34882	594	1.7%
DfT 7	70381	A289 between A226 and B2000	3313	52386	6.3%
DfT 8	56415	A228 Gun Lane	146	6787	2.2%
DfT 9	6099	Rochester Bridge	448	35138	1.3%
DfT 10	56008	M2 btwn J1 & J2	10650	100486	10.6%
DfT 11	6010	M2 btwn J2 & J3	9823	99296	9.9%
DfT 12	73645	M2 btwn J4 & J5	6928	69055	10.0%
DfT 13	78142	A287 btwn A2 & M2	1146	35681	3.2%
DfT 14	36100	A2 w of J1 of M2	10217	126325	8.1%
DfT 15	16092	A2 btwn M25 & B255	10849	131863	8.2%
DfT16	38792	A227 Dartford Crossing	18578	115926	16.0%
DfT 17	7824	M25 S of A2	13997	114976	12.2%
DfT 18	36099	A2 W of M25	4919	108301	4.5%

Traffic Growth

10.79 Tempro v7.2 has been used to derive growth factors that enable the conversion of past and present traffic counts to the predicted future baseline flows. Tempro is a program developed by the DfT providing forecast traffic growth projections for the UK based on regional characteristics and as such provides a national standardised approach to forecasting growth for future year assessment. Growth factors specific to Medway have been extracted from Tempro for this exercise.

10.80 As traffic counts were conducted in 2018 they require being factored up to predicted 2021 and 2023 levels, the start and finish years of the construction period.

10.81 The data from the DfT counters was collected in 2017, with the exception of point 16 at the Dartford Crossing which was 2014, and have also been factored up to 2021 and 2023 levels.

10.82 Table 10.12 below shows the Tempro growth factors applied to each data set according to year.

Table 10.12: Tempro v7.2 Growth Factors

Base Year	Construction Begin Year (2021)	Construction End Year (2023)
2014	1.1222	1.1544
2017	1.0698	1.1005
2018	1.0520	1.0822

Receptor Sensitivity

10.83 A number of receptors have been identified where impacts have subsequently been assessed. For the purposes of the assessment, the receptors have been selected based on engineering judgement and are cognisant of the examples quoted in Table 10.1. They include areas where residential/ business properties and schools are close to the carriageway and key links and junctions on the local and strategic highway networks. The receptors have been assigned to the nearest traffic counter. The locations, along with their baseline sensitivity (following the criteria outlined in Table 10.1) are provided in Table 10.13.

Table 10.13: Receptors within Study Area

Site	Receptor Location	Site Location	Sensitivity Rating	Description	Distance from Site Access
1	Chapel Road	ATC 1	Medium	Shops/Businesses, Residential properties close to the carriageway	450m
2	B2001 Grain Road	ATC 1	Medium	Residential properties close to the carriageway	750m
3	London Thamesport	ATC 2	Low	London Thamesport	1.4km
4	A228 Grain Road East of Stoke	ATC 3	Medium	Medway Estuary and Marshes SPA	3.7km
5	A228 Grain Road at Stoke	ATC 3	Low	Residential properties set back from the carriageway with screening	5.3km
6	A289 at Wainscott	DfT 3	Very High	Wainscott Primary School	16.1km
7	A289	DfT 3	High	Medway Tunnel / Medway City Estate Access	17km
8	A228 Findsbury Rd	DfT 4	Very High	St. Mary's Medical Centre	18km
9	A228 Findsbury Rd	DfT 4	Medium	Shops/Businesses, Residential properties close to the carriageway	18.5km
10	A289 Pier Road	DfT 5	Very High	Universities at Medway – Chatham Maritime	18.7km
11	J1 of M2	DfT 14	Medium	M2 / A2 / A289 Grade Separated Junction	20.8km

Site	Receptor Location	Site Location	Sensitivity Rating	Description	Distance from Site Access
12	A2 Sovereign Blvd	DfT 6	Very High	Danecourt Special School	24km

Road Safety

10.84 Collision Data has been analysed to determine whether or not there are any underlying road safety issues on the surrounding highway network. STATS19, which is a code designating the protocol which outlines information to be collected whenever an injury crash is reported to the Police and is used to refer to Britain's official Road Accident Statistics, which are derived from Police STATS19 returns and compiled by the Department for Transport, data was obtained from crashmap.co.uk for the most recent five-year period available was analysed within the study area shown in Figure 10.1. The study area covers the village of Grain, the B2001 continuing west along the A228 until Upper Stoke. There have been a total of 15 collisions within the study area, five of which caused serious injury. Table 10.14 lists the collisions according to year of occurrence and severity.

Table 10.14: Collision Data by Year and Severity

Year	Severity			
	Slight	Serious	Fatal	Total
2013	1	0	0	**1**
2014	3	1	0	**4**
2015	2	1	0	**3**
2016	4	3	0	**7**
2017	0	0	0	**0**
Total	**10**	**5**	**0**	**15**

Source: crashmap.co.uk (accessed 08/01/2019)

Collisions Involving Goods Vehicles

10.85 Table 5.6 shows five collisions involved a goods vehicle (an average of one collision per year). Three of these were recorded as being slight in severity whilst the remaining two caused serious injury. The serious collision recorded in 2014 also involved a motorbike. The serious collision in 2016 involved two goods vehicles and a car, with the driver of a lorry sustaining the serious injury.

Table 10.15: Summary of Collisions (Goods Vehicles Only)

Year	Severity			
	Slight	Serious	Fatal	Total
2013	1	0	0	**1**
2014	2	1	0	**3**
2015	0	0	0	**0**
2016	0	1	0	**1**
2017	0	0	0	**0**
Total	**3**	**2**	**0**	**5**

Source: crashmap.co.uk (accessed 08/01/2019)

Collisions Involving Vulnerable Road Users

10.86 Vulnerable road users were involved in five of the collisions, three were categorised as 'serious' and two 'slight'. Two of the collisions that caused serious injury involved cyclists, both involving no other road user. A slight injury to a pedestrian was caused by a goods vehicle in 2014 within the village of Grain. In 2014 a serious injury was sustained by a motorcyclist who was involved in a collision with a goods vehicle at the entrance to London Thamesport on the B2001.

Summary of Collision Data

10.87 Collision data has been reviewed for the most recent five-year period available within the study area, which covers the village of Grain, the B2001 and the A228 until Upper Stoke. There have been a total of 15 collisions within the study area, five of which caused serious injury. There were no collisions recorded within proximity of the proposed Project Area access, nor were there any clusters of collisions identified within the study area.

Conclusion

10.88 Due to the low number of collisions and no discernible pattern in the locations, it is considered that the GB Onshore Scheme will not have a significant impact on the highway safety record in the surrounding area.

Potential Impacts

Overview of Potential Impacts

10.89 This section assesses the temporary impacts of percentage increase in traffic associated with the construction of the GB Onshore Scheme on the surrounding road network and receptors.

10.90 The worst-case potential impacts of traffic are likely to be temporary in nature (e.g. the peak period of construction).

10.91 Whilst traffic would be expected throughout the construction period, only the peak month for traffic has been assessed. This ensures that a robust worst-case traffic scenario is considered.

10.92 As described in the Approach to Assessment section of this chapter, a number of impacts have been specifically assessed:

- HGV construction traffic;
- Road Safety;
- Severance; and
- Pedestrian/ Cycle amenities.

10.93 The assessment of significance of each of the above elements has been assessed using the criteria set out in Table 10.2.

HGV Construction Traffic Impacts

10.94 The nature of effect is based on the worst-case scenario percentage increase in traffic.

10.95 The most significant traffic impacts will occur in the 2021 assessment year, as in 2023 the base traffic is marginally higher therefore the additional construction related traffic does not have as much of an overall impact. It is assumed that the worst-case traffic impact will last longer than six months.

10.96 Consequently, a percentage change has been calculated to provide an indication of the level of impact generated by the traffic upon the key road links within the ZoI.

Road Safety Impacts

10.97 A summary of the potential effects on road safety during the construction phase has been provided in Table 10.17. The magnitude of potential impacts, described in Table 10.2 is summarised below:

- High – High increase in traffic at known collision locations;
- Medium – Moderate increase in traffic at known collision locations;
- Low – Minor increase in traffic at known collision locations; and
- Negligible – Negligible increase in traffic at known collision locations.

Severance Impacts

10.98 A summary of the potential effects on severance during the construction phase has been provided. The determination of potential impact magnitude is based on the information in Table 10.2.

Pedestrian/ Cycle Impacts

10.99 The magnitude of potential impacts, described in Table 10.2 is summarised below:

- High – Limited or no facilities for pedestrians and cyclists with limited crossing facilities and low quality linkages to the local facilities;
- Medium – few facilities for pedestrians and cyclists with limited crossing facilities and linkages to the local facilities;
- Low – Few facilities for pedestrians and cyclists with safe and convenient crossing facilities and good linkages to the local facilities; and

- Negligible – Dedicated facilities for pedestrians and cyclists with safe and convenient crossing facilities and good linkages to the local facilities.

HGV Construction Traffic Impacts

10.100 Table 10.16 presents summaries of the potential effects of the additional HGV traffic generated by the GB Onshore Scheme in the 2021 assessment year. The summary contained in Table 10.16 is as a result of the assessment criteria of significance being met at specific receptors. These are then assessed as to their significance of effect.

10.101 Tables showing all traffic scenarios are provided in Appendix 10.A.

Table 10.16: Construction HGV Traffic Impact Significance of Effect

Receptor Site No.	Receptor Location	Sensitivity Rating	HGV Traffic Increase	Magnitude	Sig of Effect
1	Chapel Road	Medium	0%	Negligible	Negligible
2	B2001 Grain Road	Medium	0%	Negligible	Negligible
3	London Thamesport	Low	28.9%	Medium	Minor
4	A228 Grain Road East of Stoke	Medium	11.0%	Low	Minor
5	A228 Grain Road at Stoke	Low	11.0%	Medium	Minor
6	A289 at Wainscott	Very High	0.7%	Negligible	Minor
7	A289	High	0.7%	Negligible	Negligible
8	A228 Findsbury Rd	Very High	1.1%	Negligible	Minor
9	A228 Findsbury Rd	Medium	1.1%	Negligible	Negligible
10	A289 Pier Road	Very High	2.1%	Negligible	Minor
11	J1 of M2	Medium	0.3%	Negligible	Negligible
12	A2 Sovereign Blvd	Very High	2.4%	Negligible	Minor

10.102 Table 10.16 shows that at worse the significance of effect will only be minor. HGV % increase is greatest between the proposed Project Area access and the London Thamesport access. The ATC counters indicate greater volumes of HGVs in the baseline traffic west of Thamesport on Grain Road so the development impact decreases further.

10.103 It is not expected that HGVs will travel east of the proposed Project Area site access into the village of Grain so it has been assumed there will be a negligible impact to links east of the Project Area. However the CTMP will ensure that all contractors working on the site and operators during the operation and maintenance will be informed of the most direct and appropriate route to the strategic network, thereby reducing the risk of any increase in HGV activity into the village of Grain.

Road Safety Impacts

10.104 Table 10.17 presents a summary of the potential effects on road safety during the construction phase. At six receptor locations there is expected to be a minor increase in total traffic Therefore, in accordance with the criteria outlined earlier in Chapter, the impact magnitude for the sites has been identified as 'Low'. At all receptors the effects are therefore not significant.

Table 10.17: Road Safety Impact Significance of Effects

Receptor Site No.	Receptor Location	Sensitivity Rating	Increase in Traffic at Known Collision Locations	Magnitude	Sig of Effect
1	Chapel Road	Medium	Negligible	Negligible	Negligible
2	B2001 Grain Road	Medium	Negligible	Negligible	Negligible
3	London Thamesport	Low	Minor	Low	Negligible
4	A228 Grain Road East of Stoke	Medium	Minor	Low	Minor
5	A228 Grain Road at Stoke	Low	Minor	Low	Negligible
6	A289 at Wainscott	Very High	Negligible	Negligible	Minor
7	A289	High	Negligible	Negligible	Minor
8	A228 Findsbury Rd	Very High	Negligible	Negligible	Minor
9	A228 Findsbury Rd	Medium	Negligible	Negligible	Negligible
10	A289 Pier Road	Very High	Negligible	Negligible	Minor
11	J1 of M2	Medium	Negligible	Negligible	Negligible
12	A2 Sovereign Blvd	Very High	Negligible	Negligible	Minor

Severance Impacts

10.105 Table 10.18 presents a summary of the potential effects on severance during the construction phase. Tables showing all traffic scenarios are provided in Appendix 10.A.

10.106 Six of the twelve receptors experience a negligible effect, five are minor and one moderate based on the assessment methodology.

10.107 Receptor site 4 is the Medway Estuary SPA and experiences the moderately significant impact according to Table 10.18. With it being an ecological site there is only a limited amount of severance that can be caused by traffic. There are no footpaths, amenities or facilities on either side of the road and therefore there is little scope for pedestrians to experience any potential severance effects. As a result the effect of severance as a result of vehicular activity associated with these proposals is insignificant.

Table 10.18: Severance Significance of Effects of Construction Traffic)

Receptor Site No.	Receptor Location	Sensitivity Rating	HGV % Increase	Magnitude	Sig of Effect
1	Chapel Road	Medium	0%	Negligible	Negligible
2	B2001 Grain Road	Medium	0%	Negligible	Negligible
3	London Thamesport	Low	28.9%	Low	Negligible

Receptor Site No.	Receptor Location	Sensitivity Rating	HGV % Increase	Magnitude	Sig of Effect
4	A228 Grain Road East of Stoke	Medium	11.0%	Medium	Moderate
5	A228 Grain Road at Stoke	Low	11.0%	Low	Negligible
6	A289 at Wainscott	Very High	0.7%	Negligible	Minor
7	A289	High	0.7%	Negligible	Minor
8	A228 Findsbury Rd	Very High	1.1%	Negligible	Minor
9	A228 Findsbury Rd	Medium	1.1%	Negligible	Negligible
10	A289 Pier Road	Very High	2.1%	Negligible	Minor
11	J1 of M2	Medium	0.3%	Negligible	Negligible
12	A2 Sovereign Blvd	Very High	2.4%	Negligible	Minor

Pedestrian / Cycling Impacts

10.108 Table 10.19 presents a summary of the potential effects on pedestrians and cyclists during the construction phase. At the worst-affected receptor location (4), there are limited or no pedestrian cycling facilities available, therefore with the criteria outlined in Table 10.2 (Impact Magnitude Criteria), the impact magnitude for the sites has been identified as moderate, but as there is minimal existing pedestrian and cycle activity within the vicinity of the Project Area the impact to pedestrian and cycling activity as a result of these proposals is not significant.

Table 10.19: Pedestrian / Cyclist Significance of Effects of Construction Traffic)

Receptor Site No.	Receptor Location	Sensitivity Rating	Pedestrian / Cycling Impact	Magnitude	Sig of Effect
1	Chapel Road	Medium		Low - footpaths	Minor
2	B2001 Grain Road	Medium		Medium - footpath	Moderate
3	London Thamesport	Low		Low – dropped kerbs	Negligible
4	A228 Grain Road East of Stoke	Medium		High – no footpaths (but nothing to walk to)	Major
5	A228 Grain Road at Stoke	Low		Negligible – sig crossing	Negligible
6	A289 at Wainscott	Very High		Negligible - footbridge	Negligible
7	A289 Medway City Estate	High		Negligible – sig crossings	Minor
8	A228 Findsbury Rd	Very High		Negligible – sig crossings	Minor
9	A228 Findsbury Rd	Medium		Negligible	Negligible
10	A289 Pier Road	Very High		Negligible - footbridge	Minor
11	J1 of M2	Medium		Negligible - footbridge	Negligible

Receptor Site No.	Receptor Location	Sensitivity Rating	Pedestrian / Cycling Impact	Magnitude	Sig of Effect
12	A2 Sovereign Blvd	Very High		Negligible – foot/cycle path segregated	Minor

10.109 When combined with receptor sensitivity values, this results in one of the receptors experiencing a 'major' significant effect.

10.110 However, it should be noted that there are currently very few pedestrians/ cyclists using the roads in the vicinity of the receptor and due to the nature of the roads, very few additional pedestrian/ cyclist movements would be expected in the future. The works are also expected to be temporary, therefore any effects will only be apparent for a limited period and therefore would be Minor and not significant.

Decommissioning Effects

10.111 The effects during the decommissioning phase would be no worse than those presented throughout the previous sections of this Chapter, as decommissioning would essentially be the reverse of the construction period. The impacts, unless there were significant levels of development and an increase in pedestrian and cycle activity would therefore be no worse in scale, nature and duration, with the resultant effects considered likely to be not significant.

Mitigation

Overview of Mitigation

10.112 In order to minimise any effect relating to traffic and transport, a number of mitigation measures have been proposed. Mitigation would be committed and delivered through the outline Construction Traffic Management Plan (CTMP) which will be agreed prior to construction with Medway Council.

Construction Traffic Management Plan

10.113 CTMP Mitigation relating to traffic movements associated with the construction of the GB Onshore Scheme would be focused primarily on HGV traffic, as the additional car/ Light Goods Vehicle (LGV) trips will have a negligible impact on future traffic flows. However, the impacts of car/ LGV trips could also be mitigated through the encouragement of worker car share.

10.114 Based on the assessment criteria of HGV traffic, the only method of reducing the overall significance of effect would be through a reduction in overall HGV traffic during construction (either by reducing the total number required or re-routeing traffic). This will not be possible, hence the residual impacts would remain the same post mitigation. However, there are a number of softer measures that would help to lessen the general impacts of the construction traffic.

10.115 The CTMP will include the following:

- Location of Project Area and the entry/ exit arrangements;
- Traffic routeing plans – defining the routes to be taken by HGVs to the Project Area. For example, prioritising the use of A and B-roads as far as possible, avoidance of built-up areas and other sensitive locations;
- Construction hours and delivery times stipulated to best avoid peak periods;
- Strategy for traffic management and measures for informing construction traffic of local access routes, road restrictions, timing restrictions and where access is prohibited;
- Measures to protect the public highway (e.g. wheel wash facilities);
- Measures for the monitoring of the CTMP to ensure compliance from drivers and appropriate actions in the event of non-compliance;
- Mechanism for responding to traffic management issues arising during the works (including concerns raised from the public) including a joint consultation approach with relevant highways authorities;
- Details of traffic management requirements; and
- Strategy for traffic management and measures for informing construction traffic of local access routes, road restrictions (statutory limits: width, height, axle loading and gross weight), timing restrictions (if applicable) and where access is prohibited.

10.116 Control measures will include:

- All construction traffic to adhere to the Traffic Route Plans included in the CTMP;
- All vehicles will be able to access and egress the Project Area in a forward gear, with sufficient room off the public highway to allow them to wait without blocking the main carriageway;
- Welfare facilities will be provided so as to minimise the need for off-site trips by staff during the working day;
- At all Project Area accesses, suitable supervision will be provided as required to ensure that traffic is controlled at access points during construction (for example banksman checking road traffic and controlling construction vehicle movements) and mud deposits on the roads are minimised; and

- Where required, traffic signals (in accordance with New Roads and Street Works Act (NRSWA), (Ref 25-7) or stop-go boards will be used to control road traffic. Road signs will conform to Chapter 8 of TSRG (Traffic Signs Manual, Ref 25-8) and NRSWA.

Road Safety

10.117 Whilst the majority of impacts relating to road safety are 'Negligible' or 'Minor', the access from the public highway at the B2001 would use Banksmen to manage the movement of HGVs on and off the public highway. Warning signage would be provided on the approaches to the access junction.

Pedestrians and Cyclists

10.118 As part of a Travel Plan developed for the GB Onshore Scheme, measures such as an internal site layout to accommodate the movement of pedestrian and cyclists would be designed. This would provide benefits within the Project Area, but would not provide benefits to external receptors.

10.119 There would however be very few pedestrian/ cyclist movements expected as part of the construction phase of the development, which relates to the relatively low number of additional workers expected.

Travel Plan

10.120 A Travel Plan would be introduced in order to encourage sustainable travel to the Project Area. The Travel Plan would include measures such as; encouragement of car sharing and public transport usage, better marketing of information and implementation of a Travel Plan Co-ordinator. Where appropriate, a shuttle bus to transport workers to key interchange locations could be introduced.

10.121 An important element in ensuring the success of the construction phase and reducing the effects on traffic receptors is effective communication with local communities before and during the construction process, and in particular to inform them of the timing of construction activities and to help alleviate any concerns they may have. To address this the Applicant will ensure, in line with NRSWA and any Section 278 Agreements with the Highway Authorities, that the Contractor maintains good communication with affected communities, keeping them informed about the timing and extent of activities which may affect them.

10.122 So far as practicable material will be retained on site including the retention of all soils and spoils, therefore minimising the need to move material on and off the site.

10.123 It is considered that with the implementation of the above measures, any minor effects on road users during the construction period will be reduced further. Where appropriate, HGVs would access and egress in a forward gear. At all accesses, warning signage will be provided on the approaches to the access junctions.

Residual Impacts

10.124 This section of the report outlines the residual effects of the potential traffic impacts, following the application of mitigation. As previously stated, only the construction phase has been considered in this assessment as the traffic impact will be negligible during the operational period of the development.

HGV Construction Traffic

10.125 Table 10.20 summarises the residual effects of the additional HGV traffic generated by the proposed converter station site on a weekday and a Saturday following the implementation of associated mitigation.

Table 10.20: HGV Traffic Impact Significance of Effects of Construction Traffic)

Receptor Site No.	Receptor Location	Sensitivity Rating	HGV % Increase	Magnitude	Sig. of Effect (Without Mitigation)	Sig. of Effect (With Mitigation)
1	Chapel Road	Medium	0%	Negligible	Negligible	Negligible
2	B2001 Grain Road	Medium	0%	Negligible	Negligible	Negligible
3	London Thamesport	Low	28.9%	Medium	Minor	Minor
4	A228 Grain Road East of Stoke	Medium	11.0%	Low	Minor	Minor
5	A228 Grain Road at Stoke	Low	11.0%	Medium	Minor	Minor
6	A289 at Wainscott	Very High	0.7%	Negligible	Minor	Minor
7	A289	High	0.7%	Negligible	Negligible	Negligible
8	A228 Findsbury Rd	Very High	1.1%	Negligible	Minor	Minor
9	A228 Findsbury Rd	Medium	1.1%	Negligible	Negligible	Negligible
10	A289 Pier Road	Very High	2.1%	Negligible	Minor	Minor
11	J1 of M2	Medium	0.3%	Negligible	Negligible	Negligible
12	A2 Sovereign Blvd	Very High	2.4%	Negligible	Minor	Minor

10.126 As indicated in Table 10.20, the highest level of significance on any of the links is classified as ‘Minor’.

10.127 The measures introduced as part of the CTMP would help to lessen the general impacts of the construction traffic. For example, the use of A and B-roads would be prioritised as far as possible, together with the avoidance of built-up areas such as Strood, Rochester, Chatham and other sensitive locations where there is a viable alternative.

Road Safety Impacts

10.128 Table 10.21 presents a summary of the residual effects on road safety during the construction phase.

Table 10.21: Road Safety Impact Significance of Effects of Construction Traffic)

Receptor Site No	Receptor Location	Sensitivity Rating	Increase in Traffic at Known Collision Locations	Magnitude	Sig of Effect (Without Mitigation)	Residual Significance
1	Chapel Road	Medium	Negligible	Negligible	Negligible	Negligible
2	B2001 Grain Road	Medium	Negligible	Negligible	Negligible	Negligible
3	London Thamesport	Low	Minor	Minor	Negligible	Negligible
4	A228 Grain Road East of Stoke	Medium	Minor	Minor	Minor	Minor
5	A228 Grain Road at Stoke	Low	Minor	Minor	Negligible	Negligible
6	A289 at Wainscott	Very High	Negligible	Negligible	Minor	Minor
7	A289	High	Negligible	Negligible	Minor	Minor
8	A228 Findsbury Rd	Very High	Negligible	Negligible	Minor	Minor
9	A228 Findsbury Rd	Medium	Negligible	Negligible	Negligible	Negligible
10	A289 Pier Road	Very High	Negligible	Negligible	Minor	Minor
11	J1 of M2	Medium	Negligible	Negligible	Negligible	Negligible
12	A2 Sovereign Blvd	Very High	Negligible	Negligible	Minor	Minor

10.129 The majority of links classified as experiencing either a 'negligible' or 'minor' residual significance of impact. The link directly to the west of the Project Area experiences an impact of moderate significance according to the assessment methodology, however due to the lack of built-up land in its surroundings the impact is not expected to be significant.

Pedestrian / Cycling Impacts

10.130 Table 10.22 presents a summary of the residual effects on pedestrian and cycling during the construction phase.

Table 10.22: Severance Significance of Effects of Construction Traffic)

Receptor Site No.	Receptor Location	Sensitivity Rating	Ped / Cycle Impacts	Magnitude	Sig. of Effect (Without Mitigation)	Sig. of Effect (With Mitigation)
1	Chapel Road	Medium		Low - footpaths	Minor	Minor
2	B2001 Grain Road	Medium		Medium - footpath	Moderate	Minor

Receptor Site No.	Receptor Location	Sensitivity Rating	Ped / Cycle Impacts	Magnitude	Sig. of Effect (Without Mitigation)	Sig. of Effect (With Mitigation)
3	London Thamesport	Low		Low – dropped kerbs	Negligible	Negligible
4	A228 Grain Road East of Stoke	Medium		High – no footpaths (but nothing to walk to)	Major	Moderate
5	A228 Grain Road at Stoke	Low		Negligible – sig crossing	Negligible	Negligible
6	A289 at Wainscott	Very High		Negligible - footbridge	Negligible	Negligible
7	A289	High		Negligible – sig crossings	Minor	Minor
8	A228 Findsbury Rd	Very High		Negligible – sig crossings	Minor	Minor
9	A228 Findsbury Rd	Medium		Negligible	Negligible	Negligible
10	A289 Pier Road	Very High		Negligible - footbridge	Minor	Minor
11	J1 of M2	Medium		Negligible - footbridge	Negligible	Negligible
12	A2 Sovereign Blvd	Very High		Negligible – foot/cycle path segregated	Minor	Minor

10.131 The impact magnitude for pedestrian/ cycling movements is driven by the level of existing amenities available. As there are little or no facilities available at some of the receptor locations and very few cyclists/ pedestrians are expected as part of the construction, the residual significance has been reduced. Sites 2 and 4 are examples of this, where the ATC traffic counters picked up an average of 9 and 6 two-way cycle movements, respectively.

10.132 The residual effects on pedestrians and cyclists has therefore been considered not significant in this assessment.

Decommissioning Effects

10.133 The residual effects during the decommissioning phase would be no worse than those presented within Potential Impacts sections, as decommissioning would essentially be the reverse of the construction period unless there were significant levels of development and an increase in pedestrian and cycle activity. The impacts would therefore be no worse in scale, nature and duration, with the resultant effects considered likely to be not significant.

Cumulative Effects

10.134 This section considers the inter-project and intra-project cumulative impacts relating to traffic and transport. Reference should be made to the cumulative assessment chapter (12) which also identifies the committed developments to be considered within the assessment.

Scope of Cumulative Assessment (Inter-Project Impacts)

10.135 This section considers the inter-project impacts, which relate to other committed developments in the vicinity of the Project Area.

10.136 Table 10.23 details the committed developments considered as part of the proposed converter station traffic and transport assessment.

10.137 The developments identified within Chapter 12 Cumulative Assessment have been reviewed and further review of relevant documentation relating to the committed developments has been undertaken to ascertain whether there would be any potential traffic impacts generated by these sites. The next stage of the process was to discount sites from the identified list if they were not deemed to generate traffic impacts.

10.138 For example, if traffic was not to be generated at the same time as that of the proposed converter station construction period and the volume of traffic was not considered significant, the committed development was omitted from the assessment at this point.

10.139 As shown in Table 10.23, none of the committed development sites have been included as part of the initial traffic and transport assessment. These sites were then assessed further to ascertain their potential effects on the proposed converter station site.

Table 10.23: Register of Nearby Developments (Stage 1 Cumulative Effects Assessment)

ID	Project	Status	Expected Construction	Relationship with the GB Onshore Scheme	Traffic Impact
1	NGET OHL Works – connection of the GB Onshore Scheme to the NETS.	Proposed – no application submitted	Construction expected to coincide with the construction of the proposed substation.	0 m – to connect with the proposed substation.	No – scale of work too small for impact
2	GB Offshore Scheme – subsea cable installation beyond MLWS.	Proposed – Scoping Opinion Request issued; planning application to be submitted in line with GB Onshore Scheme.	Construction period will align with the installation of the DC cable of the GB Onshore Scheme	0 m – connects directly to the subsea DC cable at MLWS.	No – works offshore
3	Six residential properties; Port Victoria Road, Isle Of Grain, Rochester, ME3 0EN	Outline application submitted and validated in June 2018. Planning decision is pending. Planning Reference: MC/18/1871	No details of intended construction period provided.	Approx. 580 m east (Grain)	No - scale of work too small for impact
4	Outline planning application for the development of up to 464,685 m^2 of built employment floorspace and up to 245 m^2 of floorspace for a business park management centre;	Original application (Planning Reference MC/09/1628) approved with conditions March 2010. Latest conditions discharged June 2019.	No known timeframes for construction.	Phase 1 is approx. 1.2 km southwest	No – Site to be constructed at the same time as GB Onshore, however no construction traffic information is

ID	Project	Status	Expected Construction	Relationship with the GB Onshore Scheme	Traffic Impact
	Grain Road Isle Of Grain Rochester Kent ME3 0AE				currently available
5	Construction and operation of a cementitious grinding facility and associated development; Grain Road, Isle of Grain, ME3 0DW	Scoping Opinion request for the importation of clinker and granulated blast furnace and development of a grinding facility. Scoping Opinion submitted July 2019. Planning Reference: MC/19/1793	EIA Scoping at this stage only	Approx. 1.7 km southwest	No – There is no Transport Assessment available at this stage.
6	Cement Plant; Thamesport Isle Of Grain Rochester Medway ME3 0AP Proposed development of a new cement plant at London Thamesport.	Planning application validated February 2019. Planning Reference: MC/19/0299	No construction programming information provided within submission documents.	Approx. 2 km southwest	Requires Assessment

10.140 The Thamesport Cement Limited site was considered to require further assessment. The Environmental Statement (Feb 2019, PDE Consulting Limited) submitted in support of the application states that the site is a cement production plant, including ancillary facilities and access on land within London Thamesport, Isle of Grain. The site extends approximately 8.67 hectares including the access, with the operational area of the development occupying 2.2 hectares. It lies within the administrative boundary of Medway Council approximately 7.7 km east of Hoo and is situated on the northern bank of the River Medway.

10.141 There has been no Transport Assessment submitted as part of the application, however operational traffic volumes are provided as part of the aforementioned Environmental Statement and within the associated Air Quality Assessment, January 2019 produced by White Young Green. The assumed operational opening year for the GB Onshore Scheme has been stated as 2020, which coincides with the identified peak construction scenario of 2021 for the GB Onshore development.

10.142 The Environmental Statement suggests the following regarding HGV movements:

> *"Adopting 24 working days in the month of June would give rise to 67 load outs per day (134 movements), however to accommodate larger contracts as described above we have assumed a peak of 90 loads out per day (180 movements). To allow for the provision of supplies and services to the facility an allowance of a further 16 HGV movements per day has been adopted so this would give a likely worst case scenario of 196 HGV movements (98 in: 98 out) per day. Given the substantial drop in trading levels within the wider Port and the permitted numbers of HGV movements associated therewith, this number of HGV movements is not likely to be significant."*

10.143 The Air Quality Assessment presents baseline 2017 traffic data sourced from DfT counters and growthed to the proposed opening year of 2020 using the TEMPRO factor of 1.0531 representing the 'Do Minimum' scenario. All data is presented as Annual Average Daily Traffic (AADT). The development trips to calculate the 'Do Something' scenario were distributed throughout the local highway network assuming an equal dispersion of traffic at each major junction, prioritising traffic flows westwards towards the M2.

10.144 As described in the Environmental Statement, traffic flows associated with the development have been calculated using a worst-case scenario. Based on the 20 parking spaces at the development and the 24hr operation, as well as the 196 HGV movements.

10.145 Using the data from these assessments and comparing them to the equivalent count locations used for the GB Onshore scheme Results in the following development trips, shown in Table 10.24, from the Cement Plant that will be considered within this cumulative assessment. It should be noted that the GB Onshore assessment included more count locations and a geographically broader trip distribution assessment.

Table 10.24: Thamesport Cement Plant Development Trips

		2017 Base Year			2020 Do Minimum			2020 Do Something			2020 Dev Trips Only	
Corresponding GB Onshore Counter	Link	AADT	HGV %	HGVs (veh)	AADT	HGV %	HGVs (veh)	AADT	HGV %	HGVs (veh)	AADT	HGV
ATC 1 and 2	Grain Road – East of site	2606	1.3	34	2744	1.3	36	2764	1.3	36	20	0
ATC 3	Grain Road – West of site	8582	18.5	1588	9038	18.5	1672	9294	20.1	1868	256	196
DfT 01	A228 North of Christmas Lane	8582	18.5	1588	9038	18.5	1672	9279	20.1	1865	241	193
DfT 02	Four Elms Road – West of Main Road Hoo	33024	4.1	1354	34778	4.1	1426	34996	4.6	1610	218	184

10.146 Table 10.13 of this Chapter states the sensitive receptors that have been identified and subsequently assessed. Three of these sensitive receptors can therefore be considered within a cumulative assessment as shown in Table 10.25.

Table 10.25: Comparable Receptors within Study Area

Site	Receptor Location	Site Location	Sensitivity Rating	Description	Distance from Site Access
1	Chapel Road	ATC 1	Medium	Shops/Businesses, Residential properties close to the carriageway	450m
2	B2001 Grain Road	ATC 1	Medium	Residential properties close to the carriageway	750m
3	London Thamesport	ATC 2	Low	London Thamesport	1.4km

10.147 As described in the Potential Impacts section the most significant traffic impacts will occur in the 2021 assessment year, as in 2023 the base year traffic is marginally higher therefore reducing the percentage HGV impact from the additional construction related traffic.

10.148 In order to update the Construction HGV Traffic Impact Significance of Effect assessment, the development only trips from the Thamesport Cement Plant were added to the baseline traffic flows growthed to 2021 from the original assessment along with the construction vehicle movements associated with the GB Onshore Scheme.

10.149 For the three receptors that are able to be assessed this results in the following changes in significance, shown in Table 10.26, to the results presented in Table 10.16.

Table 10.26: Construction HGV Traffic Impact Cumulative Significance of Effect

Receptor Site No.	Receptor Location	Sensitivity Rating	HGV Traffic Increase	Magnitude	Sig of Effect
1	Chapel Road	Medium	0%	Negligible	Negligible
2	B2001 Grain Road	Medium	0%	Negligible	Negligible
3	London Thamesport	Low	18%	Medium	Minor

10.150 The increased HGV activity resulting from the Thamesport Cement Plant has the result of increasing general levels of HGV traffic on the local highway network. As a result the percentage change of HGV traffic generated by construction activities for the GB Onshore scheme represent a lower magnitude of change in HGV proportions than under the previous assessment. The only receptor to change was receptor number 3 where the HGV traffic increase reduced from 28.9% to 18%. The magnitude and significance of effect however remained the same.

10.151 Receptor number 3 represented the largest effect under the original assessment and although not all of the receptors have been assessed due to the lack of available information on the Thamesport Cement Plant, it can be assumed that the Cement Plant traffic would follow a similar trip distribution pattern to that of the GB Onshore traffic and the resulting significance of effect values at all receptors would remain similar as a result. In fact the increased levels of operational HGV traffic from the Cement Plant, would raise general background traffic HGV proportions, lessening the order of magnitude of effect from the GB Onshore scheme. The assessment carried out in the Potential Impacts section represents a robust worst-case assessment and therefore Road Safety, Severance and Pedestrian/ Cycling impacts have not been re-considered within the cumulative assessment.

Scope of Cumulative Assessment (Intra-Project Impacts)

10.152 This section considers the intra-project impacts, which relate to construction activities concerning the proposed DC cable route.

10.153 For the purposes of this assessment, the traffic impacts generated by each of the components of the GB Onshore Scheme have been combined.

10.154 The construction period for the GB Onshore Scheme is scheduled to take place between 2021 and 2023.

10.155 Although it is unlikely that the peak construction periods will coincide, an assessment has been undertaken to determine the impacts of this scenario, were it to occur.

10.156 Only traffic generated by the proposed DC cable route Temporary Construction Facilities (TCFs) closest to the proposed converter station have been considered as part of the assessment due to the proximity to the Project Area.

10.157 As with the other assessments contained within this chapter, a 2021 assessment year has been assumed for the associated converter station traffic. Traffic relating to the proposed DC cable route construction has then been added to indicate the intra-project traffic impacts.

10.158 When combined, the impacts on receptors are considered to remain not significant.

Summary of Assessment

10.159 This chapter reports the results of the baseline studies and the assessment of the potential impacts of traffic and transport of the GB Onshore scheme.

Overview of Baseline Conditions

10.160 Access to the proposed converter station and substation will be via the B2001 Grain Road. An existing unnamed road runs west/ northwest from Grain Road along the southern boundary of the site, which is the preferred point of access during construction and operation of the GB Onshore Scheme.

10.161 Prediction of construction effects has focused on activities that could directly and indirectly impact on receptors within the defined study area. The ZoI includes those roads which may be utilised during construction, and upon which there is the potential for a significant impact.

10.162 The southern boundary lies adjacent to the B2001 Grain Road. The B2001 heads west, continuing into the A228 and is the only route along the along the Hoo Peninsula to the Isle of Grain, linking the site with Rochester, Chatham Docks and the A2/ M2 for onwards destinations.

10.163 Baseline traffic levels have been established in order to quantify the magnitude of impact of the development traffic. ATC and data obtained from the DfT has been used to derive the baseline.

10.164 ATCs were placed on the B2001 Grain Road near the site access and recorded 24-hour traffic flows over a seven-day period. The surveys were initially conducted from the 1st November 2018 – 7th November 2018. ATC 1 and 3 were found to be faulty and were subsequently re-surveyed from the 9th November to the 15th November.

10.165 DfT record AADT flows for every junction-to-junction link on the 'A' road and motorway network in Great Britain. DfT traffic data was used for the remainder of the ZoI.

10.166 Collision data has been reviewed for the most recent five-year period available within the study area, which covers the village of Grain, the B2001 and the A228 until Upper Stoke. There has been a total of 15 collisions within the study area, five of which caused serious injury. There were no collisions recorded within proximity of the site access, nor were there any clusters of collisions identified within the study area.

10.167 Due to the low number of collisions and no discernible pattern in the locations, it is considered that the proposed development will not have a significant impact on the highway safety record in the surrounding area.

Overview of Residual and Cumulative Effects

10.168 In summary, the results of the assessments indicate that the impacts are likely to be not significant. However, some receptors experience an effect deemed 'moderate' using the assessment methodology outlined in the 'Approach to Assessment' section. These concern Severance and Pedestrian facilities on Grain Road (Receptor 4).

10.169 It has been demonstrated that these impacts should not be considered significant due to the lack of pedestrians or cyclists around to experience the effect brought on by the increase in HGV traffic.

10.170 A search of the planning portal revealed no committed developments that are likely to have any significant impact when combined with the traffic generated by the GB Onshore Scheme. Whilst not yet classified as a committed scheme the Thamesport Cement Limited site was considered to require further assessment. It was found that the increased HGV activity generated from the Thamesport Cement Plant which increases general levels of HGV traffic on the local highway network. As a result, the percentage change of HGV traffic generated by construction activities for the GB Onshore Scheme represent a lower magnitude of change in HGV proportions than under the previous assessment. The increased levels of operational HGV traffic from the Cement Plant, would raise general background traffic HGV proportions, lessening the order of magnitude of effect from the GB Onshore Scheme.

11. Ground Conditions

Introduction

11.1 This Chapter assesses the potential impacts from the construction and operation of GB Onshore Scheme in relation to ground conditions. This Chapter considers ground conditions within the context of the potential for land contamination to impact upon the GB Onshore Scheme, or to be disturbed or caused by the GB Onshore Scheme. The Chapter establishes the method followed for the assessment, summarises the regulatory and policy framework related to the ground conditions topic and describes the existing environment in the area surrounding the application boundary. Following this, the potential impacts, mitigation, residual and cumulative impacts of the GB Onshore Scheme are discussed.

11.2 The area defined as the application boundary (depicted on Figure 11.1) is interchangeably referred to as the ‘’Project Area’ as appropriate throughout this Chapter.

Approach to Assessment

Previous Assessment

11.3 An Environmental Liability Desk Study[6] report was prepared for the Project Area in August 2018. This report has been used to inform the baseline conditions and has been included for reference in Appendix 11.A (with commercially-sensitive information removed).

Consultation

11.4 A Screening Report[7] was prepared and associated Screening Opinion sought from Medway Council in November 2018 the schedule of responses is presented in Appendix 3.1, covering all disciplines including ground conditions. No comments for the Ground Conditions discipline were received in relation to the GB Onshore Scheme screening report. Comments from the Offshore Screening Report were responded to by the Environment Agency; this details that contamination of soils and sediments may be an issue of concern, and further assessment is required, particularly in relation to perceived "minimal impacts" from sediment disturbance. The Environment Agency also noted that disturbed contaminated sediments may have a broader impact than just localised sediment release.

Data and Information

11.5 A Landmark Envirocheck data report has been obtained in GIS data format for the Project Area to provide environmental data that includes potential sources of contamination, previous industrial land uses and sensitive land uses and receptors. The data was obtained as part of the preparation of the Environmental Liability Desk Study and purchased in May 2018, and the data was relicensed in May 2019 to allow for its continued use.

11.6 Requests for further information in relation to potential sources of contamination identified during the assessment process, water abstractions, pollution incidents, discharges to controlled waters and landfilling within the study area were sent to the Environment Agency and Medway Council on the 30th May 2019. The Environment Agency responded to requests detailing records they hold within 2km of a single point near Perry's Farm. This information included six discharge consents, four pollution incidents, four records of historical landfills and details of one groundwater abstraction licence which could be located on plans.

11.7 Details of a further seventy-three pollution incidents were supplied but their location was not held by the Environment Agency, due to the level of pollution being recorded as minor or no impact on the environment. Medway Council responded to requests for information, however it was considered that there was no need for further engagement at this stage given the level of information already available.

11.8 The Defence Infrastructure Organisation (DIO) were also contacted as a result of recommendation from the Environment Agency as they held no information on former military land present within the study area. A reply was received from the Defence Business Service who stated they hold no records of this area of military land as all records dating prior to 1993 are held in the UK National Archives.

11.9 No Local Geological Sites (LGS) have been identified within the study area based on the information provided by the GeoConservation Kent website and so no engagement with local geological groups has been undertaken.

[6] Isle of Grain Environmental Liability Desk Study (2018)
[7] NeuConnect: Great Britain to Germany Interconnector, GB Onshore Scheme Screening Report. November 2018.

Assessment Method

Introduction

11.10 The ground conditions topic has been assessed using published information and existing information from historical site investigation/ assessments which are referenced accordingly throughout this Chapter. This section outlines the proposed assessment methodology.

11.11 General and topic-specific guidance presented in the Design Manual for Roads and Bridges (DMRB) Volume 11[8], together with relevant industry guidance and practice applied when undertaking EIA for ground conditions has been considered in the preparation of this Chapter. Further details can be found in the Planning Policy and Legislation section of this Chapter.

Geographical Scope

11.12 The study area for the ground conditions assessment comprises the Project Area and an additional radial zone of 250 metres (m). A radial zone of 1 kilometre (km) is considered for groundwater, and surface water abstractions within the context of identifying potential receptors to any soil and/ or groundwater contamination and is herein referred to as the 'extended study area'. This study area is appropriate for the consideration of historical and current potentially contaminative land uses which may have resulted in contamination and is consistent with how study areas for ground conditions are defined with other schemes, which in the absence of specific published guidance is based on professional judgement and accepted best practice within the industry.

11.13 The study area and the extended study area are illustrated on Figure 11.1.

11.14 The Environmental Liability Desk Study describes how the application boundary is distributed over three separate land parcels. Within the Environmental Liability Desk Study the area surrounding Perry's Farm, including the area of the proposed converter station, substation, access track and cable sealing end compound is subdivided into 'Area 1', 'Area 2' and 'Area 3' based on historical landfilling activity. This zoning has been retained in the Chapter to assist in describing the baseline conditions and is depicted on Figure 11.1.

Temporal Scope

11.15 The temporal scope covers the construction and operational phases of the GB Onshore Scheme.

Geology and Soils

11.16 Geology has been assessed using published information and existing information available from the Environmental Liability Desk Study report undertaken in 2018.

Geo-conservation Sites

11.17 No geological Sites of Special Scientific Interest (SSSI) or LGS have been identified within the study area. Therefore, these receptors are scoped out of the assessment.

Mineral Resources

11.18 Parts of the study area contain former sand and gravel workings, some of which are now occupied by water bodies, others have been utilised for landfill.

11.19 As per the Medway Development Strategy (2012-2035), the study area is not located within a Mineral Area of Search. Part of the study area is noted to overlap with an area earmarked as a 'disposal to land resource area', which is crossed by the proposed access track and the proposed DC cable route. It is noted that this area of land has already been subject to landfilling. Given this the GB Onshore Scheme is considered to be consistent with the Medway Development Strategy.

[8] Highways Agency, Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 11 Geology and Soils, 1999

11.20 The Project Area is not located in an area affected by coal mining and so this is scoped out of the assessment.

Land Instability

11.21 Reference to land stability is included within the 'Baseline Conditions' section drawing on information provided within the Envirocheck data and Environmental Liability Desk Study report. However, where land instability is identified to be an issue, it will be investigated and addressed with an engineering solution as part of the detailed design and so is not assessed within this Chapter.

Land Contamination

11.22 Areas of potential ground contamination have been identified within the study area. In line with the Environment Agency's Contaminated Land Report CLR11[9], the assessment of land contamination takes the form of a tiered, risk-based approach, as summarised here:

- Tier 1: qualitative risk assessment based on a desk top study of available information to identify potential sources of contamination, receptors to contamination and potential pathways between them. The identified sources, pathways and receptors are presented in the form of a Conceptual Site Model (CSM) showing the potential contaminant linkages (PCL);
- Tier 2: If PCLs are identified, this means there is a theoretical risk to receptors from contamination and intrusive investigation should be used to provide data to inform a generic quantitative risk assessment (GQRA). The GQRA involves comparison of site-specific, laboratory analytical data against appropriate generic assessment criteria (GAC) for human health and/or controlled waters which represent minimal or tolerable risk; and
- Tier 3: detailed quantitative risk assessment to identify whether contamination identified above minimal or tolerable risk levels represents an unacceptable risk and therefore requires mitigation, such as remediation.

Screening Assessment

11.23 A qualitative assessment of the risks posed by land contamination within the ground conditions study area has been undertaken by first assigning a 'site rating' (on a scale of 1 to 5) to each identified historical or current area of potential land contamination identified in the baseline review. The site rating has been determined using the tables provided in Appendix 11.B (part 11.B1). The site rating is based partly on the relationship between the identified area of potential land contamination and its proximity to the Project Area (Appendix 11.B, Table 11.B1.1) together with the extent of any proposed cut/ fill earthworks to be undertaken to facilitate the GB Onshore Scheme (Appendix 11.B, Table 11.B1.3). The site rating also considers the nature of the current and/ or historical land use, as certain land uses typically result in a greater potential for contamination of the ground to have occurred (Appendix 11.B, Table 11.B1.2). The lower the site rating then the lower the risk. Professional judgement has been applied in reviewing the generated site ratings. Generally, site ratings of two or less are considered not to pose a significant risk and have not been considered for further assessment. Site ratings of three or more have been considered further.

11.24 The next step for screening relates to a review of sensitive receptors and their proximity to the potential contaminated site; a combination of this review and the site rating defines whether a site advances to the detailed assessment stage for further risk and impact assessment which is described in the following sections.

[9] Environment Agency (2004), Contaminated Land Report (CLR11) Model Procedures for the Management of Land Contamination.

Risk and Impact Assessment

11.25 The approach to assessing the potential impacts of the GB Onshore Scheme has been undertaken by comparing the risk levels at baseline with the CSM and the risk levels for the construction and post-construction stages respectively, to determine any change in risk at each stage.

11.26 Potential risks have been determined and assessed based on the likelihood (or probability) and consequence using the principles noted in the National House Building Council (NHBC), Environmental Agency and Chartered Institute of Environmental Health (CIEH) report R&D66[26]. This provides guidance on development and application of the consequence and probability matrix to risk assessment and broad definitions of consequence. The risk matrix is presented in Table 11.1.

Table 11.1: Estimation Level of Risk

Probability	Consequence			
	Severe	Medium	Mild	Minor
High likelihood	Very high risk	High risk	Moderate risk	Low risk
Likely	High risk	Moderate risk	Moderate/low risk	Low risk
Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

11.27 The significance of the effects of land contamination has been assessed by comparing the difference in risk for each contaminant linkage at baseline to those at construction and at post construction stages. Where there is shown to be a decrease in risk the GB Onshore Scheme is assessed as having a potential beneficial effect on the environment in the long term.

11.28 The definitions of the significance criteria to be used are presented in Table 11.2. This provides details of how increases and decreases in the contamination risks identified are related to the significance criteria adopted. Potential effects that are determined as being 'moderate' or 'major' are classed as 'significant' effects. Where an effect is anticipated to be 'neutral' or 'minor', these effects are classed as 'not significant'.

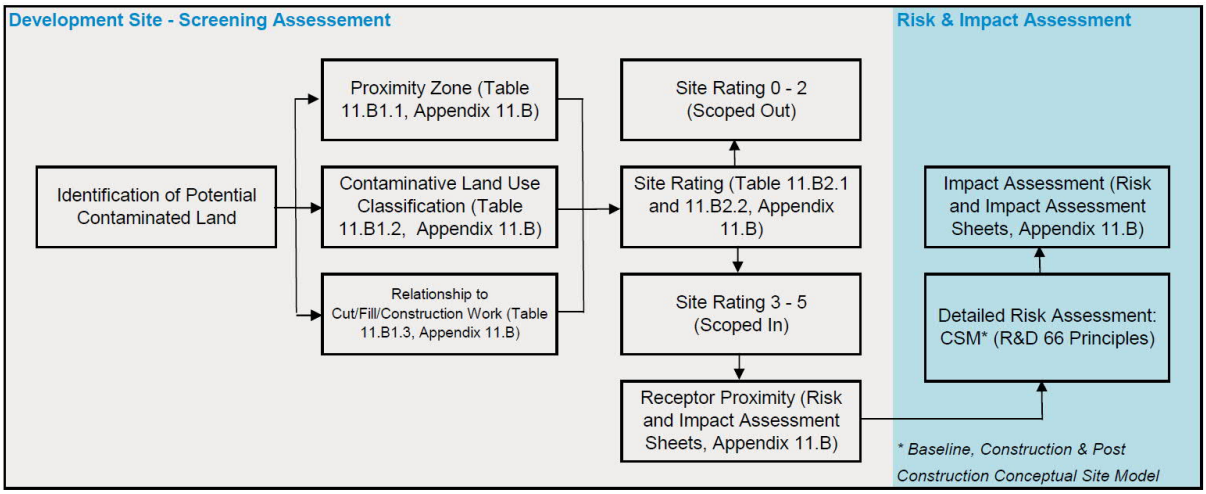
Table 11.2: Significance Criteria

Potential impact during construction	Importance of receptors
Major adverse effect	An increase in contamination risk of 4 or 5 risk levels in the risk matrix, e.g. from land that has a very low contamination risk in the baseline becomes a high or very high risk
Moderate adverse effect	An increase in contamination risk of 2 or 3 risk levels in the risk matrix, e.g. land that has a low contamination risk in the baseline becomes a moderate or high risk
Minor adverse effect	An increase in contamination risk of 1 risk level in the risk matrix, e.g. land that has a low contamination risk in the baseline becomes a moderate/low risk
Neutral effect	No change in contaminated land risks
Minor beneficial effect	A reduction in contamination risk of 1 risk level in the risk matrix, e.g. land that has a moderate/low contamination risk in the baseline becomes a low risk

Potential impact during construction	Importance of receptors
Moderate beneficial effect	A reduction in contamination risk of 2 or 3 risk levels in the risk matrix, e.g. land that has a high contamination risk in the baseline becomes a moderate/low or low risk
Major beneficial effect	A reduction in contamination risk of 4 or 5 risk levels in the risk matrix, e.g. land that has a very high contamination risk in the baseline becomes a low or very low risk

11.29 A flow chart summarising the screening, risk and impact assessment steps is presented as Figure 11.2.

Figure 11.2: Summary of screening, risk and impact assessment steps



Assumptions & Limitations

11.30 The assessment undertaken for ground conditions has been based on the evaluation of available key documentation provided by the British Geological Survey (BGS), Department for Environment, Food and Rural Affairs (DEFRA), Environment Agency, the Landmark Envirocheck GIS data, Natural England, Medway Council, and other data sources including the Environmental Liability Desk Study report. Unless stated otherwise, the data presented in other consultant's reports has not been independently verified.

11.31 Whilst some reference to land stability is included within the baseline conditions section, an engineering solution will be determined at detailed design phase, which will be signed off by the local planning authority.

11.32 It is assumed that a detailed Construction Environmental Management Plan (CEMP) will be secured by a condition as part of the outline planning permission. The CEMP will be prepared by the appointed Contractor for their part of the construction works. The CEMP will be developed in conjunction with stakeholders to ensure compliance with legislative and best practice requirements for construction phase mitigation methods and environmental requirements. The assessment has been undertaken on the assumption that a CEMP will be prepared and assumes such mitigation contained within it is in place.

Planning Policy & Applicable Legislation

Legislative Context

11.33 The following key legislation (UK Acts/ Regulations) is of direct relevance to the assessment of effects of the GB Onshore Scheme on, and to, ground conditions.

11.34 Current legislation relating to contaminated land in the UK is contained within Part 2A of The Environmental Protection Act (EPA) 1990, which was inserted by s57 of the Environment Act 1995 and by s86 of the Water Act 2003 and elaborated upon within the Contaminated Land (England) Regulations 2006 [S.I. 2006/1380] (amended 2012 [S.I. 2012/263]). Under Part 2A, sites are identified as 'contaminated land' if they are: causing significant harm, if there is a significant possibility of significant harm, or if the Project Area is causing, or could cause, significant pollution of controlled waters (i.e. both surface and groundwater).

The Water Act 2003[10]

11.35 The Water Act 2003 introduced a revision to the wording of the EPA, which requires that if a site is causing or could cause significant pollution of controlled waters, it may be determined as contaminated land. Once a site is determined to be contaminated land then remediation may be required to render significant pollutant linkages insignificant (i.e. the source-pathway-receptor relationships that are associated with significant harm to human health and/ or significant pollution of controlled waters), subject to a test of reasonableness.

The Water Resources Act 1991[11]

11.36 The Water Resources Act 1991 provides statutory protection for controlled waters (i.e. streams, rivers, canals, marine environment and groundwater) and makes it an offence to discharge to controlled waters without the permission or consent of the regulators of these areas.

The Building Act 1984 and the Building Regulations & c (Amendment) Regulations 201612

11.37 The Building Act 1984 and in particular the associated Building Regulations & c (Amendment) Regulations 2016 are key when considering structural and design aspects of a development in terms of the geotechnical properties of the ground. The Building Act 1984 requires that buildings are constructed so that ground movement caused by swelling, shrinkage, freezing, landslip or subsidence of the sub-soils will not impair the stability of any part of the building. Notably, the Building Regulations & c (Amendment) Regulations 2016 also control ground gas mitigation which is a particularly pertinent consideration when considering land contamination.

Other relevant legislation

11.38 Other legislation (EU Directives, followed by UK Acts then Regulations) of relevance to this topic, and not already outlined above, includes:

- The Water Framework Directive (2000/60/EC)[13];
- The Groundwater Directive (2006/118/EC)[14];
- The Environmental Quality Standards (EQS) Directive (2008/105/EC)[15];
- The Environmental Liability Directive (2004/35/EC)[16];
- The Environment Act 1995[17];
- The Town and Country Planning Act 1990[18];
- Environmental Permitting (England and Wales) Regulations 2016[19];

[10] Her Majesty's Stationery Office (2003), The Water Act 2003.
[11] Her Majesty's Stationery Office (2009), The Water Resources Act 1991
[12] Her Majesty's Stationery Office (1984), The Building Act 1984; The Building Regulations & c (Amendment) Regulations 2016.
[13] EU (2000), The Water Framework Directive (2000/60/EC).
[14] EU (2006), The Groundwater Directive (2006/118/EC).
[15] EU (2008), The Environmental Quality Standards (EQS) Directive (2008/105/EC).
[16] EU (2004), The Environmental Liability Directive (2004/35/EC);
[17] Her Majesty's Stationery Office (1995), The Environment Act 1995;
[18] Her Majesty's Stationery Office (1990), Town and Country Planning Act 1990
[19] Her Majesty's Stationery Office (2016), The Environmental Permitting (England and Wales) Regulations 2016.

- Hazardous Waste (England and Wales) (Amendment) Regulations 2016[20];
- Contaminated Land (England) (Amendment) Regulations 2012[21];
- Environmental Damage (Prevention and Remediation) (England) Regulations 2015[22]; and
- Anti-Pollution Works Regulations 1999[23].

Planning Policy and Guidance

11.39 The following planning policy and guidance documents are of direct relevance to the assessment of effects of the GB Onshore Scheme on ground conditions.

National Planning Policy

11.40 National planning policy is established within the recently revised National Planning Policy Framework (NPPF)[24]. Relevant policy references/summaries are presented in Table 11.3.

Table 11.3: Revised National Planning Policy Framework (Department for Communities and Local Government (DCLG), 2018)

Policy reference	Summary
Paragraph 117	Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land.
Paragraph 118 c)	Planning policies and decisions should give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land.
Paragraph 170 a)	Planning policies and decisions should contribute to and enhance the natural and local environment by: …. protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan).
Paragraph 170 e)	Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.
Paragraph 170 f)	Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.
Paragraph 171	Plans should: distinguish between the hierarchy of international, national and locally designated sites; allocate land with the least environmental or amenity value, where consistent with other policies in this Framework…...
Paragraph 178 a)	Planning policies and decisions should ensure that: …a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation).

[20] Her Majesty's Stationery Office (2016), The Hazardous Waste (England and Wales) (Amendment) Regulations 2016.
[21] Her Majesty's Stationery Office (2012), Contaminated Land (England) (Amendment) Regulations, 2012.
[22] Her Majesty's Stationery Office (2015), Environmental Damage (Prevention and Remediation) (England) Regulations, 2015.
[23] Her Majesty's Stationery Office (1999), Anti-Pollution Works Regulations 1999.
[24] Her Majesty's Stationery Office (2019), National Planning Policy Framework, 2019.

Policy reference	Summary
Paragraph 178 b)	Planning policies and decisions should also ensure that after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990.
Paragraph 178 c)	Planning policies and decisions should also ensure that… adequate site investigation information, prepared by a competent person, is presented.
Paragraph 179	Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.
Paragraph 180	Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development.
Paragraph 183	The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.

11.41 The NPPF Planning Practice Guidance sections on 'land affected by contamination' and 'land instability' have also been taken into account and provide further detail regarding the approach to assessing and managing land contamination and instability.

11.42 Other relevant policy/ guidance includes the Department of the Environment, Transport and the Regions guidance 'Soil Strategy for England'[25]. This sets out national objectives for the sustainable management of soil. The four key objectives detailed in that strategy, which have been taken into account in this assessment are:

- agricultural soils will be better managed and threats to them will be addressed;
- soils will play a greater role in the fight against climate change and in helping us manage our impacts;
- soils in urban areas will be valued during development and construction practices will ensure vital soil functions can be maintained; and
- pollution of our soils is prevented, and our historic legacy of contaminated land is being dealt with.

Local Planning Policy

11.43 Medway Council has a legal duty to prepare plans that cover the Medway area and to manage and regulate most forms of built development.

11.44 The Medway Local Plan 2003 was adopted and implemented on 14th May 2003, replacing the former Medway Towns Local Plan 1992 and the Medway Local Plan Deposit Version 1999. Policy S13 'Isle of Grain' and Policy BNE23 'Contaminated Land' are considered of particular relevance to the ground conditions topic.

11.45 Medway Council are currently working on a new Local Plan which will replace the 2003 Medway Local Plan and cover the period up to 2037. Subject to the outcomes of an independent examination by a planning inspector, the emerging Local Plan will be adopted in 2021.

Guidance/ Best Practice

11.46 The following includes a non-exhaustive list of additional guidance considered pertinent and applicable to the ground conditions topic:

[25] Department of the Environment, Transport and the Regions (2009), Soil Strategy for England, 2009.

- Contaminated Land Report (CLR11) Model Procedures for the Management of Land Contamination, 2004[26];
- CIRIA C665, assessing risks posed by hazardous ground gases to buildings, 2007[27];
- BS 10175 (2011 +A2 2017), Investigation of Potentially Contaminated Sites - Code of Practice[28];
- BS 8576 (2013), Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs)[29];
- BS 8485 (2019), Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings[30]; and
- Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66[31].

[26] Environment Agency (2004), Contaminated Land Report (CLR11) Model Procedures for the Management of Land Contamination, 2004.
[27] CIRIA C665 (2007), Assessing risks posed by hazardous ground gases to buildings, 2007.
[28] British Standard BS 10175 (2011 +A1 2013), Investigation of Potentially Contaminated Sites - Code of Practice.
[29] British Standard BS 8576 (2013), Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs).
[30] British Standard BS 8485:2015 +A1:2019 (2019), Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.
[31] National House Building Council, Environment Agency and Chartered Institute of Environmental Health (2008), Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66.

Baseline Conditions

Baseline Data Collection

11.47 Establishment of the baseline environment has involved reference to existing data sources and consultation with statutory bodies and other organisations. Information has been obtained from the following sources:

- BGS[32];
- DEFRA[33];
- Environment Agency[34];
- Landmark GIS Data[35];
- Natural England[36];
- Medway Council[37];
- GeoConservation website[38]; and
- Historical site investigation information pertinent to the ground conditions topic including any relevant information recorded in the Environmental Liability Desk Study.

Baseline conditions

11.48 This section focuses on the baseline conditions for the application boundary in its current condition and presents an overall CSM for the Project Area. Reference is therefore made to surface water, groundwater and sensitive sites such as ecological features which are also discussed in more detail in Chapter 9 (Water Resources & Flood Risk) and Chapter 6 (Ecology & Nature Conservation).

11.49 Various components of the GB Onshore Scheme are referenced in this section to help define the baseline conditions, these are further detailed in Chapter 3.

Ground Conditions

Geology

11.50 Data obtained from the BGS does not show the presence of artificial deposits, such as made ground or fill. However, Areas 1 and 2 surrounding Perry's Farm is an area of active landfill, albeit no longer receiving waste, with some areas having been returned to agricultural use and others never developed from agricultural use. Anecdotal information suggests this area to be historical landfill although a site inspection undertaken in May 2019 has not confirmed this to be the case and the area north of the main track appears to be former pits, some filled with water. Similarly, the land adjacent north of Area 1 is in an area containing former sand and gravel workings. Details provided by the Environment Agency at the time of submission indicate that the site has never been permanently capped.

11.51 Superficial geology is mapped to be River Terrace Deposits, comprising sand and gravel. In the western part of the proposed substation/ converter station area (Area 3), Head Deposits are indicated which comprise clay, silt, sand and gravel. There is mapped to be an area Alluvium to the north west of this. A sequence of Head Deposits, Alluvium and Tidal Flats deposits (clay, silt and sand) are present towards the coastline near to the landfall location of the DC cable route.

[32] British Geological Survey (BGS) (2019), https://www.bgs.ac.uk/.
[33] Department for Environment, Food and Rural Affairs (2019), https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs.
[34] Environment Agency (2019), https://www.gov.uk/government/organisations/environment-agency.
[35] Landmark Envirocheck Report (Order Number: 193022474_1_1, dated 5th February 2019).
[36] Natural England (2019), https://www.gov.uk/government/organisations/natural-england.
[37] Medway Council (2019), https://www.medway.gov.uk/.
[38] GeoConservation Kent (2019), https://www.geoconservationkent.org.uk/

11.52 Historical BGS borehole records indicate the depths of these deposits vary from approximately 4.7 m in the west of the Project Area to 1.9 m in the east of the Project Area. This is broadly consistent with records associated with the historical landfill sites where deposits are noted to be approximately 5 m thick in 'Area 1' (consisting of River Terrace sand and gravel deposits) and 2 m thick in 'Area 2' of the Project Area (consisting of gravelly clay). No records are held for the western side of the study area as this has not been subject to extraction or landfilling activities. It is understood from the Environmental Liability Desk Study that Area 1 has been restored to pre-extraction level through landfilling and Area 2 has not yet been in-filled or restored. In the land parcels north of West Lane, the River Terrace sand and gravel is reported by the Environmental Liability Desk Study to have been extracted down to the London Clay. It is understood from the Environmental Liability Desk Study that this area was not infilled with waste following extraction which is consistent with observations made during the aforementioned site inspection.

11.53 The superficial deposits at the Project Area are recorded to be underlain by the London Clay. This comprises blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt, plus sometimes silt and layers of sandy clay[32]. Based on historical documentation/ BGS borehole records presented in the Environmental Liability Desk Study, the London Clay has been encountered between 6.2 m above Ordnance Datum (AOD) (to the north western part of Perry's Farm land) and 8.8 m AOD (to the northwest of Perry's Farm land). No faulting is reported in the area of the study area by the BGS.

Hydrogeology

11.54 The London Clay bedrock is classified as Unproductive strata. These are defined as geological strata with low permeability with negligible significance for water supply or river base flow. The River Terrace Deposits are classified as a Secondary A aquifer and Head and Alluvium deposits are classified as a Secondary Undifferentiated Aquifer. These are defined as permeable strata capable of supporting water supplies at a local scale and, in places, form an important source of base flow to rivers.

11.55 The Project Area is not located within a Source Protection Zone (SPZ), and no SPZ are located within the extended study area.

11.56 According to information from the Environment Agency, excluding abstractions of less than twenty cubic metres a day (which do not require a licence), one abstraction license has been identified in the extended study area relating to two locations, denoted Points 'A' and 'B'. Points A and B of the abstraction licences fall within areas of apparent former mineral extraction near the Project Area approximately 190m to the northeast and 140m southwest of the DC cable route and approximately 170m and 200m from the landfall location respectively. This abstraction was granted to J Clubb on the 13th September 1993 for mineral washing. The source of supply is listed as 'River Gravel and ditch' and so it can be inferred from the record that the abstraction is at least in part from surface water, but it is unclear if this relates to both locations or just one with the other being sourced from groundwater via a borehole. Although there is no information indicating this licence has been cancelled or revoked, mineral extraction activities have now ceased in the areas surrounding the licence locations. Therefore, it is assumed that the abstraction is no longer active and as such does not represent a sensitive receptor.

11.57 The Environmental Liability Desk Study highlights that, groundwater in monitoring wells at the Perry's Farm land has been measured at between approximately 6 m AOD and 12 m AOD; it notes that, based on the geological information available , this places it within the River Terrace Deposits and that the inferred direction of groundwater flow is broadly to the northwest. More detail in relation to long-term groundwater monitoring data is provided in Section 3 of the Environmental Liability Desk Study.

Mineral Extraction

11.58 Parts of the study area contain former sand and gravel workings, some of which are now occupied by water bodies. These relate to open cast sand and gravel and open cast common clay and shale sites and further detail is provided within the Environmental Liability Desk Study report. However, the resources within the area of the proposed substation/ converter station are not deemed to be appropriate for commercial extraction based on previous studies as indicated within the Screening Report. The Project Area is not located within an area affected by underground mining.

Radon

11.59 The Project Area is in a Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level) and is therefore not considered to be affected by Radon.

Coal Mining

11.60 The Project Area is not considered to be located in an area likely to be affected by coal mining.

Land Stability

11.61 Information contained within the Envirocheck data indicates that ground stability hazards may exist within the study area. These are presented in Table 11.4.

Table 11.4: BGS ground stability hazard potential

Hazard	Hazard potential
Shrinking or Swelling Clay	low to no hazard
Landslide	very low hazard
Ground Dissolution	no hazard
Compressible Ground	moderate to no hazard
Collapsible Ground	very low to no hazard
Running Sand	very low hazard

Soil Chemistry

11.62 Based on information indicated within the Envirocheck data, natural background concentrations for certain heavy metals are reported as follows for the area:

- arsenic (15 - 25mg/kg);
- cadmium (<1.8 mg/kg);
- chromium (60 - 120mg/kg);
- lead (<100mg/kg); and
- nickel (15 - 30mg/kg).

11.63 Information provided by the United Kingdom Soil Observatory (UKSO)[39] BGS broadly supports the above ranges.

Soil and groundwater contamination potential

General

11.64 This section discusses the hydrology, sensitive sites and regulatory/ third party data available from the baseline sources reviewed.

Hydrology

11.65 There are numerous surface water features present, both within the Onshore GB Scheme, and within the extended study area. The key features are listed below and further details are provided in Chapter 9 (Water Resources & Flood Risk):

- Thames Estuary, an Estuarine and Coastal Water Body under the Water Framework Directive (WFD) present to the east of the study area, at the landfall location.
- An elongated pond, approximately 260 m in length and orientated north west to south east along the access road to Perry's Farm, partially traversing the boundary of the proposed DC cable route,

[39] United Kingdom Soil Observatory (UKSO) (2019), http://mapapps2.bgs.ac.uk/ukso/home.html

- A large pond is present to the northeast of the Project Area boundary adjacent south of West Lane, indicated to be a fishing pond in the Environmental Liability Assessment.
- A water feature is present 135 m – 480 m to the east of the DC Cable Route, near the coast line, a pond connecting a series of small streams; and
- A network of creeks, streams or small rivers is present adjacent west of the Project Area boundary, including Hamshill Fleet approximately 370 m northwest.

11.66 According to information received from the Environment Agency, there are three Pollution Incident Register records within the study area, two within the application boundary, with the other located approximately 50 m north and associated with an existing pond area. These incidents relate to a 'Land Impact Category 2 Significant Incident' and 'Water Impact Category 2 Significant Incident' for one of the onsite Pollution Incidents and 'Water Impact Category 3 Minor Incident' for the remaining two. The on-site incidents occurred on the 19th September 2013 and 1st May 2018 associated with 'other' pollutants and landfill leachate, the offsite occurred on the 27th May 2014 from 'other' pollutants.

11.67 One discharge consent for domestic property (multiple, including farms) is indicated by the information provided by the Environment Agency. A second record is indicated a few meters away by the Envirocheck data; this is for the same property type and so is assumed to relate to the same discharge consent. The data from Envirocheck indicates this is relating to sewage discharges – final/ treated effluent to land/ soakaway.

11.68 As detailed in 'Baseline Conditions' section, only one abstraction license is recorded by the Environment Agency within the extended study area which, at least in part, appears to be from surface water. However, it is assumed that the abstraction is no longer active and as such does not represent a sensitive receptor.

Regulatory Data and Third-Party Information

11.69 A summary of the regulatory data as recorded by the Environment Agency, Landmark (in their Envirocheck data package) and the Environmental Liability Desk Study is presented in this Section as part of Tables 11.5 and 11.6. Where data appears to relate to similar information, records have been grouped based on professional judgment. Any relevant third-party information is also summarised.

Table 11.5: Summary of on-site Regulatory Data and Third-Party Information

Type	Comments	Location Details
Discharge Consents	No entries	
Pollution Incidents	Pollution incident – environmental impact – Land: Significant Incident (Cat 2); Water: Significant Incident (Cat 2). Incident date 01/05/2018 Pollution incident – environmental impact – Land: Significant Incident (Cat 2); Water: Minor Incident (Cat 3). Incident date 19/09/2013	In the northern part of Area 3 in Perry's Farm Land In the northern part of Area 3 in Perry's Farm Land
Integrated Pollution Prevention Controls	No entries	
Registered and Historical Landfill Sites	J Clubb Ltd, Perry's Farm. Medium input (between 25,000 and 75,000 tonnes per year). No known restriction on source of waste. Operational as far as is known (since 1996). Reference: P/03/34. In addition, there is a superseded record (from 1990) for this ref. stating large input (Equal to or greater than 75,000 and less than 250,000 tonnes per year), with no known restriction on source of waste.	Covering Areas 1 and 2 of Perry's Farm Land

Type	Comments	Location Details
	J Clubb Ltd, Whitehall Farm. Deposited waste included inert waste. First input 1983, last input 1993. References: EAHLD19253 & P/06/25, P/03/25, 21DP. Medium input (between 25,000 and 75,000 tonnes per year). No known restriction on source of waste. Licence lapsed/cancelled/defunct/not applicable/surrendered. It should be noted that the land owner has stated no knowledge of the area of Whitehall Farm being used for landfill.	Covering part of the DC Cable Route to the north-east of West Lane
Licensed Waste Management Facilities	J Clubb Limited (expired). Class: A4: Household, Commercial & Industrial Waste Landfill, ref. 19397. Issue date: 02/07/1990 J Clubb Limited (modified). Process: Inert Landfill. Issue date: 09/11/2005; modified date: 12/05/2010	Covering all of the Perry's Farm land, but likely to just be limited to Areas 1 and 2.
BGS Recorded Mineral Sites	Perry's Farm Quarry (dormant). Opencast, sand and gravel, ref 5882	Located within the route of the DC Cable in Area 2 of Perry's Farm land.
Hazardous Substances Consents	No entries	
Historical Tanks	No entries	
Trade Directory Entries	No entries	

Table 11.6: Summary of off-site Regulatory Data and Third-Party Information

Type	Comments	Location
Discharge Consents	Domestic Property (multiple) (incl. farm house) 1,2,3 and 4 High Grove, Sewage Discharges - Final/Treated Effluent - Not Water Company. Groundwater Via Standpipe & Soakaway. Ref: Npswqd005270	36 m east, on Highgrove off Grain Road
Pollution Incidents	Pollution incident – environmental impact – Land: Significant Incident (Cat 2); Water: Minor Incident (Cat 3). Incident date 27/05/2014	56 m north east of Site boundary in pond off West Lane
Integrated Pollution Prevention Controls	Two entries for J Clubb Limited, ref. BP3335SR, effective date 31/03/2008 and YP3733MV (both listed as revoked)	52 m east, located at Perry's Farm buildings.
Historical Landfill Sites	Indicated on-site landfill that extends beyond the application boundary	
Licensed Waste Management Facilities	Indicated on-site waste management facility that extends beyond the application boundary boundary	
BGS Recorded Mineral Sites	Perry's Farm sand and gravel Quarry. Status: ceased. Type: open cast. Ref: 50748	173 m west of DC Cable Route boundary, near West Lane
	2 entries: Rose Court Farm sand and gravel Status: ceased. Type: open cast. Ref:50746	140 m – 150 m east and west of DC Cable Route.
	Whitehall Farm Quarry, common clay and shale. Status: active. Type: open cast. Ref: 2502.	95 m west of DC Cable Route.
Hazardous Substances Consents	Perry's Farm, storage of unknown hazardous substances (status unknown). Reference MC2007/2081, dated 21/12/2007	124 m east, located at Perry's Farm buildings.
Historical Tanks	Historical tank entries within oil refinery land (various dates: 1968, 1969, 1983)	240 m southeast historical tank entries within oil refinery land 375 m south of Perry's Farm: historical

Type	Comments	Location
		tanks point classed as electrical substation facilities (1987)
Trade Directory Entries	J Clubb Ltd. Office - sand, gravel and other aggregates (inactive)	35 m east of the DC cable rout boundary

Sensitive sites

11.70 North Kent Marshes Environmentally Sensitive Area (ESA) borders the north-western boundary of the substation/ converter station area.

11.71 Thames Estuary & Marshes Special Protection Area (SPA) and RAMSAR sites border the northeast shoreline and then extends westwards, situated approximately 150 m north of the northern edge of the Project Area. The Thames Estuary and Marshes SSSI covers the same area, with the addition of a designated area within St James Park 590 m east of the Project Area boundary.

11.72 Medway Estuary Marine Nature Reserve (MNR) borders the northeast shoreline and falls within the Project Area boundary of the DC Cable Route at the Landfall Area.

Land Use Summary

11.73 Current Ordnance Survey (OS) Mapping[40], aerial imagery[41], and data from Landmark have been reviewed to identify the present land uses within the study area.

Current/ Recent land use

11.74 Part of the Project Area forms the Perry's Farm landfill (Area 1 and Area 2), the associated permit is still operational, although the landfill is not currently receiving waste. Some areas have been returned to agricultural use, and others never developed from agricultural use.

11.75 Leachate breakthrough at the surface has been recorded, and this occurs to the east of the Perry's Farm building, which is off Project Area, but forms part of the Perry's Farm landfill. Measures have been implemented (drainage and siltbuster) to address leachate. The Project Area is also partially in use as agricultural land.

11.76 Other potentially contaminative current/recent land uses identified off site, but within the study area, include Perry Farm and two other small farms (and associated buildings), a fire station and an air conditioning and refrigeration contractors.

Historical land use

11.77 The Perry's Farm land parcel was acquired by J Clubb in the late 1980s. Prior to this it is indicated to have comprised agricultural land. Planning permission for aggregate extraction and backfilling with waste was granted in 1990 by Kent County Council (KCC), and the site was licensed to accept cement precipitator waste until 1999. Detail from the land owner indicates that the area of landfilling on Perry's Farm had been split into two cells and does not cover the whole of the licenced area. These cells are hereafter referred to as 'Area A' (within Area 1) and 'Area B' (within Area 2). Area A has been subject to the historical deposition of Cement Kiln Dust (CKD), a hazardous waste. Area B has been restricted to receiving inert waste only.

11.78 The land adjacent to the north east of Perry's Farm is indicated to have comprised mostly agricultural land, with a military installation present along the shoreline in 1940, No records of this are held by the DIO based on the engagement undertaken. From 1997 planning permission was granted for sand and gravel extraction in this area. Washing plant was reported within this area during the extraction of aggregate at the sand and gravel workings at the Perry's Farm land. Material is understood to have been transferred to the washing plant via a conveyor located along the eastern edge of the Perry's Farm workings. Areas of historic landfill are also indicated within the Envirocheck data, known as Whitehall Farm Landfill, however the land owner indicated no knowledge of landfilling occurring within this area.

[40] Ordnance Survey (2019), https://osmaps.ordnancesurvey.co.uk
[41] Google Earth (2019), www.google.com/maps.

11.79 In addition to the former Perry's Farm Landfill, the potentially infilled land and former military land to the north and the disused oil pipeline running through Area 3 of Perry's Farm, other potentially contaminative historical land uses identified within the study area include the Kent Oil Refinery and several former ponds (assumed infilled/ partially infilled). Th Environment Agency information provided indicated that gas related activity land and import terminals have superseded Oil refinery since 1980s and that the area may have been assessed and remediated by National Grid.

Conceptual site model (CSM)

11.80 To determine potential contaminant linkages, a CSM has been developed. The topography, geology, hydrogeology and hydrology are the main factors that influence the way in which potential contaminants in the soil or groundwater can be transported on or off the Project Area, and the ways in which contamination can affect different receptors. Potential receptors are summarised initially in this section. Potential sources and pathways linking any sources to the defined receptors are then identified.

Receptors

11.81 Receptors have been identified based on the proposed future land use as well as the environmental setting and sensitivity of the Project Area and study area. Table 11.7 presents the sensitive receptors identified that have been considered within the assessment. Figure 11.3a, 11.3b and 11.3c depict controlled waters, sensitive sites and human health receptors respectively within the study area and extended study area as appropriate.

Table 11.7: Summary of receptors

Receptor type	Receptor description		Receptor Sensitivity
Human Health	Future construction and maintenance workers;		High
	Future site users (employees at the converter station and substation, agricultural workers, landfill management operatives)		Moderate
	Current site users (e.g. agricultural workers, landfill management operatives)		Moderate
	Off-site residents and workers in Isle of Grain village, nearby farms and industrial areas to the south of the Project Area		Moderate
Property	Existing or future buildings and structures		Low
	Proposed interconnector cable and associated infrastructure		Low
	Other buried services or conduits		Low
	Crops and livestock on the reclaimed landfill or on neighbouring land or land returned to direct/indirect public use (where uncontrolled access).		Low
Controlled Waters	Surface Water	Ponds and connecting streams 140m east	Moderate
		Elongated pong between Perry's Farm's areas 1 and 2	High

Receptor type	Receptor description	Receptor Sensitivity
	Fishing Pond south of West Lane	Hight
	Network of creeks, streams and rivers including Hamshill Fleet to the northwest	Moderate
	Thames Estuary and coastal water body	Moderate
	The River Terrace Deposits (where not extracted) are classified as a Secondary A aquifer. Other superficial deposits including the Head and Alluvium classed as Secondary Undifferentiated Aquifer.	Low/Moderate
Sensitive Sites	Thames Estuary to the northeast and north (SSSI, SPA, RAMSAR);	High
	North Kent Marshes to the west (SSSI, SPA, RAMSAR, ESA);	High
	Medway Estuary Marine Nature Reserve (MNR) to the northeast; and	Moderate
	Medway Estuary and Marshes to the east (SSSI)	High

Potential sources of contamination

11.82 A summary of the potential sources of land contamination within the study area identified following the baseline review is presented in this section with those sites identified within 250 m of the Project Area summarised in Table 11.8.

Table 11.8: Summary of potential sources of land contamination within the application boundary and within the study area

Land uses within the application boundary	Land Uses outside the application boundary
• Current undeveloped land / former Perry's Farm Landfill and buried disused oil pipeline (CL05)	• Current residential land use / former Perry's Farm (including current storage of farm activity related materials) (CL01)
• Current undeveloped land / former mineral workings and historical landfills (assumed potentially infilled) (CL11)	• Current Farm (CL02)
• Buried disused oil pipeline (CL12)	• Current Farm (CL03)
	• Current Fire Station (CL04)
	• Current undeveloped land / former military land use (CL06)
	• Current unoccupied land / former Kent Oil Refinery (CL07)
	• Current undeveloped land/ former pond (assumed infilled) (CL08)

- Current pond / former pond (assumed infilled) (CL09)
- Current undeveloped land / former pond (assumed infilled) (CL10)

Potential Pathways

11.83 Potential pathways associated with the application boundary have been identified as the following:

Human Health

- Ingress of ground gas or vapour into buildings. Inhalation of VOC or ground gas;
- Ingestion of, inhalation of and dermal contact with soil particulates;
- Dermal contact with or ingestion of leachate following uncontrolled discharge at the landfill surface;
- Permeation of plastic potable water supply pipes by VOC or hydrocarbons.

Property (including buried infrastructure)

- Ingress of ground gas or vapour into buildings or service conduits;
- Direct contact with chemicals of potential concern (COPC) in soil, groundwater or contact with leachate (including CKD, a hazardous waste);
- Ingestion/ uptake by crops and livestock.

Controlled Waters

- Partitioning/ leaching of COPC from soil into pore water;
- Migration of COPC in recharge to groundwater in the River Terrace Deposit or other superficial deposits;
- Lateral migration of COPC in shallow groundwater present in the River Terrace Deposits or other superficial deposits with discharge as basal flow into surface water receptors;
- Overland flow into surface water features and shallow groundwater arising from uncontrolled leachate discharge at the landfill surface.

Sensitive Sites

- Lateral migration of COPC in shallow groundwater present in the River Terrace Deposits or other superficial deposits with discharge as basal flow into protected areas (e.g. SSSI);
- Overland flow into protected areas, arising from uncontrolled leachate discharge at the landfill surface.

Conceptual site model summary

11.84 A review of the baseline conditions indicates that there is generally a moderate/ high potential for ground contamination to exist associated with the site which is primarily driven by the onsite landfill presence and known leachate breaches from the landfill. In addition, there are potentially contaminated sites located in the study area that could interact with the site including military land, farms, landfill, former mineral extraction workings, and infilled ponds and pits. Based on the CSM, potential contaminant linkages have been identified and these are discussed in Appendix 11.B.

Future Baseline

11.85 The potential for the baseline ground conditions to change in the lead up to the construction of the GB Onshore Scheme is limited to the extent to which any new development necessitates remediation or mitigation measures to control potential contamination releases. Should there be any new development in the study area on potentially contaminated land, it would need to be suitable for its intended use as set out in the NPPF. To meet this requirement new development sites may require remediation to be undertaken. This would mean that some areas described as

having potentially contaminative current and/or historical land use, may no longer be of significance at the time of construction of the GB Onshore Scheme.

11.86 The potential for the baseline conditions to change would also depend on whether any land has been classified as contaminated land by the Local Authority (Medway Council) under Part 2A of the Environmental Protection Act 1990. A number of mechanisms drive these determinations therefore they are difficult to predict. Where Part 2A determinations are made, the potential baseline change would occur where remediation works are subsequently undertaken.

11.87 The Cumulative Impacts section of this Chapter outlines that, with the exception of those related to the Proposed Scheme, there is only one committed development within the study area. Based on the available information, it is not considered that the future baseline will be materially different to that outlined in this section.

Potential Impacts

Proposed Converter Station & Substation

Temporary Impacts

11.88 A number of activities will occur at the Project Area during the construction phase that have the potential to interact with the underlying ground conditions. These are considered to include, but may not be limited to, the following:

- Soil stripping;
- Cut and fill earthworks;
- Excavations for foundations and ground works for the proposed substation, converter station and cable sealing end compound, drainage, utilities and AC cable;
- Dewatering of excavations;
- Excavated materials management and soil storage; and
- Establishment of temporary construction compounds and the storage of hazardous materials within them for use in construction e.g. fuels and oils.

11.89 There will be two temporary construction compounds including laydown areas and storage areas near the proposed substation/ converter station these will be located to the south and west of the proposed converter station. An access road will serve the proposed features entering from the south east from the B2001/ Grain Road.

Ground Conditions

Materials Management

11.90 The scope of the works within the proposed substation/ converter station area of the Project Area includes for preliminary works, site establishment, and earthworks. This will include land re-profiling in order to establish a level platform on which the proposed converter station will be constructed. Other civil engineering works and construction works will include construction of building foundations.

11.91 There is expected to be a surplus of excavated materials following the cut and fill earthworks to create the development platform. These materials will either need to be managed on site, managed off site or disposed of off-site.

Aquifer Permeability

11.92 Re-profiling of the site may increase the landform height in some areas, which may result in increased loading and localised decreased permeability of the underlying ground conditions. Any ground improvement adopted to support a shallow foundation solution for the proposed substation/ converter station area or associated with any connection works for the AC cable may also have this effect, although it is acknowledged that a piling solution may be more likely given the high anticipated loadings associated with the substation/ converter station. However, as detailed previously there is only one abstraction licence within the extended study area, this is located in an area of apparent inactive mineral workings and so it is considered that there are no sensitive water abstractions that could be affected by a localised reduction in permeability.

Dewatering and Drainage

11.93 Dewatering of excavations may be required which will generate a quantity of groundwater that will need to be managed and discharged appropriately from the Project Area. An abstraction licence is required when extracting more than twenty cubic metres a day. Where discharges from site are uncontrolled this could result in pollution of the receiving waters, which may impact on surface water quality. If too much water is discharged, or the discharge rate is too high in the absence of sufficient controls, the capacity of the receiving surface water environment could be exceeded which may cause flooding off site in the wider area. The discharge of groundwater will require an environmental permit from the Environment Agency.

11.94 As detailed in the ground conditions baseline conditions section there is only one abstraction license within the extended study area, this is located in an area of apparent inactive mineral workings and so it is considered that there are no sensitive water abstractions that could be affected by dewatering activities and it is expected that discharges will be required to be managed in accordance with permitting and dewatering requirements.

11.95 It is anticipated that land drains will be present in agricultural land within the study area and the potential exists for these to be temporarily severed as a result of earthworks or foundation excavations for the proposed substation/ converter station and associated AC cable.

11.96 Potential impacts to groundwater quality from construction activities are considered below.

Soil and Groundwater Contamination

Human Health – Construction Workers

11.97 The handling of excavated soils, construction materials and the use of construction machinery all include the potential to introduce hazardous materials and potential impacts to construction workers. Construction workers have the potential to come into contact with fuels and other chemicals during construction activities, posing a potential risk to human health through dermal contact, ingestion and inhalation.

11.98 Prior to construction activities taking place it is contingent on the appointed Contractor that risk assessments will be undertaken in full accordance with the Health and Safety at Work Act[42] to restrict and manage any potential exposure to harmful substances. Potential impacts specific to construction workers are expected to be mitigated by the specification and implementation of appropriate Personal Protective Equipment (PPE) and site controls which will be managed through the CEMP (which will be prepared prior to the commencement of construction activities and signed off by Medway Council), as well as procedures in accordance with the Principal Contractor's Construction Phase Plan, as required under the Construction Design and Management (CDM) Regulations 2015[43].

Human Health – Neighbouring Site Users, Occupiers and the General Public

11.99 Neighbouring site users, occupiers and the general public immediately adjacent to, or in proximity to the proposed construction activities, could be impacted upon. Contaminated soils encountered during earthworks including the creation of stockpiled materials, may be exposed to wind and rain which may increase dispersal through the spread of soil dust in air and/ or soil in uncontrolled water run-off, in the absence of mitigation.

11.100 It is possible that construction works could introduce contaminants into the environment through accidental release or unexpected contamination may also be uncovered. In the event that soil derived dusts and/ or run-off do migrate to affect neighbouring properties and their occupants, this would be a short-term impact.

Controlled Waters

11.101 Hazardous materials will be introduced and stored on-site during construction, in the form of diesel fuel, oils, chemicals and solvents, as well as construction materials such as cement and bentonite. Chemicals and solvents might include detergents, degreasers, paints, thinners, firefighting fluids, resins and glues. Improper handling and use of hazardous materials has the potential to introduce contaminants into underlying soils and groundwater which may in turn result in impacts to surface water courses through groundwater migration or uncontrolled run off. Leakages/ spillages from materials and fuel storage areas or from the incorrect disposal of waste/ surplus material, could also impact on the underlying ground and hydrogeological conditions which would affect the groundwater resource potential.

11.102 The increased use of water during construction works, e.g. for dust suppression, wheel washing, drilling or dewatering may lead to increased potential for contaminated water to be

[42] The Health and Safety Commission and the Health and Safety Executive, (1974), Health and Safety at Work etc. Act
[43] Health and Safety Executive, (2015), Managing Health and Safety in Construction: Construction (Design and Management) Regulations

generated and increased surface water run-off. This poses a risk to the underlying aquifers and to nearby surface water features that may interact with groundwater.

Sensitive Sites

11.103 Sensitive sites in proximity to the proposed construction activities, could be impacted upon. Contaminated soils encountered during earthworks including the creation of stockpiled materials, may be exposed to wind and rain which may increase dispersal through the spread of soil dust in air and/ or soil in uncontrolled water run-off, in the absence of mitigation.

Longer Term, Operational and Permanent Impacts

Ground Conditions

11.104 There are not expected to be any longer term, operational or permanent impacts on ground conditions resulting from the operation of the proposed substation/ converter station or proposed ancillary infrastructure.

11.105 In view of appropriate drainage solutions being implemented, no potential longer term, operational or permanent impacts on hydrogeological conditions associated within the proposed substation/ converter station and ancillary infrastructure have been identified.

Soil and Groundwater Contamination

11.106 During the operation of the proposed substation/ converter station minor quantities of fuels and other chemicals may be stored and used in association.

11.107 In the event of an uncontrolled release of such fuels or other chemicals, either from storage areas or during handling, contamination of the ground may occur. The magnitude of impact will depend on the type of material released, as well as the quantity and timing of the release and the sensitivity of the receiving environment. The nearest receptors will be direct employees involved with dealing with the uncontrolled release, groundwater contained within the underlying aquifer and the nearby surface water features. The greatest potential effects would arise from large-scale, uncontained releases of materials, which have a high environmental toxicity and which are resistant to degradation (such as diesel oil).

Human Health – Future Employees and Site Maintenance Workers

11.108 Ground cover within the proposed substation/ converter station area will comprise predominantly hardstanding or gravel surfacing. In the event of an uncontrolled release, the potential exists for personnel in the proposed substation/ converter station area to be exposed to potentially hazardous materials through dermal contact, ingestion and/or inhalation pathways.

Controlled Waters

11.109 Within the proposed substation/ converter station area, operations will be contained with no uncontrolled discharges to land, surface water or groundwater. Chemical substances and hazardous materials should be stored in accordance with Environment Agency guidance and applicable storage regulations and it is assumed that accredited operational and environmental management standards will be employed for activities undertaken during the operational stage.

11.110 The foundations associated with the proposed substation/ converter station may provide a preferential pathway for contaminants to migrate to non-contaminated soils and subsequently into groundwater throughout the operational period. However, any contamination encountered during construction would be expected to be removed, treated and/or mitigated as part of the construction process.

Property – Proposed Buildings and Below Ground Infrastructure

11.111 Certain organic contaminants in soil or groundwater (hydrocarbons and solvents) can permeate through or corrode pipe work and possibly contaminate water supplies. Plastic water supply pipes can be at risk of attack from oils and phenols. Additionally, concrete infrastructure can be subject to attack from acids and high sulphate concentrations in soils.

Sensitive Sites

11.112 Ground cover within the proposed substation/ converter station area will comprise predominantly hardstanding or gravel surfacing. In the event of an uncontrolled release, the potential exists for sensitive sites in the vicinity of proposed substation/ converter station area to be exposed to potentially hazardous materials through dust migration or surface run off pathways.

Decommissioning Impacts

11.113 Decommissioning impacts are assumed to be similar to, but no worse than, the temporary impacts defined in the assessment of construction impacts on the basis of the similar nature of activities envisaged during construction and decommissioning.

Proposed DC Cable Route

Temporary Impacts

11.114 A number of activities will occur at the site during the construction phase that have the potential to interact with the underlying ground conditions. These have been identified as:

- Topsoil and subsoil stripping;
- Excavations for proposed DC cable route using trenching and trenchless cable installation techniques;
- Laying of DC cable using alternative methods, such as laying the cable in surface troughs and covering or capping
- Dewatering of excavations;
- Installation of pre and post construction drainage;
- Excavated materials management and soil storage;
- Imported material for backfill of excavations; and
- Establishment of temporary construction compounds and the storage of hazardous materials within them for use in construction, e.g. fuels and oils.

Ground Conditions

Materials Management

11.115 Inappropriate materials management could have adverse potential impacts on the GB Onshore Scheme. Associated potential impacts may relate to the creation/re-use of waste, suitability for use (both chemically and geotechnically) and quantities used for example. The construction of the proposed DC cable route, where in open cut, will require a single trench accommodating two DC cables as well as up to four cable conduits or ducts to allow for other cables to be installed with minimal impact. Open cut installation will be adopted wherever feasible, but it is envisaged that the application of trenchless installation techniques (e.g. horizontal directional drilling (HDD)) will be required in some locations, particularly at the landfall area. Alternative methods are available, such as laying the cable in surface troughs and covering or capping these, which has the benefit of not disturbing any areas of historical landfill.

Dewatering and Drainage

11.116 Dewatering of excavations is expected to be required which will generate a quantity of groundwater that will need to be managed and discharged appropriately from the site. An abstraction licence from the Environment Agency is required when extracting more than twenty cubic metres a day. Where discharges from site are uncontrolled this could result in pollution of the receiving waters, which may impact on surface water quality. If too much water is discharged, or the discharge rate is too high in the absence of sufficient controls, the capacity of the receiving surface water environment could be exceeded which may cause flooding off site in the wider area. The discharge of groundwater will require an environmental permit from the Environment Agency as well as consent from the Internal Drainage Board (IDB) where discharging to an IDB maintained water course or drain.

11.117 As detailed previously there is only one abstraction license within the extended study area, this is located in an area of apparent inactive mineral workings and so it is considered that there are no sensitive water abstractions that could be impacted from dewatering activities and it is expected that discharges will be required to be managed in accordance with permitting and dewatering requirements.

11.118 It is anticipated that land drains will be present in any areas of agricultural land within the study area and the potential exists for these to be temporarily severed as a result of open cut trench excavations for the proposed DC cable route (most notably in the far southern extent where it enters the western part of the Perry's Farm land parcel (Area 3)). This could impact on local near surface ground conditions by reduced drainage and increased water retention if not re-instated during construction.

Soil and Groundwater Contamination

Human Health – Construction Workers

11.119 The handling of excavated soils, construction materials and the use of construction machinery all include the potential to introduce hazardous materials and potential impacts to construction workers. Construction workers have the potential to come into contact with fuels and other chemicals during construction activities, posing a potential risk to human health through dermal contact, ingestion and inhalation.

11.120 Prior to construction activities taking place it is contingent on the appointed Contractor that risk assessments will be undertaken in full accordance with the Health and Safety at Work Act to restrict and manage any potential exposure to harmful substances. Potential impacts specific to construction workers are expected to be mitigated by the specification and implementation of appropriate Personal Protective Equipment (PPE) and site controls which will be managed through the CEMP, which will be prepared prior to the commencement of construction activities and signed off by Medway Council, as well as procedures in accordance with the Principal Contractor's Construction Phase Plan, as required under the Construction Design and Management (CDM) Regulations 2015.

Human Health – Neighbouring Site Users, Occupiers and the General Public

11.121 Neighbouring site users, occupiers and the general public immediately adjacent to, or in proximity to the proposed construction activities could be impacted upon by construction activities. Contaminated soils encountered during earthworks including the creation of stockpiled materials, potentially may be exposed to wind and rain which may increase dispersal through the spread of soil dust in air and/ or soil in uncontrolled run off, in the absence of mitigation.

11.122 It is possible that construction works could introduce contaminants into the environment through accidental release or unexpected contamination may also be uncovered. In the event that soil derived dusts and/ or run-off do migrate to affect neighbouring properties and their occupants, this would be a short-term impact.

Groundwater and Surface Water

11.123 The increased use of water during construction works, e.g. for dust suppression, wheel washing or dewatering may lead to increased potential for contaminated water to be generated and in turn increased surface water run-off. This poses a risk to the underlying aquifers and to nearby surface water features that may interact with groundwater.

11.124 Where trenchless techniques are undertaken, potential impacts may arise through the inaccurate design depth, whereby excavations or drilling may create pathways for drilling fluids, or other fluids used during construction, to reach groundwater receptors. Where crossing water courses or drains, and where using HDD, drilling too shallow could create a contamination pathway to sensitive surface water receptors, should a break out of drilling fluids, or other fluids used during construction, occur through the bed of the overlying watercourse. This is of particular relevance when working within loose granular deposits, such as those that may be encountered at the landfall location as part of the Tidal Flat deposits. Aside from the intertidal area, the only surface water features likely to be traversed by the proposed DC cable route will be the drain from the leachate system (typically following the proposed DC cable route north of West Lane),

the elongated pond (located along the access track to Perry's Farm) and an unnamed drain at the southern extent of the proposed DC cable route.

Longer Term, Operational and Permanent Impacts

Ground Conditions

11.125 There are not expected to be any longer term operational or permanent impacts on ground conditions resulting from the operation of the proposed DC cable route. On completion, there will be limited permanent above ground infrastructure with the exception of cable marker posts at locations along the route and it is planned to restore the land and features that have been affected by the construction works to a condition suitable for its original use/ function.

11.126 In view of appropriate drainage solutions being implemented, no potential longer term, operational or permanent impacts on hydrogeological conditions associated within the proposed DC Cable Route have been identified.

Soil and Groundwater Contamination

11.127 There are not expected to be any operational risks from contaminated soil and groundwater to, or from, the proposed DC cable route. This is because, once constructed the cable would not represent a potential source of contamination and it will be designed for the ground conditions into which it is constructed.

Decommissioning Impacts

11.128 Decommissioning impacts are assumed to be similar to, but no worse than, the temporary impacts defined in the assessment of construction impacts on the basis of the similar nature of activities envisaged during construction and decommissioning.

Mitigation

Design Mitigation

General

11.129 This section outlines the design mitigation associated with the GB Onshore Scheme with respect to the ground conditions topic. As design mitigation is by its nature applied by default as part of the design, the associated mitigation will be secured by planning condition as part of the outline planning consent.

Substation/ Converter Station

General

11.130 Mitigation by design has been a consideration since the early optioneering stages. Opportunities have been taken, where possible, to avoid potential ground constraints and in particular any areas of landfilling or potentially infilled ground in relation to the site selection for the proposed substation/ converter station and associated infrastructure. As the AC cable route will be sited in the immediate vicinity of the proposed substation/ converter station, no additional ground disturbance is envisaged as part of accommodating the AC cables.

11.131 Chemical substances and hazardous materials will be stored in accordance with Environment Agency Pollution Prevention Guidance (withdrawn but widely considered good practice)[44] and applicable storage regulations and accredited operational and environmental management standards will be employed for these activities.

11.132 A ground investigation is in the process of being undertaken as part of design development. The outcomes of these further studies will inform the final adopted foundation solutions, the cut/ fill extents, dewatering strategies, the extent to which excavation support is required and also the extent to which ground gas mitigation is required.

11.133 Materials used in buildings and infrastructure will be specified accordingly, taking due account of the ground conditions such as elevated sulphate or ground gases. The assessment methodology set out in BRE Special Digest 1 (2005)[45] will be adopted to determine the appropriate concrete classification.

11.134 Ground gas assessment and mitigation will be undertaken and implemented in accordance with BS 8485 (2015)[46] and CIRIA guidance document C665 (2007)[47] based on the findings from the ground investigation and subsequent monitoring.

11.135 Mitigating controls that will be adopted during construction that influence how construction interacts with the ground conditions are set out later in this section.

Proposed DC Cable Route

11.136 Mitigation by design has been a consideration since the early routeing and optioneering stages. Opportunities have been taken, where possible, to avoid potential ground constraints and in particular any areas of landfilling or potentially infilled ground. In addition, the Limits of Deviation (LoD) approach allows for cable routeing refinement to take place once detailed design and additional survey data has been collected, which will provide flexibility to reduce construction and operation impacts as the detailed design stage develops.

11.137 The preferred method for installation of the proposed underground DC cable will be by open cut methods with the cables laid in trenches or within buried ducts (subject to the ground conditions and cable specifications). However alternative methods are available, such as laying the cable in surface troughs and covering or capping these; this has the benefit of not disturbing any areas of historical landfill

[44] Environment Agency Pollution Prevention Guidance 1 to 28 (withdrawn 2015
[45] Building Research Establishment (BRE) SD1, (2005), Concrete in Aggressive Ground;
[46] British Standards Institute BS 8485, (2015), Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings;
[47] CIRIA, (2007), CIRIA Guidance C665. Assessing risks posed by hazardous ground gases to buildings

11.138 The Proposed scheme routes the DC cable along an area of hardstanding to the east of the Perry's Farm Landfill capping, in turn avoiding any significant disturbance/ interaction with the underlying landfill materials,

11.139 As detailed in the 'Mitigation' section, alternative methods of cable installation are available, such as laying the cable in surface troughs and covering or capping these; this has the benefit of not disturbing any areas of historic landfill which is particularly relevant to the proposed DC cable route.

11.140 A ground investigation will be undertaken as part of design development. This information will inform how the proposed DC cable route will be constructed and the extent to which excavation support and dewatering may be required. It will also be used to confirm the depth that the proposed DC cables will be placed taking due account of any minimum vertical clearances specified by affected asset owners (e.g. the IDB and the presence of watercourses and land drains). It is assumed that where excavation support is deemed to be necessary, as defined by prior ground investigation, this will be adopted during construction.

11.141 There is always the potential for unexpected soil and/ or groundwater to be encountered, which recognises the inherent limitations of ground investigation compared to the extent of excavation works that will be required to be undertaken during construction. Mitigating controls that will be adopted during construction that influence how construction interacts with the ground conditions, are set out in the remainder of this section.

Construction Mitigation

Legislation and Regulation

11.142 A significant amount of legislation bears relevance to construction work and its actual and potential interactions with ground conditions. A CEMP will be developed and secured by planning condition that will contain measures to ensure compliance with relevant standards and legislation. The CEMP will set out the environmental mitigation requirements and also the project level expectations on how the proposed substation, converter station, AC/ DC cable routes and ancillary infrastructure will be constructed.

Ground Stability

11.143 There may be a requirement to provide temporary support for excavations. Such support may include benching of excavations, shoring or the construction of retaining walls (e.g. sheet piles) or struts to mitigate the risk associated with settlement or excessive spalling. It is expected that the need for such control would be established during detailed design and where specified and implemented correctly, would be sufficient to mitigate any residual effects.

Soil and Groundwater Pollution Control Mitigation

11.144 Measures contained within the CEMP would be designed to limit the potential for dispersal and accidental releases of potential contaminants, soil-derived dusts and uncontrolled run-off to occur during construction. For example, the CEMP will set out how material is to be excavated and stockpiled to minimise the potential for run-off, soil degradation or wind dispersal of dusts. The use of biodegradable netting and the binding of the surface through temporary grass seeding will be specified together with dampening procedures during dry weather. Sheeting may be used if any material is identified to be hazardous with a view to limiting water ingress and potential leachate generation. Soil storage and handling areas will be defined prior to construction commencing. In the event of uncontrolled releases occurring, the CEMP and the Contractor's own method statements contained in their Construction Phase Plan (CPP) will also set out the measures required to ensure that the extent and impact of any such releases are contained and ultimately remediated.

11.145 A Pollution Response Plan will be in place prior to the commencement of construction works. The plan will outline key pollution mitigation measures to be adopted including a Control of Substances Hazardous to Health (COSHH)/ fuel inventory and key contacts to be notified in the event of a significant pollution incident, which may subsequently lead to the contamination of controlled waters or soils. All bulk fuel and COSHH items will be stored in accordance with the relevant Environment Agency Pollution Prevention Guidance notes40 (withdrawn but widely considered good practice) and storage regulations. Tanks and dispensing pumps will be locked when not in use to prevent unauthorised access.

11.146 Any hazardous materials will be stored in designated locations with specific measures to prevent leakage and the release of their contents. This will include a requirement to position storage areas at least 10 m away from surface water features/ drains (and take into consideration the positions of any groundwater abstraction wells), on an impermeable base with an impermeable bund that has no outflow and is of adequate capacity to contain at least 110% of the contents. Valves and trigger guns will be protected from vandalism and kept locked when not in use.

11.147 Only well-maintained plant will be used during construction to minimise the potential for accidental pollution from leaking machinery or damaged equipment. Static machinery and plant are expected to be stored in hardstanding areas when not in use and, where necessary, to make use of drip trays beneath oil tanks/ engines/ gearboxes/ hydraulics. Spill response kits containing equipment that is appropriate to the types and quantities of materials being used and stored during construction will be maintained on Project Area for the duration of the works.

11.148 The CEMP will set out procedures for dealing with unexpected soil or groundwater contamination that may be encountered. This would typically require affected works to stop to enable appropriate people to be notified, and further characterisation and risk assessment to be undertaken, before remediation or mitigation proposals are agreed with all required stakeholders.

11.149 Potential exposure impacts specific to construction workers during site preparation and construction would be mitigated by the following measures and through working in accordance with CIRIA C741 4th Edition 'Environmental Good Practice On Site' (2015)[48].

- measures to minimise dust generation;
- provision of PPE, such as gloves, barrier cream, overalls etc. to minimise direct contact with soils;
- provision of adequate hygiene facilities and clean welfare facilities for all construction site workers;
- monitoring of confined spaces for potential ground gas accumulations, restricting access to confined spaces, i.e. to suitably trained personnel only, and use of specialist PPE, where necessary; and
- preparation and adoption of a site and task specific health and safety plan as is required under Health and Safety legislation[49].

11.150 Specific mitigation measures may be required in the form of treating/ remediating any contamination encountered during construction (e.g. any contamination that may be associated with any potentially contaminative sites identified as part of the assessment, notably the landfills and areas of potentially infilled land). This will be confirmed based on information gathered through ground investigation.

Excavated Materials Management

11.151 Prior to construction, a strategy will be prepared as part of the design development, which will set out how the earthworks stage of the construction phase will be undertaken. Where necessary the strategy will consider what excavated materials can be reused, or are required within the development of the various components of the GB Onshore Scheme, and what materials are surplus and require either disposal or onward management to ensure appropriate re-use. The strategy will also define whether any geotechnical improvement may be required, prior to re-use or disposal.

11.152 To minimise the effects on soil resources during any earthworks, including materials management following foundation construction in relation to the substation/ converter station, high standards of soil handling and management will be employed with a view to minimising where possible the double handling of soils and the extent to which exposed soils will be left vulnerable to erosional processes.

11.153 The re-use of excavated materials during construction will be governed by either a Materials Management Plan developed in accordance with the CL:AIRE Definition of Waste: Development

[48] Environmental good practice on site guide (fourth edition) (C741) (2015)
[49] The Health and Safety Commission and the Health and Safety Executive, (1974), Health and Safety at Work etc. Act

Industry Code of Practice[50], an environmental permit or a relevant exemption. The CL:AIRE Code of Practice is a voluntary framework for excavated materials management and re-use. Following this framework results in a level of information being generated that is sufficient to demonstrate to any regulator that excavated material has been re-used appropriately and is suitable for its intended use. It demonstrates that waste material has not been used in the development. The Materials Management Plan details the procedures and measures that will be taken to classify, track, store, reuse and dispose of all excavated materials that will be encountered during the development works.

11.154 The disposal of soil waste, contaminated or otherwise to landfill sites would be best mitigated by minimisation of the overall quantities of waste generated during construction, and by ensuring that excavated material consigned to landfill cannot, as an alternative, be put to use either on Project Area or on other sites.

11.155 Where there is a requirement to dispose of surplus excavated materials off site as waste, the material will be characterised to determine firstly whether it is Hazardous or Non-Hazardous waste in accordance with the Environment Agency's Technical Guidance WM3[51] and then once this is established, the appropriate disposal facility will be determined through Waste Acceptance Criteria (WAC) analysis, as required.

Groundwater and Dewatering

11.156 If groundwater is not adequately controlled then excavations may flood or become unstable, and the efficiency of construction operations will be impacted. Where the volume of groundwater requiring dewatering exceeds twenty cubic metres a day then an abstraction permit will be obtained from the Environment Agency. Consents will also be obtained where discharging to watercourses including IDB managed water courses or public sewer. Control measures adopted for dewatering/ discharges will be agreed with the Environment Agency as part of the permitting process.

11.157 The adopted dewatering techniques will be appropriate to the type of excavation and hydrogeological conditions. The hydraulic conductivity of the ground within each excavation or trench section will be considered to establish the required abstraction volume to achieve the necessary drawdown of groundwater levels. The type of dewatering undertaken may include the use of cut off walls, sump dewatering and potentially well point dewatering with some provision for attenuation capacity to allow for water treatment and/or settlement prior to final discharge.

11.158 The inclusion of attenuating capacity for dewatering will ensure that discharge rates are controlled and this will effectively mitigate against the capacity of the receiving surface water environment being exceeded.

11.159 Further detailed hydrogeological assessment will be undertaken to design temporary works and dewatering particularly in areas that desk study and/ or ground investigation has identified a potential shallow groundwater table, highly permeable deposits or where dewatering is required and there are groundwater abstractions located nearby. Further hydrogeological assessment may include targeted ground investigation and permeability testing, groundwater level monitoring, or pumping tests whereby water from a test well is pumped at a controlled rate whilst the flow rate from the well, and the drawdown in an array of observation wells at varying distances from the test well, is observed. The information from these tests would be used to construct a hydrogeological model to predict the potential transmissivity and drawdown effects of dewatering.

11.160 Routeing within the LoD will seek to be at least 50 m away from any groundwater abstractions. There is only one abstraction license within the extended study area, this is located in an area of apparent inactive mineral workings and so it is considered that there are no sensitive water abstractions that could be affected.

11.161 Due to the requirement to protect controlled waters (groundwater and surface water), further risk assessments will need to be undertaken at all trenchless crossing locations to ensure that the ground model is understood and potential risks quantified prior to construction. Detailed design will seek to control the potential for ground or surface water contamination to occur, for

[50] CL:AIRE, (March 2011), 'Definition of Waste: Development Industry Code of Practice
[51] Environment Agency, (2015), 'Waste classification guidance on the classification and assessment of waste. 1st Edition'

example, through specifying vertical alignments that minimise the potential for "break out" of drilling fluids, or other fluids used in construction, therefore reducing potential impacts on ground and surface water quality. This is particularly relevant where designing works within granular materials or in particularly sensitive groundwater environments.

Land Drains

11.162 Pre-construction surveys to identify land drains should be carried out to inform the detailed design, which would seek to avoid or re-instate any land drains affected.

Residual Impacts

General

11.163 This section presents the outcome of the soil and groundwater potential contamination assessment undertaken and assumes that mitigation measures that will be adopted such as a CEMP (including appropriate PPE and site controls) will be implemented during construction with any benefits from remediation undertaken in relation to the GB Onshore Scheme realised at the post-construction stage.

11.164 In line with the assessment approach and Appendix 11.B, an initial screening process has been undertaken on the potential land contamination sites identified in the baseline review. The screening process seeks to identify areas of current or historical contaminative land use that might pose contamination risks during construction and operation of the GB Onshore Scheme.

11.165 The following factors have been used to generate site rating scores for the sites identified as part of the screening process. Further information on the criteria used is provided in Appendix 11.B:

- the location of the potential land contamination site in relation to the Project Area;
- the extent of any proposed cut/fill earthworks to be undertaken to facilitate the GB Onshore Scheme and the type of earthworks to be undertaken at the closest point to the potential land contamination site e.g. primarily whether this is earthworks cut or fill. Given the earthworks/detailed design is ongoing and the current understanding is a combination of both cut and fill across all components of the GB Onshore Scheme, a conservative assumption has been made that all of the Project Area may have some degree of cut taken during earthworks; and
- the presence of sensitive receptors e.g. underlying sensitive groundwater aquifers (Secondary A and B aquifers), surface watercourses, human, property and ecological receptors.

11.166 For potential contaminated land sites that present a low risk (site ratings of zero, one or two), as determined in accordance with Appendix 11.B, Table 11.B2.1, these have not been taken further in the assessment. For potential contaminated land sites with ratings of three or higher (moderate to higher risk), and which are summarised in Table 11.B2.2 in Appendix 11.B and indicated on Figure 11.4, these have been assessed further. A total of three sites have been excluded, with a total of nine sites included for more detailed assessment. Of these, three sites are located partially within the Project Area boundary and six sites are located within 250 m of the Project Area boundary.

11.167 For the sites identified for further assessment, site-specific CSM have been produced: one for the baseline conditions; one for the construction phase; and one for the post construction (operation) phase. Sites of similar land use and history have been grouped where appropriate. The CSM are presented in Appendix 11.B.

11.168 As detailed in the Future Baseline section of this Chapter, the assessment does not consider that the future baseline will be materially different to the current baseline outlined in the Baseline Conditions section.

Construction

Temporary Effects

11.169 To determine whether there are any potential temporary effects on human health, groundwater, surface water, buildings or sensitive sites during the construction phase, the baseline and construction risk levels, as defined in their respective CSM have been compared.

11.170 Where there is no predicted change between the main baseline risk and the main construction risk, the temporary effect significance is deemed to be neutral.

11.171 An increase in risk at the construction stage compared to baseline would result in an adverse effect and conversely, any improvement resulting from construction, for example where

remediation is undertaken, or a contaminant linkage is removed, would result in a beneficial effect. Whilst adoption of the measures expected to be included as part of a CEMP would make it unlikely that there would be significant adverse effects during construction e.g. through the control of surface run off and dust, it is considered that there may still be some temporary minor adverse effects during construction from ground disturbance or groundwater controls which may inadvertently mobilise contamination or create preferential pathways.

11.172 The assessment of temporary effects has shown that whilst there are predicted **minor adverse** impacts associated with the construction stage, none of these would be regarded as significant following adoption of the measures noted in the 'Mitigation' section. A summary of the assessment, split by component for additional clarity, is provided in Table 11.9 and the key considerations are outlined below. Details of the full assessment are presented in Appendix 11.B.

Table 11.9: Summary of Construction Temporary Effects

Risk and impact assessment CSM	Construction impact significance for substation / converter station	Construction impact significance for DC cable route
Historical infilled land and landfills (within and extending outside of the application boundary)	Neutral to minor adverse	Neutral to minor adverse
Buried disused oil pipeline (within and extending outside of the application boundary)	Neutral	Neutral
Former ponds (assumed infilled) (outside of the application boundary)	Neutral	N/A
Former Kent Oil Refinery (outside of the application boundary)	Neutral	N/A
Former military land use (outside of the application boundary)	N/A	Neutral
Current and former farm land (outside of the application boundary)	Neutral	Neutral

11.173 The greatest risks identified are to controlled waters during construction (earthworks/ remediation). There is considered to be a potential for temporary increases in risk during construction due to the potential for ground disturbance, dewatering and contaminant mobilisation/ migration that may result from these activities. The impact significance has been assessed to range from neutral to temporary minor adverse (not significant) during this phase of works as the CEMP will include appropriate measures to control and mitigate potential impacts therefore preventing a significant effect.

11.174 Construction compounds would include the storage of potentially hazardous substances, such as fuels and lubricating oils and may also be used for temporary storage of potentially contaminated soils. Mitigation measures expected to be set out within a CEMP prepared prior to the commencement of construction activities, will include a Control of Substances Hazardous to Health (COSHH)/ fuel inventory, storage of COSHH in accordance with relevant Environment Agency Pollution Prevention Guidance notes and storing any hazardous materials in designated locations with specific measures to prevent leakage and release of their contents. No significant temporary effects are identified.

Permanent Effects

11.175 To determine whether there are any potential permanent effects, the baseline and post-construction CSM have been compared. A summary of the assessment, split by component for additional clarity, is provided in Table 11.10 and the details of these comparisons are presented in Appendix 11.B.

Table 11.10: Summary of Construction Permanent Effects

Risk and impact assessment CSM	Post-construction impact significance for substation / converter station	Post-construction impact significance for DC cable route
Historical infilled land and landfills (within and extending outside of the application boundary)	Neutral	Neutral to minor beneficial
Buried disused oil pipeline (within and extending outside of the application boundary)	Neutral	Neutral
Former ponds (assumed infilled) (outside of the application boundary)	Neutral	N/A
Former Kent Oil Refinery (outside of the application boundary)	Neutral	N/A
Former military land use (outside of the application boundary)	N/A	Neutral
Current and former farm land (outside of the application boundary)	Neutral	Neutral

11.176 The assessment has shown that the construction of the GB Onshore Scheme has predicted **neutral** to **minor beneficial** effects. It is considered that the effects of the development will be neutral, as areas of potential contamination will be returned to their original state or improved following construction. A beneficial effect is not considered in the case of the substation/ converter station development as it is restrained to an area which has not been subject to landfilling and remains undeveloped, and in turn remediation in this area would not be envisaged. A neutral to minor beneficial effect is considered in association with the proposed DC cable route in order to capture the areas of the proposed route that may interact with potentially contaminative land, whilst acknowledging the geographical extent of any associated remediation will be limited; furthermore, the routing of the DC cable along an area of hardstanding to the east of the Perry's Farm Landfill capping, will avoid any significant disturbance/ interaction with the underlying landfill materials.

Operation

11.177 There are not expected to be any significant operational effects on ground conditions as the design of the GB Onshore Scheme is expected to include both best practice and statutory measures that would contain and control any releases of contaminants to the Project Area and its associated infrastructure during the operation period.

Decommissioning

11.178 Decommissioning effects are assumed to be similar to but no worse than the temporary effects defined in the assessment of potential construction impacts on the basis of the similar nature of activities envisaged during construction and decommissioning.

Summary

11.179 In summary, it is considered that there are no significant adverse construction or operation stage effects in relation to ground conditions. There are predicted to be **neutral** to **minor beneficial** effects associated with remediation of the Project Area.

Impact of Climate Change and Major Accidents and Disasters

Climate Change

11.180 Based on climate predictions[52], the UK will experience more extreme weather. Hotter, drier summers and warmer, wetter winters will become more common. The frequency and severity of short periods of high rainfall will increase.

[52] Met Office, 2018, UK Climate Projections 2018 (UKCP18),

11.181 Potential impacts associated with climate change include, but are not limited to:

- Increased frequency and severity of short periods of high rainfall may adversely affect groundwater / surface water
- Decreased aquifer recharge may lead to depleted groundwater resources.
- Increased frequency and severity of drought event may adversely affect magnitude and duration of dust generation.
- Drier climate and high temperatures may adversely affect soil quality.
- Flooding and severe storms may promote increased erosion that adversely affects soil quality.

11.182 The impact of climate change upon the Proposed Scheme has been qualitatively assessed by way of a potential future baseline scenario, similar to that outlined earlier in this Chapter. It is not considered that the potential impacts associated with climate change would significantly alter the predicted effects relative to those described in the current assessment.

Major Accidents and Disasters

11.183 Risks associated with major accidents and disasters may include, but are not limited to, the following with the scope of the ground conditions discipline:

- Physical damage or contamination of aquifer or water abstraction borehole/ well/ reservoir.
- Spillage or longer term seepage of pollutants into groundwater or surface water.
- Fire, explosion, release or exposure to harmful gas/ materials.
- Extreme weather (e.g. flood, drought, heat wave, snow, high winds).
- Collapse/ damage to structures/ infrastructure.
- Fatality/ injury to member of public (e.g. pedestrians, nearby residents) during construction/ operation.
- Emergency response impacts on designated environmental receptors.

11.184 Potential impacts associated with major accidents and disasters would be considered to be reduced to as low as is reasonably practicable assuming all mitigation measures outlined are correctly implemented.

Cumulative Impacts

11.185 Potential cumulative effects may be realised if ground remediation, or significant earthworks, from other developments or activities were planned to occur at the same time, and in close proximity to the Project Area. The cumulative effect may be quite localised in terms of potential construction related impacts on local receptors, but ultimately in combination the residual post construction effects could be beneficial if, for example, areas are remediated or brought into beneficial use from an otherwise derelict condition.

11.186 There are committed developments linked to the Project Area including a new lattice tower (50m tall) north of the substation and associated down leads from the tower direct to the substation, as well as new underground cables between the cable sealing end compound and the substation. It is not considered that any of these committed developments will generate significant cumulative effects in relation to ground conditions as, whilst they are not part of the GB Onshore Scheme, in the context of cumulative effects they are considered to be part of the sequence in preparing the Project Area for subsequent re-development. Consideration has been given as to whether temporal overlap of the committed developments could in combination lead to cumulative effects. However, in the context of the ground conditions assessment and the mitigation contained within a CEMP (to be prepared), it is not considered that any overlap between the GB Onshore Scheme and the aforementioned committed developments will generate cumulative effects for ground conditions.

11.187 A review of the Medway Council planning portal was undertaken in September 2018 as part of preparing the Screening report (November 2018) in order to identify other proposed and committed developments within the vicinity of the GB Onshore Scheme. The planning portal has been reviewed to ensure the committed developments considered at the time of submission are current and those developments identified within the study area are outlined below:

- Employment floorspace and business park management centre; Grain Road Isle Of Grain. Approximately 1.2km southwest of the Project Area. Original planning application approved with conditions, latest conditions discharged, no known timeframes for construction.

11.188 The employment and business park management floorspace considered as part of the cumulative assessment are not located in an area where earthworks associated with the GB Onshore Scheme will directly interact. On this basis, it is not considered that it will generate cumulative effects in relation to ground conditions and the GB Onshore Scheme and is not considered further as part of this assessment.

Summary of Assessment

11.189 The ground conditions topic assesses the potential impacts of the construction and operation of the GB Onshore Scheme in relation to ground conditions.

11.190 In view of the mitigation outlined, it is considered that there are no significant adverse construction or operation stage effects in relation to ground conditions. There are predicted to be **neutral** to **minor beneficial** effects associated with remediation of the Project Area.

11.191 The assessment of temporary effects has shown that whilst there are predicted **minor adverse** impacts associated with the construction stage, none of these would be regarded as significant following adoption of the measures as part of a CEMP which will be prepared prior to the commencement of construction activities and signed off by Medway Council.

11.192 There are not expected to be any significant operational effects on ground conditions as the design of the GB Onshore Scheme is expected to include measures that would contain and control any releases of contaminants to the Project Area and its associated infrastructure during the operation period.

11.193 Decommissioning effects are assumed to be similar to but no worse than the temporary effects defined on the basis of the similar nature of activities envisaged during construction and decommissioning.

11.194 It is not considered that any of the identified committed schemes will generate cumulative effects in relation to ground conditions.

12. Cumulative Assessment

Introduction

12.1 This Chapter considers the potential for cumulative effects, including intra-project and inter-project effects, to occur as a result of the GB Onshore Scheme. It draws on the results of the technical assessments of the GB Onshore Scheme as reported in chapters 5 to 11 of the Environmental Statement.

Cumulative Effect Assessment

Overview

12.2 The cumulative effects assessment follows guidance set out in the Institute of Environmental Management and Assessment (IEMA) 'State of Environmental Impact Assessment Practice in the UK' Report.

12.3 IEMA's Report recognises two major sources of cumulative effects:

- Intra-project effects: These effects occur where a single receptor is affected by more than one source of effect arising from different aspects of a project. An example of an intra-project effect would be where a local resident is affected by dust, noise and traffic disruption during the construction of a project, with the results being a greater nuisance than each individual effect alone; and
- Inter-project effects: These effects occur as a result of a number of developments, which individually might not be significant, but when considered together could result in a significant cumulative effect on a common receptor, and will include developments separate from and related to the project.

Intra-Project Effects

12.4 The 'Assessment of Intra-Project Effects' section of this chapter reports the assessment of intra-project effects where a common receptor is being affected by two or more effects reported in different specialist assessments.

Inter-Project Effects

12.5 The 'Assessment of Inter-Project Effects' section of this chapter reports the assessment of inter-project effects. The effects have been considered in the specialist assessments but are also reported here on a project by project basis.

Assessment of Intra-Project Effects

Identification of Potential Intra-Project Effects

Identification of Potential Effects

12.6 Intra-project effects may also occur where a common receptor is being affected by two or more effects reported in different specialist assessments e.g. the two separate impacts may interact or combine to result in an intra-project effect. The first step in the assessment has been to consider where there is the potential for an intra-project effect to occur. An overview of where potential intra-project effects may interact or combine between specialist assessment topics may occur is provided in Table 12.1. An 'X' in the table denotes that a potential intra-project effect could occur, however, this does not mean that an intra-project effect will arise. An 'O' in the table denotes a potential indirect cumulative effect, for example the removal of vegetation will directly impact on ecological resources, but may also have an indirect impact on visual amenity as this vegetation may have screened views of the Project Area previously. These linkages have been developed in consideration of whether or not receptors are shared between specialist assessment topics, and also in consideration of the proposed GB Onshore Scheme.

Table 12.1: Potential for Intra-project Cumulative Effects

	L&V (Ch05)	Ecology (Ch06)	Noise (Ch07)	Heritage (Ch08)	Water (Ch09)	Transport (Ch10)	Ground (Ch11)
L&V (Ch05)		O	X	X			O
Ecology (Ch06)	X		X		X		X
Noise (Ch07)	X	X				X	
Heritage (Ch08)	X						
Water (Ch09)		X					
Transport (Ch10)			X				
Ground (Ch11)	O	X			O		

12.7 The second step, taking account of the above, has been to review the results of specialist assessments to identify potential common receptors and the residual effects which they are predicted to experience. The specialist assessments reported in the ES have identified a number of effects which would occur as result of the construction and operation of the GB Onshore Scheme ranging from negligible or minor significance (such effects are classed as not significant) to moderate or major significance (such effects are classed as significant). Several effects on one or more receptors could theoretically interact or combine to result in an intra-project effect which is significant. When considering intra-project effects, the mitigation measures as set out within the assessment chapters have been taken into account i.e. only residual effects (after mitigation) are considered.

12.8 Intra-project effects have only been identified where more than one specialist assessment chapter has identified a residual effect of minor significance or greater on an individual or group of common receptors. Where residual effects are regarded to be negligible for any one technical assessment it is considered that any potential intra-project cumulative effect would not be significant and therefore further detailed assessment is not required.

Assessment of Potential Effects

Impact on Amenity During Construction

12.9 An intra-project effect on residents and visitors could result from construction of the GB Onshore Scheme due to a combination of noise and visual effects leading to a reduction in amenity. Potential receptors are predominantly the residential properties in the near vicinity of the Project Area, namely on the B2001/ Grain Road, along West Lane. This may also impact on the users of the proposed coastal path that will extend along West Lane.

12.10 Visual effects have been assessed from a number of different viewpoints which are representative of the views which would be experienced from residential properties in the vicinity of the GB Onshore Scheme, including from West Lane, which would cover users of the coastal path. Visual amenity effects during construction from West Lane, the Circular Walk 3 in the Allhallows Marshes (and therefore the proposed Coastal Path), and the properties on Stoke Road were regarded to be potentially significant.

12.11 Noise effects have been assessed based on the construction works which will be undertaken and potential receptors have been identified based on their proximity to the Project Area. The extent of the effect experienced by receptors will depend on the nature of construction works and the proximity of receptors to them. Individually these effects are not regarded as being significant.

12.12 Construction effects from noise are temporary and intermittent, both through the day and the construction period. Visual effects will be constant throughout the construction period albeit the magnitude of the effect will change as construction progresses due to the differing equipment in use, and extent of temporary change to land cover. Whilst receptors may experience a cumulative reduction in amenity, such effects will be short term, temporary and intermittent and therefore when considered in-combination the significance of effects will not increase. As a result it is predicted that a small number of receptors in close proximity to the Scheme (typically within less than 0.5 km) will experience moderate adverse intra-project effects which are therefore significant.

Impact on Amenity During Operation

12.13 At year one of operation of the GB Onshore Scheme, visual amenity impacts to the users and residents of West Lane, the Circular Walk 3 (and the proposed Coastal Path), and the properties on Stoke Road were assessed to be the same as during construction, and therefore significant, as the proposed reinstatement would not yet be established. However by year 15 of operation when the landscaping plan is established visual amenity from the users of Circular Walk 3 and the residences on Stoke Road would be negligible, whilst properties on West Lane and the users of the proposed coastal path would remain moderate adverse and significant.

12.14 During operation noise impacts are regarded as being not significant, including from residential receptors in closer proximity that West Lane. As such the intra-project effects are considered to be no greater than moderate adverse for the residents on West Lane and the users of the coastal path.

Assessment of Inter-Project Effects

Identification of Inter-Project Effects

Overview

12.15 The assessment of inter-project cumulative effects has followed a tiered approach:

- Identify the study area, or likely extent to which cumulative effects may persist;
- Identify all projects within the study area recording all projects that reasonably can be considered as having a potential cumulative impact in combination with the GB Onshore Scheme;
- Information gathering about the identified developments; and
- Assessment of inter-project effects.

12.16 A review of the Medway planning system was undertaken, specifically on the Isle of Grain, including those at application stage or that have been granted approval as well as potential developments for which a local plan allocation may exist.

12.17 In order to assess the potential for inter-project effects to occur in combination with the identified developments the following was undertaken:

- For developments where a planning application has been submitted information presented within the Environmental Statement or application material has been reviewed.
- For developments that are known to be proposed (either via screening or scoping opinion requests or following presentation of information in the public domain) but where an Environmental Statement (or other environmental reports) has not yet been prepared or submitted, any readily available information has been utilised.
- For developments which may occur in the vicinity of the GB Onshore Scheme the relevant local plans have been reviewed to identify any planning allocations.

12.18 Following information gathering from available sources, the effects of the GB Onshore Scheme have been considered in combination with the potential effects from other developments that are both reasonably foreseeable and are geographically located in a position where environmental impacts could act together to result in an inter-project effect.

12.19 In assessing inter-project effects, it should be acknowledged that the relative contributions that different projects make to a cumulative effect, and carefully consider whether a cumulative effect occurs at all. For example, effects associated with a large scale project may be significant, and whilst a smaller project may contribute to this effect, the cumulative effect of the smaller project and the larger project is only considered to be significant if it is of greater significance than the effect of either project in isolation.

12.20 Inter-project effects are generally unlikely to arise unless the other developments are in close proximity to a component of the GB Onshore Scheme (i.e. the proposed converter station and substation site and/ or the proposed DC cable route), recognising that actual distance varies with the nature of the potential effect and nature of the receptor.

12.21 The study area for the consideration of inter-project effects has been developed taking account of the predicted extent of impacts associated with the different elements of the GB Onshore Scheme (i.e. effects from the construction of the proposed converter station and substation, and effects from installation of the proposed DC cable route). The study area extends to the point at which the associated effects become insufficient to contribute in any meaningful way to those of another development.

12.22 The study area for each environmental assessment topic is defined in the relevant technical chapter (Chapters 5 to 11). Information on the likely extent of impacts associated with other developments in the area has also been considered.

Identification of Projects for Consideration within the Cumulative Assessment

12.23 The identification of potential and committed developments within the vicinity of the GB Onshore Scheme (i.e. on the Isle of Grain) identified developments that were considered to have the potential for inter-project effects (e.g. cumulative landscape and visual impacts have potential to occur over a greater distance than, for example, cumulative noise or archaeology impacts).

12.24 Table 12.2 provides a long list of other proposed developments considered for their potential for inter-project effects.

Table 12.2: Register of Nearby Developments

ID	Project	Status	Expected Construction	Relationship with the GB Onshore Scheme
1	NGET OHL Works – connection of the GB Onshore Scheme to the NETS.	Proposed – no application submitted	Construction expected to coincide with the construction of the proposed substation.	0 m – to connect with the proposed substation.
2	GB Offshore Scheme – subsea cable installation beyond MLWS.	Proposed – Scoping Opinion Request issued; planning application to be submitted in line with GB Onshore Scheme.	Construction period will align with the installation of the DC cable of the GB Onshore Scheme	0 m – connects directly to the subsea DC cable at MLWS.
3	Six residential properties; Port Victoria Road, Isle Of Grain, Rochester, ME3 0EN.	Outline application submitted and validated in June 2018. Planning decision is pending. Planning Reference: MC/18/1871	No details of intended construction period provided.	Approx. 580 m east (Grain).
4	Outline planning application for the development of up to 464,685 m^2 of built employment floorspace and up to 245 m^2 of floorspace for a business park management centre; Grain Road Isle Of Grain Rochester Kent ME3 0AE.	Original application (Planning Reference MC/09/1628) approved with conditions March 2010. Latest conditions discharged June 2019.	No known timeframes for construction.	Phase 1 is approx. 1.2 km southwest
5	Construction and operation of a cementitious grinding facility and associated development; Grain Road, Isle of Grain, ME3 0DW.	Scoping Opinion request for the importation of clinker and granulated blast furnace and development of a grinding facility. Scoping Opinion submitted July 2019. Planning Reference: MC/19/1793	EIA Scoping at this stage only	Approx. 1.7 km southwest
6	Cement Plant; Thamesport Isle Of Grain Rochester Medway ME3 0AP. Proposed development of a new cement plant at London Thamesport.	Planning application validated February 2019. Planning Reference: MC/19/0299	No construction programming information provided within submission documents.	Approx. 2 km southwest

12.25 All of the developments listed above have been considered by the technical specialists in assessing the potential cumulative effects when considered in combinations with the GB Onshore Scheme.

12.26 Where environmental information has not been available it has been assumed that all projects would be constructed and operated to good practice standards and approval of the appropriate regulatory bodies and stakeholders.

12.27 The location of the other developments in relation to the GB Onshore Scheme is shown in Figure 12.1.

Assessment of Inter-Project Effects

Overview

12.28 The following sub-sections identify whether or not the specialist assessments undertaken as part of the Environmental Impact Assessment (EIA) (as reported in Chapters 5 to 11 of this Environmental Statement) have identified any potential cumulative effects from the GB Onshore Scheme in combination with those projects identified in Table 12.2. Where specialist assessments scoped out the need to assess the potential cumulative effects with these projects these have not been recorded within this section.

12.29 Detailed assessment of potential cumulative effects are reported within the technical assessment chapters.

Project ID 1 – NGET OHL Works

12.30 The potential for cumulative effects between the NGET OHL Works and the GB Onshore Scheme were considered as part of the Landscape and Visual Amenity, Cultural Heritage and Water Resources and Flood Risk technical assessments. However within each of these assessments there were no conclusions of potentially significant cumulative impacts.

Landscape and Visual Amenity

12.31 The potential erection of a new lattice tower to support the connections of the GB Onshore Scheme was recognised to result in a new structure within the landscape. The assessment noted that this would be seen in the context and in alignment with the existing OHL and therefore will not result in a material change to the landscape or further impact amenity views from the surrounding area beyond those effects likely to be experienced as a result of the GB Onshore Scheme.

Cultural Heritage

12.32 It is assessed that there is the potential for cumulative effects to as yet unknown archaeological assets that extend beyond the boundary of the GB Onshore Scheme to the location of the proposed new tower foundations. However the potential for an impact to occur as a result of the GB Onshore Scheme is already recorded as a potentially significant impact, and as such the cumulative effect will not be significantly greater than as already recorded.

Water Resources and Flood Risk

12.33 Whilst the NGET OHL Works are a separate project, due to the proximity of the project to the GB Onshore Scheme and through consultation with NGET throughout the development of the project, an allowance has been made for the potential development of a new lattice tower as part of the GB Onshore Scheme assessment, drainage strategy and mitigation. Therefore no potential cumulative effects are predicted from flood risk and drainage. It is assumed that during construction standard good practice will be utilised and therefore potential cumulative effects on water quality will also be avoided and/ or minimised.

Project ID 2 – GB Offshore Scheme

12.34 The potential for cumulative effects between the GB Offshore Scheme and the GB Onshore Scheme were considered as part of the Ecology and Nature Conservation and Cultural Heritage technical assessments. However within each of these assessments there were no conclusions of potentially significant cumulative impacts.

Ecology and Nature Conservation

12.35 Based on the spatial context of the GB Onshore Scheme and the GB Offshore Scheme aligning at MLWS, the potential for cumulative impacts to the internationally and nationally designated Thames Esturary and Marshes SPA, Ramsar and SSSI site was further considered. However when considering that the installation of subsea DC cable would be undertaken as part of the

same activity and at a time that avoids the most sensitive period for the designated features, any cumulative impact are not predicted to be significant.

Cultural Heritage

12.36 It is assessed that there is the potential for cumulative effects to as yet unknown archaeological assets that extend beyond the boundary of the GB Onshore Scheme to the location of the proposed new tower foundations. However the potential for an impact to occur as a result of the GB Onshore Scheme is already recorded as a potentially significant impact, and as such the cumulative effect will not be significantly greater than as already recorded.

Project ID 3 – Residential Properties

12.37 Following consideration across all environmental disciplines, no inter-project cumulative effects have been identified beyond those identified in their individual assessments.

Project ID 4 – Phase 1 of Grain Business Park

12.38 Following consideration across all environmental disciplines, the cementitious grinding facility was only considered further in the Landscape and Visual Amenity Assessment. However due to the distance between the projects and the existing infrastructure at Thamesport and the Grain LNG facility any potential cumulative effects are not predicted to be significant.

Project ID 5 – Cementitious Grinding Facility

12.39 Following consideration across all environmental disciplines, no inter-project cumulative effects have been identified beyond those identified in their individual assessments.

Project ID 6 – Cement Plant

12.40 Following consideration within the transport assessment, with the information available, it is concluded that the worst-case scenario has been considered and that the cumulative impact of both projects on the local highway network would not be greater than either project in isolation.

Summary of Assessment

12.41 A cumulative assessment has been undertaken to take in to account both inter-project and intra-project effects.

12.42 Intra-project effects has considered the impact of multiple environmental topics on the same receptor (i.e. the combined impact of increased disturbance (such as noise) and reduced visual amenity on walkers and visitors, as well as in-combination effects from different components the Scheme (i.e. the proposed DC cable route and the proposed converter station) on the same receptor.

12.43 Inter-project effects have considered the potential cumulative impacts from the simultaneous development of the UK Onshore Scheme with other projects within the near vicinity of the Scheme. A systematic review of projects either already within or known to soon enter the planning system were reviewed by each of the specialists to determine potential cumulative impacts.

Intra-Project Effects

12.44 The assessment potential cumulative effects on an individual receptor from different components of the GB Onshore Scheme, and from multiple sources has determined that whilst there have been some impacts identified these are not likely to be of greater significance than when considering the potential effects individually. Intra-project effects are limited to the amenity of residential receptors, and users of surrounding walking routes adjacent to the Project Area.

Inter-Project Effects

12.45 Of the six short-listed projects identified that had the potential to result in cumulative impacts when taken in to consideration with the GB Onshore Scheme, potential impacts associated with the proposed NGET OHL Works, GB Offshore Scheme and the cement plant at Thamesport were considered for further assessment. However it was concluded that any potential cumulative impacts would not be significantly impacted as a result of the simultaneous development or operation of the GB Onshore Scheme and these other projects.

13. Schedule of Mitigation

Introduction

13.1 This chapter sets out, in a single location, all of the measures proposed to mitigate the potential environmental impacts associated with the construction and operation of the GB Onshore components of the GB Onshore Scheme.

Approach to Mitigation

13.2 As set out within Chapter 4 of the ES, a hierarchal approach to the development of mitigation measures has been adopted with the objective of avoiding, preventing or reducing adverse effects as much as possible through project design. Equally, mitigation has been developed to maximise or enhance any potential beneficial effects.

13.3 The Environmental Impact Assessment (EIA) has been undertaken in parallel with the development of the GB Onshore Scheme; this has presented opportunities to incorporate mitigation into its design.

13.4 The approach below sets out how mitigation has been developed and categorised:

- **Design Measures**: These are measures which are embedded within the fundamental design for the GB Onshore Scheme or which would help to inform – or where required, restrict – the Contractor's detailed scheme design.
- **Construction Measures**: These are measures which are incorporated into the parameters of how the scheme will be constructed by the Contractor.
- **Other Measures**: These are measures which are required – or reflect best practice – but can neither be categorised as design or construction measures.
- **Compensatory Measures**: Following the hierarchal approach above, this is the least-preferable option and relates to measures required in the event that an effect cannot be effectively mitigated.

Purpose of the Schedule of Mitigation

13.5 A wide variety of mitigation measures are identified within Chapters 5 to 11 of the ES. The purpose of the Schedule of Mitigation is to provide a single reference point for all mitigation such that it can be easily transposed into each relevant Construction Management Plan, or other form of project control.

13.6 The register also provides an 'at a glance' summary of how mitigation will be delivered for example, whether it is embedded in design or to be applied during construction.

13.7 Each mitigation measure has been given a unique reference based on the specialist area it relates to; this also provides a useful reference for any future documents governing project construction.

13.8 For some topics, it should be noted that 'common' mitigation measures have been identified which may also be adopted by another specialist topic; for example, pollution-prevention mitigation measures may be applicable to both Water Resources and Ground Conditions. For completeness and to avoid the risk of future omission in project controls, common measures have been repeated for each specialist theme.

Landscape and Visual

Table 13.1 - Schedule of Mitigation for the GB Onshore Scheme (Landscape and Visual)

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Design	Converter Station and Substation	LV01	**Landscape** The location of the proposed converter station and substation has been located as close as possible alongside the existing industrial development at the National Grid Liquified Natural Gas (LNG) terminal and away from the majority of residential properties in Grain. The proposed siting and massing of converter station and substation alongside the existing industrial complexes and the proposed landscape reinstatement would improve the landscape fit and therefore reduce potential impacts on the setting of the North Kent Marshes Special Landscape Area (SLA) and Allhallows to Stoke Marshes Landscape Character Area (LCA).	Embedded within the design of the GB Onshore Scheme.
Design	Converter Station and Substation	LV02	**Landscape** Appropriate boundary vegetation within the Project Area has been developed to improve the interface between the built edge of the converter station and substation and the transition to the adjacent marshland landscape. The combination of boundary vegetation on a slightly raised earth mound would also help to reduce the overall scale and mass of the proposed building façades. The proposed selection of scrub and wetland species has been developed in conjunction with ecologists and makes reference to the landscape character guidelines set out to improve and restore the characteristic feature of the Allhallows to Stoke Marshes LCA.	Embedded within the design of the GB Onshore Scheme.
Design	Access Road	LV03	**Landscape** The proposed location and working width of the primary access road has been selected in part to minimise physical impacts on the Project Area and the immediate context. The proposed route and 5.5 m working width would be in keeping with the existing landscape pattern and layout with a simple connection to the B2001/ Grain Road.	Embedded within the design of the GB Onshore Scheme.
Design	Converter Station and Substation	LV04	**Biodiversity** The outline Landscape Plan has been developed to enhance the biodiversity found within the Project Area. The introduction of a Sustainable Drainage System (SuDS) detention basin, attenuation pond and swale each planted with marginal wetland	Embedded within the design of the GB Onshore Scheme.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
			species will create a green corridor and more complex vegetation structure and improve the biodiversity value within the Project Area.	

Ecology and Nature Conservation

Table 13.2 - Schedule of Mitigation for the GB Onshore Scheme (Ecology and Nature Conservation)

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Design	Converter Station and Substation	ECO01	**Overall Scheme Design** The design of the GB Onshore Scheme will deliver compliance with industry good practice and environmental protection legislation during both construction and operation e.g. prevention of surface and ground water pollution, fugitive dust management, noise prevention or amelioration.	Embedded within the design of the GB Onshore Scheme.
Design / Construction	DC Cables	ECO02	**Drilling** The use of a Horizontal Directional Drilling (HDD) cable installation method to minimise habitat loss and disturbance within the intertidal zone. HDD conduits will be drilled at sufficient depth to ensure disturbance to surface habitats and species as a result of drilling vibrations will not occur.	Embedded within the design of the GB Onshore Scheme. Sustainable installation method embedded within construction phase.
Construction	DC Cables	ECO03	**Drilling** Drilling fluids required for HDD operations will be carefully managed to minimise the risk of breakouts into the marine environment. Specific avoidance measures would include: • The use of biodegradable drilling fluids that Pose little or no risk ('PLONOR substances') where practicable • Drilling fluids will be tested for contamination to determine possible reuse or disposal • If disposal is required, drilling fluids would be transported by a licensed courier to a licensed waste disposal site. • The end of the ducts would be bundled in order to capture discharges from the breakout points.	Requirement during construction phase.
Construction	Scheme-Wide	ECO04	**Construction Environmental Management Plan** The preparation and implementation of a Construction and Environmental Management Plan (CEMP) to manage the environmental effects of the GB Onshore Scheme and to demonstrate compliance with environmental legislation, which will then be implemented by the selected construction contractor. The CEMP, Emergency Spill Response Plan and a Waste Management Plan shall be developed and	Requirement during construction phase. A detailed CEMP, Emergency Spill Response Plan and a Site Waste Management Plan will be prepared by the Contractor before commencement of works.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
			implemented for the installation phase of the Project in accordance with the Coastal and Marine Environmental Site Guide (John et al., 2015).	
Construction	Scheme-Wide	ECO05	**Non-Native Species** The latest guidance from the GB Non-Native Species Secretariat (2015) will be followed and a Biosecurity Plan produced to cover cable installation and any maintenance or repair works. All project vessels shall adhere to the International Convention for the Control and Management of Ships' Ballast Water and Sediments with the aim of preventing the spread of Invasive Non-Native Species (INNS).	Good construction practice embedded into how the scheme will be developed. A Biosecurity Plan will be prepared by the Contractor before commencement of works.
Construction	DC Cables	ECO06	**Marine Pollution** All Project vessels will be required to comply with the International Regulations for Preventing Collisions at Sea (1972) and regulations relating to International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) with the aim of preventing and minimising pollution from ships. Most critically, all vessels shall have a contingency plan for marine oil pollution (Shipboard Oil Pollution Emergency Plan).	Good construction practice embedded into how the scheme will be developed. A Marine Pollution Contingency Plan will be prepared by the Contractor before commencement of works.
Construction	DC Cables	ECO07	**Benthic Ecology** Where practicable, the cable route will be micro routed around sensitive benthic ecology receptors as identified from surveys of the Project Route Corridor.	Good construction practice embedded into how the scheme will be developed.
Construction	DC Cables	ECO08	**Spoil** Dredge spoil will be deposited adjacent to the cable route to minimise the footprint of disturbance effects.	Good construction practice embedded into how the scheme will be developed.
Construction	DC Cables	ECO09	**Cable Installation** Cable installation will be carried out on a 24-hour basis in order to reduce the overall installation time and associated disturbance of benthic ecological receptors.	Good construction practice embedded into how the scheme will be developed.
Design	Scheme-Wide	ECO10	**Landscape** An outline landscape design will be delivered which includes boundary planting incorporating tree and shrub planting.	Embedded within the design of the GB Onshore Scheme.
Design	Scheme-Wide	ECO11	**Landscape and Biodiversity** A SuDS detention basin, attenuation pond and swale will each be planted with marginal wetland species; further development of the landscape design will take place to support the application and detailed design, in particular any ecological mitigation requirements.	Embedded within the design of the GB Onshore Scheme.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Construction	Scheme-Wide	ECO12	**Protected Species** Standard environmental best practice and mitigation will be implemented to ensure construction and operation of the GB Onshore Scheme complies with legislation relating to protected species and does not compromise the local conservation status of ecological receptors present within or in the vicinity of the GB Onshore Scheme.	Good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	ECO13	**Protected Species** Obtaining, where required, protected species licences from Natural England sufficiently in advance of the works to meet with the optimum time for mitigation and to minimise any changes to the construction programme; production of mitigation strategies for protected species and application for species licences for translocation of animals away from construction areas where required	Good construction practice embedded into how the scheme will be developed; licence to be obtained by the Contractor where required.
Construction	Scheme-Wide	ECO14	**Vegetation Clearance** Site vegetation clearance undertaken in advance of construction and at an appropriate time of year so as to avoid incidental injuring or killing of reptiles.	Good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	ECO15	**Water Vole - *Arvicola amphibius*** Avoidance where possible of lagoons and ditch with potential to support the Water Vole (a legally protected species). Where avoidance is not possible, mitigation measures will be implemented in consideration of the legal status of the species.	Good construction practice embedded into how the scheme will be developed.
Construction	DC Cables	ECO16	**Cable Corridor Habitat** Habitat removed from within the DC cable corridor will be restored post-construction.	Good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	ECO17	**Lagoons** The lagoons outside of the site boundary will be retained.	Good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	ECO18	**Landscaping** Soft landscaping will be utilised on site to create diverse habitats for locally important species, using trees and shrubs of local provenance.	Good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	ECO19	**Nesting Birds** The key nesting bird period - March to August (inclusive) - will be avoided for site vegetation clearance. For any vegetation clearance proposed outside of this time, the site will be checked for the presence of any nest by a suitably qualified ornithologist, prior to removal; if active nests are found, appropriate buffer zones would be put in place and the area monitored until the young birds have fledged	Good construction practice embedded into how the scheme will be developed.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Construction	DC Cables	ECO20	**Marsh Harrier - *Circus aeruginosus*** Noise disturbance, during construction of the DC cable, has the potential to directly impact breeding Marsh Harrier, if such works are undertaken during the breeding season (typically March to August inclusive). Therefore, to avoid any such impacts, the mitigation will be adopted and formalised into the CEMP such that construction of the DC cable, within 200 m of the Marsh Harrier territory, will not be undertaken between March and August, inclusive.	Good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	ECO21	**Lighting** The lighting for the GB Onshore Scheme, during construction and operation, would be appropriately designed to minimise impacts on bats and off-site habitats (details to be confirmed). Brightness would be as low as legally possible and the times during which the lighting is to be used limited to provide some dark periods, if possible subject to safety requirements. Lighting would be directed to where it is needed to avoid any horizontal light spillage. Any upward lighting would be minimal to avoid light pollution and disturbance to foraging and commuting bats. Limiting the height of lighting columns and directing light at a low level would reduce the ecological impact of lighting on bats and off-site habitats. An outline Lighting Strategy will be prepared. Any lighting that is required for the construction and operation of the GB Onshore Scheme will be directed away from surrounding habitat to minimise light disturbance to off Site habitats.	Good construction practice embedded into how the scheme will be developed. An outline Lighting Strategy will be prepared by the Contractor prior to the commencement of works.
Construction	DC Cables	ECO22	**Benthic Ecology** Deployment of anchors/anchor chains on the seabed will be kept to a minimum in order to reduce disturbance to seabed within the intertidal zone; the preferred method of cable installation in the intertidal would be boat-based, as whilst there is potential for small non-significant effects to intertidal habitats and species from beaching of the barge and vessel anchorage, the alternative shore based option would be associated with a much larger potential Zone of Influence (ZoI) and magnitude of effect although the significance is predicted to remain as minor adverse	Good construction practice embedded into how the scheme will be developed.
Design / Construction	Scheme-Wide	ECO23	**Operational Noise** Operational noise impacts will be controlled by detailed design and mitigation measures; if required, this will be determined by the appointed contractor. The project specification will require that internal operational sound levels in nearby	Good construction practice embedded into how the scheme will be developed. Requirement embedded into the project specification.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
			residential properties do not exceed Noise Rating (NR) 20. This limit applies to the cumulative operational sound of the converter station and the substation.	
Design / Construction	Scheme-Wide	ECO24	**Backup Generator** Although the noise of the proposed backup generator is not anticipated to be significant, it will be necessary to apply Best Practicable Means (BPM) with respect to its operation. BPM is likely to include: • Minimising the running of the generator i.e. keeping testing times as short as possible; • Positioning the generator such that line of sight to nearby receptors is blocked as much as possible to provide the maximum acoustic screening thereby minimising potential operational noise impacts; and • Providing an acoustic enclosure to the generator if required.	Good construction practice embedded into how the scheme will be developed. Requirement embedded into the project specification.

Noise and Vibration

Table 13.3 - Schedule of Mitigation for the GB Onshore Scheme (Noise and Vibration)

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Construction	Scheme-Wide	NVIB01	**Construction Environmental Management Plan** A CEMP will be prepared and implemented by the construction contractors. The final CEMP will include the relevant noise and vibration criteria, giving regard to the criteria presented within the ES, proposed surveys and a range of BPM which are likely to include the following: • Implementing processes to minimise noise before works begin and ensuring that BPM are being achieved throughout the construction programme, including the use of localised screening around significant noise producing plant and activities where appropriate; • Ensuring that modern plant is used, complying with the latest European noise emission requirements. Selection of inherently quiet plant where possible; • Use of lower noise piling (such as rotary bored or hydraulic jacking) rather than driven piling techniques if any piling is required, where possible; • Off-site pre-fabrication, where practical; • All plant and equipment being used for the works to be properly maintained, silenced where appropriate, operated to prevent excessive noise and switched off when not in use; • Ensuring contractors are made familiar with current legislation and the guidance in British Standard (BS) 5228 which should form a prerequisite of their appointment; • Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials around the Project Area to be conducted in such a manner as to minimise noise generation; • Consultation with Medway Council and local residents as appropriate to advise of potential noisy works that are due to take place; and • Monitoring of any noise complaints, and reporting to the contractor for immediate investigation.	Good construction practice embedded into how the scheme will be developed. A CEMP will be prepared by the Contractor prior to the commencement of works.
Construction	Scheme-Wide	NVIB02	**Construction Traffic Management Plan** A Construction Traffic Management Plan (CTMP) will be implemented, which will present the haul routes and road management procedures used to manage traffic movements within the works areas, the construction compound and on the local road network in the vicinity of the closest Noise Sensitive Receptors (NSRs).	Good construction practice embedded into how the scheme will be developed. A CTMP will be prepared by the Contractor prior to the commencement of works.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Construction	Scheme-Wide	NVIB03	**Noise and Vibration Best Practice** The best available operational methods will be employed at all times, having regard to the principles of BPM to minimise noise and vibration from the development.	Good construction practice embedded into how the scheme will be developed.
Design / Construction	Scheme-Wide	NVIB04	**Operational Noise** Operational noise impacts will be controlled by detailed design and mitigation measures; if required, this will be determined by the appointed contractor. The project specification will require that internal operational sound levels in nearby residential properties do not exceed NR 20. This limit applies to the cumulative operational sound of the converter station and the substation.	Good construction practice embedded into how the scheme will be developed. Requirement embedded into the project specification.
Design / Construction	Scheme-Wide	NVIB05	**Backup Generator** Although the noise of the proposed backup generator is not anticipated to be significant, it will be necessary to apply BPM with respect to its operation. BPM is likely to include: • Minimising the running of the generator i.e. keeping testing times as short as possible; • Positioning the generator such that line of sight to nearby receptors is blocked as much as possible to provide the maximum acoustic screening thereby minimising potential operational noise impacts; and • Providing an acoustic enclosure to the generator if required.	Good construction practice embedded into how the scheme will be developed. Requirement embedded into the project specification.

Archaeology and Cultural Heritage

Table 13.4 - Schedule of Mitigation for the GB Onshore Scheme (Archaeology and Cultural Heritage)

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Construction	Scheme-Wide	ARCH01	**Archaeological Investigations - Overview** The results of the Archaeological Desk Based Assessment (DBA) has identified that there is the potential for archaeological remains to survive within the Site. Mitigation measures, in the form of a staged programme of archaeological investigation, recording and dissemination, if deemed appropriate by Kent County Council (KCC), could be employed to establish the presence and significance of archaeological remains within the Site. An outline programme of initial investigations follows based on the results of the desk-based assessment and impact assessment and in consultation with KCC.	Good construction practices embedded into how the scheme will be developed, as required. Pending confirmation from KCC, a range of archaeological investigation measures will be secured.
Construction	Scheme-Wide	ARCH02	**Geoarchaeological Investigation** A programme of sample recovery and analysis may be undertaken to investigate paleoenvironmental conditions and soil sediment development that may be relevant to the research of archaeological remains recovered within the vicinity. This would be achieved through trial pit excavations or other geotechnical soil sample retrieval methods (such as soil cores or boreholes).	Where required or deemed appropriate by KCC, good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	ARCH03	**Targeted Watching Brief** A programme of observation, investigation and recording of archaeological remains during or alongside construction activities in which the contractor's preferred method of working would be controlled as necessary to allow archaeological recording to take place to the required standard. Targeted watching briefs can be undertaken in specific cases where the presence of potential remains has been demonstrated, but where detailed investigation prior to the main construction programme is unjustified, unfeasible due to safety or logistical considerations, or undesirable.	Where required or deemed appropriate by KCC, good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	ARCH04	**General Watching Brief** A programme of observation, investigation and recording of archaeological remains during or alongside construction activities in which the contractor's preferred method of working would be controlled as necessary to allow archaeological recording to take place to the required standard.	Where required or deemed appropriate by KCC, good construction practice embedded into how the scheme will be developed.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Construction	Scheme-Wide	ARCH05	**Strip Map and Sample Investigation** A flexible programme of fieldwork, which is of particular value where the presence of archaeological remains is known but the extent of areas requiring archaeological excavation is unclear. Topsoil and overburden would be stripped under archaeological control, over a defined area, in order to carefully expose archaeological remains. This work will be undertaken prior to the main construction programme in order to allow sufficient time for archaeological recording. A scope of work appropriate to record any archaeological remains exposed would be agreed on site during consultation with KCC.	Where required or deemed appropriate by KCC, good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	ARCH06	**Trial Trench Evaluation** Either targeted or sample-based investigation in which mechanical excavated trenches are excavated in order to establish the presence/absence, location, extent, and character of archaeological deposits or activity foci identified by non-intrusive baseline survey methods. Trial trenching would also inform the need for further appropriate mitigation. Trial trenching would be applied to areas where no significant archaeological remains have been identified to control the risk to the construction programme and to 'unforeseeable' finds.	Where required or deemed appropriate by KCC, good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	ARCH07	**Detailed Excavation** Detailed Excavation would be undertaken where significant archaeological remains are either known previously or discovered during works. This may be targeted at specific area locations such as the sites of archaeological interest identified during the baseline assessment or identified as the result of a programme of trial trench evaluation or watching brief monitoring.	Where required or deemed appropriate by KCC, good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	ARCH08	**Written Scheme of Investigation** Any appropriate archaeological investigation or mitigation measures would be undertaken in accordance with an Archaeological Project Design and Written Scheme of Investigation (WSI) prepared and approved in advance with KCC and Medway Council. All archaeological investigations will be undertaken by suitably qualified archaeologists who will be monitored as necessary by KCC to ensure compliance with both the agreed project design and professional standards.	Where required or deemed appropriate by KCC, good construction practice embedded into how the scheme will be developed.

Water Resources and Flood Risk

Table 13.5 - Schedule of Mitigation for the GB Onshore Scheme (Water Resources and Flood Risk)

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Design / Construction	DC Cables	WAT01	**Embankment Protection** Modifications to the embankment along the coastline will be avoided by using HDD construction methods (as opposed to trenching or 'cut and cover') to drill underneath the defences. The depth of the defences and appropriate standoff distances will be agreed in consultation with the Environment Agency prior to works being undertaken. The installation of the cable beneath the coastal embankment, which forms the existing tidal flood defence line, will also require a Flood Risk Activity Permit (FRAP) from the Environment Agency.	Embedded within the design of the GB Onshore Scheme. Sustainable installation method embedded within construction phase. A FRAP will be obtained prior to the commencement of works, further offering the opportunity for adjustments to help minimise impact.
Design / Construction	Scheme-Wide	WAT02	**Water Demand** Processes during the construction phase that may require significant volumes of water supply include supply for washing down and potable water for sanitary facilities for site staff. The most intensive use of water, for the mixing of concrete, will be done off-site where possible and therefore will not affect water supply to the Project Area. Water supply to the site during construction phase will be provided from the existing Southern Water sources, via an application to use an existing water supply for building purposes. Water requirements during operation will be minimal and will entail provision of sanitary facilities for a small team of onsite staff. Should larger teams of site personnel be needed for periods of maintenance, temporary welfare facilities will be provided, and suitable arrangements made at that time.	Good construction practice embedded into how the scheme will be developed. Ongoing monitoring of demand and appropriate actions undertaken by the Contractor as and when required.
Design / Construction	Scheme-Wide	WAT03	**Wastewater** Wastewater generation on construction sites includes effluent from sanitary facilities provided on-site and from washing down and wheel wash facilities. It is expected that foul water generated at the Project Area will be drained via the existing combined sewers in the surrounding area, following treatment if required.	Good construction practice embedded into how the scheme will be developed.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
		WAT03 (Cont.)	If dewatering is required during excavations, then abstracted water may be discharged to the Southern Water network, following sediment removal. Wastewater generation during operation will be minimal and will entail provision of sanitary facilities for a small team of onsite staff. Should larger teams of site personnel be needed for periods of maintenance, temporary welfare facilities will be provided, and suitable arrangements made at that time.	Ongoing monitoring of demand and appropriate actions undertaken by the Contractor as and when required.
Construction	Scheme-Wide	WAT04	**Sustainable Drainage System Phasing** Suitable construction phasing will be used to enable the SuDS features to be constructed at the beginning of the works. This would ensure that any rainfall events during construction of the substation and converter building would be intersected and attenuated by the SuDS before being discharged at a restricted rate into the agreed receiving waterbodies, in agreement with the North Kent Marshes Internal Drainage Board (IDB).	Good construction practice and approach to scheduling which will be embedded into how the scheme is developed.
Construction	Scheme-Wide	WAT05	**Ongoing Water Quality Monitoring** Surface water quality monitoring of the receiving waterbodies should be undertaken throughout construction to ensure any discharges from the works are not adversely impacting these waterbodies. Should any negative impacts be identified such as water pollution, site drainage pathways will be immediately reviewed.	Good construction practice embedded into how the scheme will be developed. Proactive ongoing monitoring undertaken by the Contractor.
Construction	Scheme-Wide	WAT06	**Construction Environmental Management Plan (Sediment Runoff)** The following mitigation sediment-specific measures will be put in place and embedded within the CEMP: • Development of an Erosion and Sediment Control Plan prior to execution of the Proposed Scheme; • Sufficient rumble pads will be provided at site access points to prevent tracking of sediments onto public roads; • Sediment traps will be provided at downstream edges of site to treat runoff prior to it leaving site; and, • Where possible, all runoff will be directed to the onsite sediment basin for treatment.	Good construction practice embedded into how the scheme will be developed. An Erosion and Sediment Control Plan will be prepared by the Contractor prior to the commencement of works. A CEMP will be prepared by the Contractor prior to the commencement of works.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Construction	Scheme-Wide	WAT07	**Construction Environmental Management Plan (Leaks, Spillages and Contaminant)** There is potential for hydraulic leaks from plant and machinery, as well as spills from chemical storages and sources such as concrete mixing to result in pollutant pathways to surrounding water resources. In relation to leaks and spillages of contaminants, the following mitigation measures will be embedded within a CEMP to reduce the risk of leaks and spills: • An emergency spillage action plan will be produced and included within the CEMP, which site staff will have read and understood, and will have been trained in its implementation on site; • Any damage to the drainage network will be repaired as soon as practical; • Any maintenance of plant and machinery will take place in a bunded impermeable area a minimum 20 m from any external drainage lines and the onsite waterbodies and those adjacent to the boundary; • The majority of concrete used will be pre-mixed and delivered from an off-site source, thereby negating the need to mix concrete on-site and reducing the creation of alkaline wastewater. Any mixing and handling of wet concrete on-site will be undertaken in designated impermeable areas, away from any drainage channels or surface water; and, • A designated impermeable area will be used for any washing down or equipment cleaning associated with concrete or cementing processes and wastewater will be discharged to the foul drainage system (with approval from Southern Water) or contained and removed by tanker to a suitable discharge location via a licensed waste operator.	Good construction practice embedded into how the scheme will be developed. A CEMP will be prepared by the Contractor prior to the commencement of works.
Design / Construction	Converter Station and Substation	WAT08	**Surface Water Management** During operation, the GB Onshore Scheme will generate several storm and wastewater sources including process waste, foul waste from sanitary facilities and surface water runoff from buildings, car parks and landscaped areas. Process and foul water management will be addressed as information about the sources of these flows becomes available and the design progresses. All surface water will be collected by rainwater pipes, gullies and linear drainage channels from all areas of hardstanding including building roofs, carparks and access roads.	Embedded within the design of the GB Onshore Scheme. Ongoing, proactive approach to water management as information on flows becomes available.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
		WAT08 (Cont.)	Runoff will be attenuated onsite by the proposed SuDS features, prior to being conveyed via swales to discharge at greenfield runoff rates to the defined receiving waterbodies, in agreement with the North Kent Marshes IDB.	
Construction	Converter Station and Substation	WAT09	**Surface Water Quality** Silt traps will be incorporated into the surface water pipe networks to intersect silt and sediment before runoff is attenuated within the SuDS features. Silt traps will require periodic maintenance to ensure they remain operational throughout the design life of the GB Onshore Scheme. There is a residual risk of silts and sediments entering the SuDS features. However, the nature of the proposed SuDS will provide a treatment train and will trap potentially contaminated sediments within the vegetation, thus preventing the conveyance of silts and sediments into the receiving waterbodies Oil separator units will be installed upstream of all attenuation systems on all drainage serving roads and yard areas, where potential hydrocarbon contamination could occur.	Good construction practice embedded into how the scheme will be developed.
Design	Converter Station and Substation	WAT10	**Tidal Flood Risk** Correspondence with the Environment Agency included in the Flood Risk Assessment (FRA) Report confirmed that proposed infrastructure associated with the convertor station and substation should be set above the flood level for the defended 0.5% Annual Exceedance Probability (AEP) flood event, including climate change over the lifetime of the development. This corresponds to a flood level of 3.1 m Above Ordnance Datum (AOD). The platform for the converter station and substation will be set above this level including a suitable freeboard.	Embedded within the design of the GB Onshore Scheme informed by the Environment Agency.

Transport and Access

Table 13.6 - Schedule of Mitigation for the GB Onshore Scheme (Transport and Access)

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Construction	Scheme-Wide	TRA01	**Construction Traffic Management Plan** Mitigation would be committed and delivered through the outline Construction Traffic Management Plan (CTMP) which will be agreed prior to construction with Medway Council. The CTMP will include the following: • Location of site and the entry/ exit arrangements; • Traffic routeing plans – defining the routes to be taken by Heavy Goods Vehicles (HGVs) to the site. For example, prioritising the use of A and B-roads as far as possible, avoidance of built-up areas and other sensitive locations; • Construction hours and delivery times stipulated to best avoid peak periods; • Strategy for traffic management and measures for informing construction traffic of local access routes, road restrictions, timing restrictions and where access is prohibited; • Measures to protect the public highway (e.g. wheel wash facilities); • Measures for the monitoring of the CTMP to ensure compliance from drivers and appropriate actions in the event of non-compliance; • Mechanism for responding to traffic management issues arising during the works (including concerns raised from the public) including a joint consultation approach with relevant highways authorities; • Details of traffic management requirements; and • Strategy for traffic management and measures for informing construction traffic of local access routes, road restrictions (statutory limits: width, height, axle loading and gross weight), timing restrictions (if applicable) and where access is prohibited.	Good construction practice embedded into how the scheme will be developed. The contractor will prepare a CTMP prior to the commencement of works.
Construction	Scheme-Wide	TRA02	**CTMP Controls** In addition to the areas of focus referenced in 'TRA01', the following control measures will be adopted by the scheme: • All construction traffic to adhere to the Traffic Route Plans included in the CTMP; • All vehicles will be able to access and egress the site in a forward gear, with sufficient room off the public highway to allow them to wait without blocking the main carriageway; • Welfare facilities will be provided so as to minimise the need for off-site trips by staff during the working day;	Good construction practice embedded into how the scheme will be developed. The contractor will prepare a CTMP prior to the commencement of works.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
		TRA02 (Cont.)	• At all site accesses, suitable supervision will be provided as required to ensure that traffic is controlled at access points during construction (for example banksman checking road traffic and controlling construction vehicle movements) and mud deposits on the roads are minimised; and • Where required, traffic signals (in accordance with New Roads and Street Works Act (NRSWA), (Ref 25-7) or stop-go boards will be used to control road traffic. Road signs will conform to Chapter 8 of TSRG (Traffic Signs Manual, Ref 25-8) and NRSWA.	
Construction	Converter Station and Substation / Access Road	TRA03	**Road Safety** Whilst the majority of impacts relating to road safety are 'Negligible' or 'Minor', the access from the public highway at the B2001 would use Banksmen to manage the movement of HGVs on and off the public highway. Warning signage would be provided on the approaches to the access junction.	Good construction practice embedded into how the scheme will be developed.
Construction	Converter Station and Substation / Access Road	TRA04	**Travel Plan** A Travel Plan would be introduced in order to encourage sustainable travel to the site. The Travel Plan would include measures such as; encouragement of car sharing and public transport usage, better marketing of information and implementation of a Travel Plan Co-ordinator. Where appropriate, a shuttle bus to transport workers to key interchange locations could be introduced. An important element in ensuring the success of the construction phase and reducing the effects on traffic receptors is effective communication with local communities before and during the construction process, and in particular to inform them of the timing of construction activities and to help alleviate any concerns they may have. To address this the Applicant will ensure, in line with NRSWA and any Section 278 Agreements with the Highway Authorities, that the Contractor maintains good communication with affected communities, keeping them informed about the timing and extent of activities which may affect them. So far as practicable material will be retained on site including the retention of all soils and spoils, therefore minimising the need to move material on and off the site.	Good construction practice embedded into how the scheme will be developed. A Travel Plan will be prepared by the Contractor prior to the commencement of works. Proactive local engagement. Ongoing, proactive approach to travel management as demand evolves.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
		TR04 (Cont.)	It is considered that with the implementation of the above measures, any minor effects on road users during the construction period will be reduced further. Where appropriate, HGVs would access and egress in a forward gear. At all accesses, warning signage will be provided on the approaches to the access junctions.	
Design / Construction	Converter Station and Substation / Access Road	TR05	**Pedestrians and Cyclists** As part of a Travel Plan developed for the proposed site, measures such as an internal site layout to accommodate the movement of pedestrian and cyclists would be designed. This would provide benefits within the site, but would not provide benefits to external receptors. There would however be very few pedestrian/ cyclist movements expected as part of the construction phase of the development, which relates to the relatively low number of additional workers expected.	Good construction practice embedded into how the scheme will be developed.

Ground Conditions

Table 13.7 - Schedule of Mitigation for the GB Onshore Scheme (Ground Conditions)

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Design	AC Cables	GEO01	**AC Cables** As the AC cable route will be sited in the immediate vicinity of the proposed substation/ converter station, no additional ground disturbance is envisaged as part of accommodating the AC cables.	Embedded within the design of the GB Onshore Scheme.
Construction	Scheme-Wide	GEO02	**Chemical and Hazardous Material Storage** Chemical substances and hazardous materials will be stored in accordance with Environment Agency Pollution Prevention Guidance (withdrawn but widely considered good practice) and applicable storage regulations and accredited operational and environmental management standards will be employed for these activities. Any hazardous materials will be stored in designated locations with specific measures to prevent leakage and the release of their contents. This will include a requirement to position storage areas at least 10 m away from surface water features/ drains (and take into consideration the positions of any groundwater abstraction wells), on an impermeable base with an impermeable bund that has no outflow and is of adequate capacity to contain at least 110% of the contents. Valves and trigger guns will be protected from vandalism and kept locked when not in use.	Good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	GEO03	**Ground Gas** A ground investigation is in the process of being undertaken as part of design development. The outcomes of these further studies will inform the final adopted foundation solutions, the cut/ fill extents, dewatering strategies, the extent to which excavation support is required and also the extent to which ground gas mitigation is required.	Good construction practice embedded into how the scheme will be developed. Proactive ongoing approach to ground gas mitigation.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
		GEO03 (Cont.)	Materials used in buildings and infrastructure will be specified accordingly, taking due account of the ground conditions such as elevated sulphate or ground gases. The assessment methodology set out in BRE Special Digest 1 (2005) will be adopted to determine the appropriate concrete classification. Ground gas assessment and mitigation will be undertaken and implemented in accordance with BS 8485 (2015) and CIRIA guidance document C665 (2007) based on the findings from the ground investigation and subsequent monitoring.	
Design / Construction	DC Cables	GEO04	**Ground Constraints** Opportunities have been taken, where possible, to avoid potential ground constraints and in particular any areas of landfilling or potentially infilled ground. In addition, the Limits of Deviation (LoD) approach allows for cable routeing refinement to take place once detailed design and additional survey data has been collected, which will provide flexibility to reduce construction and operation impacts as the detailed design stage develops. The preferred method for installation of the proposed underground DC cable will be by open cut methods with the cables laid in trenches or within buried ducts (subject to the ground conditions and cable specifications). However alternative methods are available, such as laying the cable in surface troughs and covering or capping these; this has the benefit of not disturbing any areas of historical landfill The Proposed scheme routes the DC cable along an area of hardstanding to the east of the Perry's Farm Landfill capping, in turn avoiding any significant disturbance/ interaction with the underlying landfill materials.	Embedded within the design of the GB Onshore Scheme. Proactive approach to refinement of the cable route depending on specific ground constraints. Good construction practice embedded into how the scheme will be developed.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Construction	Scheme-Wide	GEO05	**Ground Stability** There may be a requirement to provide temporary support for excavations. Such support may include benching of excavations, shoring or the construction of retaining walls (e.g. sheet piles) or struts to mitigate the risk associated with settlement or excessive spalling. It is expected that the need for such control would be established during detailed design and where specified and implemented correctly, would be sufficient to mitigate any residual effects.	Good construction practice embedded into how the scheme will be developed. Proactive ongoing management of ground risks.
Construction	Scheme-Wide	GEO06	**Construction Environmental Management Plan (Contaminant)** Measures contained within the CEMP would be designed to limit the potential for dispersal and accidental releases of potential contaminants, soil-derived dusts and uncontrolled run-off to occur during construction. For example, the CEMP will set out how material is to be excavated and stockpiled to minimise the potential for run-off, soil degradation or wind dispersal of dusts. The use of biodegradable netting and the binding of the surface through temporary grass seeding will be specified together with dampening procedures during dry weather. Sheeting may be used if any material is identified to be hazardous with a view to limiting water ingress and potential leachate generation. Soil storage and handling areas will be defined prior to construction commencing. In the event of uncontrolled releases occurring, the CEMP and the Contractor's own method statements contained in their Construction Phase Plan (CPP) will also set out the measures required to ensure that the extent and impact of any such releases are contained and ultimately remediated.	Good construction practice embedded into how the scheme will be developed. A CEMP will be prepared by the Contractor prior to the commencement of works.
Construction	Scheme-Wide	GEO07	**Pollution Response Plan** A Pollution Response Plan will be in place prior to the commencement of construction works. The plan will outline key pollution mitigation measures to be adopted including a Control of Substances Hazardous to Health (COSHH)/ fuel	Good construction practice embedded into how the scheme will be developed.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
		GEO07 (Cont.)	inventory and key contacts to be notified in the event of a significant pollution incident, which may subsequently lead to the contamination of controlled waters or soils. All bulk fuel and COSHH items will be stored in accordance with the relevant Environment Agency Pollution Prevention Guidance (PPG) notes 40 (withdrawn but widely considered good practice) and storage regulations. Tanks and dispensing pumps will be locked when not in use to prevent unauthorised access.	A Pollution Prevention Plan will be prepared by the Contractor prior to the commencement of works.
Construction	Scheme-Wide	GEO08	**Plant Equipment** Only well-maintained plant will be used during construction to minimise the potential for accidental pollution from leaking machinery or damaged equipment. Static machinery and plant are expected to be stored in hardstanding areas when not in use and, where necessary, to make use of drip trays beneath oil tanks/ engines/ gearboxes/ hydraulics. Spill response kits containing equipment that is appropriate to the types and quantities of materials being used and stored during construction will be maintained on Project Area for the duration of the works.	Good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	GEO09	**Impacts to Workers** Potential exposure impacts specific to construction workers during site preparation and construction would be mitigated by the following measures and through working in accordance with CIRIA C741 4th Edition 'Environmental Good Practice on Site' (2015): • Measures to minimise dust generation; • Provision of Personal Protective Equipment (PPE), such as gloves, barrier cream, overalls etc. to minimise direct contact with soils; • Provision of adequate hygiene facilities and clean welfare facilities for all construction site workers; • Monitoring of confined spaces for potential ground gas accumulations, restricting access to confined spaces, i.e. to suitably trained personnel only, and use of specialist PPE, where necessary; and	Good construction practice embedded into how the scheme will be developed. The contractor will be required to work in accordance with CIRIA 'Environmental Good Practice on Site'.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
		GEO09 (Cont.)	• Preparation and adoption of a site and task specific health and safety plan as is required under Health and Safety legislation.	
Construction	Scheme-Wide	GEO10	**Material Remediation** Specific mitigation measures may be required in the form of treating/ remediating any contamination encountered during construction (e.g. any contamination that may be associated with any potentially contaminative sites identified as part of the assessment, notably the landfills and areas of potentially infilled land). This will be confirmed based on information gathered through ground investigation.	Good construction practice embedded into how the scheme will be developed. Proactive ongoing management of contaminant risk as more information becomes available through, for example, ground investigations.
Construction	Scheme-Wide	GEO11	**Earthworks Strategy** Prior to construction, a strategy will be prepared as part of the design development, which will set out how the earthworks stage of the construction phase will be undertaken. Where necessary the strategy will consider what excavated materials can be reused or are required within the development of the various components of the GB Onshore Scheme, and what materials are surplus and require either disposal or onward management to ensure appropriate re-use. The strategy will also define whether any geotechnical improvement may be required, prior to re-use or disposal.	Good construction practice embedded into how the scheme will be developed. An Earthworks Strategy will be prepared by the Contractor prior to the commencement of works.
Construction	Scheme-Wide	GEO12	**Soil Management** To minimise the effects on soil resources during any earthworks, including materials management following foundation construction in relation to the substation/ converter station, high standards of soil handling and management will be employed with a view to minimising where possible the double handling of soils and the extent to which exposed soils will be left vulnerable to erosional processes.	Good construction practice embedded into how the scheme will be developed.
Construction	Scheme-Wide	GEO13	**Material Re-Use and Management** The re-use of excavated materials during construction will be governed by either a Materials Management Plan developed in accordance with the CL:AIRE Definition of Waste: Development Industry Code of Practice , an environmental	Good construction practice embedded into how the scheme will be developed. A Materials Management Plan will be developed prior to the commencement of works.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
		GEO13 (Cont.)	permit or a relevant exemption. The CL:AIRE Code of Practice is a voluntary framework for excavated materials management and re-use. Following this framework results in a level of information being generated that is sufficient to demonstrate to any regulator that excavated material has been re-used appropriately and is suitable for its intended use. It demonstrates that waste material has not been used in the development. The Materials Management Plan details the procedures and measures that will be taken to classify, track, store, reuse and dispose of all excavated materials that will be encountered during the development works.	
Construction	Scheme-Wide	GEO14	**Soil Disposal** The disposal of soil waste-contaminated or otherwise-to landfill sites would be best mitigated by minimisation of the overall quantities of waste generated during construction, and by ensuring that excavated material consigned to landfill cannot, as an alternative, be put to use either on Project Area or on other sites. Where there is a requirement to dispose of surplus excavated materials off site as waste, the material will be characterised to determine firstly whether it is Hazardous or Non-Hazardous waste in accordance with the Environment Agency's Technical Guidance WM3 and then once this is established, the appropriate disposal facility will be determined through Waste Acceptance Criteria (WAC) analysis, as required.	Good construction practice embedded into how the scheme will be developed. Assessment of an appropriate disposal facility as informed by WAC.
Design / Construction	Scheme-Wide / Cable Routes	GEO16	**Routeing** Routeing within the LoD will seek to be at least 50 m away from any groundwater abstractions. There is only one abstraction license within the extended study area, this is located in an area of apparent inactive mineral workings and so it is considered that there are no sensitive water abstractions that could be affected.	Good construction practice embedded into how the scheme will be developed.

Mitigation	Project Component	Reference	Description of Mitigation	How Measures will be Secured
Design / Construction	Scheme-Wide	GEO17	**Controlled Water Management** Due to the requirement to protect controlled waters (groundwater and surface water), further risk assessments will need to be undertaken at all trenchless crossing locations to ensure that the ground model is understood, and potential risks quantified prior to construction. Detailed design will seek to control the potential for ground or surface water contamination to occur, for example, through specifying vertical alignments that minimise the potential for "break out" of drilling fluids, or other fluids used in construction, therefore reducing potential impacts on ground and surface water quality. This is particularly relevant where designing works within granular materials or in particularly sensitive groundwater environments.	Good construction practice embedded into how the scheme will be developed. Proactive ongoing approach to management of risks to controlled waters informed by ground investigations and modelling / detailed design.

14. Summary & Conclusions

Introduction

14.1 This chapter summarises the results of the Environmental Impact Assessment (EIA) of the potential effects of the construction and operation of the components of NeuConnect (also referred to as 'the Project') that are located at Grain, UK to Mean Low Water Spring (MLWS) (the 'GB Onshore Scheme'), as presented in this Environmental Statement ES.

About NeuConnect

14.2 NeuConnect is a 1400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks; two of the largest electricity markets in Europe. The new link will create a connection for electricity to be transmitted in either direction between Great Britain and Germany. The Project comprises approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HDVC) cables, with onshore converter stations linking into the existing electricity grids at Grain in Great Britain and at Wilhelmshaven in Germany. The subsea cables will traverse through British, Dutch and German waters.

14.3 In Great Britain the GB Onshore Scheme extend as far as MLWS. The GB Onshore Scheme will comprise the following main elements:

- Cable sealing end compound within a fenced compound occupying an area of approximately 1,600 square metres (m^2) or 0.16 hectares (ha).
- Substation within a fenced compound occupying an area of approx. 6,400 m^2 or 0.64 ha. The substation will comprise a single building and some outdoor electrical equipment, and an internal road will allow access to equipment within the compound.
- Approximately 50 metre (m) long AC cable route from the substation to the converter station. The AC cable may be either underground or above ground.
- Converter station within a fenced compound occupying an area of approximately 62,500 m^2 or 6.25 ha. The converter station will comprise buildings and some outdoor electrical equipment, as well as internal roads around the buildings/ equipment.
- Access to the GB Onshore Scheme will be taken from the existing junction on the B2001/ Grain Road. The existing junction will be improved and a new approximately 850 m long permanent access road will be constructed. This provide access to both the proposed converter station and substation compounds.
- An approximate 1,550 m long underground DC cable route from the converter station to the landfall point.
- At the point of landfall, there will be a Transition Joint Pit (TJP), where underground and subsea DC cables are joined together (subsea cable are slightly larger than underground cables due to additional protective armouring).
- From the TJP and across the intertidal zone subsea DC cables will be installed in buried ducts for a distance of approximately 1,700 m.

Development of the GB Onshore Scheme

14.4 The development of the GB Onshore Scheme has been undertaken in parallel to the consideration of environmental and technical constraints and restrictions. The siting and orientation of the components of the GB Onshore Scheme, and the landscape of the Application Boundary have been designed to best align the development to the existing surroundings.

14.5 The GB Onshore Scheme is subject to further detailed design by the appointed Contractor, and as such the design of GB Onshore Scheme is set in terms of maximum parameters within which the final design will be constructed. In undertaking the EIA in parallel to the development of the

maximum parameters a number of embedded mitigation measures have been included within the design that have avoided or minimised potential environmental impacts. This approach allows for flexibility and efficiencies for the Contractor whilst also establishing commitments and requirements that will be embedded within the construction methods and final design of the GB Onshore Scheme.

Results of the EIA

Landscape & Visual

14.6 The Landscape and Visual Impact Assessment (LVIA) considered the potential effects on the landscape and visual receptors at the construction phase, year 1 of operation and year 15 of operation from the GB Onshore Scheme. The LVIA also assesses the likely significant cumulative effects of the GB Onshore Scheme when considered in combination with the cumulative schemes.

14.7 In respect of effects on the landscape fabric and landscape character, the assessment found that significant effects during construction would be limited to the eastern edge of the Allhallows to Stoke Marshes LCA. Significant effects would arise from the loss of agricultural land as a result of construction activity at the proposed converter station and substation site as well as the DC cable route corridor. These effects would be short term during construction and there would be no physical change to the most distinctive landscape elements of the marshland. The landscape assessment concludes that there would be no significant effects at years 1 and 15 of operation. The assessment also concludes that the North Kent SLA would not be significantly affected.

14.8 In respect of visual amenity, of the nine viewpoints assessed during construction, visual receptors at three of the viewpoints would be significantly affected over the short term, with the furthest viewpoint located 3.9 km from the Project Area. The source of significant effects was due to receptors of medium sensitivity where the scale and extent of construction activity would be a prominent addition within the overall composition of the view. At year 1 of operation of the GB Onshore Scheme, the number of viewpoints significantly affected would be the same due to the scale and prominence of the proposed converter station and substation within close proximity views. At year 15 of operation of the GB Onshore Scheme, the number of viewpoints significantly affected would be reduced to one, at West lane. This finding relates to the establishment of landscape planting at the western edge of the Project Area which would reduce the prominence of the proposed converter station and substation over time.

14.9 The cumulative assessment concludes that there would be no significant cumulative effects on the landscape and visual receptors.

Ecology

14.10 The Ecological Impact Assessment (EcIA) considered the potential effects associated with the GB Onshore Scheme on Ecology and Nature Conservation. It evaluated relevant ecological receptors (including nature conservation designations, priority habitats, protected species and invasive non-native species (INNS)) associated with the GB Onshore Scheme, with each being assigned a nature conservation value (sensitivity).

14.11 Thereafter, the GB Onshore Scheme's potential impacts and effects on ecological receptor conservation status, inter-relationships, and their contribution to local (and if appropriate regional and national) biodiversity were identified. The assessment takes into account impact avoidance design measures and management activities when determining the significance of potential effects.

14.12 The assessment found that the residual effects – those that will remain after the implementation of mitigation measures – and not significant during construction or operation of the GB Onshore Scheme. Requirements for mitigation relating to potential effects are minimal and relate primarily to requirements to comply with good practice and relevant legislation.

Noise & Vibration

14.13 The assessment considered the potential significant impacts from noise and vibration generated from the construction and operation of the GB Onshore Scheme. The assessment was based on existing noise levels monitored from various surrounding receptors, namely residential properties within close proximity to the Project Area.

14.14 From the assessment of the potential noise and vibration generated during construction, including noise generated by construction traffic, it was concluded that the potential impacts to adjacent residences would not be significant. This assessment was based on the adoption of 'best practicable means' of mitigation measures to control noise, which would be documented within a Construction Environment Management Plan (CEMP) to ensure Contractor compliance. A project route map and delivery schedule would also be required to control construction traffic, in line with active onsite management of access points.

Noise emissions from operational activities will be considered during the detailed design, however the assessment concluded that the appropriate operational noise limits can readily be achieved at the nearest residential receptor, and therefore operational impacts will not be significant.

Cultural Heritage

14.15 The cultural heritage assessment considered the potential impact of the GB Onshore Scheme on designated and local heritage assets and their setting, during construction and operation, and also considered the likely risk of disturbing previously unrecorded assets.

14.16 The GB Onshore Scheme would not affect any World Heritage Sites, Registered Battlefields, Registered Parks and Gardens or Scheduled Monuments. It will cause change to the settings of two Listed Buildings, and two non-designated built heritage assets. Furthermore, the GB Onshore Scheme would directly impact on five non-designated archaeological assets located within the Site, and may impact on potential archaeological remains dating to the Palaeolithic, Iron Age, Roman, medieval, post-medieval, and modern periods.

14.17 The construction phase of the GB Onshore Scheme would have a temporary Minor adverse effect on the grade II listed World War II Anti-Tank Obstacles on the foreshore. The operational phase of the GB Onshore Scheme would have a Minor adverse effect on the Church of All Saints, Allhallows. Convention and professional judgement dictate that neither effect is significant.

14.18 The construction and operational phases of the GB Onshore Scheme would have Negligible to Minor adverse effects on the non-designated built heritage assets of Rosecourt Farm and Perry's Farm and Wilford's Farm. Convention and professional judgement dictate that these effects are not significant.

14.19 Five archaeological assets have been identified within the Site consisting of the remains of the post-medieval White Hall Farm, the remains of medieval ridge and furrow, the remains of a Second World War camp, and the remains of the a modern outfarm south of White Hall Farm. The fifth asset consists of a dipole anomaly of possible anthropogenic origin which is assessed in the GB Offshore Scheme ES Chapter 16. It has also been determined that the Site holds a potential to contain Palaeolithic, Iron Age, Roman, medieval, post-medieval and modern remains ranging in value from negligible to high.

14.20 It has been established that the GB Onshore Scheme would result in the truncation and/ or removal of archaeological assets, resulting in, at most, a permanent major adverse effect to the archaeological resource which would be significant. It has been recommended that a staged program of archaeological investigations is undertaken to identify the extent and further assess the significance of known and potential archaeological remains within the Site.

Water Resources & Hydrology

14.21 The residual impacts resulting from the proposed construction of the converter station, substation and DC cable have been considered collectively, considering potential impacts in regards to flood risk, water demand and discharge, surface water management and the risk of pollution or contaminant release.

14.22 As part of the development of the design of the GB Onshore Scheme Sustainable Drainage Systems (SuDS) have been incorporated within the landscaping masterplan, including two attenuation basins connected via swales to collect runoff from the Project Area. These SuDS have been design to accommodate increased runoff from the areas of hardstanding introduced to the area, and also compensation for some loss of flood storage capacity.

14.23 The phasing of construction activities will be managed to ensure that the SuDS measures are implemented at the beginning of construction to allow these measures to mitigate potential impacts from runoff. Further good practice measures will be embedded within the CEMP to avoid impacts from leaks and spillages of contaminants and sediment in runoff during construction, such as the use of rumble pads and sediment traps, and the use of hardstanding, bunded areas for the storage and use of potential contaminants.

14.24 A Flood Warning and Response Plan will be prepared prior to construction commencing detailing the planned response in the event of receiving a flood warning from the Environment Agency.

14.25 Based on the implementation of such mitigation measures there will be no significant residual effects during the construction of the GB Onshore Scheme.

14.26 No significant effects to water resources and flood risk are expected during the operation of the GB Onshore Scheme assuming a suitable Flood Warning and Evacuation Plan is established.

Transport & Access

14.27 Access to the proposed converter station and substation will be via the B2001 Grain Road. An existing unnamed road runs west/ northwest from Grain Road along the southern boundary of the site, which is the preferred point of access during construction and operation of the GB Onshore Scheme.

14.28 Prediction of construction effects has focused on activities that could directly and indirectly impact on receptors within the defined study area. The ZoI includes those roads which may be utilised during construction, and upon which there is the potential for a significant impact.

14.29 The results of the assessments indicate that the impacts are likely to be not significant. However, some receptors experience an effect deemed ‘moderate’. These concern Severance and Pedestrian facilities on Grain Road. These are not considered to be significant due to the lack of pedestrians or cyclists around to experience the effect brought on by the increase in HGV traffic.

Ground Conditions

14.30 The ground conditions topic assesses the potential impacts of the construction and operation of the GB Onshore Scheme in relation to ground conditions.

14.31 The assessment of temporary effects has shown that whilst there are predicted minor adverse impacts associated with the construction stage, none of these would be regarded as significant following adoption of the measures as part of a CEMP which will be prepared prior to the commencement of construction activities.

14.32 There are not expected to be any significant operational effects on ground conditions as the design of the GB Onshore Scheme is expected to include measures that would contain and control any releases of contaminants to the Project Area and its associated infrastructure during the operation period.

14.33 It is not considered that any of the identified committed schemes will generate cumulative effects in relation to ground conditions.

Cumulative Effects

14.34 A cumulative assessment has been undertaken to take in to account both inter-project and intra-project effects.

14.35 Intra-project effects has considered the impact of multiple environmental topics on the same receptor (i.e. the combined impact of increased disturbance (such as noise) and reduced visual

amenity on walkers and visitors, as well as in-combination effects from different components the Scheme (i.e. the proposed DC cable route and the proposed converter station) on the same receptor.

14.36 Inter-project effects have considered the potential cumulative impacts from the simultaneous development of the GB Onshore Scheme with other projects within the near vicinity of the Project Area. A systematic review of projects either already within or known to soon enter the planning system were reviewed by each of the specialists to determine potential cumulative impacts.

Intra-Project Effects

14.37 The assessment potential cumulative effects on an individual receptor from different components of the GB Onshore Scheme, and from multiple sources has determined that whilst there have been some impacts identified these are not likely to be of greater significance than when considering the potential effects individually. Intra-project effects are limited to the amenity of residential receptors, and users of surrounding walking routes adjacent to the Project Area.

Inter-Project Effects

14.38 Of the six short-listed projects identified that had the potential to result in cumulative impacts when taken in to consideration with the GB Onshore Scheme, potential impacts associated with the proposed NGET OHL Works, GB Offshore Scheme and the cement plant at Thamesport were considered for further assessment. However it was concluded that any potential cumulative impacts would not be significantly impacted as a result of the simultaneous development or operation of the GB Onshore Scheme and these other projects.

Conclusions

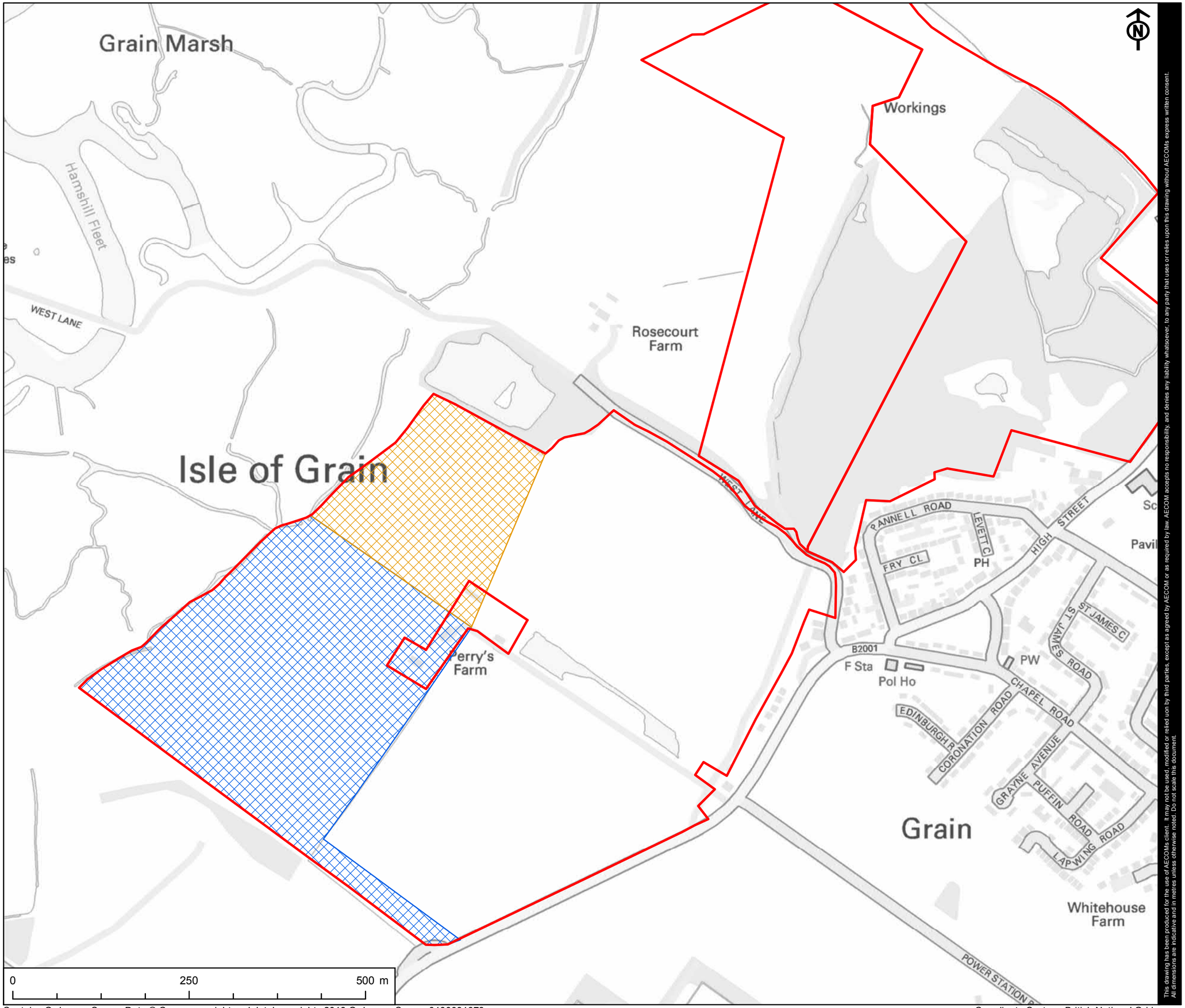
14.39 The results of the EIA ensure that the LPA and statutory consultees as well as other interested parties including local communities are aware of the GB Onshore Scheme's environmental impacts and whether these may be significant or not. The purpose of identifying the significant effects (adverse and beneficial) is to ensure that they may be considered alongside other material considerations in determining the applications for planning permission.

14.40 The EIA of the GB Onshore Scheme has identified and assessed the likely significant effects which would result from its construction and operation. Through the iterative development of the design in line with the EIA, NeuConnect Britain Limited, the Applicant, has prevented or reduced a number of potentially significant environmental effects. However, given the scale of the GB Onshore Scheme some significant environmental effects are unavoidable and as such some will remain following mitigation. As set out above, the significant environmental effects will be limited to landscape character during construction, visual amenity during construction and operation, and potentially to unrecorded archaeological assets during construction (although impact would be permanent. The operational impacts regarded to be significant are from West Lane only, which would include users of the road and users of the Coastal Path (which is yet to be established).

14.41 The GB Onshore Scheme has been designed to measures to help mitigate identified potential impacts, including the enhancement and establishment of boundary screening planting, for the provision of green corridors and to phase the development in to the existing landscape context in-fitting with the industrial units to the south of the existing overhead line. Further to this mitigation embedded in the design, the Applicant has committed to a number of additional measures to be implemented during construction to further avoid and minimise potential adverse impacts.

14.42 Should planning permission for the GB Onshore Scheme be granted the Applicant is committed to working with their appointed Contractor(s) to reduce the GB Onshore Scheme's environmental effects as far as practicable in finalising the detailed scheme design and undertaking construction works. This approach will ensure that the actual effects of the GB Onshore Scheme would be no greater than the likely effects identified and assessed in this ES.

Project Management Initials: DR Designer: LC Checked: TC Approved: DR



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Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Land Ownership Boundary
- Proposed converter station site
- Proposed substation site

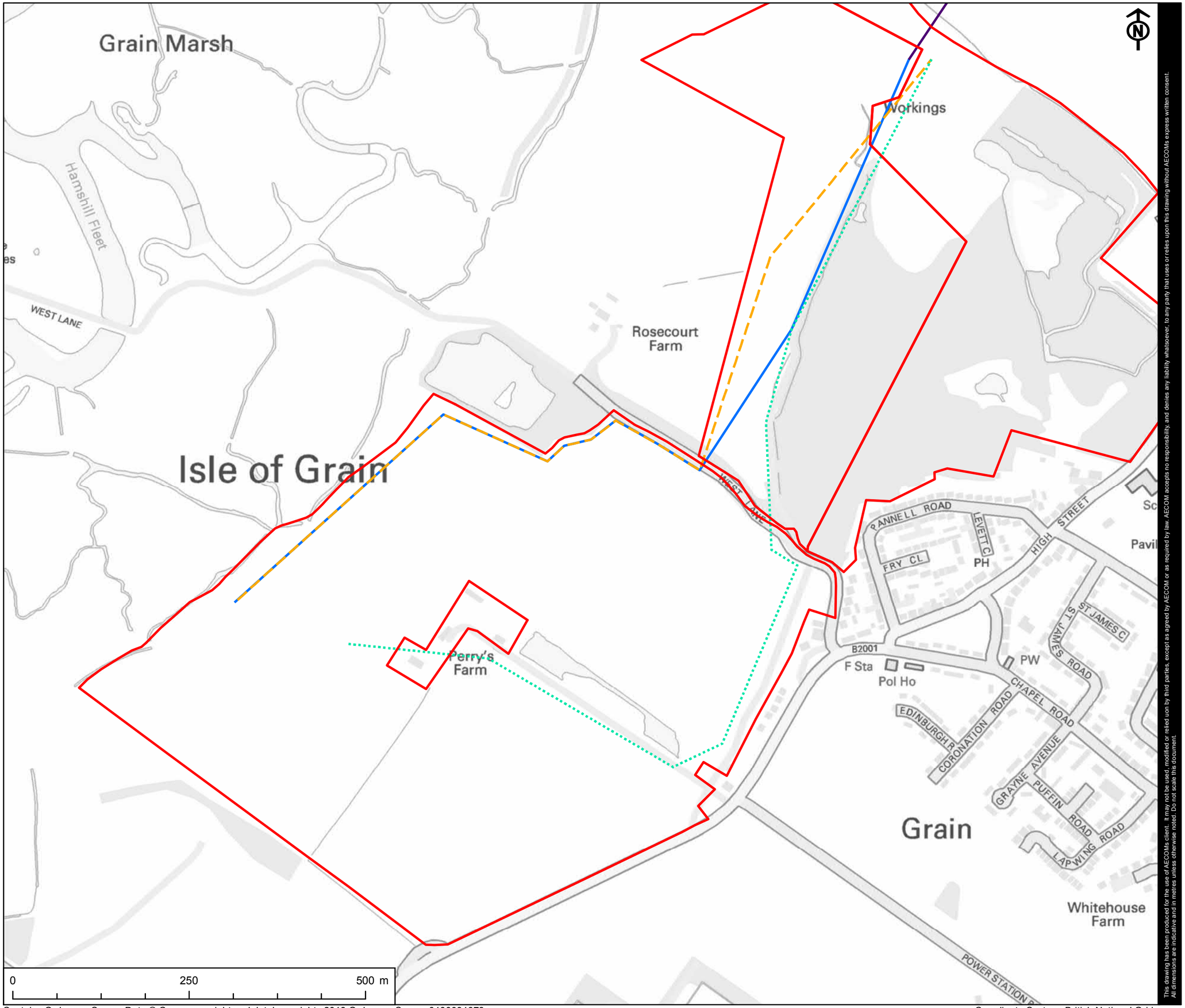
TITLE
FIGURE 2.2
PROPOSED GB ONSHORE SCHEME LOCATION

REFERENCE
NC_190801_UKON_ES_2.2_v1

SHEET NUMBER
1 of 1

DATE
01/08/19

Project Management Initials: DR Designer: LC Checked: TC Approved: DR



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Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Land Ownership Boundary
- Proposed Offshore DC Cable Route
- DC Cable Route - A
- DC Cable Route - B
- DC Cable Route - C

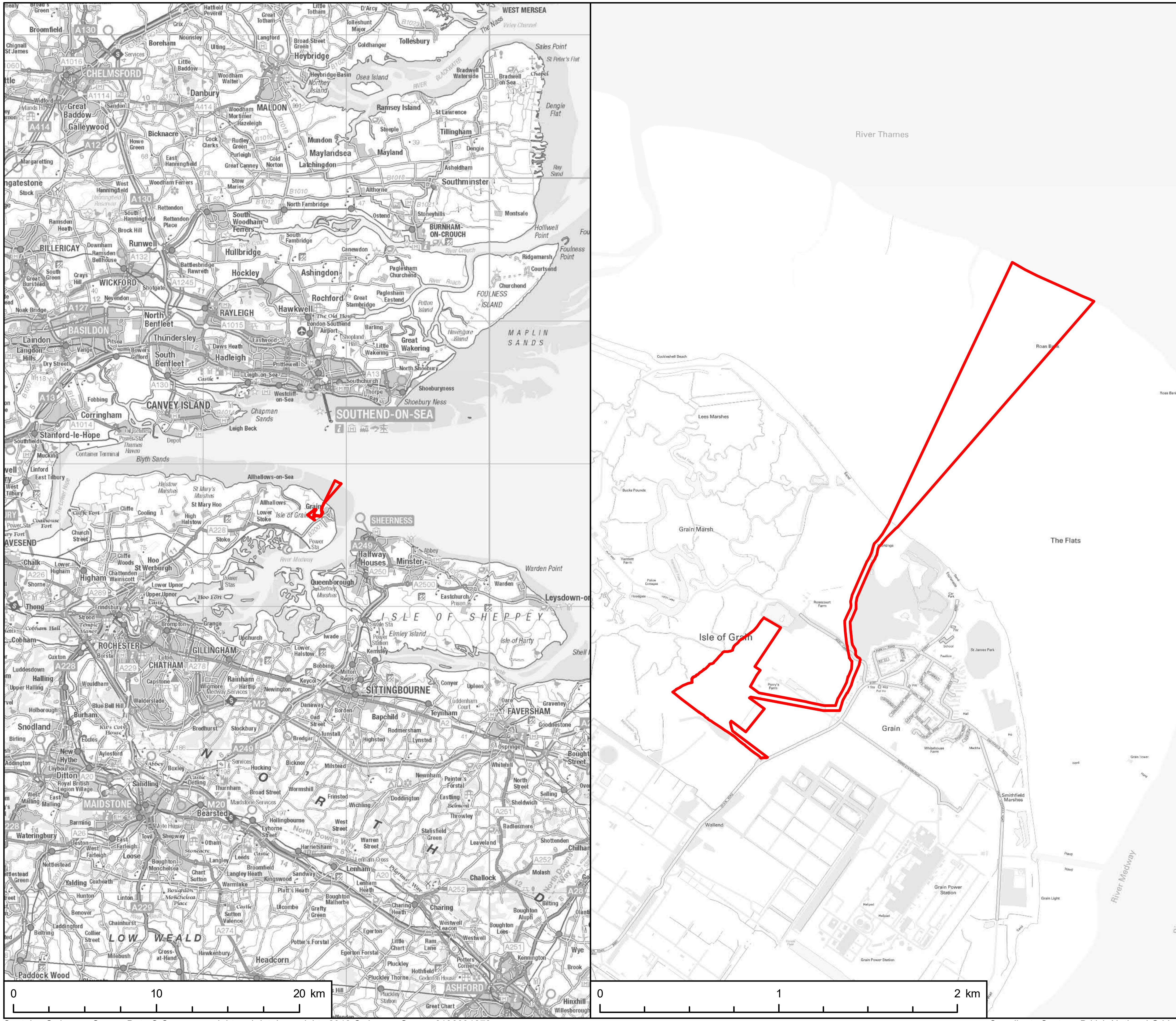
TITLE
FIGURE 2.3
IDENTIFIED POTENTIAL DC CABLE ROUTES

REFERENCE
NC_190801_UKON_ES_2.3_v1

SHEET NUMBER
1 of 1

DATE
01/08/19

Project Management Initials: DR Designer: LC Checked: TC Approved: DR



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Coordinate System: British National Grid

Scale @ A3 1:250,000 / 1:20,000

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
Application Boundary

TITLE
FIGURE 3.1
SITE LOCATION AND APPLICATION BOUNDARY

REFERENCE
NC_191001_UKON_ES_3.1_v1

SHEET NUMBER
1 of 1

DATE
01/10/19

Project Management Initials: DR Designer: LC Checked: TC Approved: DR

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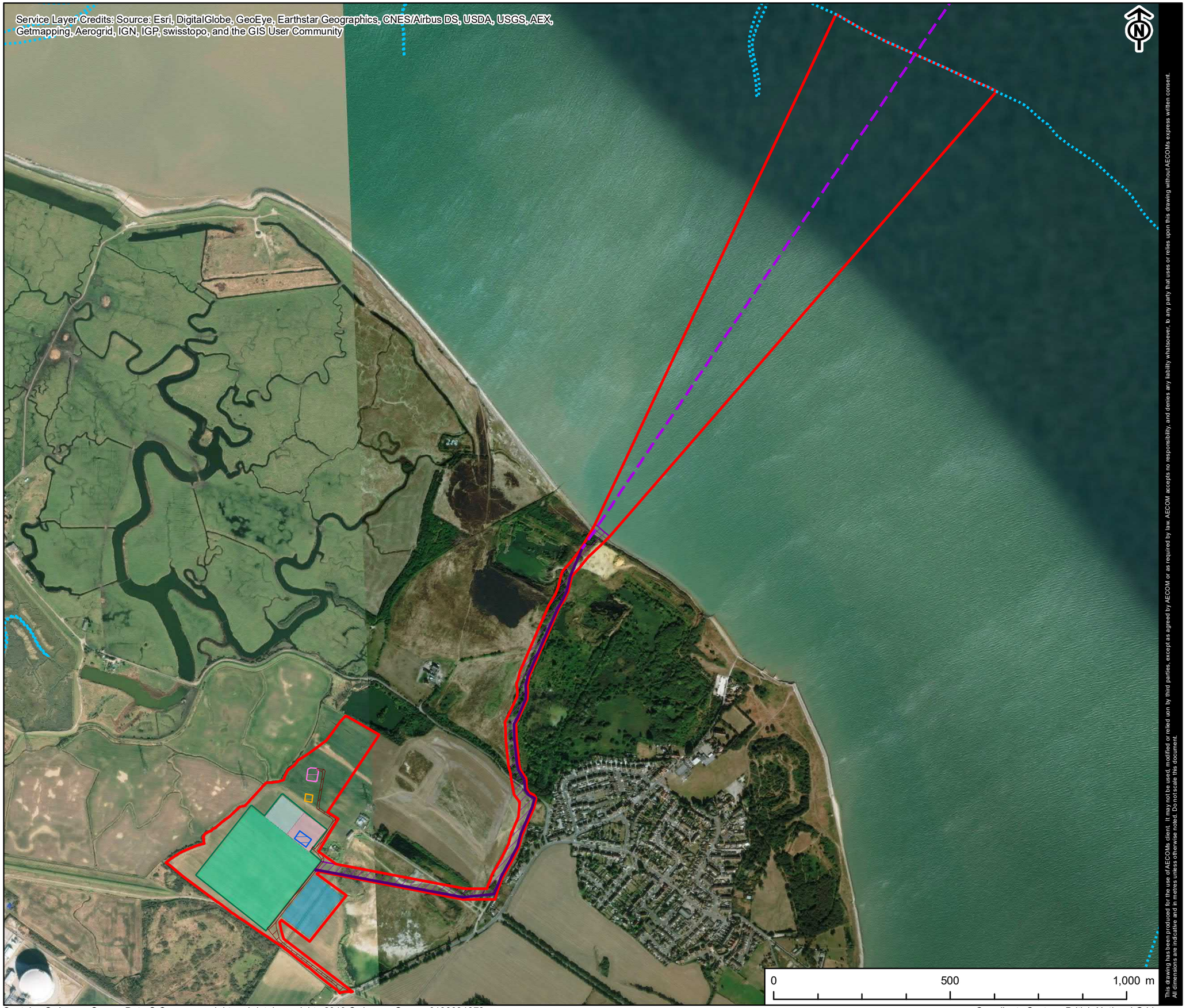

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Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- Mean Low Water Springs

Indicative Location of:

- Offshore Cable Route
- Onshore DC Cable Route
- DC Cable Route - 30m Working Width
- Converter Station and Substation Platform - 2m Fence Line Security & Maintenance Corridor
- Access Road
- Converter Station Platform
- Substation Platform
- Construction Laydown Area
- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed Sealing End Compound
- National Grid Proposed GIS Building (Maximum Parameters)

NOTE
The location of all components identified is indicative only, but is representative of the maximum parameters of each component. The GB Onshore Scheme is subject to detailed design.

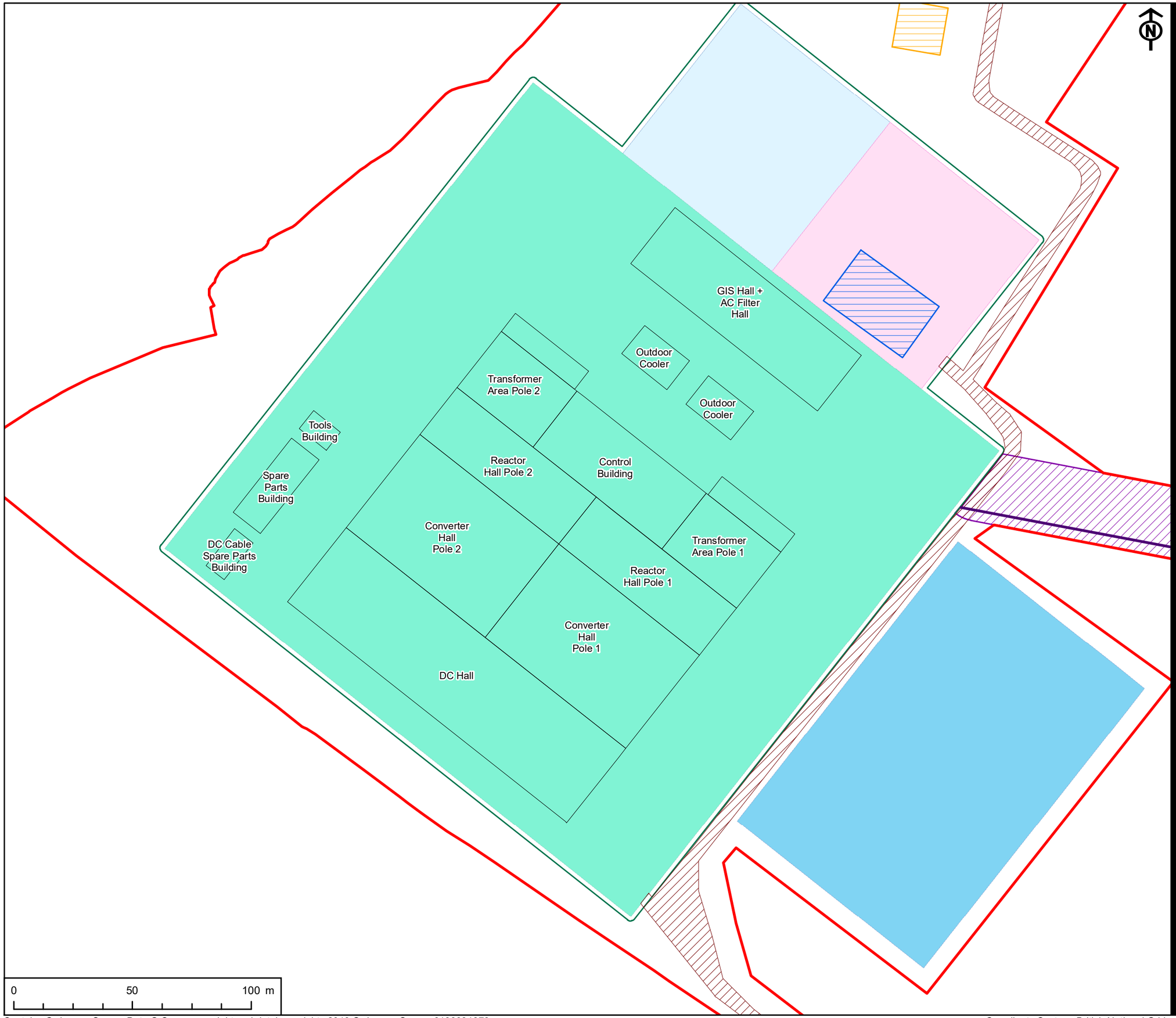
TITLE
FIGURE 3.2
PROPOSED GB ONSHORE SCHEME

REFERENCE
NC_191001_UKON_ES_3.2_v2

SHEET NUMBER
1 of 1

DATE
01/10/19

Project Management Initials: DR Designer: LC Checked: TC Approved: DR



Scale @ A3 1:1,500

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Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary

Indicative Location of:

- Onshore DC Cable Route
- Converter Station Layout and Maximum Building Parameters
- DC Cable Route - 30m Working Width
- Converter Station and Substation Platform - 2m Fence Line Security & Maintenance Corridor
- Access Road
- Converter Station Platform
- Substation Platform
- Construction Laydown Area
- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed GIS Building (Maximum Parameters)

NOTE
The layout presented is indicative only and is subject to detailed design.

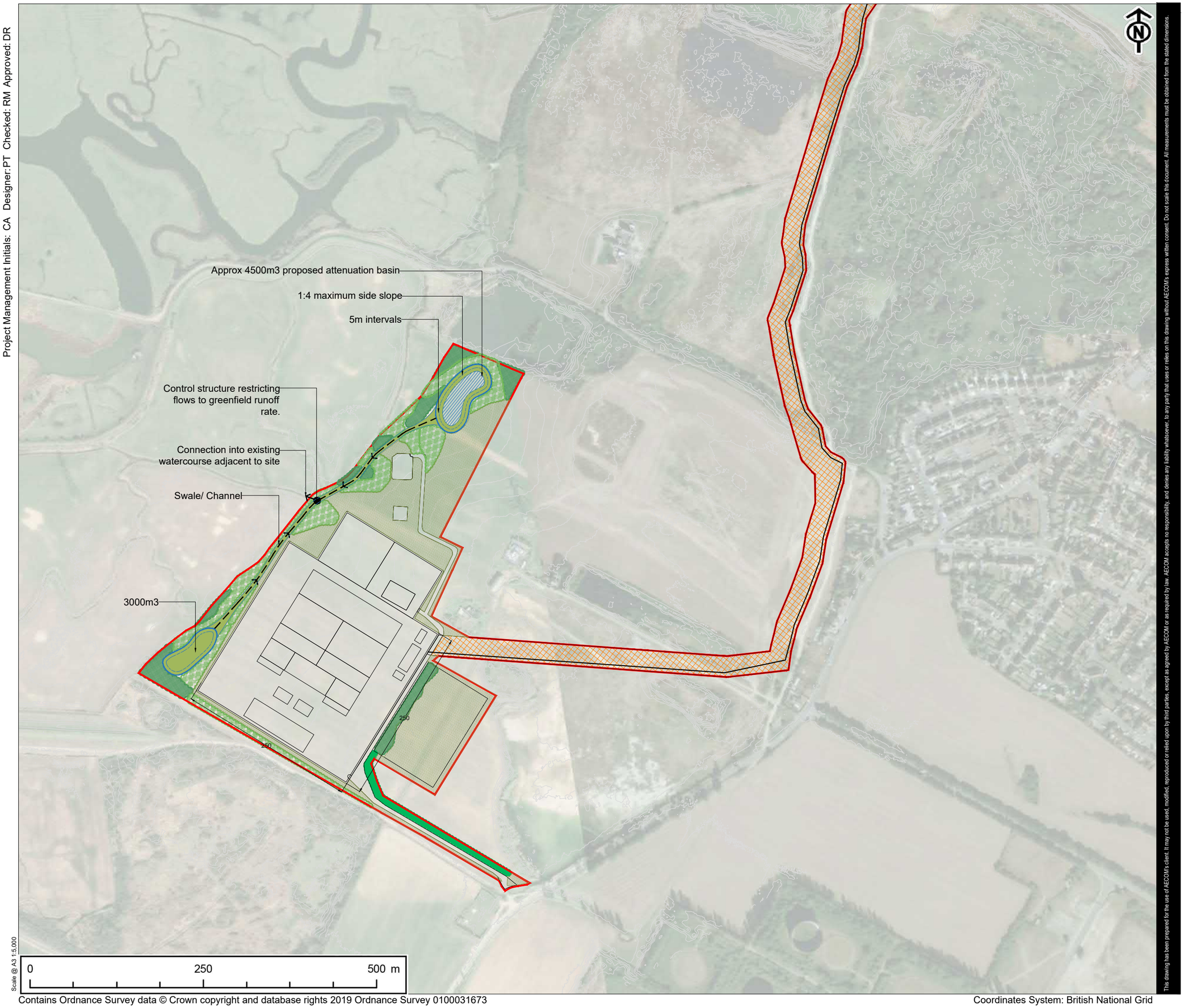
TITLE
FIGURE 3.3
INDICATIVE CONVERTER STATION LAYOUT

REFERENCE
NC_191001_UKON_ES_3.3_v2

SHEET NUMBER
1 of 1

DATE
01/10/19

Project Management Initials: CA Designer: PT Checked: RM Approved: DR



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0 250 500 m

Coordinates System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- SuDs Basin
- Swale Channel
- Reinstated Ground
- Permanent Water
- Wet Marginal Planting:
  Key species:
  -Phalaris arundinacea (Reed canary grass)
  -Lythrun salicaria (Purple loosestrife)
  -Sparganium emersum (Bur-reed)
- Woodland edge Planting:
  Key species:
  -Salix caprea (Goat Willow)
  -Salix viminalis (Osier Willow)
  -Betula pubescens (Downy Birch)
- Scrub Planting:
  Key species:
  -Salix cinerea (Grey Willow)
  -Viburnum opulus (Geulder Rose)
  -Prunus spinosa (Blackthorn)
- Mixed Hedgerow Planting:
  Key species:
  -Corylus avellana (Hazel)
  -Crataegus monogyna (Hawthorn)
  -Prunus spinosa (Blackthorn)
- Species Rich Grassland:
  General purposed meadow

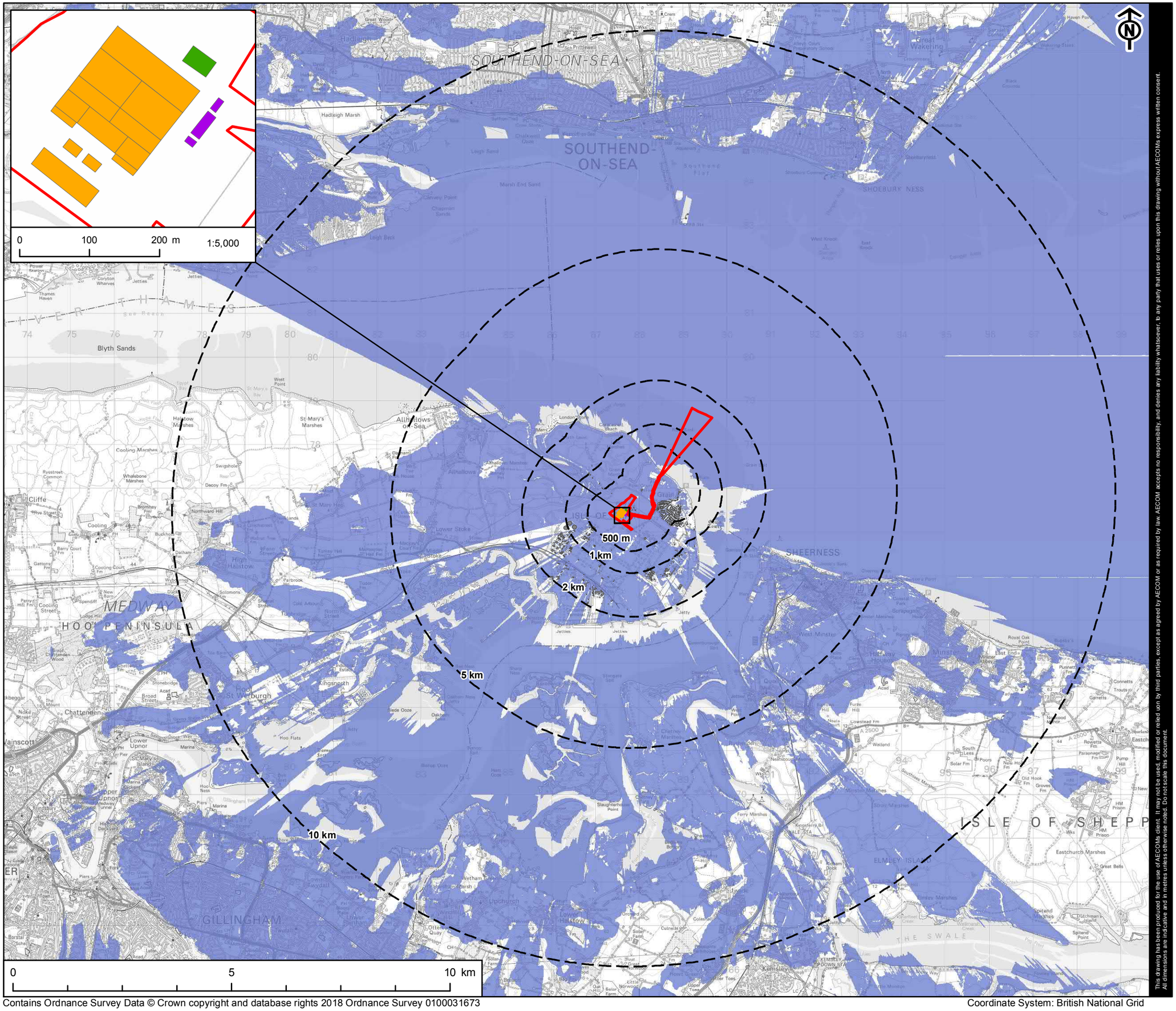
TITLE
FIGURE 3.4
LANDSCAPE MITIGATION DESIGN PLAN

REFERENCE
NC_190604_UKON_ES_3.4_V1

SHEET NUMBER 1 of 1

DATE 15/05/19

Project Management Initials: DR Designer: LC Checked: AR Approved: RM



Scale @ A3 1:5,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- Study Area
- Building - OS MasterMap
- Indicative Converter Station at 16m
- Indicative Converter Station at 26m
- Indicative Substation at 14m
- Indicative Converter Station / Substation Visible

NOTE:
Zone of Theoretical Visibility (ZTV) has been generated using Ordnance Survey Terrain 5 digital terrain model which does not take account of the screening effects of vegetation, buildings or other structures. Buildings from OS MasterMap within 2km have been incorporated into the DTM.

ZTV is based upon points taken every 10m around the edge and within the converter station and substation buildings on a levelled platform at 6m AOD using the following heights and an observer height of 1.6m:
Converter station - 16m / 26m
Substation - 14m

All heights mentioned are above ground level (AGL) unless otherwise specified.

The layout presented is indicative only and is subject to detailed design.

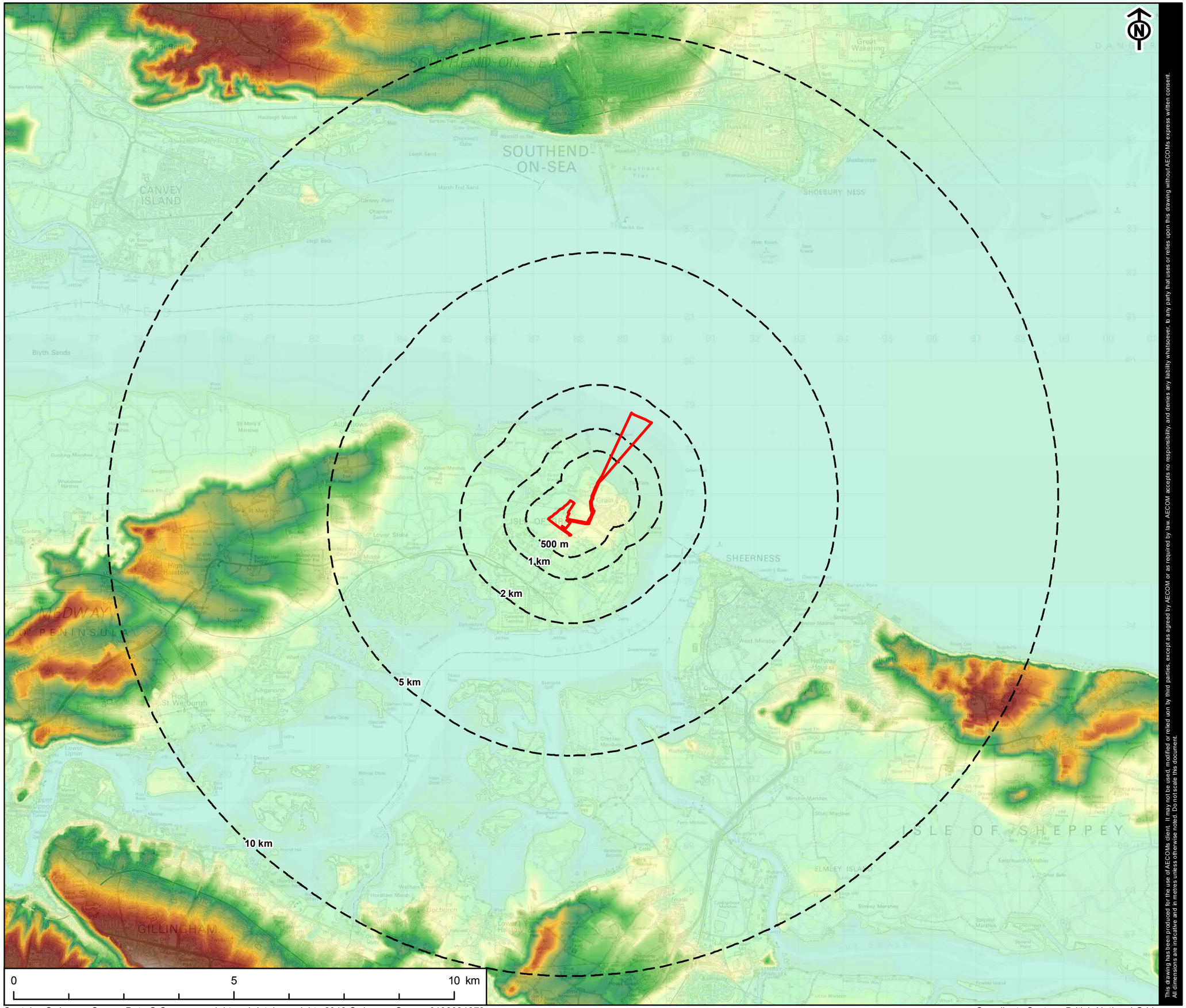
TITLE
FIGURE 5.1
ZONE OF THEORETICAL VISIBILITY
CONVERTER STATION AND SUBSTATION

REFERENCE
NC_190906_UKON_ES_5.1_v3

SHEET NUMBER
1 of 1

DATE
06/09/19

Project Management Initials: DR Designer: LC Checked: AR Approved: RM



Scale @ A3 1:80,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- Study Area

Elevation (m) - OS Terrain 5

- High : 124.71
- Low : -4.26

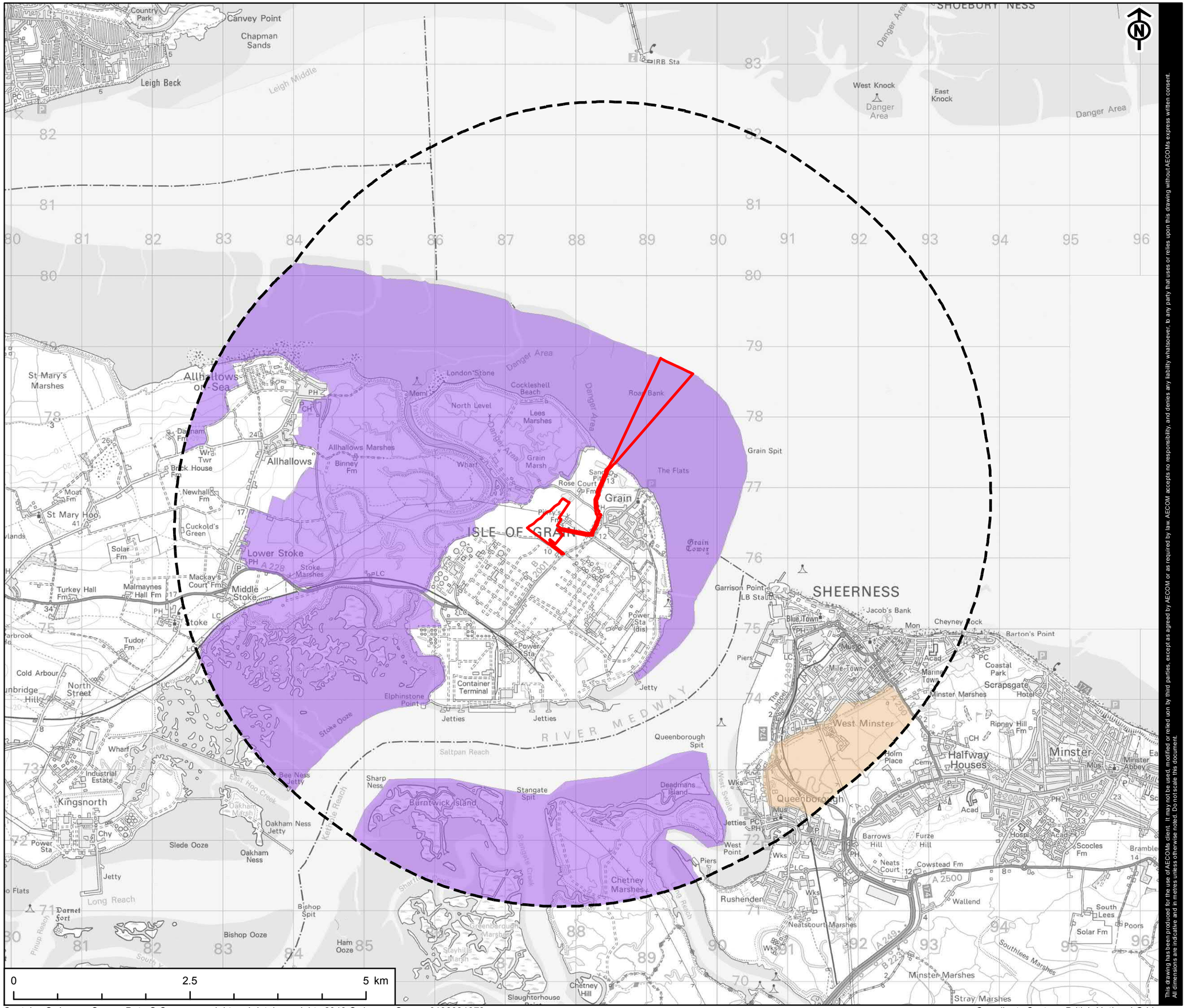
TITLE
FIGURE 5.2
SITE TOPOGRAPHY

REFERENCE
NC_190715_UKON_ES_5.2_v2

SHEET NUMBER
1 of 1

DATE
15/07/19

Project Management Initials: DR Designer: LC Checked: AR Approved: RM



Scale @ A3 1:50,000

0 2.5 5 km

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- 5km Study Area
- North Kent Marches - Special Landscape Area (Kent Level)
- Sheppey Court and Diggs Marshes - Area of High Landscape Value (Swale Level)

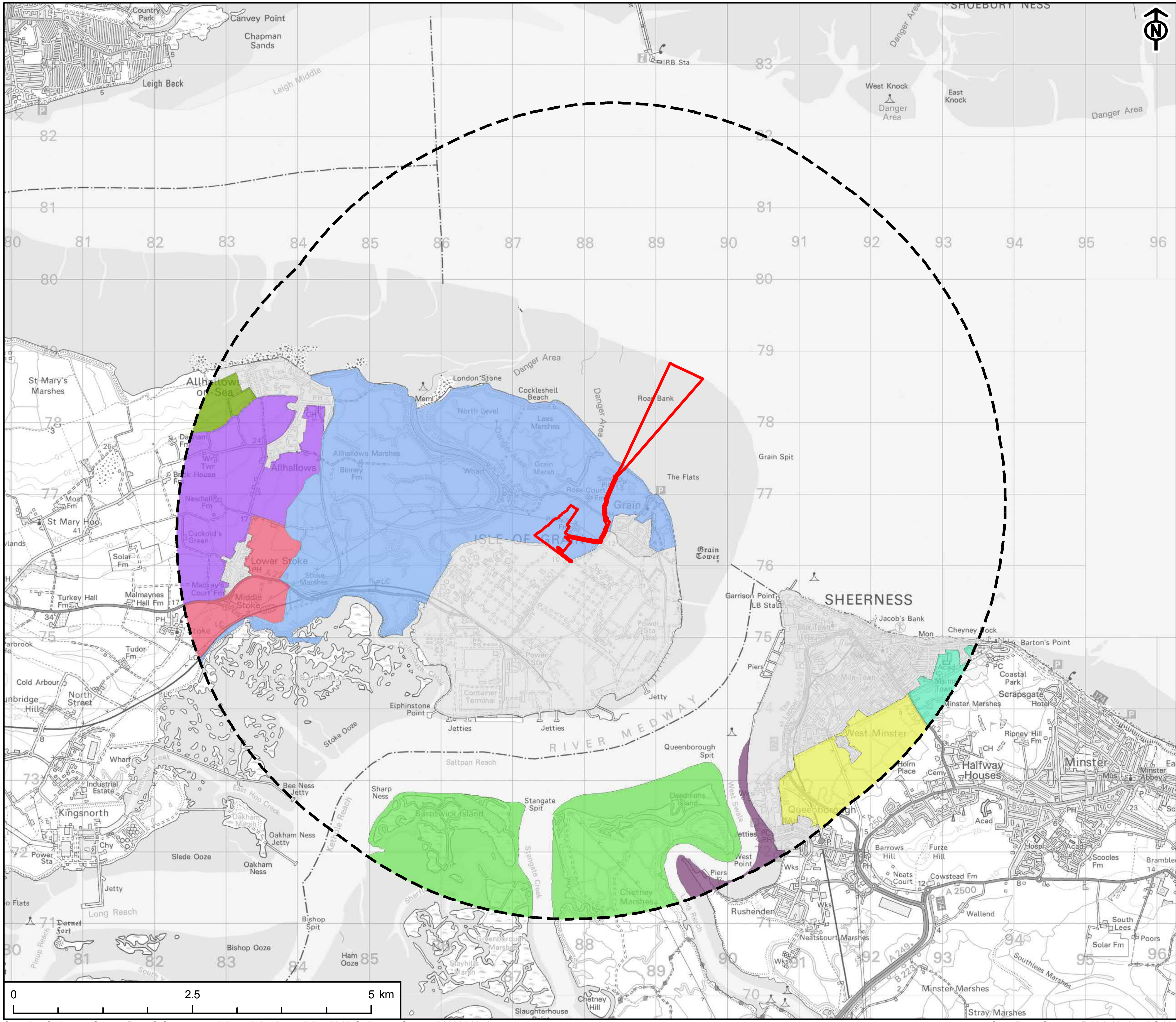
TITLE
FIGURE 5.3
LANDSCAPE DESIGNATIONS

REFERENCE
NC_190715_UKON_ES_5.3_v2

SHEET NUMBER
1 of 1

DATE
15/07/19

Project Management Initials: DR Designer: LC Checked: AR Approved: RM



Scale @ A3 1:50,000

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Coordinate System: British National Grid

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AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Application Boundary
- 5km Study Area

Local Landscape Character Type
- Medway, 3. Allhallows to Stoke Marshes
- Medway, 10. St Mary's Farmland
- Medway, 11. Hoo Peninsula Farmland
- Medway, 12. Lower Stoke Farmland
- Swale, 1. Chetney and Greenborough Marshes
- Swale, 2. Elmley Marshes
- Swale, 9. Minster Marshes
- Swale, 10. Sheppey Court and Diggs Marshes
- Urban / Industrial

TITLE
FIGURE 5.4
LANDSCAPE CHARACTER TYPES

REFERENCE
NC_190715_UKON_ES_5.4_v2

SHEET NUMBER: 1 of 1

DATE: 15/07/19

Project Management Initials: DR Designer: LC Checked: AR Approved: RM

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Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Application Boundary
- 5km Study Area
- Public right of way
- Recreational route

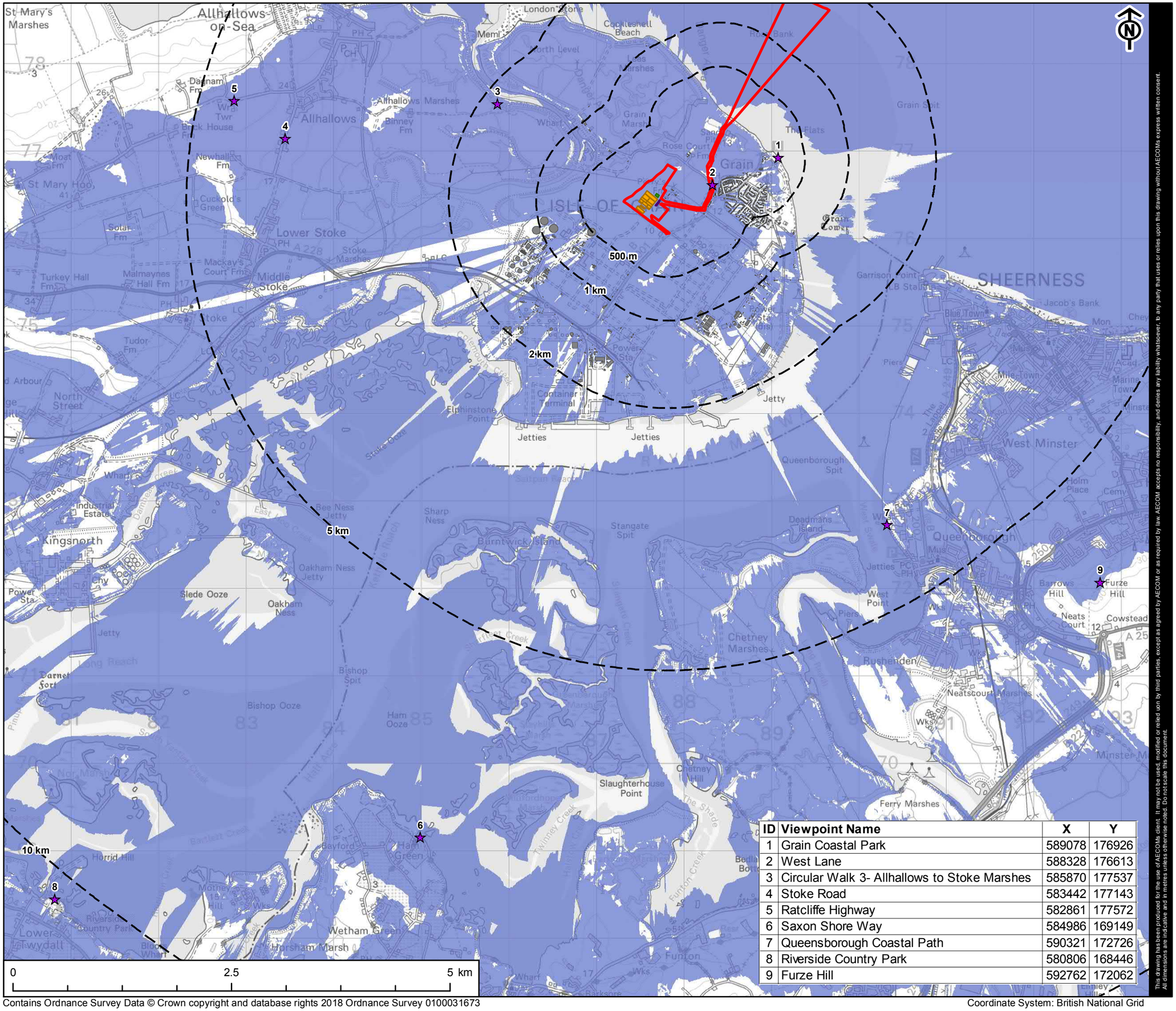
TITLE
FIGURE 5.5
RECREATIONAL ROUTES AND PUBLIC RIGHTS OF WAY

REFERENCE
NC_190715_UKON_ES_5.5_v2

SHEET NUMBER
1 of 1

DATE
15/07/19

Project Management Initials: DR Designer: LC Checked: AR Approved: RM



ID	Viewpoint Name	X	Y
1	Grain Coastal Park	589078	176926
2	West Lane	588328	176613
3	Circular Walk 3- Allhallows to Stoke Marshes	585870	177537
4	Stoke Road	583442	177143
5	Ratcliffe Highway	582861	177572
6	Saxon Shore Way	584986	169149
7	Queensborough Coastal Path	590321	172726
8	Riverside Country Park	580806	168446
9	Furze Hill	592762	172062

Scale @ A3 1:40,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Application Boundary
- Study Area
- Viewpoint location
- Building - OS MasterMap
- Indicative Converter Station at 16m
- Indicative Converter Station at 26m
- Indicative Substation at 14m
- Indicative Converter Station / Substation Visible

NOTE:
Zone of Theoretical Visibility (ZTV) has been generated using Ordnance Survey Terrain 5 digital terrain model which does not take account of the screening effects of vegetation, buildings or other structures. Buildings from OS MasterMap within 2km have been incorporated into the DTM.

ZTV is based upon points taken every 10m around the edge and within the converter station and substation buildings on a levelled platform at 6m AOD using the following heights and an observer height of 1.6m:
Converter station - 16m / 26m
Substation - 14m

All heights mentioned are above ground level (AGL) unless otherwise specified.

The layout presented is indicative only and is subject to detailed design.

TITLE
FIGURE 5.6
REPRESENTATIVE VIEWPOINTS

REFERENCE
NC_190906_UKON_ES_5.6_v3

SHEET NUMBER
1 of 1

DATE
06/09/19

Project Management Initials: CA Designer: PT Checked: RM Approved: DR

Scale @ A3 1:5,000

Coordinates System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

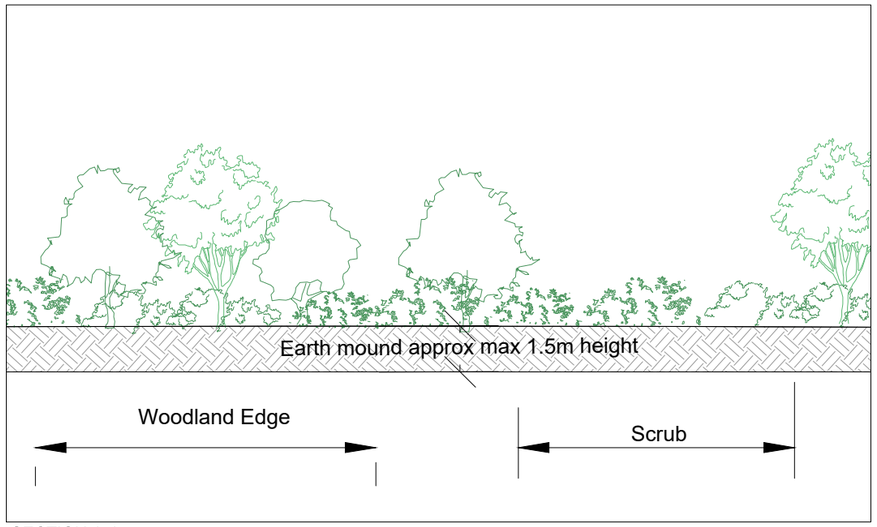
- Application Boundary
- SuDs Basin
- Swale Channel
- Reinstated Ground
- Permanent Water
- Wet Marginal Planting:
  Key species:
  -Phalaris arundinacea (Reed canary grass)
  -Lythrun salicaria (Purple loosestrife)
  -Sparganium emersum (Bur-reed)
- Woodland edge Planting:
  Key species:
  -Salix caprea (Goat Willow)
  -Salix viminalis (Osier Willow)
  -Betula pubescens (Downy Birch)
- Scrub Planting:
  Key species:
  -Salix cinerea (Grey Willow)
  -Viburnum opulus (Geulder Rose)
  -Prunus spinosa (Blackthorn)
- Mixed Hedgerow Planting:
  Key species:
  -Corylus avellana (Hazel)
  -Crataegus monogyna (Hawthorn)
  -Prunus spinosa (Blackthorn)
- Species Rich Grassland:
  General purposed meadow

TITLE
FIGURE 5.7a
LANDSCAPE MITIGATION DESIGN PLAN

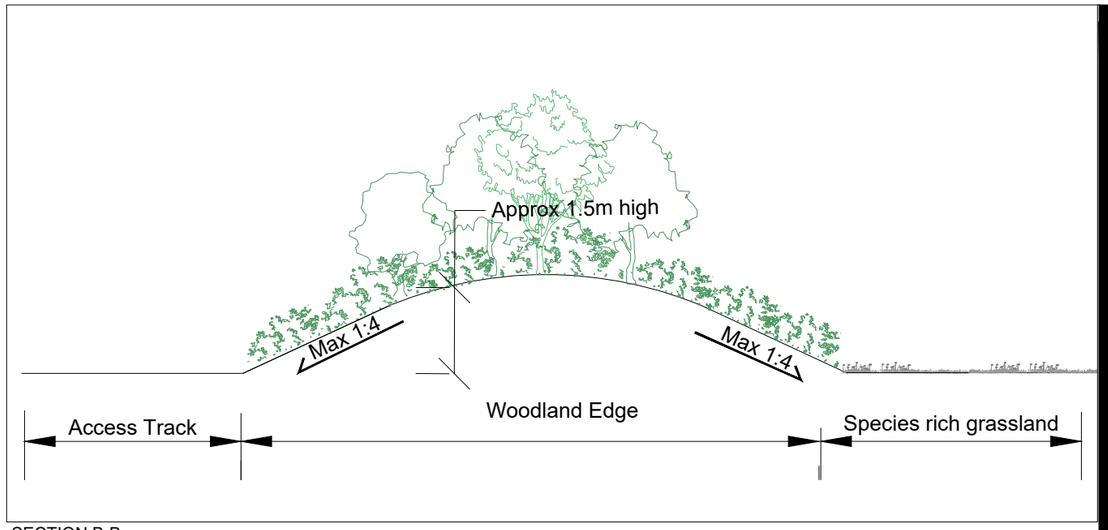
REFERENCE
NC_190604_UKON_ES_5.7a_V1

SHEET NUMBER 1 of 1

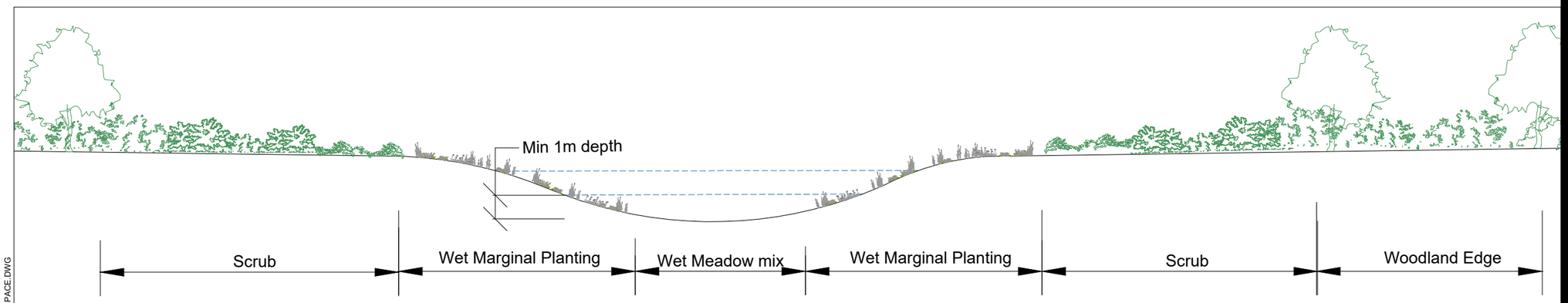
DATE 15/05/19



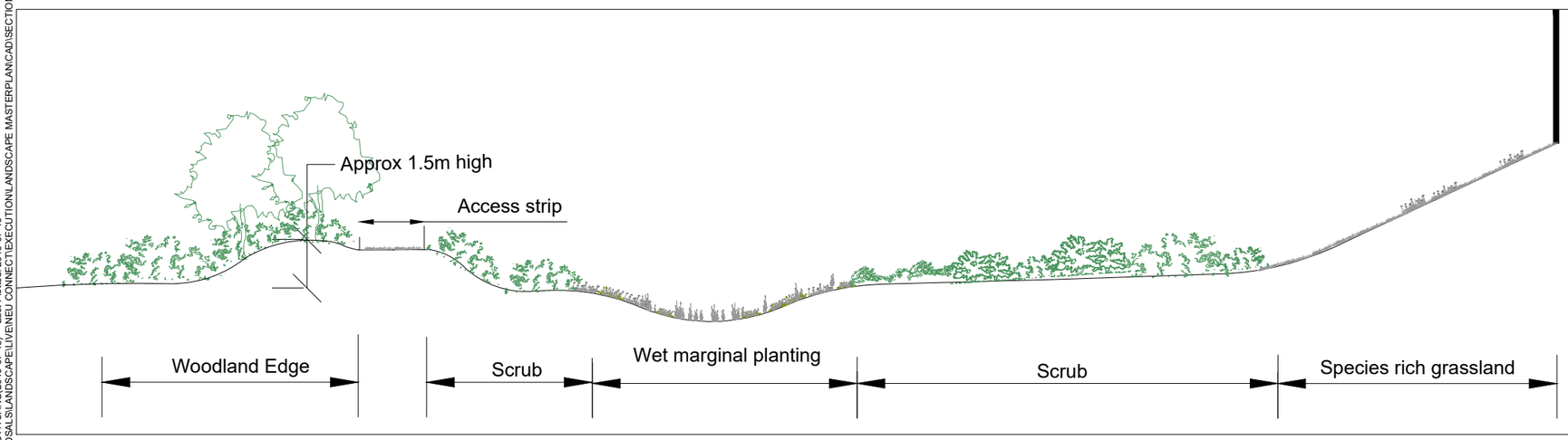
SECTION A-A
INDICATIVE SECTION THROUGH WESTERN BOUNDARY VIEW TOWARDS SUBSTATION
SCALE 1:100m



SECTION B-B
INDICATIVE SECTION THROUGH ACCESS TRACK AND MOUND
SCALE 1:100m



SECTION C-C
INDICATIVE SECTION THROUGH ATTENUATION BASIN
SCALE 1:100m



SECTION D-D
INDICATIVE SECTION THROUGH SWALE CHANNEL
SCALE 1:100m

LOCATION PLAN
SCALE 1:5000m

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

TITLE
FIGURE 5.7b
LANDSAPE MITIGATION DESIGN SECTIONS

REFERENCE
NC_190604_UKON_ES_5.7b_v1

SHEET NUMBER	DATE
1 of 1	15/05/19

Project Management Initials: CA Designer: PT Checked: RM Approved: DR
Last saved by: PEGGY.TSANG(2019-07-15) Last Plotted: 2019-07-16
Filename: Y:\PROPOSAL\LANDSCAPE\LIVEINEU CONNECT\EXECUTION\LANDSCAPE MASTERPLAN\CAD\SECTIONS AND DETAILS_PAPERSPACE.DWG

Figure: 5.8 Viewpoint 1 - Grain Coastal Park Existing View

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 13:00
OS Reference: 589078, 176926
Distance to Development: 664m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

Figure: 5.9a Viewpoint 2 - West Lane Existing View

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 12:00
OS Reference: 588328, 176613
Distance to Development: Within Boundary
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

AECOM

Figure: 5.9b Viewpoint 2 - West Lane Photomontage Year 1

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 12:00
OS Reference: 588328, 176613
Distance to Development: Within Boundary
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

AECOM

Figure: 5.9c Viewpoint 2 - West Lane Photomontage Year 15

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 12:00
OS Reference: 588328, 176613
Distance to Development: Within Boundary
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

AECOM

Figure: 5.10a Viewpoint 3 - Allhallows Marshes Existing View

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 17:35
OS Reference: 585870, 177537
Distance to Development: 1822m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

AECOM

Figure: 5.10b Viewpoint 3 - Allhallows Marshes Photomontage Year 1

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 17:35
OS Reference: 585870, 177537
Distance to Development: 1822m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

AECOM

Figure: 5.10c Viewpoint 3 - Allhallows Marshes Photomontage Year 15

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 17:35
OS Reference: 585870, 177537
Distance to Development: 1822m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

AECOM

Figure: 5.11a Viewpoint 4 - Stoke Road Existing View

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 27/02/19
Time: 13:30
OS Reference: 583442, 177143
Distance to Development: 3936m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

Figure: 5.11b Viewpoint 4 - Stoke Road Photomontage Year 1

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 27/02/19
Time: 13:30
OS Reference: 583442, 177143
Distance to Development: 3936m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

Figure: 5.11c Viewpoint 4 - Stoke Road Photomontage Year 15

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 27/02/19
Time: 13:30
OS Reference: 583442, 177143
Distance to Development: 3936m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

Figure: 5.12a Viewpoint 5 - Ratcliffe Highway Existing View

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 16:30
OS Reference: 582861, 177572
Distance to Development: 4597m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

AECOM

Figure: 5.12b Viewpoint 5 - Ratcliffe Highway Photomontage Year 1

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 16:30
OS Reference: 582861, 177572
Distance to Development: 4597m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

Figure: 5.12c Viewpoint 5 - Ratcliffe Highway Photomontage Year 15

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 16:30
OS Reference: 582861, 177572
Distance to Development: 4597m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

Figure: 5.13a Viewpoint 6 - Saxon Shore Way Existing View

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 15:00
OS Reference: 584986, 169149
Distance to Development: 7462m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

AECOM

Figure: 5.13b Viewpoint 6 - Saxon Shore Way Photomontage Year 1

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 15:00
OS Reference: 584986, 169149
Distance to Development: 7462m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

Figure: 5.14a Viewpoint 7 - Queenborough Coastal Path Existing View

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 26/02/19
Time: 12:35
OS Reference: 590321, 172726
Distance to Development: 4153m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

AECOM

Figure: 5.14b Viewpoint 7 - Queenborough Coastal Path Photomontage Year 1

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 26/02/19
Time: 12:35
OS Reference: 590321, 172726
Distance to Development: 4153m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

AECOM

Figure: 5.15a Viewpoint 8 - Riverside Country Park Existing View

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 26/02/19
Time: 13:50
OS Reference: 580806, 168446
Distance to Development: 10294m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

Figure: 5.15b Viewpoint 8 - Riverside Country Park Photomontage Year 1

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 26/02/19
Time: 13:50
OS Reference: 580806, 168446
Distance to Development: 10294m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

AECOM

Figure: 5.16a Viewpoint 9 - Furze Hill Existing View

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 14:20
OS Reference: 592762, 172062
Distance to Development: 6211m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

AECOM

Figure: 5.16b Viewpoint 9 - Furze Hill Photomontage Year 1

Camera: EOS 5D
Lens: 50mm
Horizontal Field of View: 65.5^{0}
Camera Height: 1.5m

Date : 25/02/19
Time: 14:20
OS Reference: 592762, 172062
Distance to Development: 6211m
Paper Size: 420 x 297mm

Project: NeuConnect
Client: NeuConnect Britain LTD

Project Management Initials: DR Designer: BF Checked: AB Approved: NG

Roas Bank

Roas Ban

Cockleshell Beach

Lees Marshes

Mean High Water

Sand

Pound Fleet

Bucks Pounds

Grain Marsh

Yantlett Farm

PEAT WAY

Hamshill Fleet

Police Cottages

Floodgate

WEST LANE

Rosecourt Farm

Isle of Grain

Perry's Farm

Millmarsh Fleet

Workings

The Flats

Sand Esplanade

Car Park

B2001

PW

School

St James Park

Pavilion

CANNELL ROAD

FRY CL

HIGH STREET

PH

B2001

F Sta

Pol Ho

PW

ST MARY'S ROAD

ST JAMES CL

GREEN LANE

CHAPEL ROAD

EDINBURGH ROAD

CORONATION ROAD

GRAINE AVENUE

HUNTIN ROAD

LAWLING ROAD

Hall

Grain

CHAPEL ROAD

SEAVIEW

SMITHFIELD ROAD

Ho

Whitehouse Farm

Medtha

Main High Water

Hard

Grain Tower

0 0.5 km

Scale @ A3 1:10,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary

Indicative Location of:

- Offshore Cable Route
- Onshore DC Cable Route
- DC Cable Route - 30m Working Width
- Converter Station and Substation Platform - 2m Fence Line Security & Maintenance Corridor
- Access Road
- Converter Station Platform
- Substation Platform
- Construction Laydown Area
- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed Sealing End Compound
- National Grid Proposed GIS Building (Maximum Parameters)

NOTE
The location of all components identified is indicative only, but is representative of the maximum parameters of each component. The GB Onshore Scheme is subject to detailed design.

TITLE
FIGURE 6.1
SITE LOCATION AND PROPOSED LOCATIONS OF DC CABLE AND PROPOSED CONVERTER AND SUBSTATION

REFERENCE
NC_191003_UKON_ES_6.1_v1

SHEET NUMBER
1 of 1

DATE
03/10/19

Project Management Initials: DR Designer: BF Checked: AB Approved: NG

River Thames

River Thames

Thames Estuary & Marshes (SPA)

Thames Estuary & Marshes

Medway Estuary (MCZ)

Medway Estuary & Marshes

Medway Estuary & Marshes (SPA)

Isle of Grain

Grain

Grain Marsh

The Flats

Grain Spit

Ross Bank

North Level

Cockleshell Beach

Leus Marshes

Newlands

Wallend

Grain Power

Scale @ A3 1:15,000

0 1 2 km

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary

Indicative Location of:

- Offshore Cable Route
- Onshore DC Cable Route
- DC Cable Route - 30m Working Width
- Converter Station and Substation Platform - 2m Fence Line Security & Maintenance Corridor
- Access Road
- Converter Station Platform
- Substation Platform
- Construction Laydown Area
- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed Sealing End Compound
- National Grid Proposed GIS Building (Maximum Parameters)

- Search area
- Special Protection Area (SPA)
- Ramsar
- Marine Conservation Zone (MCZ)

NOTE
The location of all components identified is indicative only, but is representative of the maximum parameters of each component. The GB Onshore Scheme is subject to detailed design.

TITLE
FIGURE 6.2
DESIGNATED SITES WITHIN 2 KM OF THE SITE

REFERENCE
NC_191002_UKON_ES_6.2_v1

SHEET NUMBER
1 of 1

DATE
02/10/19

Project Management Initials: DR Designer: BF Checked: AB Approved: NG

Grain Marsh

Hamshill Fleet

Police Cottages

WEST LANE

Rosecourt Farm

Isle of Grain

Perry's Farm

Perry's Farm

Workings

Grain

PANNELL ROAD

LEVETT CL

FRY CL

PH

HIGH STREET

ST JAMES'S

B2001

F Sta

Pol Ho

PW

CHAPEL ROAD

EDINBURGH R

CORONATION ROAD

GRAYNE AVENUE

PUFFIN ROAD

LAPWING ROAD

Whiteho Farm

POW

TN1 TN2 TN3 TN4 TN5 TN6 TN7 TN8 TN9 TN10 TN11 TN12 TN13 TN14 TN15 TN16

0 0.5 km

Scale @ A3 1:5,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary

Indicative Location of:

- Offshore Cable Route
- Onshore DC Cable Route
- DC Cable Route - 30m Working Width
- Converter Station and Substation Platform - 2m Fence Line Security & Maintenance Corridor
- Access Road
- Converter Station Platform
- Substation Platform
- Construction Laydown Area
- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed Sealing End Compound
- National Grid Proposed GIS Building (Maximum Parameters)

Phase 1 habitat

- Dense/continuous scrub
- Scattered scrub
- Semi-improved neutral grassland
- Improved grassland
- Tall ruderal
- Swamp
- Standing water
- Shingle above high tide mark
- Maritime cliff and slope
- Ephemeral/short perennial
- Arable
- Hard surface
- Running water
- Species-poor intact hedge
- Dry ditch
- Broad-leaved tree
- Scattered scrub
- Target Note

NOTE
The location of all components identified is indicative only, but is representative of the maximum parameters of each component. The GB Onshore Scheme is subject to detailed design.

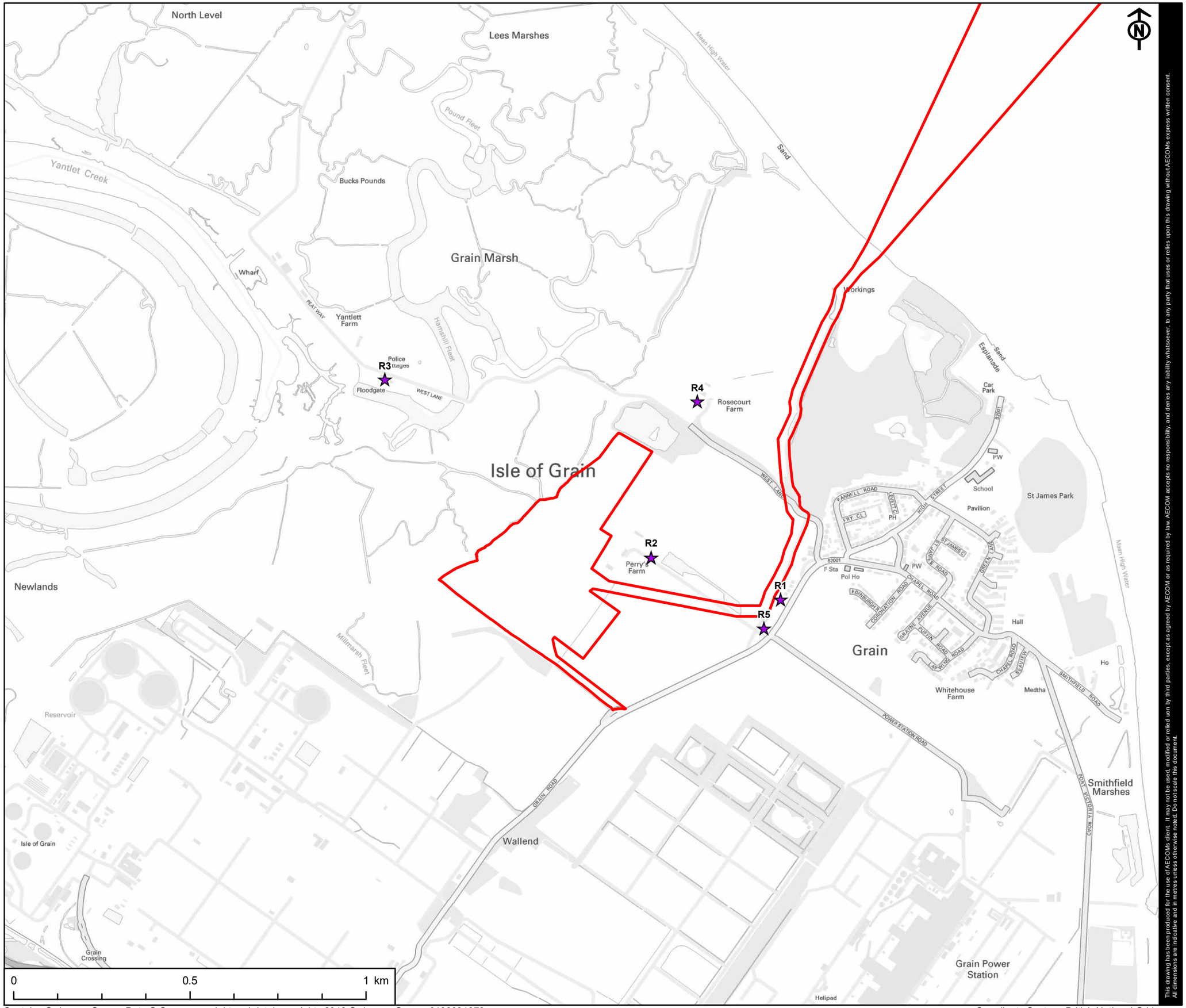
TITLE
FIGURE 6.3
PHASE 1 HABITAT

REFERENCE
NC_191003_UKON_ES_6.3_v1

SHEET NUMBER
1 of 1

DATE
03/10/19

Project Management Initials: DR Designer: LC Checked: AR Approved: TB



Scale @ A3 1:10,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Application Boundary
- Noise Sensitive Receptor

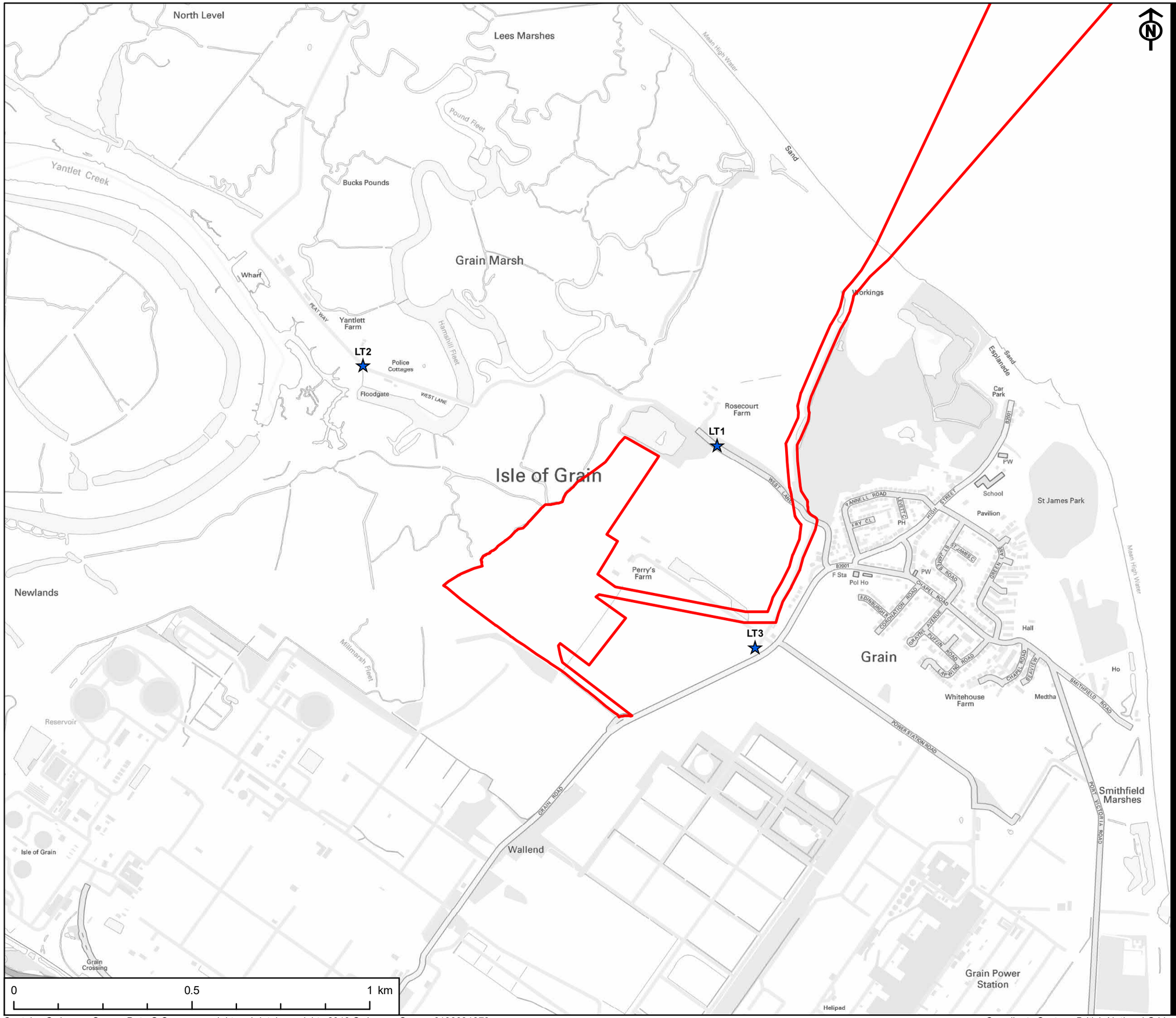
TITLE
FIGURE 7.1
NOISE SENSITIVE RECEPTORS

REFERENCE
NC_191001_UKON_ES_7.1_v2

SHEET NUMBER
1 of 1

DATE
01/10/19

Project Management Initials: DR Designer: LC Checked: AR Approved: TB



Scale @ A3 1:10,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Application Boundary
- Noise Monitoring Location

TITLE
FIGURE 7.2
NOISE MONITORING LOCATIONS

REFERENCE
NC_191001_UKON_ES_7.2_v2

SHEET NUMBER
1 of 1

DATE
01/10/19

Project Management Initials: DR Designer: SM Checked: LB Approved: TC

Yantlet Beach
Allhallows-on-Sea
Cockleshell Beach
Roas Bank
The Flats
Binney Farm
Yantlet Creek
Yantlett Farm
Hamshill
Millmarsh Fleet
Ramhooks Fleet
Stoke Great Fleet
Wallend
Grain Road
Power Station Road
House Fleet
Black Stakes
River Medway
Stoke Ooze

AAP around grid pattern of cropmarks
AAP around World War II observation tower
AAP around possible prehistoric settlement site
AAP surrounding undated stone foundations
AAP around Grain military defences, prehistoric and Roman sites and industrial area. Quarried areas not included.
AAP surrounding MD & PM church
AAP surrounding PM fort & battery
Coastal artillery defences on the Isle of Grain, immediately east and south east of the Grain Village
AAP around Grain Fortifications
AAP surrounding PM battery
AAP surrounding Ro cemetery
AAP around barrow
AAP around geology of archaeological potential
AAP surrounding MD & PM saltworkings
AAP surrounding Ro flask
AAP surrounding PM tower/beacon
AAP surrounding Ro occupation
AAP around former militasry installation
AAP surrounding EM pottery kiln
AAP around military and river front remains
AAP around pillbox and jetty
AAP around World War II Tank Farm
AAP around Yantlet Creek
AAP around Wharf
Second World War QF P series oil bombing decoy

A63
2001

0 1 2 km

Scale @ A3 1:20,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Application Boundary
- Heritage Study Area
- Area of Archaeological Potential (AAP)
- Scheduled Monument

Archaeological Assets
- Palaeolithic
- Lower Palaeolithic
- Neolithic
- Iron Age
- Iron Age to Roman
- Roman
- Early Medieval
- Medieval
- Post-medieval
- Post-medieval to Modern
- Modern
- Unknown

- Post-medieval
- Medieval
- Modern

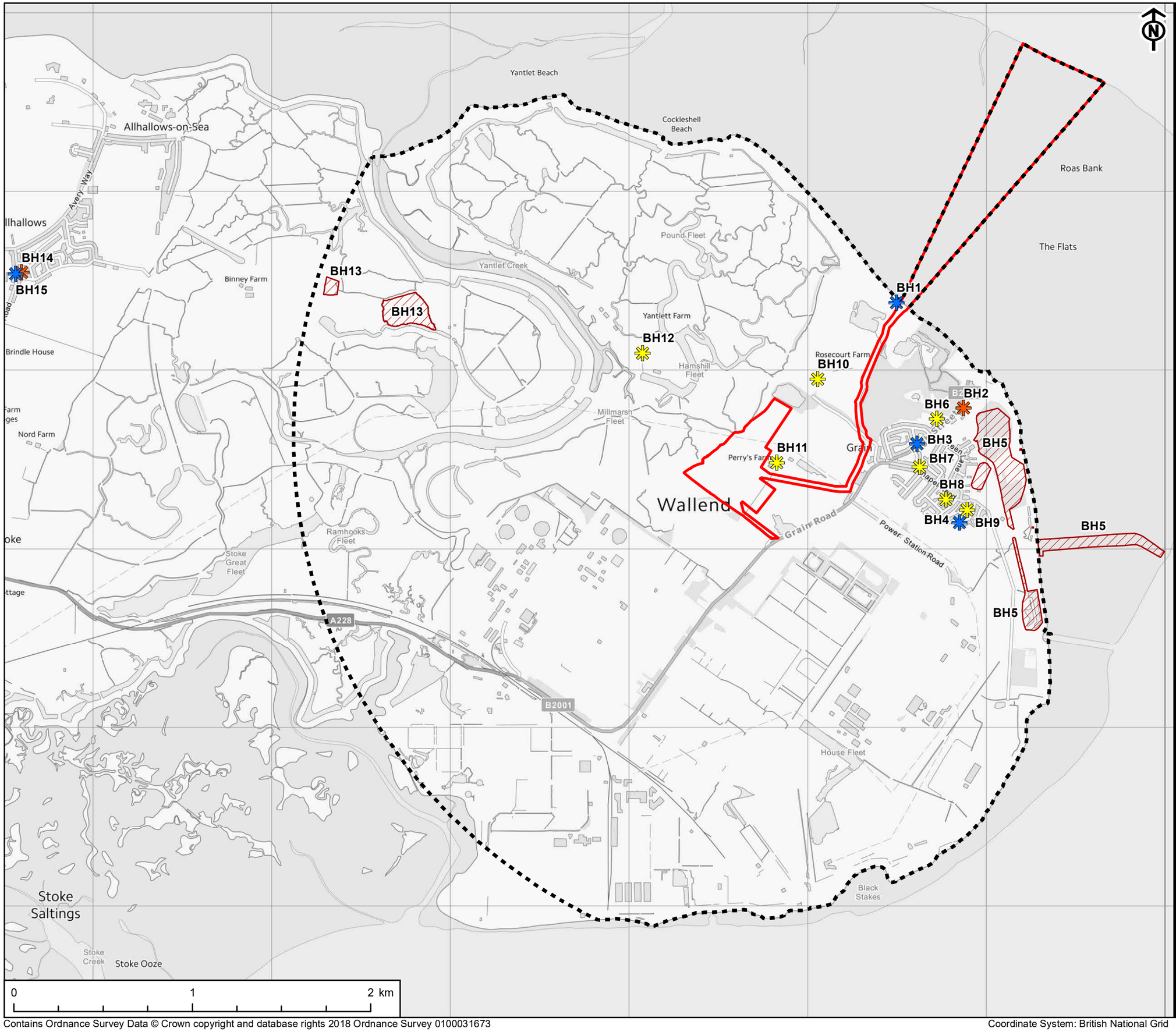
TITLE
FIGURE 8.1
ARCHAEOLOGICAL ASSETS

REFERENCE
NC_191002_ES_8.1_v2

SHEET NUMBER
1 of 1

DATE
02/10/19

Project Management Initials: DR Designer: SM Checked: MS Approved: TC



Scale @ A3 1:20,000

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Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- Heritage Study Area
- Scheduled Monument

Built Heritage Assets

- Grade I Listed Building
- Grade II Listed Building
- Non-designated Heritage Asset

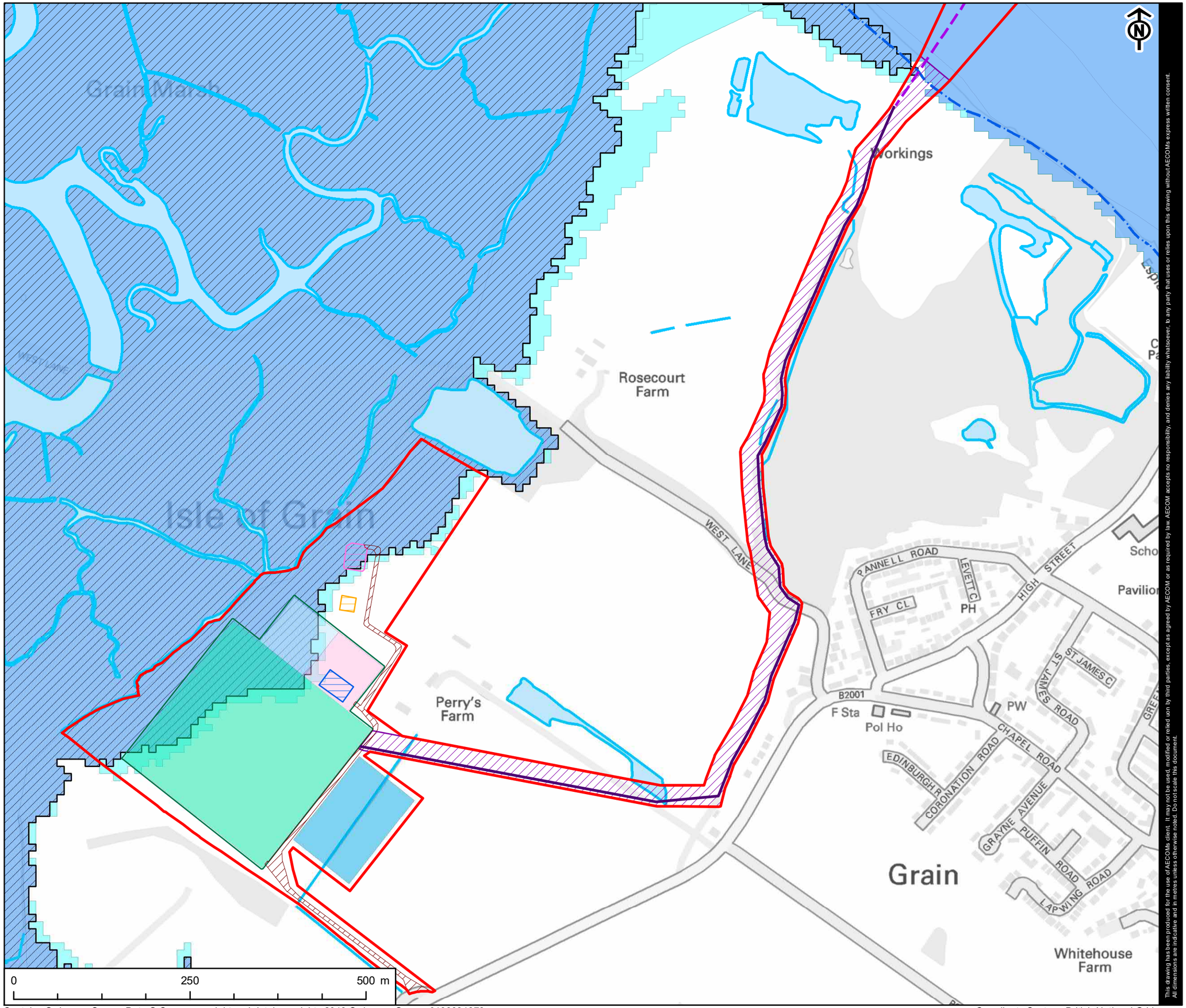
TITLE
FIGURE 8.2
BUILT HERITAGE ASSETS

REFERENCE
NC_191002_ES_8.2_v2

SHEET NUMBER
1 of 1

DATE
02/10/19

Project Management Initials: DR Designer: LC Checked: SL Approved: TC



Scale @ A3 1:5,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary

Indicative Location of:

- Offshore Cable Route
- Onshore DC Cable Route
- DC Cable Route - 30m Working Width
- Converter Station and Substation Platform - 2m Fence Line Security & Maintenance Corridor
- Access Road
- Converter Station Platform
- Substation Platform
- Construction Laydown Area
- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed Sealing End Compound
- National Grid Proposed GIS Building (Maximum Parameters)
- Surface Water (OS)
- Flood Defences
- Areas Benefiting from Flood Defences
- Flood Zone 3
- Flood Zone 2

NOTE
The location of all components identified is indicative only, but is representative of the maximum parameters of each component. The GB Onshore Scheme is subject to detailed design.

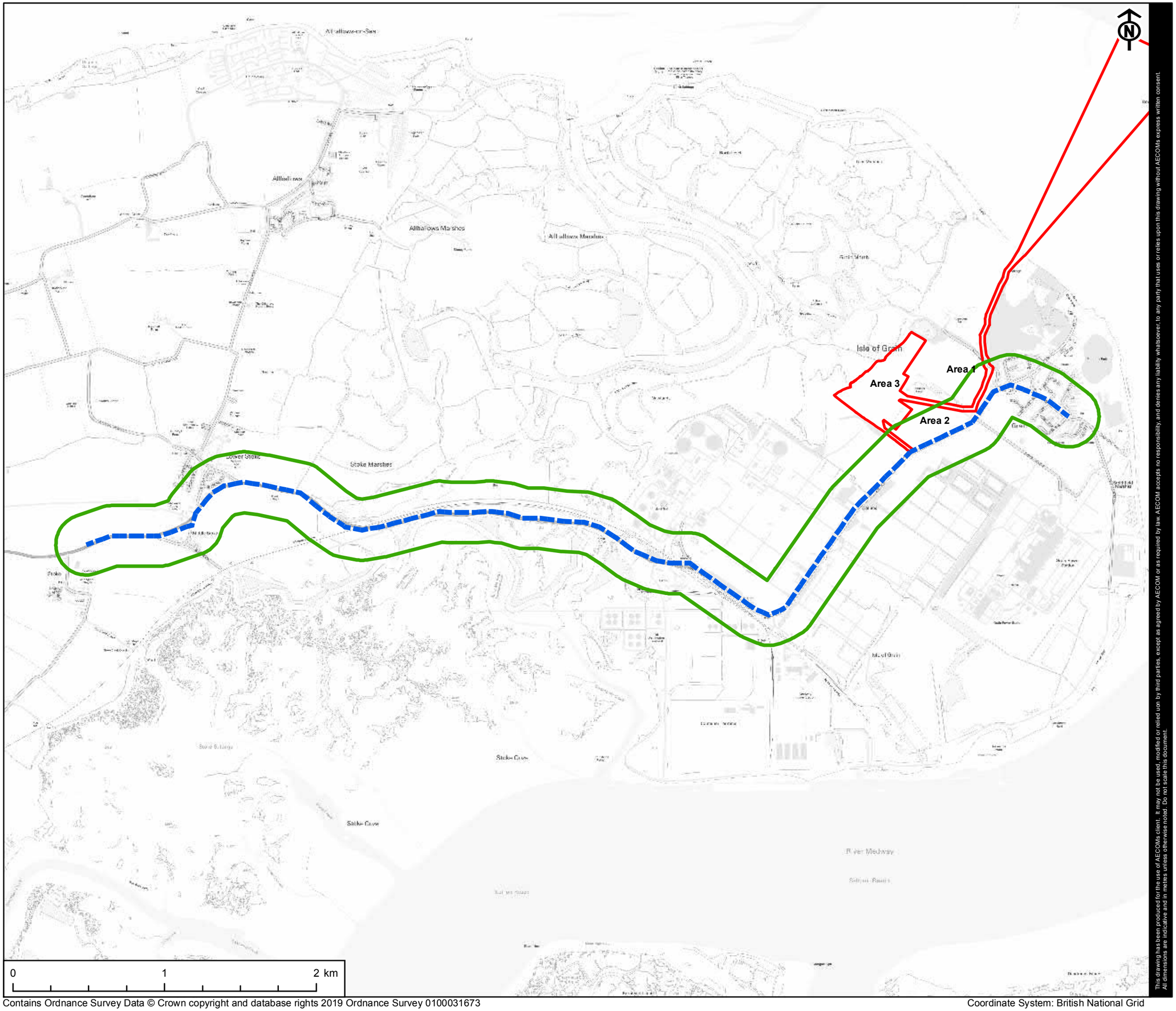
TITLE
FIGURE 9.1
WATER RESOURCES AND FLOOD RISK

REFERENCE
NC_191001_UKON_ES_9.1_v2

SHEET NUMBER
1 of 1

DATE
01/10/19

Project Management Initials: TC Designer: JC Checked: JS Approved: PK



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Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Application Boundary
- Study Area
- Site Access Road

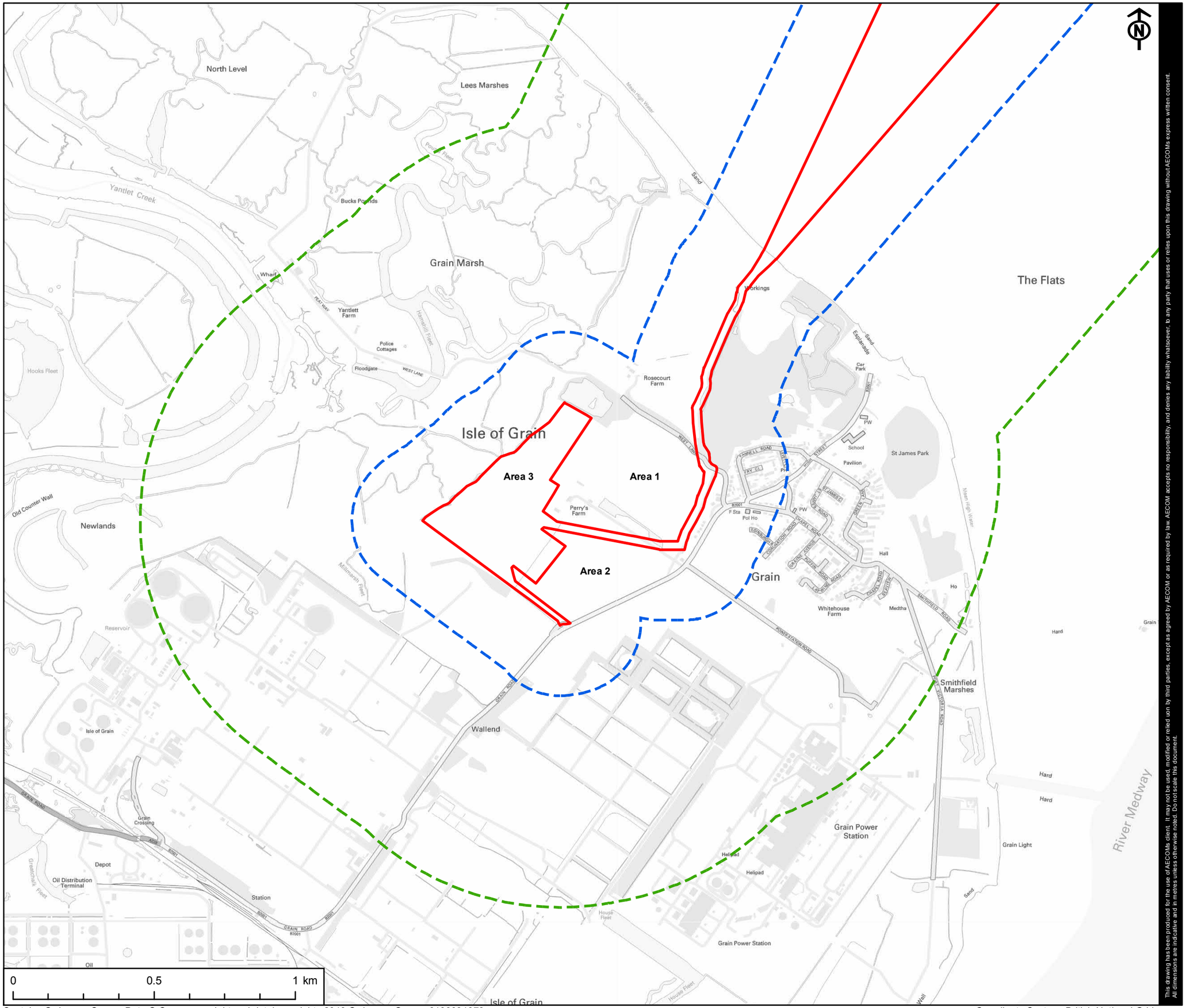
TITLE
FIGURE 10.1
COLLISION DATA STUDY AREA

REFERENCE
NC_191003_UKON_ES_10.1

SHEET NUMBER
1 of 1

DATE
03/10/19

Project Management Initials: DR Designer: LC Checked: JOK Approved: DR



Scale @ A3 1:12,500

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Application Boundary
- 250m Study Area
- 1km Extended Study Area

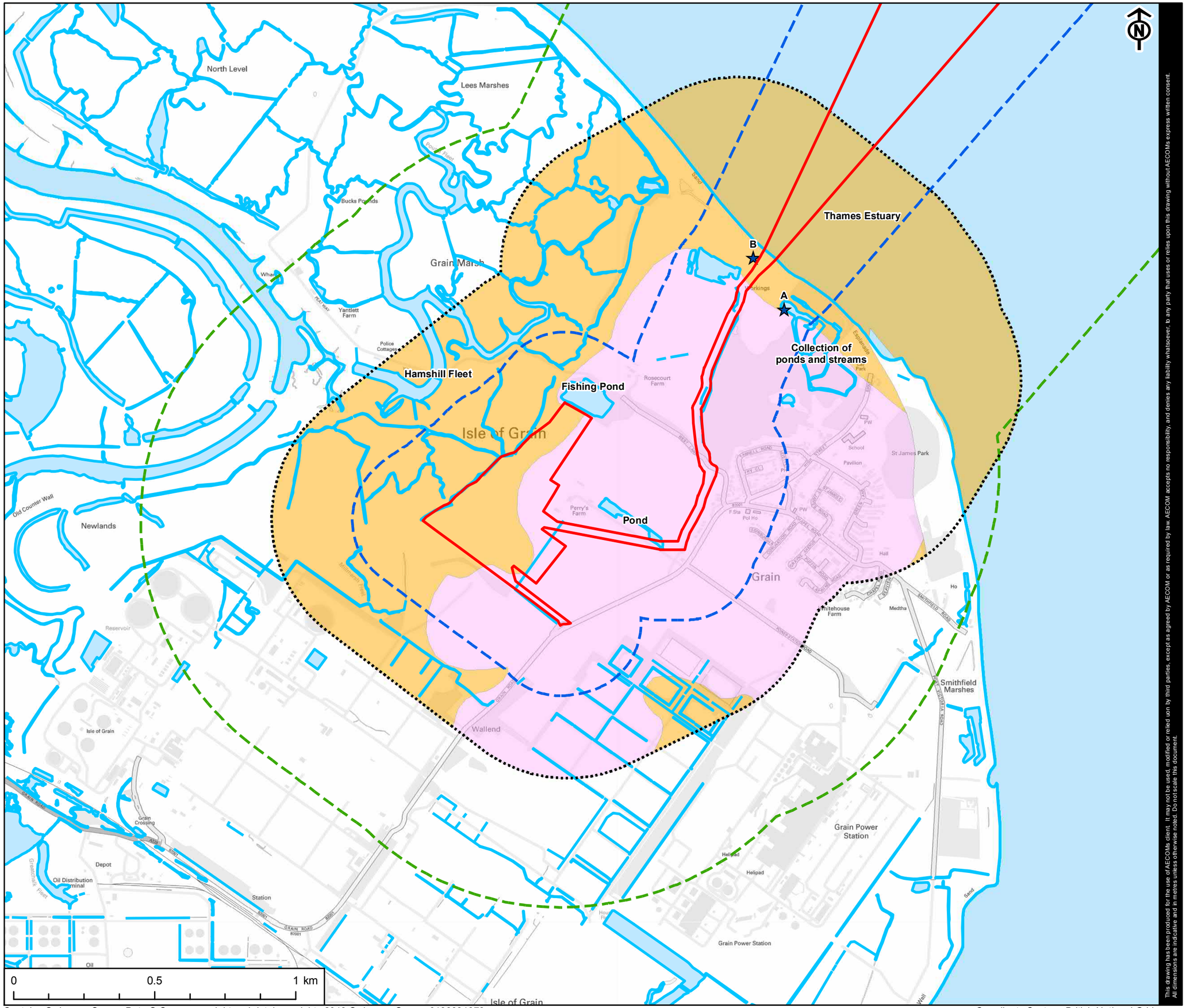
TITLE
FIGURE 11.1
GROUND CONDITIONS STUDY AREA AND THE EXTENDED STUDY AREA

REFERENCE
NC_190719_UKON_ES_11.1_v3

SHEET NUMBER
1 of 1

DATE
19/07/19

Project Management Initials: DR Designer: LC Checked: JOK Approved: DR



Scale @ A3 1:12,500

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- 250m Study Area
- 1km Extended Study Area
- Landmark GIS data extent
- Surface Water (OS)

Superficial Aquifer (BGS)

- Secondary A Aquifer- River Terrace Deposits
- Secondary (undifferentiated) Aquifer – Alluvium and Head deposits
- Environment Agency abstraction license identified in the extended study area (relating to two locations denoted Points 'A' and 'B') – assumed no longer active

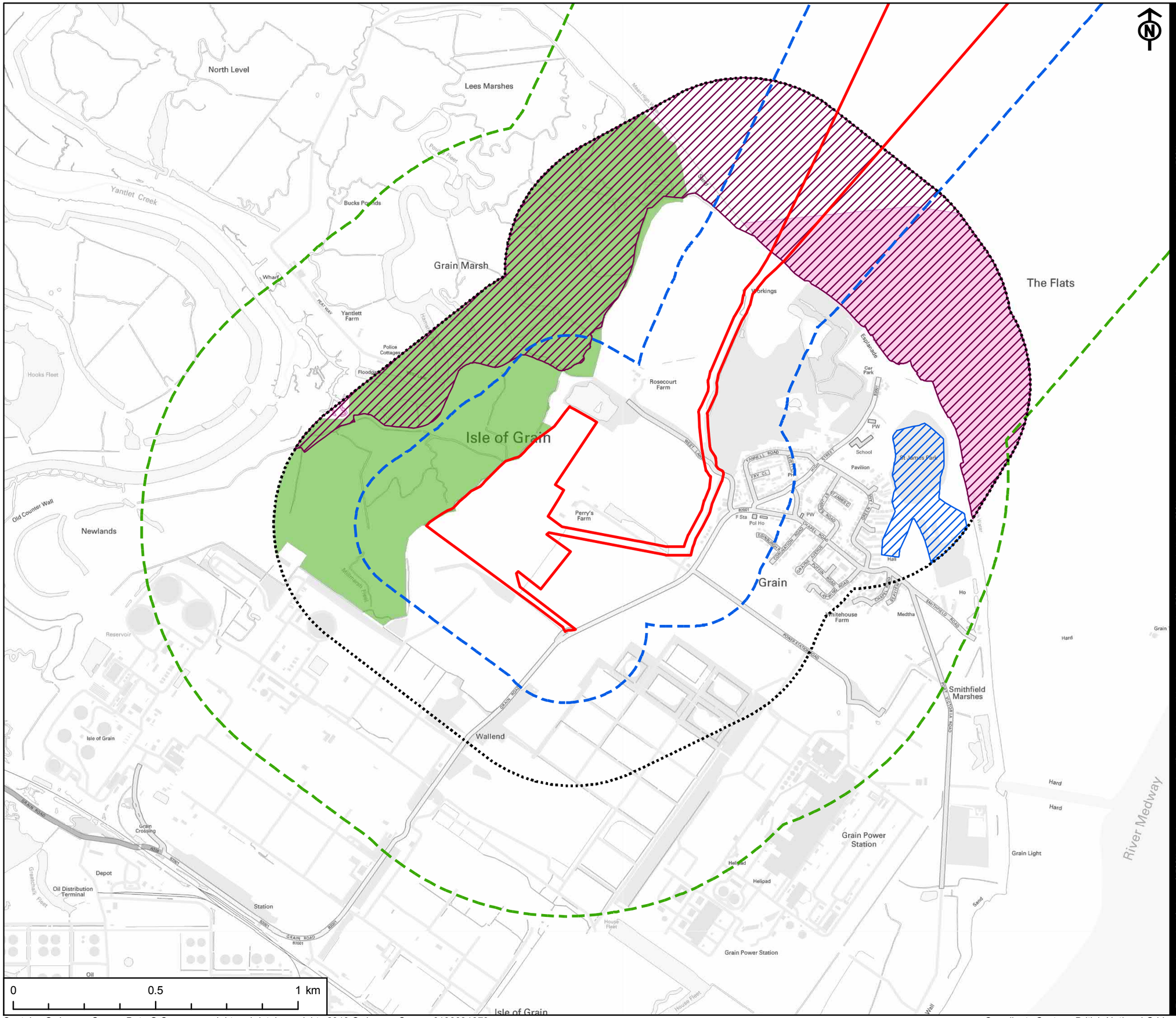
TITLE
FIGURE 11.3a
GROUND CONDITIONS
CONTROLLED WATERS RECEPTORS

REFERENCE
NC_190905_UKON_ES_11.3a_v4

SHEET NUMBER
1 of 1

DATE
05/09/19

Project Management Initials: DR Designer: LC Checked: JOK Approved: DR



Scale @ A3 1:12,500

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- 250m Study Area
- 1km Extended Study Area
- Landmark GIS data extent
- Medway Estuary And Marshes Site of Special Scientific Interest
- South Thames Estuary And Marshes Site of Special Scientific Interest, Special Protection Area and Ramsar
- Marine Nature Reserve
- North Kent Marshes Environmentally Sensitive Area

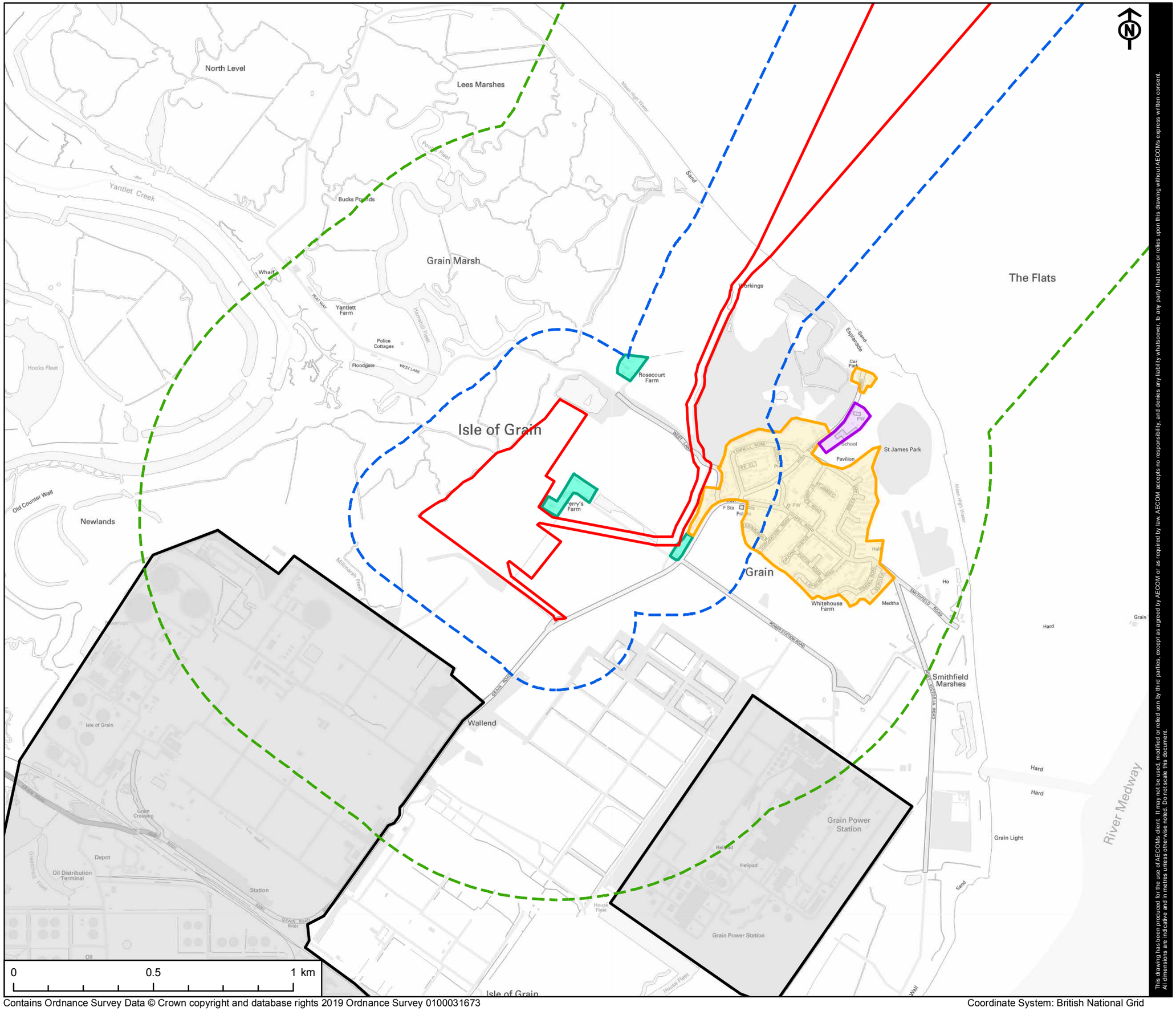
TITLE
FIGURE 11.3b
GROUND CONDITIONS
ENVIRONMENTALLY SENSITIVE RECEPTORS

REFERENCE
NC_190717_UKON_ES_11.3b_v3

SHEET NUMBER
1 of 1

DATE
17/07/19

Project Management Initials: DR Designer: LC Checked: JOK Approved: DR



Scale @ A3 1:12,500

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Application Boundary
- 250m Study Area
- 1km Extended Study Area
- Farm
- Industrial
- Residential
- School / Church

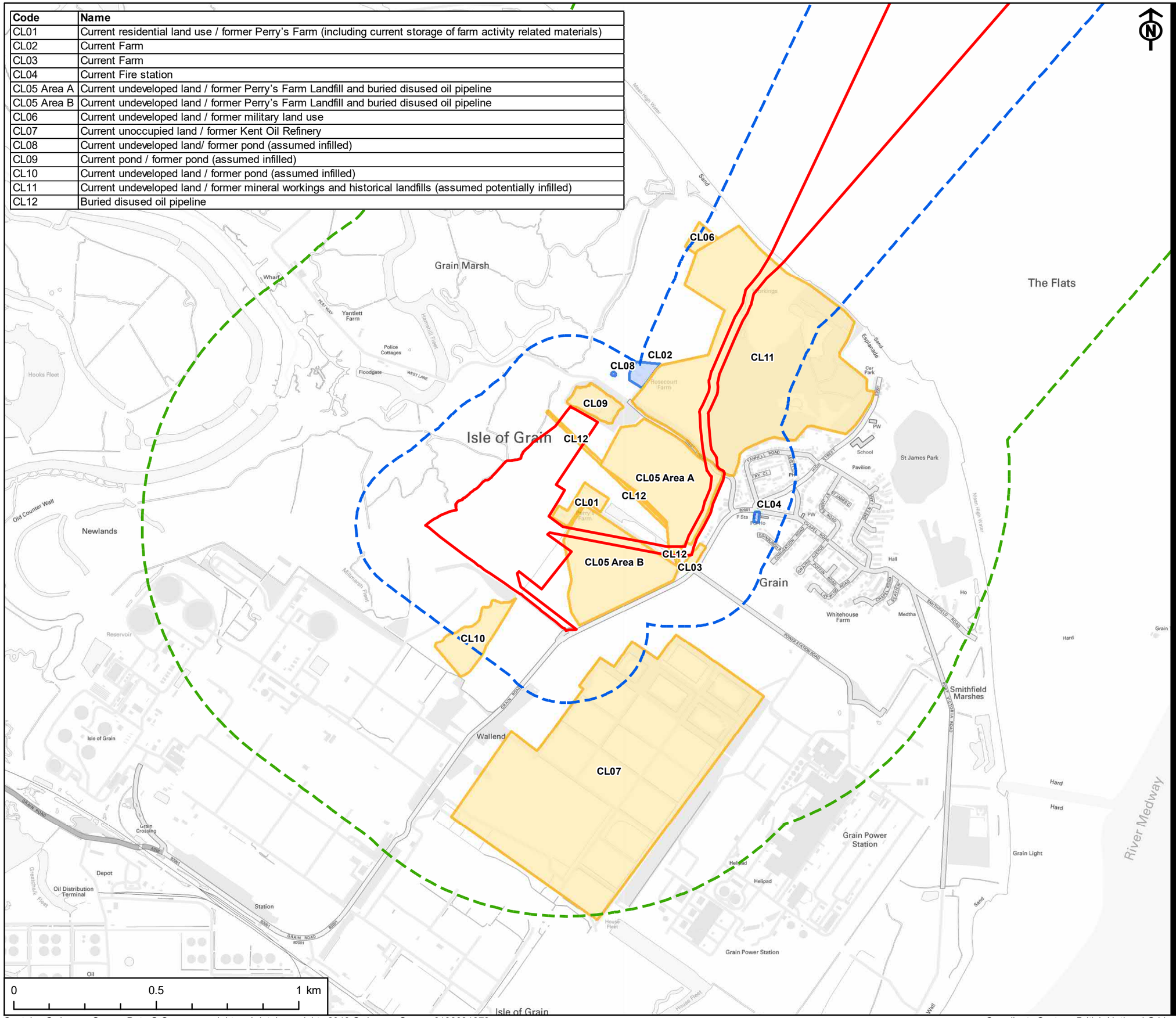
TITLE
FIGURE 11.3c
GROUND CONDITIONS
HUMAN HEALTH AND OTHER RECEPTORS

REFERENCE
NC_190717_UKON_ES_11.3c_v4

SHEET NUMBER
1 of 1

DATE
17/07/19

Code	Name
CL01	Current residential land use / former Perry's Farm (including current storage of farm activity related materials)
CL02	Current Farm
CL03	Current Farm
CL04	Current Fire station
CL05 Area A	Current undeveloped land / former Perry's Farm Landfill and buried disused oil pipeline
CL05 Area B	Current undeveloped land / former Perry's Farm Landfill and buried disused oil pipeline
CL06	Current undeveloped land / former military land use
CL07	Current unoccupied land / former Kent Oil Refinery
CL08	Current undeveloped land/ former pond (assumed infilled)
CL09	Current pond / former pond (assumed infilled)
CL10	Current undeveloped land / former pond (assumed infilled)
CL11	Current undeveloped land / former mineral workings and historical landfills (assumed potentially infilled)
CL12	Buried disused oil pipeline



Scale @ A3 1:12,500

0 0.5 1 km

Coordinate System: British National Grid

Project Management Initials: DR Designer: LC Checked: JOK Approved: DR

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY
- Application Boundary
- 250m Study Area
- 1km Extended Study Area

Potential Sources of Land Contamination
- Included in Risk and Impact Assessment
- Excluded from Risk and Impact Assessment

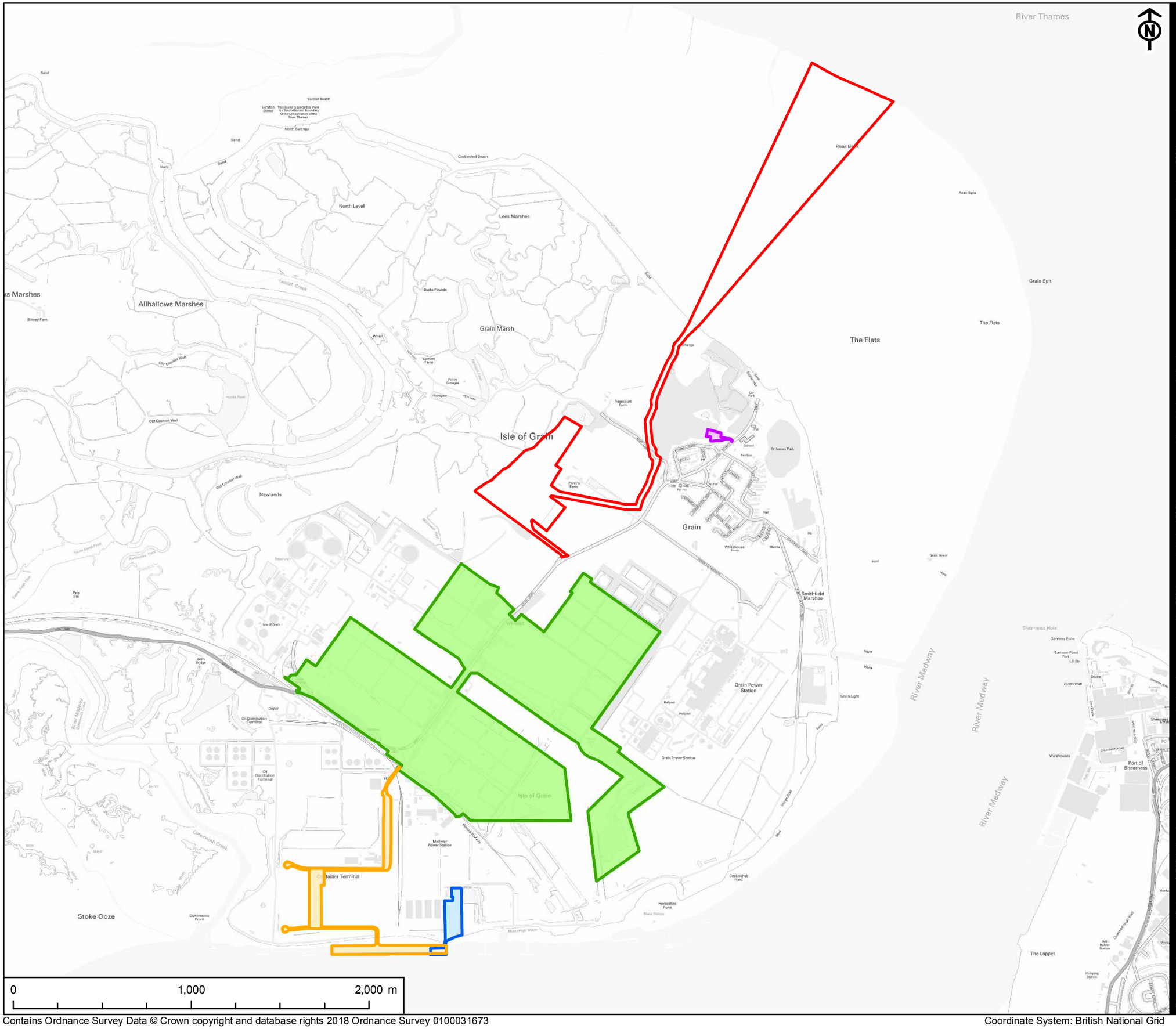
TITLE
FIGURE 11.4
POTENTIAL CONTAMINATED LAND SITES

REFERENCE
NC_191002_UKON_ES_11.4_v4

SHEET NUMBER
1 of 1

DATE
02/10/19

Project Management Initials: DR Designer: LC Checked: TC Approved: DR



Scale @ A3 1:20,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary

Cumulative Development

- Grain Business Park – MC/09/1628
- Proposed Concrete Batching Plant – MC/19/0299
- Proposed Concrete Grinding Facility – MC/19/1793
- Proposed Development of Six Houses - MC/18/1871

TITLE
FIGURE 12.1
CUMULATIVE EFFECTS ASSESSMENT

REFERENCE
NC_190716_UKON_ES_12.1_v1

SHEET NUMBER
1 of 1

DATE
16/07/19

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement
Volume III: Figures

NeuConnect Britain Ltd

September 2019

Prepared for:

NeuConnect Britain Ltd
C/O Fulcrum
105 Piccadilly
London, W1J 7NJ
United Kingdom

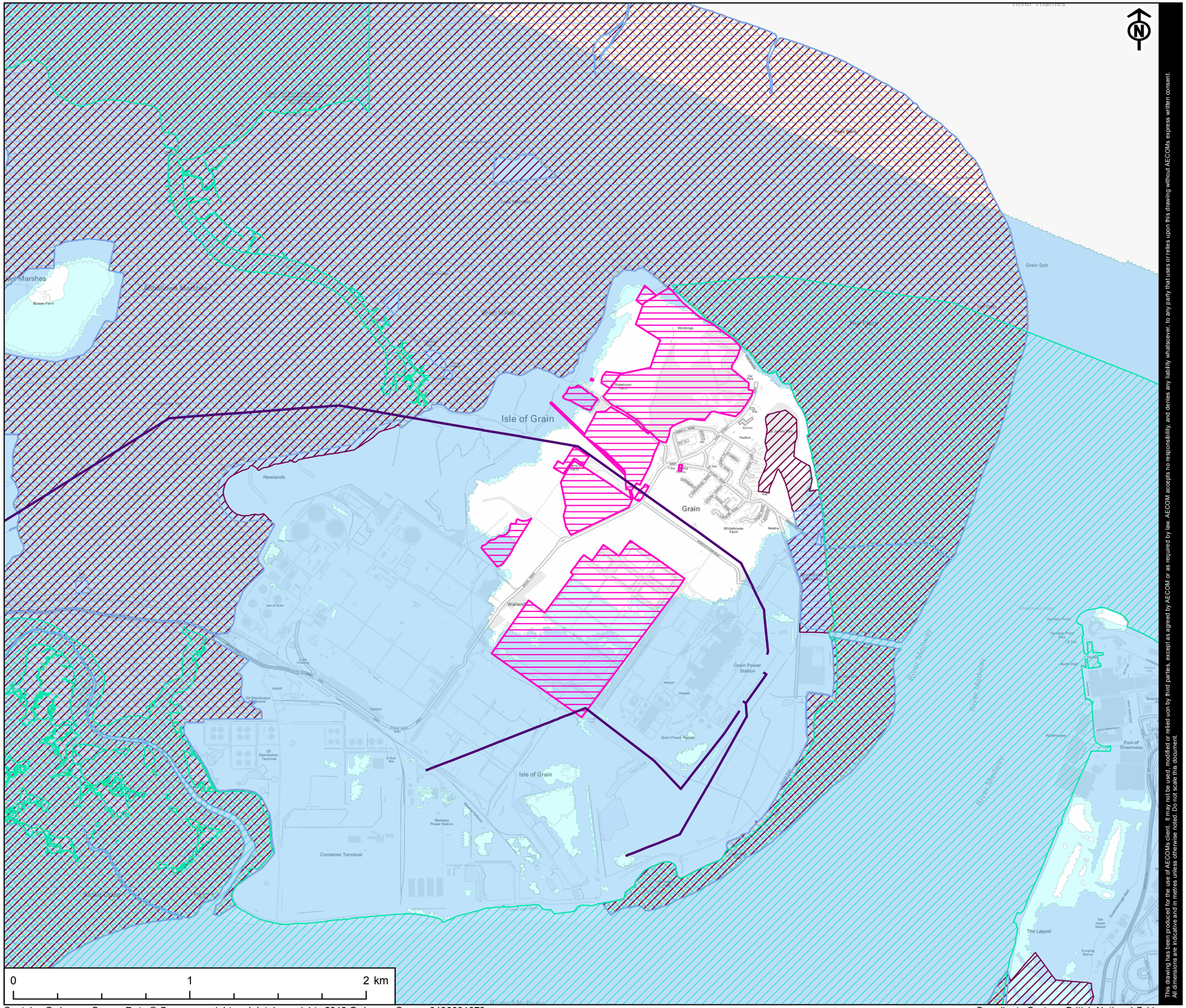
Prepared by:

AECOM Infrastructure & Environment UK Limited
1 Tanfield
Edinburgh EH3 5DA
United Kingdom

T: +44 131 301 8600
aecom.com

Table of Contents

Project Management Initials: DR Designer: LC Checked: TC Approved: DR



Scale @ A3 1:20,000

Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Existing Overhead Cable
- Potential Sources of Land Contamination
- Ramsar
- Site of Special Scientific Interest
- Special Protection Area
- Marine Conservation Zone
- Flood Zone 3
- Flood Zone 2

TITLE
FIGURE 2.1
GB ONSHORE SCHEME SITING CONSTRAINTS

REFERENCE
NC_190801_UKON_ES_2.1_v1

SHEET NUMBER
1 of 1

DATE
01/08/19

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement
Volume IV: Technical Appendices

NeuConnect Britain Ltd

September 2019

Prepared for:

NeuConnect Britain Ltd
105 Piccadilly
London, W1J 7NJ
United Kingdom

Prepared by:

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1 Tanfield
Edinburgh EH3 5DA
United Kingdom

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Table of Contents

Figures

No table of figures entries found.

Tables

No table of figures entries found.

Introduction

ES Vol II - Chapter	Appendix Number	Title
03 Approach to Assessment	3.A	Screening Responses
	3.B	Statement of Community Involvement
05 Landscape and Visual	5.A	Landscape Assessment
	5.B	Visual Assessment
06 Ecology and Nature Conservation	6.A	Preliminary Ecological Appraisal
	6.B	Report on Surveys of Breeding Birds
	6.C	Report on Surveys of Wintering Birds
	6.D	Report on Surveys for Intertidal Waterbirds
	6.E	Report on Surveys for Reptiles
	6.F	Report on Surveys for Great Crested Newts
	6.G	Report on Surveys for Water Vole
	6.H	Aquatic Ecology Report
	6.I	Report on Survey for Bats
	6.J	Benthic Characterisation Survey
07 Noise and Vibration	7.A	Baseline Survey
	7.B	Monitoring Information
08 Cultural Heritage	8.A	Desk-Based Assessment
09 Water Resources and Flood Risk	9.A	Flood Risk Assessment Report
	9.B	Drainage Strategy
	9.C	Hydrology
10 Transport	10.A	Traffic Scenario
11 Ground Conditions	11.A	Environmental Liability Desk Study
	11.B	Contaminated Land Assessment Methodology, Risk and Impact Assessment

Appendix 3.A Screening Responses

Decision Notice

MC/18/3363

Medway Council
Serving You

Mr T Cramond
AECOM
AECOM Limited
One Trinity Gardens
First Floor
Quayside
Newcastle-upon-Tyne
NE1 2HF

Applicant Name:
NeuConnect Britain Limited

Planning Service
Physical & Cultural Regeneration
Regeneration, Culture, Environment & Transformation
Gun Wharf
Dock Road
Chatham
Kent
ME4 4TR
01634 331700
01634 331195
Planning.representations@medway.gov.uk

TOWN & COUNTRY PLANNING ACT 1990
Town & Country Planning (Environmental Impact Assessment) Regulations 2017.

Location: Land At Grain, Isle Of Grain , Kent , ,

Proposal: Town and Country Planning Act (Environmental Impact Assessment) (England and Wales) Regulations 2017 request for a screening opinion for the proposed development of a coverter station, substation and underground Direct Current electricity cables on land at Grain, Isle of Grain

---

Take Notice that the Medway Council in pursuance of its powers under the above Act HAS DETERMINED THAT AN ENVIRONMENTAL IMPACT ASSESSMENT IS NECESSARY for the development as described above in accordance with your request for a Screening Opinion received complete on the 21 November 2018.

For the following reasons:

1 The proposed development has been assessed against the criteria in Schedule 2 to the Town and Country Planning (Environmental Impact Assessment) Regulations 2017. It is considered that an EIA is required as the proposed development as it is located in close proximity to sensitive areas and could result in significant impacts on the environment and the impacts that may arise should be addressed by the formal submission of an ES.

Your attention is drawn to the following informative(s) :-

1 This decision relates to the letter (dated 20 Nov 2018) requesting a screening opinion, the AECOM - Screening Report (dated November 2018).

David Harris
Head of Planning
Date of Notice 19 December 2018

TOWN & COUNTRY PLANNING (APPEALS) (WRITTEN REPRESENTATIONS) (ENGLAND) (AMENDMENT) (REGULATIONS 2013)

TOWN AND COUNTRY PLANNING ACT 1990

Appeals to the Secretary of State

- If you are aggrieved by the decision of your Local Planning Authority to refuse permission for the proposed development or to grant it subject to conditions, then you can appeal to the Secretary of State under section 78 of the Town and Country Planning Act 1990.

- If you want to appeal against your Local Planning Authority's decision then you must do so within **12 weeks** from the date of this notice for appeals being decided under the **Commercial Appeals Service** and **6 months** from the date of this notice for all other **minor and major applications.**

  - However, if an enforcement notice has been served for the same or very similar development within the previous 2 years, the time limit is:
  - **28 days** from the date of the LPA decision if the enforcement notice was served before the decision was made yet not longer than 2 years before the application was made.
  - **28 days** from the date the enforcement notice was served if served on or after the date the decision was made (unless this extends the appeal period beyond 6 months).
  - Appeals must be made using a form which you can obtain from the Planning Inspectorate by contacting Customer Support Team on 0303 444 50 00 or to submit electronically via the Planning Portal at

  https://www.planningportal.co.uk/info/200207/appeals/110/making_an_appeal

Commercial Appeals Service

- This type of appeal proceeds by way of written representations, known as the "Commercial Appeals Service". Third parties will not have the opportunity to make further representations to the Planning Inspectorate on these.

All other Minor and Major Applications

- The Secretary of State can allow a longer period for giving notice of an appeal, but he will not normally be prepared to use this power unless there are special circumstances which excuse the delay in giving notice of appeal.

- The Secretary of State need not consider an appeal if it seems to him that the Local Planning Authority could not have granted planning permission for the

proposed development or could not have granted it without the conditions they imposed, having regard to the statutory requirements, to the provisions of any development order and to any directions given under a development order.

- In practice, the Secretary of State does not refuse to consider appeals solely because the Local Planning Authority based on their decision on a direction given by him.

Purchase Notes

- If either the Local Planning Authority or the Secretary of State refuses permission to development land or grants it subject to conditions, the owner may claim that he can neither put the land to a reasonably beneficial use in its existing state nor render the land capable of a reasonably beneficial use by the carrying out of any development which has been or would be permitted.

- In these circumstances, the owner may serve a purchase notice on the Council (District Council, London Borough Council or Common Council of the City of London) in whose area the land is situated. This notice will require the Council to purchase his interest in the land in accordance with the provisions of Part VI of the Town and Country Planning Act 1990.

Date: 13 December 2018
Our ref: 266421
Your ref: MC/18/3363

Customer Services
Hornbeam House
Crewe Business Park
Electra Way
Crewe
Cheshire
CW1 6GJ

T 0300 060 3900

Hannah Gunner
Medway Council - Planning Service
Physical & Cultural Regeneration
Regeneration, Culture, Environment & Transformation
Civic Headquarters
Gun Wharf
Dock Road
Chatham ME4 4TR

BY EMAIL ONLY

Dear Hannah Gunner

Screening consultation: Town and Country Planning Act (Environmental ImpactAssessment) (England and Wales) Regulations 2017 (for the proposed development of a coverter station, substation and underground Direct Current electricity cables on land at Grain, Isle of Grain
Location: Land At Grain, Isle Of Grain , Kent.

Thank you for your consultation on the above dated 28 November 2018 which was received by Natural England on the same date.

Natural England is a non-departmental public body. Our statutory purpose is to ensure that the natural environment is conserved, enhanced, and managed for the benefit of present and future generations, thereby contributing to sustainable development.

There is no formal requirement of an Environmental Impact Assessment (EIA) for the proposed development under Schedule 2 or 3 of the Town & Country Planning (Environmental Impact Regulations) 2011 as the proposal is for the conduction, and not the production of electricity. However it would be advised that the statutory environmental evidence is presented in one consolidated document to facilitate the organisation of environmental assessments for the proposed development. A Habitats Regulations Assessment (HRA) will need to be undertaken in accordance with The Conservation of Habitats and Species Regulations 2017 and The Conservation of Offshore Marine Habitats and Species Regulations 2017. MCZ assessments will also be required under the Marine and Coastal Access Act 2009. A single consolidated environmental document would inform the Habitats Regulations Assessment as well as the Site of Special Scientific Interest (SSSI) process of the development. More detail on each topic can be provided to the applicant via their current DAS (discretionary advice service) contract, through which we have previously provided pre-application advice for this project.

Natural England has identified that the proposed location of the development would be within or adjacent (proximity of approximately 1.3km) to the following sites:

- South Thames Estuary and Marshes Site of Special Scientific Interest (SSSI)
- Medway Estuary and Marshes SSSI
- Thames Estuary and Marshes Special Protection Area (SPA)
- Medway Estuary and Marshes SPA
- Thames Estuary and Marshes Ramsar Site
- Medway Estuary and Marshes Ramsar Site

- Medway Estuary Marine Conservation Zone (MCZ)

Additionally the proposal site, as highlighted in the screening report, is also in close proximity to numerous other designated sites in the area. All of which are within 10km of the proposal site and therefore must also be considered as a route of impact on habitats and species. Furthermore the site is adjacent to an environmentally Sensitive Area known as the North Kent Marshes. Consideration should also be given to the potential environmental value of brownfield sites, often found in urban areas and former industrial land, further information including links to the open mosaic habitats inventory can be found here.

Natural England does not hold information on the location of significant populations of protected species, so is unable to advise whether this proposal is likely to affect such populations to an extent sufficient to require an EIA. It remains the case, however, that the developer must provide information supporting this application sufficient for you to assess whether protected species are likely to be affected and, if they are, whether sufficient mitigation, avoidance or compensation measures will be put in place.

Notwithstanding this advice, Natural England does not routinely maintain locally specific data on all potential environmental assets. As a result this application may raise environmental issues that we have not identified on local or national biodiversity action plan species and/or habitats, local wildlife sites or local landscape character that may be sufficient to warrant an EIA.

We therefore recommend that advice is sought from your own ecological and/or landscape advisers, local record centre, recording society or wildlife body on the local landscape, geodiversity and biodiversity receptors that may be affected by this development before determining whether an EIA is necessary.

Should you determine that an EIA is not required in this case, you should still ensure that the application is supported by sufficient biodiversity and landscape information in order for you to assess the weight to give these material considerations when determining the application.

Please note that Natural England reserves the right to provide further comments on this proposal beyond this EIA screening opinion, should your authority seek our views on the planning application. This includes any third party appeal against any screening decision you may make.

We would be happy to comment further should the need arise but if in the meantime you have any queries please do not hesitate to contact us.

For any queries relating to the specific advice in this letter only please contact Lucy Crooks on 07554116046. For any new consultations, or to provide further information on this consultation please send your correspondences to consultations@naturalengland.org.uk.

Yours sincerely

Lucy Crooks
Lead Advisor

Cramond, Tom

From: bratton, paul <paul.bratton@medway.gov.uk>
Sent: 05 December 2018 15:41
To: gunner, hannah
Cc: representations, planning
Subject: MC/18/3363 - Screening Opinion

Hi Hannah,

MC/18/3363 – Land at Grain

A full Landscape Visual Impact Assessment should be included as part of the EIA for this application.

- Clarification on the justification of location is needed.
- The development is not located within the industrial infrastructure envelope and is instead situated isolated, away from the developed edge.
- The application should consider the most appropriate location for development, being sensitive to minimise upon its impact on the landscape and any encroachment on the countryside. Consideration for the proposed development location should give as much importance on impact upon landscape character, as any importance on the proposal's visual impact.

- The Medway Landscape Character Assessment states:
  Landscape Character Area 3: Allhallows to Stoke Marshes:
  - Characteristics: Open, flat and expansive marshland landscape with big skies and wide views.
  - Guidelines: Ensure new development proposals respect open, remote character of marshland landscape and minimise visual intrusiveness; mitigation of impacts should be sought primarily through careful design and siting; planting and earth binding as secondary mechanisms; introducing extensive areas of planting (even using water tolerant species) would not generally be considered suitable to character of open marshland.

Paul Bratton | Landscape Officer
Medway Council, Planning Department, Gun Wharf, Dock Road, Chatham, ME4 4TR
Direct dial: 01634 333734 | Email: paul.bratton@medway.gov.uk

Cramond, Tom

From: steed, stuart <stuart.steed@medway.gov.uk>
Sent: 14 December 2018 12:03
To: gunner, hannah
Cc: representations, planning
Subject: MC/18/3363 Land at Grain, Isle of Grain

Hi Hannah,

I have reviewed the application for a an EIA scoping opinion.

My colleague Eric Lawson has already reviewed with respect to potential contamination issues.

I am happy with the proposed scope of the EIA with respect to air quality and noise.

There are likely to be construction and operational phase noise. Due to the long duration of the project I recommend that a construction phase noise assessment is carried out, and this should inform the scope of a Construction Environmental Management Plan (CEMP) and so set construction noise limits at representative noise sensitive receptors. The most appropriate standard for assessing the construction phase noise, and setting suitable noise limits and best practice controls and mitigation measures for this phase is BS5228.

The operational phase noise assessment should refer to applicable standards and guidelines (for example BS4142:2014) and particular attention needs to be taken to the consideration of low frequency sound. It may be beneficial to seek the advice of UK Power Networks on the suitable assessment of low frequency sound from these types of installations.

The noise assessments should be submitted with the application, however the CEMP can be included as a condition on any permission.

There are unlikely to be any operational air quality impacts associated with the development, however, like noise, there are likely to be construction phase impacts associated with emissions of fugitive dust (and other construction related emissions). I am satisfied with the proposed approach to include mitigation in accordance with the Institute of Air Quality Management guidance, which is a requirement of the Medway Air Quality Planning Guidance. The mitigation shall be included in the CEMP.

Regards,

Stuart.

Stuart Steed
Environmental Protection Officer
Medway Council
Gun Wharf
Dock Road
Chatham
Kent
ME4 4TR
Tel: 01634 331105
email: stuart.steed@medway.gov.uk

Cramond, Tom

From:	lawson, eric <eric.lawson@medway.gov.uk>
Sent:	05 December 2018 11:54
To:	gunner, hannah
Cc:	representations, planning
Subject:	MC/18/3363 - Land At Grain Isle Of Grain Kent

Hi Hannah

Town and Country Planning Act (Environmental Impact Assessment) (England and Wales) Regulations 2017 request for a screening opinion for the proposed development of a converter station, substation and underground Direct Current electricity cables on land at Grain, Isle of Grain

Further to your memo of 28 November 2018 regarding the above application I have now had the opportunity to review the EIA Scoping Report submitted in support of the application. I note that land contamination, noise and air quality are likely to be issues and these have been commented on in the report. The issues can be dealt with through conditions when a full application is received with more details of the proposed development. I will pass the application to Stuart Steed to comment further on air quality and noise issues.

Regards

Eric

Eric Lawson
Environmental Protection Officer
Environmental Health
Medway Council
Gun Wharf
Dock Road
Chatham
Kent ME4 4TR
email: eric.lawson@medway.gov.uk
Tel.: 01634 336627

Recommendation

EIA Not Required

Representations

The **Environment Agency, Natural England, KKC Archaeology and KCC Ecology have** been consulted. Internal consultees include Landscaping, Flood and Drainage, Environmental Protection, and Integrated Transport. As this is an application for a screening opinion, no neighbour consultations have been carried out.

Their comments are summarised below:

Natural England have advised that the statutory environmental evidence is presented in one consolidated document to facilitate the organisation of environmental assessments for the proposed development. A Habitats Regulations Assessment (HRA) will need to be undertaken in accordance with The Conservation of Habitats and Species Regulations 2017 and The Conservation of Offshore Marine Habitats and Species Regulations 2017. MCZ assessments will also be required under the Marine and Coastal Access Act 2009. A single consolidated environmental document would inform the Habitats Regulations Assessment as well as the Site of Special Scientific Interest (SSSI) process of the development. More detail on each topic can be provided to the applicant via their current DAS (discretionary advice service) contract, through which we have previously provided pre-application advice for this project.

Should you determine that an EIA is not required in this case, you should still ensure that the application is supported by sufficient biodiversity and landscape information in order for you to assess the weight to give these material considerations when determining the application

The ***Environment Agency*** have stated that they no longer make representations on screening opinion applications.

KCC Ecology have reviewed the submitted information in regards to determining if an ecological impact assessment (EcIA) will need to be carried out and advise that for this development, in terms of ecological impact, there are likely to be significant impacts. Therefore, an EIA for Ecology is required.

The Thames Estuary and Marshes SPA and Ramsar and the South Thames Estuary and Marshes SSSI is within 150m of the project area (where the substation will be located) and the cables will run directly through the designated sites. Therefore it is advised that the proposed development is likely to have a significant impact on biodiversity (both direct and indirect) and based on the above conclusion KCC Ecology advice that for this development an EIA for Ecology is required.

The submitted information has detailed that a range of ecological surveys are currently on going and the results of these surveys must inform the Environmental Statement. We

highlight that there has been a number of projects within Kent which have resulted in direct impacts to the mud flats through the installation of cables – they recommend that the results of the on-going monitoring from these projects are gathered to help inform the impact assessments and mitigation strategies.

KCC Archaeology have stated that the proposed development has the potential to impact a range of heritage assets including non-designated archaeological remains as well as designated assets (listed anti-invasion defences). It should be remembered that not all nationally important archaeological remains will be designated, either because their character is such that designation would not be appropriate or because their significance is not yet understood. The site in question lies in an area where archaeological remains of at least regional importance are already known, and there is the potential for further remains of similar or greater importance to be present within the proposed development area.

If the Council determine that EIA should be undertaken (either through the regulations or on a voluntary basis), then it is suggested any future ES should include a section on Archaeology and Cultural Heritage. If EIA is not required, then a comprehensive suite of information should still be required to support any future planning application, and KCC Arch. have confirmed that they would be pleased to engage with the applicant to ensure agree an appropriate programme of archaeological assessment.

Environmental Protection have confirmed that they are happy with the scope of works in relation to air quality and noise. It is also suggested that a construction phase noise assessment is carried out.

Flood and Drainage have no comment at this stage

Landscaping have confirmed that a full Landscape Visual Impact Assessment should be included as part of the EIA for this application.

- Clarification on the justification of location is needed.
- The development is not located within the industrial infrastructure envelope and is instead situated isolated, away from the developed edge.
- The application should consider the most appropriate location for development, being sensitive to minimise upon its impact on the landscape and any encroachment on the countryside. Consideration for the proposed development location should give as much importance on impact upon landscape character, as any importance on the proposal's visual impact.

The Medway Landscape Character Assessment states:
Landscape Character Area 3: Allhallows to Stoke Marshes:

- Characteristics: Open, flat and expansive marshland landscape with big skies and wide views.
- Guidelines: Ensure new development proposals respect open, remote character of marshland landscape and minimise visual intrusiveness; mitigation of impacts should be sought primarily through careful design and siting; planting and earth

binding as secondary mechanisms; introducing extensive areas of planting (even using water tolerant species) would not generally be considered suitable to character of open marshland.

Appraisal

EIA ANALYSIS AND SCREENING PROFORMA

1	Case details	
a	LPA case reference	
	MC/18/3363	
b	Site address	
	Land at Grain, Isle of Grain, Kent	
c	Brief description of development	
	Electricity converter station, substation and underground cables	
d	Is the request related to reserved matters?	
	Yes	
	No	*
	Is the request related to conditions	
	Yes	
	No	*
	If YES, enter the description of development subject of the related planning permission	
e	Area of development/works/new floorspace (not site area)	
	69700m² (6.97 hectares)	
2	EIA details	
A	Schedule 1	
(i)	Is the proposed development Schedule 1 development as described in Schedule 1 of the EIA Regulations?	
	Yes	
	No	*
(ii)	If YES, under which description of development i.e. No's 1 - 24?	
B	Schedule 2	
(i)	Is the proposed development Schedule 2 development as described in Column 1 of Schedule 2 of the EIA Regulations?	
	Yes	

	No	*
(ii)	If YES, under which description of the development in Column 1 i.e. No's 1 - 13?	
(iii)	Are the applicable thresholds/criteria in Column 2 of Schedule 2 of the EIA Regulations exceeded/met?	
	Yes	
	No	*
(iv)	If YES, which applicable threshold/criteria?	
(v)	Is the development within, partly within, or near a 'sensitive area' as defined by Regulation 2(1) of the EIA Regulations?	
	Yes	
	No	*
(vi)	If YES, Which area?	
3	Environmental Statement (ES)	
	Has the applicant supplied an ES for a current or previous (if reserved matters or conditions) application?	
	Yes	
	No	*

B. CONCLUSIONS		
i	Schedule and category of development	
	Does not fall into any.	
ii	Summary of features of project and of its location	
	a	Characteristics of development
		Industrial – converter and substation
	b	Location of development
		Land at Grain (nr Perry's Farm), Isle of Grain
	c	Characteristics of the potential impact
		Grain is located close to SSSI, AONB and Conservation Park – but not within any
iii	If a Screening Opinion (SO) has been provided - do you agree with it?	
	Yes	*
	No	
iv	Is an ES required?	
	Yes	
	No	*

SCREENING DECISION		
ASSESSMENT		Tick appropriate box
Schedule 1 development	ES required	No
Schedule 2 development - threshold exceeded, criterion met, within sensitive area and likely to have significant effects on the environment	ES required	No
Schedule 2 development - threshold exceeded, criterion met, within sensitive area and not likely to have significant effects on the environment	ES not required	No
Schedule 2 development - threshold exceeded, criterion met, not within sensitive area and likely to have significant effects on the environment	ES Required	No
Schedule 2 development - threshold exceeded, criterion met, not within sensitive area and not likely to have significant effects on the environment	ES not required	No
Schedule 2 development - threshold not met/not exceeded, criterion not met but within sensitive area likely to have significant effects on the environment	ES required	No
Schedule 2 development - threshold not met/not exceeded, criterion not met but within sensitive area not likely to have significant effects on the environment	ES not required	No
Schedule 2 development - threshold not met/but not exceeded, criterion not met, not within sensitive area not likely to have significant effects on the environment	ES not required	No

Recommended technical reports to accompany a subsequent planning application:

- Full Ecological and Biodiversity assessment
- Archaeological and Cultural Heritage Report
- Landscape Visual Impact Assessment
- Full Noise and Air Quality
- Transport Assessment
- Flood Risk report

See draft decision notice

ECOLOGICAL ADVICE SERVICE

TO: ***Hannah Gunner***

FROM: ***Helen Forster***

DATE: ***17 December 2018***

SUBJECT: ***MC/18/3363 Land At Grain, Isle Of Grain***

The following is provided by Kent County Council's Ecological Advice Service (EAS) for Local Planning Authorities. It is independent, professional advice and is not a comment/position on the application from the County Council. It is intended to advise the relevant planning officer(s) on the potential ecological impacts of the planning application; and whether sufficient and appropriate ecological information has been provided to assist in its determination. Any additional information, queries or comments on this advice that the applicant or other interested parties may have must be directed in every instance to the Planning Officer, who will seek input from the EAS where appropriate and necessary.

We have reviewed the submitted information in regards to determining if an ecological impact assessment (EcIA) will need to be carried out and we advise that for this development, in terms of ecological impact, there are likely to be significant impacts. Therefore, an EIA for Ecology is required.

Schedule 1
Under the Town and Country Planning (EIA) Regulations 2017, developments falling within Schedule 1 always require an EIA and are referred to as 'Schedule 1' developments.

EIA Screening
If the development falls within the selection criteria for a 'schedule 2' development of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, then it needs to be determined whether the proposal is situated within a 'sensitive area' and/or whether it is likely to have significant effects on the environment. Sensitive areas (as identified under Section 2(1), include the following ecologically designated sites: Site of Special Scientific Interest (SSSI), European Sites (Special Protection Areas (SPA), Special Areas of Conservation (SAC) and Ramsar Sites)). If the proposed development is located in, partly in, or has the potential to have any negative effect on these sites, then an assessment will be required. The regulations also include World Heritage Sites, schedule monuments, Areas of

Outstanding Natural Beauty (AONB) and National Parks, which are not dealt with in these comments.

To consider if the development will have significant effect on the environment, we have considered the selection criteria under 'Schedule 3' (EIA Regulations 2017).

The Thames Estuary and Marshes SPA and Ramsar and the South Thames Estuary and Marshes SSSI is within 150m of the project area (where the substation will be located) and the cables will run directly through the designated sites. Therefore we advise that the proposed development is likely to have a significant impact on biodiversity (both direct and indirect) and based on the above conclusion we advise that for this development an EIA for Ecology is required.

The submitted information has detailed that a range of ecological surveys are currently on going and the results of these surveys must inform the Environmental Statement. We highlight that there has been a number of projects within Kent which have resulted in direct impacts to the mud flats through the installation of cables – we recommend that the results of the on going monitoring from these projects are gathered to help inform the impact assessments and mitigation strategies.

If you have any queries regarding our comments, please do not hesitate to get in touch.

Helen Forster MCIEEM
Biodiversity Officer

This response was submitted following consideration of the following documents:
Screening Report; AECOM; November 18

Environment, Planning & Enforcement

Invicta House
County Hall
MAIDSTONE
ME14 1XX

Phone: 03000 413375
Ask for: Mr Ben Found
Email: ben.found@kent.gov.uk

14 December 2018

Your Ref: MC/18/3363
Our Ref: MC 18 3363 LE01

Mrs Hannah Gunner
Planning Service
Physical & Cultural Regeneration
Regeneration, Culture, Environment & Transformation
Medway Council
Gun Wharf
Dock Road
CHATHAM
ME4 4TR

SENT BY EMAIL

Re: **MC/18/3363**

Location: **Land at Grain, Isle Of Grain, Kent**

Proposal: **Town and Country Planning Act (Environmental Impact Assessment) (England and Wales) Regulations 2017 request for a screening opinion for the proposed development of a converter station, substation and underground Direct Current electricity cables on land at Grain, Isle of Grain.**

Dear Mrs Gunner

Thank you for your letter consulting us on the above EIA screening opinion request. In my advice I am focussing on the GB Onshore elements of the scheme. I would note however that the 'offshore' elements may also have an archaeological impact. Historic England provide specialist advice on marine projects to the Marine Management Organisation (MMO). You may wish to consult with Historic England on the application for a Screening Opinion as it is possible that constraints within the offshore area could affect the layout of onshore elements.

Appraisal
Electrical interconnectors and their individual components do not appear to be listed in the Schedules which describe and define what is an Environmental Impact

Assessment (EIA) development. Nevertheless, by virtue of their size and the nature of their physical impacts such works can lead to significant environmental effects.

In my advice below I intend to comment on the scheme's effect on non-designated heritage assets of archaeological interest within the GB Onshore Scheme area and consider the effects of the proposed works on these assets. The applicant has provided their own screening assessment to consider the effects of the scheme on Cultural Heritage and Archaeology in section 4.4 of their Screening Opinion Report but, as explained below, I do not entirely agree with their assessment and would suggest that the proposed mitigation measures set out in their report are inadequate.

I would suggest the proposed development has the potential to affect the following heritage assets and/or their setting:

- Sands and gravels of Pleistocene date which could contain Palaeolithic finds;
- Holocene deposit sequences containing a wide range of palaeoenvironmental indicators;
- Possible Late Neolithic – Early Bronze age funerary monuments and features associated with the Prehistoric exploitation of the Medway Marshes;
- A major "proto-urban" Iron Age settlement site and potentially Romano-British settlement;
- Other presently unknown non-designated archaeological remains; and
- A designated (grade II listed) line of WW2 period anti-tank/anti-invasion obstacles along the foreshore.

Archaeological interest

The site is located on the Isle of Grain which occupies a strategically important position, being at the point where two major rivers, the Thames and the Medway, meet. Now forming the easternmost point of the Hoo Peninsula, the Isle of Grain, was historically separated from the 'mainland' by a navigable tidal channel. This channel has now largely been reclaimed, but the 'island' still forms an area of flat and low upstanding ground in the Medway Marshes.

The Isle of Grain probably takes its name from the Old English *greosn*, meaning gravel. Mapping of the British Geological Survey shows the geology of the island to comprise London Clay capped by superficial deposits, including Pleistocene River Terrace Gravels. Substantial tracts of Pleistocene age sand and gravel units are known from the area, including sequences buried beneath the floodplain under varying depths of more recent Holocene alluvium. Depending on the precise age of the gravel bodies, they could contain Palaeolithic artefacts, biological and palaeoenvironmental evidence.

Elsewhere on the edge of the Isle of Grain important Holocene sediment sequences have been identified at the mouth of the Medway interbedded with marine sands. These deposits include fine-grained clays, silts and sands as well as peats and have been demonstrated to contain a wide range of palaeoenvironmental indicators including pollen, foraminifera and ostracods which provide important information for the reconstruction of past landscapes.

To the immediate south of the proposed site are a cluster of ring-ditches, which may represent the plough-flattened remains of Prehistoric (Late Neolithic to Early Bronze Age) burial mounds. These features can be seen as crop-marks on aerial photographs, located on the the 'higher' gravels of the island. It is also likely that the lower lying margins of the Isle of Grain would have attracted prehistoric activity, with communities exploiting the low-lying marshlands which would have provided natural resources and foodstuffs. Elsewhere along the Thames there is evidence from a number of locations for Bronze Age trackways, constructed to provide access to the marsh.

On the high-ground, in the area of Rose Court Farm, close to the proposed site of the substation and converter station a major proto-urban settlement site has been archaeologically investigated by the Kent Archaeological Rescue Unit ahead of gravel extraction. This major settlement covered a very substantial area and contained clear evidence for salt-working/production as well as involvement in farming and fishing. It has been suggested that the site is one of the most important Iron Age settlement sites in Kent. Along with extensive Iron Age activity, the investigations at Rose Court Farm have also revealed the presence of Romano-British features and cremations as well as a third to fourth century AD cemetery containing about 60 burials. This cemetery presumably relates to a Romano-British cemetery beyond the gravel pit limits.

There is limited evidence for Anglo-Saxon activity at Grain, mostly the result of chance finds. The Church of St James, within the modern-day settlement is thought to be of Norman date and is grade I listed. The recent history of the island is dominated by defence and industry. The Isle of Grain's position at the mouth of the Thames and Medway rivers means that it has long been identified as being of strategic importance. There are a number of defensive sites, many designated, along the eastern side of the island, whilst the low-lying marshes to the north-west along the Yanklet Creek have been used by the military as a firing range.

The defensive structures at the Isle of Grain include a line of WW2-period anti-tank obstacles along the foreshore. These anti-invasion defences are very well preserved and extend for some 570m along the foreshore. They were positioned here as the beach at Grain was perceived as an attractive landing site for any enemy invasion. The obstacles are designated, being grade II listed. The proposed line of the DC cable route (as illustrated in the applicant's Screening Opinion Report) is shown as passing through the line of these designated anti-tank obstacles.

Scheme impacts

The applicant suggests in their Screening Opinion Report that the proposed converter station and substation can be positioned to avoid known archaeological features (by means of 'micro-siting') as well as when routing the proposed underground cables. However, as described above, archaeological remains are likely to be present over an extensive area. **It is possible that currently unknown archaeological remains could be present across the scheme area, potentially including remains of at least regional, if not national importance**. Given the scale of the proposed Converter Station and Substation, which are described as

extending to some 250m by 250m and 120m by 60m respectively, it is extremely unlikely that archaeological remains could be avoided through micro-siting.

Similarly, the preferred method for cable installation is described as through open-cut trenching, within a 30m wide working corridor. Again, it may not be possible to avoid archaeological remains by means of route selection/deviation. The proposed cable route must presumably pass either through or under the listed anti-invasion defences on the foreshore and could result in physical harm to these designated assets.

Table 4 of the applicant's Screening Opinion Report suggests that an archaeological watching brief will be undertaken during construction, but I would suggest that a watching brief would be wholly inadequate as mitigation for a project of this type in this location.

Recommendations

From an archaeological perspective the proposed development does not lie within a "sensitive area" (as defined under regulation 2(1)), however I would suggest that the proposed development is in a location that has high archaeological potential and could contain archaeological remains of considerable importance, possibly including nationally important archaeology. The precise significance of any archaeological remains and the magnitude of the impacts caused by the proposals has yet to be fully established, but as a result of their nature and their scale, the proposed works could have a significant impact footprint.

It is for your council to determine whether an EIA is required; the applicant has suggested in their submission that the scheme is not development of a type referred to in Schedule 1 or Schedule 2 of the EIA Regulations and therefore is not 'EIA development'. Should you agree with the applicant's interpretation of the regulations, you might want to discuss options for the production of a "voluntary Environmental Statement" to accompany any future planning application to enable the anticipated environmental effects of the proposed works to be properly assessed and appropriate mitigation measures to be determined and implemented.

If your council determines that EIA is not required, then I would suggest that detailed assessment of the scheme's effect on the historic environment should be included as part of any future planning application. Such assessment should include a comprehensive and robust archaeological desk-based assessment (including assessment of the site's Palaeolithic interest), a Heritage Statement and it is likely that pre-determination field evaluation works will also be necessary. As such the level of baseline information required to support any planning application would be equivalent to that which we would expect to be included within a formal ES chapter on cultural heritage.

Conclusion

The proposed development has the potential to impact a range of heritage assets including non-designated archaeological remains as well as designated assets (listed anti-invasion defences). It should be remembered that not all nationally important archaeological remains will be designated, either because their character

is such that designation would not be appropriate or because their significance is not yet understood. The site in question lies in an area where archaeological remains of at least regional importance are already known, and there is the potential for further remains of similar or greater importance to be present within the proposed development area.

I would suggest that the effect of the development proposals on the site's archaeological interest should be a material consideration in the determination of any future planning application. If you determine that EIA should be undertaken (either through the regulations or on a voluntary basis), then I would suggest any future ES should include a section on Archaeology and Cultural Heritage. If EIA is not required, then a comprehensive suite of information should still be required to support any future planning application, and I would be pleased to engage with the applicant to ensure agree an appropriate programme of archaeological assessment.

I trust that the above information is helpful and would be pleased to discuss further if required.

Yours sincerely

Ben Found
Senior Archaeological Officer
Heritage Conservation

Appendix 3.B – Statement of Community Involvement

September 2019

Statement of Community Involvement

NeuConnect Interconnector

Created for NeuConnect

becg.com

Contents Page

Executive Summary

NeuConnect is proposing to develop the NeuConnect Interconnector, which would create the first direct power link between Germany and Great Britain, connecting two of Europe's largest energy markets for the first time. A pair of subsea cables will form an 'invisible highway' of around 720km allowing up to 1.4GW of electricity to move in either direction, enough to power tens of millions of homes over the life of the project.

As part of the extensive community engagement programme supporting the scheme, residents and stakeholders were given the opportunity to give their feedback on the proposals at all stages of the public consultation via a number of different channels. A freephone information line, freepost address and project email address were made available throughout the course of the planning stages for interested parties to receive further information and provide their feedback to the project team, whilst the project website was live from 15th February 2017 to provide interested parties with information on the project.

Pre-application briefing meetings with stakeholders and councillors from both Medway Council and Isle of Grain Parish Council were undertaken to enable key stakeholders to view the proposals prior to them being displayed to the wider community. These meetings took place on **Monday 5th November 2018** and **Tuesday 11th December 2018.**

An initial public information event was held on **Wednesday 21st November 2018**, which introduced the emerging proposals to the local community, to which approximately 2,000 households and businesses were invited to attend. Approximately 35 people attended the event, with 30 signing in electronically via the tablets provided. This discrepancy is common, e.g. when couples/groups sign in as one entry.

Following this initial consultation, two further public consultation events were held on **Thursday 20th June 2019** and **Saturday 22nd June 2019**, to which approximately 2,000 households and businesses were invited to attend. 26 people attended the consultation events, with 25 signing in electronically via the tablets provided. Feedback forms were made available for attendees to complete, so they could offer their opinions and views on the proposals. Members of the project team were also on hand to answer questions, discuss the plans and take note of all verbal feedback received.

To ensure as many local people as possible could hear about the plans and provide their feedback, NeuConnect proactively conducted a further mailing to residents of the Isle of Grain, which included the project's information leaflet and a feedback form to enable the local community to have their say.

This mailing was followed by a community canvassing session on the High Street of Grain village on **Monday 15th July 2019**. The post-event mailing and canvassing session both helped boost engagement levels even further and generated additional feedback responses from members of the local community.

As a result of NeuConnect's early and proactive engagement, a total of 32 feedback forms were completed, with extensive verbal feedback received at the consultation events and during canvassing.

The response to the proposals has been positive: **67%** supported or had no view on the proposed converter station and substation locations, whilst **71%** supported or had no view on the onshore underground cable route. In addition, **75%** of respondents noted that they found the consultation helpful in addressing their concerns and providing answers to their queries.

Two public consultation events were held on Thursday 20th June 2019 and Saturday 22nd June 2019 at Grain Village Hall, Chapel Road, Isle of Grain.

A number of respondents provided positive comments, noting that they were in favour of the proposals, with some respondents highlighting how the project would create jobs and provide a boost for the local economy.

A number of constructive comments and suggestions were also made, including suggested visual mitigation measures to limit the impact of the converter station and ensuring deliveries of materials were only permitted during non-peak hours, with some individuals noting there is only a single highways access to and from the site.

NeuConnect has carefully reviewed all the feedback received to date and, where possible, has evolved the proposals to address the comments raised by the local community. The main comments raised by the local community have been addressed within this document and the wider material submitted as part of the planning application.

NeuConnect is committed to engaging with the local community and, following the submission of the application, will ensure that interested parties and key stakeholders remain informed and updated regarding the proposals.

This document provides a chronological account of the pre-application consultation undertaken and a review of the feedback received.

1. Introduction

1.1 NeuConnect is developing plans for NeuConnect Interconnector: the first direct power link between Germany and Great Britain, providing a dependable and resilient connection between two of Europe's largest energy markets.

1.2 NeuConnect is being developed by an international, experienced consortium that includes Meridiam, Allianz Capital Partners on behalf of Allianz Group and Kansai Electric Power, with the project also supported by Greenage Power and Frontier Power as developers. The key partners bring a proven track record in delivering large-scale energy infrastructure, creating a team with significant experience and expertise in interconnector projects.

1.3 This document has been produced with the aim of clearly and concisely highlighting the community consultation undertaken by NeuConnect in respect of its proposal for the site.

1.4 This document will provide a chronological account of the consultation activity that has been undertaken during the pre-application stages of the planning application and the activity that Seaward proposes to undertake post-application.

1.5 In order to assist with the community consultation and communication, NeuConnect appointed Built Environment Communications Group (BECG), a specialist communications consultancy, to form part of its wider project team for the proposed redevelopment.

2. Background

2.1 Proposal site

2.1.1 All British onshore elements of NeuConnect are proposed to be located on land near the north shoreline of the Isle of Grain and to the west of Grain village.

A satellite image depicting the GB onshore elements at the site on the Isle of Grain.

2.2 Proposal

2.2.1 The GB onshore elements of NeuConnect's proposals, as depicted above, include:

- A landfall location, situated on the north coastline of the Isle of Grain, where an underground Transition Joint Bay (TBJ) will be constructed to bring the offshore High Voltage Direct Current (HVDC) cables ashore;

- Underground HVDC cables running from the landfall location to the new substation and converter station;
- A new substation, to enable NeuConnect to connect to the National Grid; and
- A converter station, to convert electricity from Direct Current (DC) to Alternating Current (AC).

2.1.1 In addition to the underground cable route, some changes will need to be made to the existing pylons close to the converter station site. This may include an additional pylon close to the proposed new substation, or the relocation of the exiting pylon currently located to the west of the proposed substation and converter station.

3. Pre-application Consultation

3.1 Statement of Community Involvement

3.1.1 NeuConnect has complied with the Government's National Planning Policy Framework (NPPF) which states that "*early engagement has significant potential to improve the efficiency and effectiveness of the planning application system for all parties.*"

3.1.2 The NPPF also highlights that *"good quality pre-application discussion enables better coordination between public and private resources and improved outcomes for the community."*

3.1.3 Medway Council formally adopted its SCI in December 2018. The pertinent section of the SCI is highlighted below:

> ***Working with developers***
>
> *3.6 Where developers are proposing major or sensitive developments, the council expects pre-application consultation and ongoing engagement. This should be carried out by developers or their agents to the standards set out in this SCI.*
>
> *3.7 The NPPF highlights the link between well-designed places and effective engagement. It states:*
>
> *"Good design is a key aspect of sustainable development, creates better places in which to live and work and helps make development acceptable to communities. Being clear about design expectations, and how these will be tested, is essential for achieving this. So too is effective engagement between applicants, communities, local planning authorities and other interests throughout the process".*
>
> *3.8 Applicants of major developments are expected to submit a separate Statement of Community Involvement to explain how they have built engagement into the development proposal process.*
>
> *3.9 The NPPF states: "Applicants should work closely with those affected by their proposals to evolve designs that take account of the views of the community. Applications that can demonstrate early, proactive and effective engagement with the community should be looked on more favourably than those that cannot".'*

3.10 The council encourages developers to present significant development proposals to councillors at early stages in the planning process, before submitting an application. These presentations are useful in advising members about the proposals and raising key issues. The council also encourages the use of models and materials to help communicate the scope and impact of developments. These can be particularly helpful at exhibitions. Design Review Panels, run in Medway by Design South East, have a valuable use with larger or more sensitive proposals.

Encouraging early involvement with neighbours in small-scale proposals

3.11 The council encourages applicants to talk to their neighbours informally before finalising their plans and submitting their application.

3.12 There are added benefits to both local people and applicants in involving neighbours at an early stage. For applicants, it can inform them of issues that they can address prior to a planning application being submitted saving time and avoiding conflict. For neighbours, it allows them to have an input before proposals reach an advanced stage.

3.1.4 Government guidance and Medway Council's SCI encourage pre-application discussions and community involvement. As a result, the public consultation programme had a number of key objectives, including:

- To encourage as much input as possible from the local community, including residents, interest groups, councillors and businesses;
- To provide the community with a genuine opportunity to provide feedback on the plans;
- To allow people to become actively involved in the process; and
- To identify and address any issues raised by the local community and stakeholders.

3.1.5 Therefore, prior to submitting the formal planning application for the site, NeuConnect undertook a detailed programme of community consultation, as outlined in the following documentation.

3.2 Contacting Statutory Bodies

3.2.1 During the pre-application stage, NeuConnect sought engagement with all relevant statutory bodies. This included engaging in Medway Council's formal pre-application process.

3.2.2 This process was undertaken in parallel with the community engagement programme, allowing for feedback from statutory and non-statutory stakeholders to be considered and input into the final planning application, where possible.

3.3 Stakeholder Briefings (Late 2018)

3.3.1 NeuConnect felt it was important to discuss the early proposals for the project with local stakeholders in advance of the wider community consultation.

3.3.2 Therefore, NeuConnect arranged a presentation for both councillors and officers at Medway Council on **Monday 5th November 2018**.

3.3.3 The presentation included information on the following topics:

- About NeuConnect;
- Overview of the project;
- Benefits;
- GB onshore elements;
- Offshore elements;
- Project timescales;
- Public consultation; and
- Contact details.

3.3.4 In addition, NeuConnect also attended Medway Council's Rural Liaison Committee on **Tuesday 11th December 2018** and gave a presentation to both elected Medway councillors and Isle of Grain Parish Council representatives.

3.3.5 The presentation included information on the following topics:

- About NeuConnect;
- Overview of the project;
- Benefits;
- GB onshore elements;
- Offshore elements;
- Project timescales;
- Public consultation; and
- Contact details.

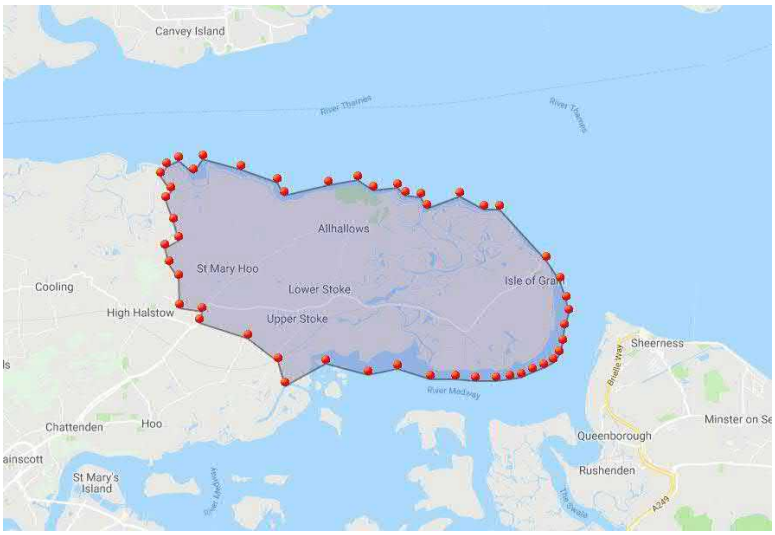
3.3.6 Both meetings also provided stakeholders with an opportunity to discuss the proposals with members of the project team and ask any questions they had with regards to the project.

3.4 Public Information Event (November 2018)

3.4.1 NeuConnect held a public information event to display its initial proposals for NeuConnect Interconnector on **Wednesday 21st November 2019** between 3.00pm and 7.00pm at Grain Village Hall, Chapel Road, Isle of Grain. A stakeholder preview was held between 2pm – 3pm, ahead of the information event for the Parish and Medway councillors, as well as interested community groups and stakeholders.

3.4.2 The purpose of the information event was to introduce the proposals to the wider community prior to conducting pre-application consultation on the proposals.

3.4.3 An invitation newsletter was distributed to 2,120 households and businesses in the local area advising them of the proposals, and the public information event. The invitations were sent to those homes and businesses thought to be most affected by the proposals within the immediate vicinity and were distributed on **Tuesday 13th November 2018**. The following map illustrates the distribution area.



A map depicting the area targeted in the information event invitation newsletter distribution area

3.4.4 The A4 invitation leaflet contained the following:

- Information about NeuConnect;
- Details of the public information event;
- An overview of the proposals;
- Background to the project;
- Benefits;
- Need for interconnectors; and
- Contact details.

3.4.5 A copy of the invitation newsletter can be found in the Appendices.

3.4.6 Copies of the invitation were also issued to a number of local stakeholders, including:

- Medway Council Cabinet members;
- Medway Council Ward Members for Peninsula;
- Local Parish Councils;
- Kelly Tolhurst MP; and
- A number of third-party groups based in the vicinity of Grain.

3.5 Media Relations

3.5.1 To further publicise the public information event, a press release was issued to the Medway Messenger. The press release contained the following information:

- Background to NeuConnect;
- Overview of the project;
- Details of the public information event;
- Project timescales; and
- Contact details.

3.5.2 Following the information event, a second press release was issued to the Medway Messenger, which contained the following information:

- Background to NeuConnect;
- Overview of the project;
- Summary of the public information event;
- Project timescales; and
- Contact details.

3.5.3 Copies of both press releases are included in the Appendices.

3.6 Information Event Display

3.6.1 The information event displayed details about the proposal ahead of submitting a planning application. The display boards included the following information:

- Background to NeuConnect;
- Overview of the project;
- Need for interconnectors;
- GB onshore elements, including:
    - Onshore cable, and potential onshore cable routes
    - Converter station and proposed converter station location at Grain
    - Proposed substation location at Grain
- Offshore elements, including:
    - Subsea cable route; and
    - Landfall location.
- Benefits;
- Onshore and offshore planning processes;
- Project timescales; and
- Contact details.

3.6.2 A copy of the display boards presented at the public information event can be found in the Appendices.

3.6.3 The following materials were also available:

- Copies of the display boards;
- Copies of the invitation newsletter;
- Copies of the information leaflet; and
- iPads, for registering attendance.

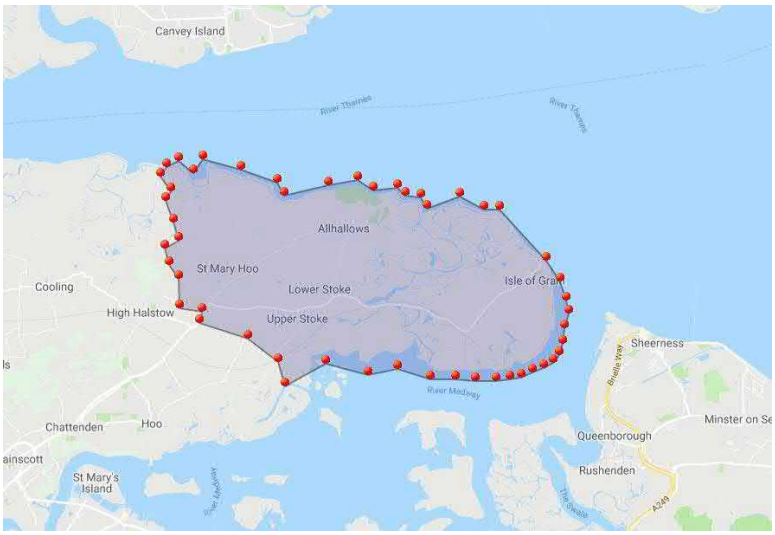
3.6.4 Representatives of the project team were available to answer questions throughout the information event, including two members of NeuConnect staff, two engineering consultants from AECOM and two consultants from BECG.

3.7 Public Consultation Events (June 2018)

3.7.1 Following the public information event, NeuConnect held two public consultation events to display its final proposals for NeuConnect Interconnector on **Thursday 20th June** 2019 between 4.00pm and 8.00pm, and on **Saturday 22nd June** between 11.00am and 4.00pm. Both events were held at Grain Village Hall, Chapel Road, Isle of Grain.

3.7.2 A stakeholder preview was held between 3.00pm and 4.00pm, ahead of the event on **Thursday 20th June 2019** for the Parish and Medway councillors, as well as interested community groups and stakeholders.

3.7.3 An invitation newsletter was distributed to 2,120 households and businesses in the local area advising them of the proposals, and the public information event. The invitations were sent to those homes and businesses thought to be most affected by the proposals within the immediate vicinity and were distributed on **Thursday 6th June**. The following map illustrates the distribution area.



A map depicting the area targeted in the public consultation invitation newsletter distribution area

3.7.4 The A4 invitation leaflet contained the following:

- Information about NeuConnect;
- Details of the public information event;
- An overview of the proposals;
- Background to the project;
- Benefits;
- Need for interconnectors; and
- Contact details.

3.7.5 A copy of the invitation newsletter can be found in the Appendices.

3.7.6 Copies of the invitation were also issued to a number of local stakeholders, including:

- Medway Council Cabinet members;
- Medway Council Ward Members for Peninsula;
- Local Parish Councils;
- Kelly Tolhurst MP; and
- A number of third-party groups based in the vicinity of Grain.

3.8 Media Relations

3.8.1 To further publicise the public information event, a press release was issued to the Medway Messenger. The press release contained the following information:

- Background to NeuConnect;
- Overview of the project;
- Details of the public consultation events;
- Benefits;
- Project timescales; and
- Contact details.

3.8.2 A copy of the press release is included in the Appendices.

3.8.3 In addition, NeuConnect placed a paid-for advert in the Medway Messenger. The advert included the following information:

- Overview of the project;
- Details of the public consultation events; and
- Contact details

3.8.4 A copy of the advert is included in the Appendices.

3.8.5 Following the information event, a second press release was issued to the Medway Messenger, which contained the following information:

- Background to NeuConnect;
- Overview of the project;
- Summary of the public consultation events;
- Summary of the feedback received;
- Project timescales; and

- Contact details.

3.8.6 A copy of the press release is included in the Appendices.

3.9 Public Consultation Display

3.9.1 The public consultation events displayed details about the proposal ahead of submitting a planning application. The display boards included the following information:

- Background to NeuConnect;
- Overview of the project;
- Need for interconnectors;
- Offshore elements, including:
    - Offshore cable route; and
    - Landfall location;
- GB onshore elements, including:
    - Onshore cable route;
    - National Grid overhead line;
    - Cable installation;
    - Converter station;
    - Substation;
    - Mitigation measures;
- Highways and environment;
- Environment & ecology works;
- Benefits;
- Project timescales; and
- Contact details.

3.9.2 A copy of the display boards presented at the public consultation events can be found in the Appendices.

3.9.3 The following materials were also available:

- Copies of the display boards;
- Copies of the invitation newsletter;
- Copies of the information leaflet;
- Feedback forms;
- iPads, for registering attendance;

- Freepost envelopes for the feedback forms; and
- A video providing an overview of the project.

3.9.4 Feedback forms could either be filled in on the project website, at the venue or posted back by using the supplied freepost envelopes. All feedback received by Friday 19th July 2019 was then collated and analysed. The original feedback deadline of Monday 8th July 2019 was extended to provide interested parties with additional time to provide their thoughts on the proposals.

3.9.5 A copy of the feedback form is included in the Appendices.

3.9.6 Representatives of the project team were available to answer questions throughout the information event, including two members of NeuConnect staff, two engineering consultants from AECOM and two consultants from BECG.

3.10 Additional Mailing and Canvassing (July 2019)

3.10.1 In order to generate additional feedback from the local community, NeuConnect sent a copy of the information leaflet, together with a copy of the feedback form and a freepost envelope to 681 households and businesses in Grain village to provide the local community with a further opportunity to comment on the proposals. The following map illustrates the distribution area:

A map depicting the area targeted in the post-consultation feedback distribution area

3.10.2 A copy of the information leaflet is available in the Appendices.

3.11 Community Canvassing Session (July 2019)

3.11.1 To ensure as many local people as possible could hear about the plans and provide their feedback, NeuConnect followed up on the public consultation events by proactively conducting a further community canvassing session on High Street, Isle of Grain on **Monday 15th July 2019**. This session helped boost engagement levels even further and generated additional feedback responses from members of the local community.

3.11.2 Following the mailing, NeuConnect conducted a community canvassing session on High Street, Isle of Grain on **Monday 15th July** between 4.30-7pm.

3.11.3 Two consultants from BECG were present on the High Street during this period to present the proposals to those who were not familiar with the project and provide the opportunity for members of the local community to provide their thoughts via a digital version of the feedback form.

3.11.4 This proactive approach was well received by the community, with many members of the public noting their appreciation for opportunity to comment on the proposals further.

3.12 Dedicated project website

3.12.1 A dedicated project website was set up to provide information about the proposals and was continuously updated throughout the public consultation process. The website is hosted at www.neuconnect.eu.

3.12.2 The website address was printed on all collateral produced as part of the public consultation process.

3.12.3 The website includes:

- Overview of the project;
- Background to NeuConnect;
- Need for interconnectors;
- Details of public consultation;
- Procurement information;
- News about the project;
- Benefits;
- Project timescales; and
- Contact details.

3.12.4 In addition to the website, NeuConnect also created a custom video for use both on the project website and at the public exhibition events, which provided information on the following topics:

- Overview of the project;
- Background to NeuConnect;
- Need for interconnectors; and
- Benefits.

Between November 2018 and up to 29th July 2019, the website was viewed by a total of 1,693 users across 2,328 sessions, with approximately 110 users visiting the site per day at its peak.

3.13 Post-paid and 0800 Comment Facility

3.13.1 During the consultation, access to a freephone telephone enquiry line was offered to those who wished to find out more about the proposals, or to register their comments via the telephone.

3.13.2 The telephone number used (0800 298 7040) was in operation Monday-Friday between the hours of 9.00am and 5.30pm. Outside of these hours a message facility was available for voicemails to be left and responded to at the earliest opportunity to ensure information was readily available and queries or concerns addressed.

3.13.3 Information was given to callers where possible and if questions were of a technical nature, these were passed on to project team members.

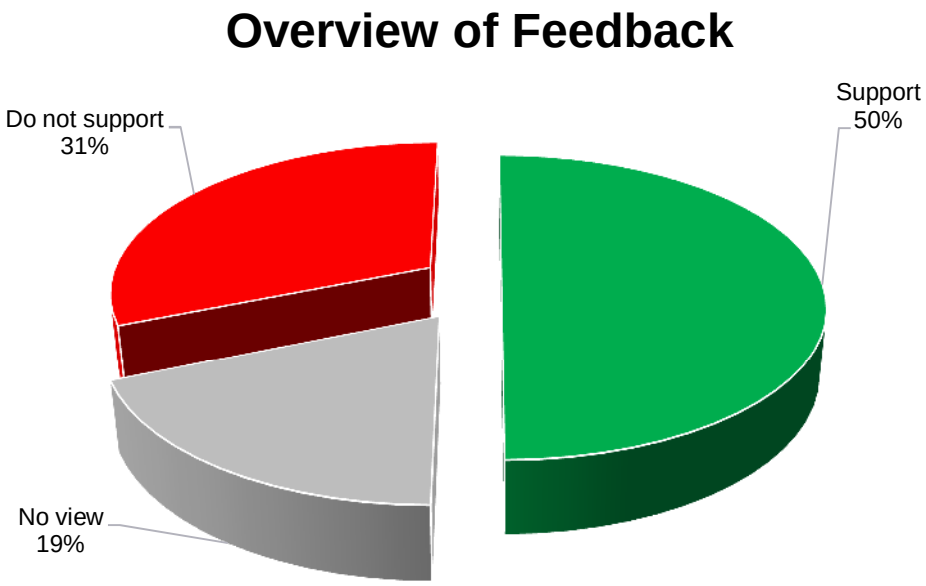
3.13.4 A freepost envelope was available (to take away) by all public consultation attendees to encourage feedback.

3.14 Review of Comments

3.14.1 The tone of the responses received to all feedback questions on forms received by Friday 19th July 2019 (including postal responses, telephone and email feedback) was as follows:

Total no. of responses	Support	No View	Oppose
32	16	6	10
-	50%	19%	31%

NB: Percentages are rounded to the nearest whole number throughout this document.



3.14.2 The tables below analyse responses to the specific questions asked on the feedback form provided at the public exhibition. A number of responses were received via the website or by post via email.

Q1. Have you found the information presented at the pubic consultation helpful in addressing concerns or questions you may have had?		
Total no. of responses	**Yes**	**No**
28	21	7
-	75%	25%

Neutral comments, questions and suggestions	Frequency
Maintain open lines of communication throughout the project	1
Was not aware of the consultation	1
Unable to attend a consultation event	1

Negative comments	Frequency
Oppose the project	1
NeuConnect has failed to consult fully with National Grid LNG	1
Lack of optioneering in relation to converter station siting	1
Inadequate consultation with Thamesport International Limited	1
No illustrations provided of the converter station	1

Q2. What are your views on the plans for the converter station and substation, and the proposed approach to landscape mitigation?			
Total no. of responses	**Support**	**No view**	**Do not support**
30	15	**5**	10
-	50%	17%	33%

Positive comments	Frequency
Converter station will not have a visual impact on the landscape	1

Neutral comments, questions and suggestions	Frequency
Minimise visual impact	3
Should be located adjacent to the BritNed converter station	2
Will visual mitigation measures be put in place?	1
Keep the area tidy	1
Why were the other cable route options discounted?	1
Need to ensure that there is no impact on the landfill site at the former BP Refinery	1

Negative comments	Frequency
Oppose converter station location	4
Oppose the project	2
Concerned about potential noise impact	2
Converter station is located too close to Grain village	1
Will have a detrimental impact on the local environment	1
Oppose the cable route	1
Converter station will remove farmland	1
Will negatively impact LNG terminal	1
Negative impact on residential properties	1

Q3. Do you agree with the approach to the onshore underground cable?			
Total no. of responses	Support	No view	Do not support
28	13	7	8
-	46%	25%	29%

Neutral comments, questions and suggestions	Frequency
Locating the converter station adjacent to the existing BritNed infrastructure would significantly reduce the length of the cable route	1

Negative comments	Frequency
Cable is too close to residential properties	2
Concerned at potential impact of EMF	1

Q4. Do you have any general comments regarding the landfall location, such as environmental considerations, timing and management plan for the works?	
Neutral comments, questions and suggestions	**Frequency**
How will local wildlife be protected?	1
Carry out work in accordance with agreed plans	1
Why not locate this adjacent to the existing BritNed Interconnector?	1
Grid connection and new substation have been dictated by National Grid	1

Negative comments	Frequency
Concerned at potential impact of EMF	1
Will have a detrimental impact on the local environment	1
Will cause disruption on Grain Road	1
Landfall should be located further down the River Medway, away from the village	1
New substation does not need to be located on the north coastline of Grain	1

Q5. To assist us in developing a traffic plan to minimise disruption during construction, are there any factors you believe we should take into consideration?	
Neutral comments, questions and suggestions	**Frequency**
Noted that there is only one access to and from Grain village	3
Place daily limits on numbers of construction vehicles	2
Large plant should be brought in via boat using Thamesport	2
Do not allow deliveries during morning and evening rush hour	2
Manage light pollution	1
Ensure construction traffic only enters and exits the site during agreed working hours	1
Address drainage issues near proposed access	1
Ensure all large loads are delivered at night	1
Maintain access to Grain village at all times	1
Provide two weeks' notice of any road closures	1
Install a lorry rejection facility to prevent lorries reversing, should they accidentally bypass the site entrance	1
Lorries must obey speed limit	1
Construction traffic unlikely to have an impact due to significant heavy vehicle movements at present	1

Negative comments	Frequency
Condition of the road surface may be worsened by construction traffic	2
Potential for additional traffic congestion/disruption	1
Grain Road is not suitable for construction traffic	1
Opposition to the project	1

Q6. Do you have any comments in regard to our plans in preparing for the environment and ecology works on site?	
Neutral comments, questions and suggestions	**Frequency**
Need to mitigate impact on the recently re-introduced reptiles in the area of the former BP refinery	2
Reinstate land to previous condition following completion of construction	1
Do not disturb wildlife during breeding season	1

Negative comments	Frequency
Will have a detrimental impact on the local environment	3
Oppose the project	1
Will have a negative visual impact	1

Q7. Do you have any further comments or questions?	
Positive comments	**Frequency**
Expressed support for the project	4
Will create jobs and boost the local economy	3
In favour of increased connectivity with European energy markets	1

Neutral comments, questions and suggestions	Frequency
Interested in job opportunities	2
Keep residents informed throughout the planning process	1
Construct breeding habitats to promote re-introduction of wildlife in the area	1
Will the substation produce any additional noise?	1
Requested financial contributions to fund local infrastructure improvements	1

Neutral comments, questions and suggestions	Frequency
Will negatively impact upon property prices	1
Oppose the project	1
Project will cause significant disruption	1
Concerned at noise impact	1
Project will have a negative visual impact	1
Increase in pollution during construction will negatively impact residents	1
NeuConnect have overlooked preferable brownfield sites for the converter station	1
Thamesport International Limited will register their objection to the planning application	1
National Grid LNG intend to object to the planning application	1

4. Response to Comments

4.1 All comments received have been reviewed by the project team and, where possible, amendments were made to the proposal. Feedback was also given at the public consultation events and questions were answered. Many of the issues raised are covered in the application documents which accompany this response.

4.2 During the consultation feedback review period, NeuConnect's project team responded directly to a number of specific enquiries and questions relating to the proposals and individual response letters were drafted and issued where appropriate.

4.3 NeuConnect is pleased to have received a significant amount of feedback on the proposals, and will continue to review these comments as it refines its proposals.

4.4 The main issues which arose during the pre-application consultation process and NeuConnect's response to each are detailed below:

- **Visual mitigation of the converter station:** A number of individuals expressed their desire to see the converter station screened adequately so as to minimise the visual impact of the building.

- **NeuConnect's response:** As part of the application, NeuConnect have considered all possible options to minimise the visual impact of the converter station and have incorporated revisions into the final design proposals.

  Measures include setting the converter and substation buildings into their dropped landscape, maximizing the screening that the current environment provide, and further planting around the site perimeter.

  The siting and orientation of the converter station within the chosen site at Grain has been selected taking into consideration the best 'fit' into the existing landscape. This includes being farthest away from the residences in Grain village and orientated so that the larger massing of buildings is located further south also.

- **Mitigation measures to combat additional noise:** Multiple respondents stated that the existing BritNed converter station produced an audible 'hum', despite being located a significant distance from Grain, and asked NeuConnect to implement measures to mitigate any additional noise from the converter station and substation.

- **NeuConnect's response:** While the substation and converter station will produce some additional noise, the audible impact upon residential properties in the respective localities at the Isle of Grain is expected to be minimal due to the significant distance between the local properties and the converter station and substation. Medway Council will set appropriate noise limits that NeuConnect will not be permitted to exceed.

  In order to meet such designated limits, NeuConnect will implement a number of measures to mitigate against the audible impact of the substation and converter station. These measures could include:

  - Use of enclosures;
  - Localised barriers; and
  - Improving the acoustic performance of the buildings to better contain the noise.

- **Traffic Management:** Several individuals noted that there is only one road access to and from Grain village and asked that this be taken into consideration when developing a Traffic Management Plan.

- **NeuConnect's response:** NeuConnect are aware of the need to ensure very robust traffic management plans are in place, and will work closely with Medway Council to establish a

Construction Management Plan which will help manage the impact of construction. The Construction Management Plan will mitigate the impact of construction traffic and sets out best practice in terms of acceptable operating hours to minimise any disruption to local residents.

- **Protecting the environment:** Several respondents noted that the local environment had been improving in recent years and requested that NeuConnect minimise the environmental impact of the project wherever possible.

- **NeuConnect's response:** As part of the application, NeuConnect has submitted an Environmental Statement (ES) to Medway Council which sets out and defines the commitments for the project to help protect the environment.

  The scope of the ES includes the following areas:

  - Ecology;
  - Landscape and visual amenity;
  - Noise;
  - Traffic and transport;
  - Water resources and flood risk;
  - Archaeology and cultural heritage; and
  - Ground conditions.

  In addition, the proposed onshore cable route has been designed to limit environmental disturbance during the installation process by following areas of existing hardstanding, whilst the area of landfill to the northeast of the converter station site has been avoided to prevent the risk of disturbance of the landfill material and the potential impacts to the environment.

5. Post-Application Consultation

5.1 On-going Stakeholder Engagement

5.1.1 Given the interest shown by residents and stakeholders, NeuConnect will ensure information continually flows through existing channels to interested parties.

5.2 Updating Materials

5.2.1 The project website, www.neuconnect.eu will be updated at key milestones throughout the application process.

5.3 Updating Materials

5.3.1 A notification will be sent to all stakeholders informing them of the application's submission.

5.3.2 NeuConnect will also update all local residents and businesses who registered an interest in the development via the project website, or acknowledged that they wished to be kept updated on the feedback forms or iPad sign-in surveys.

6. Conclusion

6.3 This Statement of Community Involvement summarises the extensive engagement activities, consultation and feedback received during the pre-application period. The Applicant has demonstrated their commitment to conduct an early and proactive programme of political and community engagement.

6.4 In addition to the public exhibitions, public information events and community canvassing sessions which have taken place over the preceding year, BECG reached out to local political stakeholders over the life of the project and have provided local people with the opportunity to feedback their ideas online, in person, through the post and over the phone.

6.5 The Public consultation events held in November 2018 and in July 2019 were underpinned by both pre-exhibition engagement and post-exhibition follow-up activities. The engagement programme has allowed the development team to gauge the local community's perception of the proposals and relay any comments or discussion points to the Applicant to review against the proposals.

6.6 The Applicant will continue to engage with stakeholders and the public to inform them about the progress of the development to seek further feedback from the community.

7. Appendices

- Copy of the information event boards;
- Copy of the information leaflet available at the information event;
- Copy of the public consultation event boards;
- Copy of the information leaflet available at the public consultation events;
- Copy of the feedback form;
- Copy of the pre-information event stakeholder letter;
- Copy of the pre-information event press release;
- Copy of the post-information event press release;
- Copy of the pre-public consultation event stakeholder letter;
- Copy of the pre-public consultation event press release;
- Copy of the pre-public consultation paper advert; and
- Copy of the post-public consultation press release.

Appendix 5.A – Landscape Assessment

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Appendix 5.A: Landscape Assessment

NeuConnect Britain Ltd

September 2019

Prepared for:

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Table of Contents

Figures

No table of figures entries found.

Tables

Appendix 5.A Landscape Assessment

1.1 This Appendix should be read in conjunction with Chapter 5: Landscape and Visual Amenity and Figures 5.1-5.4. All landscape and visual mitigation is embedded and descried in Chapter 02-Proposed GB Onshore Scheme. All effects identified in the tables below are therefore residual.

1.2 This appendix provides a detailed assessment of the significance of effects on landscape receptors at each of the assessment phases: Construction, Operation (year 1) and Operation (year 15). The assessment is set out in Tables 1 to 5 below.

1.3 For the purposes of this assessment construction activities associated with the DC cable route would be experienced for up to 1 year and construction of the proposed converter station and substation would extend across a three-year programme and therefore duration is considered to be short term and reversible.

1.4 At year 1 and year 15 of operation it is considered that the duration would be long term and permanent and the proposed converter station, substation and DC cable route would not be decommissioned.

Allhallows to Stoke Marshes

Table 1 Allhallows to Stoke Marshes

Sensitivity of Landscape Receptor	Magnitude of Change	Significance of Effect
Value: Medium Susceptibility: This is a low level landscape where the horizontal nature of the big skies contributes to the strong identity and is vulnerable to the introduction largescale structures not currently present within this landscape. However given the close proximity of other industrial development to the Project Area, this LCA offers some capacity to accommodate the development. Susceptibility is considered to be **Medium**. Landscape Sensitivity: Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character is considered to be **Medium**.	Construction: Construction activity related to the proposed converter station and substation would be located within this LCA at the eastern edge resulting in effects on both the landscape fabric and character. Construction activities would be concentrated at the eastern edge, adjacent to the National Grid LNG terminal complex where extensive earthworks to create the platform, storage of materials, lay down areas, movement of plant and operation of cranes would be more apparent. However the area of land occupied by construction activities is somewhat physically detached from the majority of this LCA due to pockets of boundary vegetation, land use and most notably higher topography with very limited access. Therefore construction activities would be confined to a small portion of this LCA and concentrated away from the core area of the marshland where there would be no change to the most distinctive elements of the landscape fabric. The presence and scale of activity would have a noticeable bearing on the setting and perceptual quality of this LCA. In particular the scale and intensity of activity would reduce the existing level of tranquillity experienced and is more prevalent in eastern areas. Construction activities related to the DC cable route corridor would result in temporary physical changes to the fabric of the landscape and character within a very small footprint to the north-east of this LCA. Construction of the intertidal section of the subsea cable route would extend across the distinctive mudflats which are a characteristic feature of the North Kent Marshes SLA. Construction activities would extend from the intertidal mudflats leading to the landfall site and within the corridor for the proposed DC cable route leading to the proposed converter station and would further increase the scale and extent of activity within the landscape and North Kent Marshes SLA. Activities associated with the onshore length of the DC cable route would include the movement of plant and earthworks required for open cut trenches within a 30m wide corridor, between the proposed converter station and the landfall at the eastern extent of this LCA. Overall construction activities would affect some of the key characteristics and special qualities across a small but noticeable portion of the landscape. However there would be no physical change to the distinctive core landscape elements. On balance the magnitude of change is considered to be **Medium**.	**Moderate Adverse (Significant)**

Sensitivity of Landscape Receptor	Magnitude of Change	Significance of Effect
	The magnitude of change, assessed alongside the sensitivity would result in a **Moderate Adverse** effect, which is considered **significan**t.	
	<u>Operation (Year 1):</u> The completed proposed converter station and substation would occupy an area within this LCA but outside of the North Kent Marshes SLA and therefore would result in physical changes to the landscape fabric. Changes to the special qualities of the SLA would however be limited to the setting and perceptual aspects. The proposed converter station and substation would occupy a small area of agricultural farmland and vacant land at the eastern edge of this LCA and adjacent to the industrial complexes including the LNG terminal on land that does not exhibit the core characteristics and higher value landscape elements of the marshland landscape. The scale and mass of the proposed converter station and substation would be smaller than the adjacent LNG storage tanks and would be contained within the area of land between the OHL to the north and the industrial complexes to the south which together would limit the impression of change within this LCA. The DC cable route corridor would be fully reinstated and no permanent structures would remain in the landscape. Therefore the completed cable route would have no bearing on this LCA. Although the proposed converter station and substation would increase the influence of industrial development on the setting and backcloth of this LCA, the strong sense of place, open and panoramic views of the coastline and distinctive landscape elements would all remain intact. Overall the proposed converter station and substation would affect very few of the key characteristics across a small portion of this LCA. Taking all of this into account the magnitude of change is considered to be **Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	**Minor Adverse**
	<u>Operation (Year 15):</u> Physical changes to the landscape fabric of this LCA due to the introduction of the proposed converter station and substation would be the same at year 1 of operation. However the establishment of vegetation would help to reduce the scale and mass of proposed buildings and subsequently reduce the influence of the proposed converter station and substation would have on this LCA. The boundary vegetation would provide a transitional interface between the marshland landscape and the proposed converter station and substation. The resulting impression would be that the proposed converter station and substation would no longer be associated within the character and impression of this LCA. In the long term the proposed converter station and substation would be more characteristic and associated with the adjacent Industrial/ Urban Area. The establishment of native scrub and wetland vegetation would improve the strength of	**Minor Adverse**

Sensitivity of Landscape Receptor	Magnitude of Change	Significance of Effect
	the boundary vegetation and biodiversity at the interface between the proposed converter station and substation site and the core of the marshland landscape. Overall although the proposed converter station and substation would have a small but noticeable bearing on the eastern setting of this LCA, the most integral key characteristics of the landscape and the special qualities of the SLA would remain intact. Taking all of this into account the magnitude of change is considered to be **Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	

Hoo Peninsula Farmland

Table 2 Hoo Peninsula Farmland

Sensitivity of Landscape Receptor	Magnitude of Change	Significance of Effect
Value: Low Susceptibility: The intervening landscape and existing influence of the large scale industrial complexes on Grain, in particular the LNG terminal, and the Project Area result in a landscape tolerant of the change proposed. Susceptibility is considered to be **Low**. Landscape Sensitivity: Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character is considered to be **Low**.	Construction: Construction activities associated with the proposed converter station and substation would be located outside of this LCA at the eastern extents of the Allhallows to Stoke Marshes LCA. Activities including the movement of plant, earthworks and the operations of tower cranes would have some bearing on the eastern setting but limited to a relatively small area of farmland to the east of the neighbouring Allhallows and Lower Stoke LCA. The incremental movement of plant associated with the cable route corridor and open trench construction technique in the neighbouring LCA would have a barely perceptible bearing on the setting of this LCA. Overall all of the majority of the key characteristics would remain unchanged and changes to the setting would be minor and limited in extent. Therefore the magnitude of change is considered to be **Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	**Minor Adverse**
	Operation (Year 1): At year 1 of operation the proposed converter station and substation would be located within the adjacent Allhallows to Stoke Marshes LCA and alongside the existing LNG terminal. The proposed converter station and substation would add to the existing context of industrial development in the landscapes to the east of this LCA. However, given this existing context there would be very little perceptible change to the character and perceptual qualities of this LCA. The DC cable route would be reinstated and would have no bearing on this LCA. The magnitude of change is considered to be **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**
	Operation (Year 15) The establishment of vegetation would further assimilate the proposed converter station and substation into the landscape further reduce their influence on the setting of the Hoo Peninsula Farmland. Overall there would be very little perceptible change to this LCA and the magnitude of change would remain **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**

Lower Stoke Farmland

Table 3 Lower Stoke Farmland

Sensitivity of Landscape Receptor	Magnitude of Change	Significance of Effect
Value: Low Susceptibility: The existing influence of the large scale industrial complexes on Grain in particular the LNG terminal and the Application Site result in a landscape tolerant of the change proposed. Susceptibility is considered to be **Low**. Landscape Sensitivity: Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character is considered to be **Low**.	Construction: Construction activities would be located to the east in the neighbouring Allhallows to Stoke Marshes LCA and as such potential effects would be limited to the setting of this LCA. Operations at the proposed converter station and substation site including the movement of plant, earthworks and the operations of tower cranes would slightly increase the scale of movement and industry across the backcloth of this LCA. The incremental movement of plant associated with the cable route corridor and open trench construction techniques would result in limited bearing on the setting of the most easterly part of this LCA. Overall the magnitude of change is considered to be **Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	**Minor Adverse**
	Operation (Year 1): The completed and operational proposed converter station would be situated alongside the existing LNG terminal. Given the existing presence of industrial development and its influence on the setting of this LCA, the introduction of the convertor station and substation would result in very little perceptible change to the character and perceptual qualities of this LCA. The DC cable route would be reinstated and would have no bearing on this LCA. Therefore the magnitude of change is considered to be **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**
	Operation (Year 15): The establishment of vegetation would further assimilate the proposed converter station and substation into the landscape further reducing the influence on the setting of the Lower Stoke Farmland. There would be very little perceptible change and the magnitude of change would remain **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**

Industrial / Urban Area

Table 4 Industrial / Urban Area

Sensitivity of Landscape Receptor	Magnitude of Change	Significance of Effect
Value: Low Susceptibility: This LCA is dominated by the physical presence of industrial complexes and tolerant of the change therefore susceptibility is **Low**. Landscape Sensitivity: Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character is considered to be **Low**.	Construction: Construction activities would be located at the north-west boundary of this character area in the neighbouring Allhallows to Stoke Marshes LCA. The transportation of plant, HGVs and other vehicles to the Project Area would be via Grain Road (B2001), the primary road network within this character area. However, the regular movement of HGVs and vehicles is common place in this landscape and despite the temporary increase in the frequency of movement along the B2001 there would be little perceptible change to the overall impression of the industrial character. Construction activities along the DC cable route corridor would also temporarily increase vehicle movements through this LCA but there would be little perceptible change to the overall character. Therefore, the magnitude of change is considered to be **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**
	Operation (Year 1): Although the converter and substation is located immediately adjacent in the neighbouring character area it would effectively read as an extension to the Industrial / Urban character area. The industrial nature and scale of buildings within the proposed converter station and substation would be in keeping with the existing industrial complexes within this character area and as such there would be no perceptible change to the key characteristics. The DC cable route would be reinstated and would have no bearing on this LCA. Overall the proposed converter station and substation would read as a very small extension to this LCA and reinforce the existing industrial character. Therefore, the magnitude of change is considered to be **Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**
	Operation (Year 15) As is the case at year 1 of operation, the proposed converter station and substation would read as an extension to this character area and would be in keeping with the industrial character. Therefore, at year 15 of operation the magnitude of change would remain **Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**

Chetney and Greenborough Marshes

Table 5 Chetney and Greenborough Marshes

Sensitivity of Landscape Receptor	Magnitude of Change	Significance of Effect
Value: Medium Susceptibility: This LCA is located to the south of the Project Area and is physically separated by the Medway Estuary and as such is more tolerant of a large degree of change. Therefore, susceptibility is **Low**. Landscape Sensitivity: Taking into account value judgements and susceptibility to change, overall sensitivity of the landscape character is considered to be **Medium**.	Construction: The scale of intervening development to the north of the Medway Estuary at London Thamesport, Grain Power Station and the LNG terminal would substantially limit intervisibility between construction activities within the Project Area and this LCA. Tall cranes associated with the construction of buildings may be perceptible on the skyline setting to the north but would result in little discernible change to the existing industrial backdrop of this landscape. Construction activities along the DC cable route corridor would have no bearing on this LCA. Overall the magnitude of change is considered to be **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**
	Operation (Year 1): The completed and operational proposed converter station and substation would add to the existing industrial backdrop to the north of the Medway Estuary and setting of this LCA. Given the distance and limited intervisibility as a result of the scale of intervening industrial complexes London Thamesport, Grain Power Station and the LNG terminal, the introduction of the proposed converter station and substation would result no discernible change to the key characteristics of this LCA. The DC cable route would be reinstated and would have no bearing on this LCA. Therefore the magnitude of change is considered to be **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**
	Operation (Year 15) There would be no change from the assessment of effects at year 1 of operation. Therefore the magnitude of change would remain **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**

Appendix 5.B – Visual Assessment

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Appendix 05.B: Visual Assessment

NeuConnect Britain Ltd

September 2019

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Table of Contents

Figures

No table of figures entries found.

Tables

Appendix 5.B Visual Assessment

1.1 This appendix should be read in conjunction with **Chapter 5: Landscape and Visual Amenity** and **Figures 5.5** and **5.6**.

1.2 The visual assessment is also supported by a package of visualisations from each of the 9 viewpoints at Operation (year 1) and Operation (year 15) which are presented on **Figures 5.8** to **5.16**.

1.3 All landscape and visual mitigation is embedded and descried in **Chapter 02- Proposed GB Onshore Scheme**. All effects identified in the tables below are therefore residual.

1.4 The following tables present the detailed assessment of visual effects at construction, operation (year 1) and operation (year 15). The baseline description and value judgment of each viewpoint is considered in Chapter 5: Landscape and Visual Amenity.

1.5 The assessment is set out in Tables 1 to 9.

1.6 For the purposes of this assessment construction activities associated with the DC cable route would be experienced for up to 1 year and construction of the proposed converter station and substation would extend across a three year programme and therefore duration is considered to be short term and reversible.

1.7 At year 1 and year 15 of operation it is considered that the duration would be long term and permanent and the proposed converter station, substation and Direct Current (DC) cable route would not be decommissioned.

Viewpoint 1

Table 1: Viewpoint 1 – Grain Coastal Park

Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Receptor Group: Recreational Distance to the Project Area: 663m Value: Medium Susceptibility: This viewpoint is representative of people walking along this coastal section of Grain Coastal Park, whose attention is in part focussed on the coastline and towards the mouth of the Thames Estuary and Southend-on-Sea. The wide angel aspect of views somewhat reduce the capacity to absorb change. Therefore susceptibility is considered to be **Medium**. Visual Sensitivity: Taking into account the value judgements and the susceptibility to change, overall visual sensitivity is considered to be **Medium**	Construction: Intervening coastal landform and woodland vegetation to the north-west would limit views of construction activities to those related to the offshore subsea cable construction leading towards the landfall site. The landfall, proposed converter station, substation and onshore DC cable route would be screened by intervening vegetation and landform. Visible construction activity would therefore be limited to the presence of plant mounted on boats associated with horizontal directional drilling techniques required for the installation of the subsea cable from the sea and across the mudflats. Construction activity would occupy a small part of this wide angle view as sections of mounted plant and vessels would move incrementally along the cable route corridor closer towards the shore. The addition of working vessels in this part of the view is not entirely uncommon amongst the frequent movement of cargo ships and is therefore unlikely to distract from the wider focus of views along the coastline. Tidal influence, in particular low tide would reveal a slightly greater extent of construction activity on the mudflats closer to the shoreline. Taking all of this into account, the magnitude of change is considered to be **Low**. The magnitude of change assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	**Minor Adverse**
	Operation (Year 1): Intervening woodland vegetation would entirely screen views of the proposed converter station and substation. At operation, the offshore cable route would be buried and together the GB Onshore Scheme would result in no perceptible change in views from Grain Coastal Park. Therefore, the magnitude of change would be **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**
	Operation (Year 15): Impacts at year 15 would be the same as those experienced at year 1 of operation and the proposed converter station and substation would be barely discernible. Therefore, the magnitude of change would remain **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**

Viewpoint 2

Table 2: Viewpoint 2 – West Lane

Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Receptor Group: Residential Distance to the Project Area: 0m (adjacent to Project Area) Value: Low Susceptibility: This viewpoint is representative of views from a residential property where the views will be experienced daily and are an important part of the experience. Susceptibility is **High**. Visual Sensitivity: Taking into account the value judgements and the susceptibility to change, overall visual sensitivity is considered to be **Medium**	Construction: Construction activity at the proposed converter station and substation site would be prominent in mid-range views. The introduction of plant, largescale earthworks, storage of materials, building works and laydown areas would be partially screened at ground level by intervening vegetation at Perry's Farm. The overall scale and extent of construction activities would be highly noticeable across half of the horizontal extent of views. The majority of the tallest building works associated with the proposed converter station and substation would be contained between the Liquified Natural Gas (LNG) terminal and the overhead line (OHL) however lay down areas and civil engineering works associated with the proposed National Grid Electricity Transmission (NGET) sealing end compound would extend north of the OHL. Construction activity associated with the DC cable route corridor would be visible in incremental lengths along the construction corridor in close proximity to the residential properties on West Lane and a number of properties along the B2001. The movement of plant, earthworks and temporary storage of material associated with open cut trenches and other techniques would temporarily dominate the focus of close range views experienced by residents. Overall construction activities would result in substantial disruption to visual amenity therefore the magnitude of change is considered to be **Medium**. The magnitude of change assessed alongside the sensitivity would result in a **Moderate Adverse** effect, which is considered **significant**.	**Moderate Adverse (Significant)**
	Operation (Year 1): At year 1 of operation the proposed converter station and substation would occupy a noticeable proportion of mid-range views but contained between the LNG terminal and the OHL. The height of the proposed converter station would appear less than the pylon tower and LNG storage tanks. The substation would appear against the façade of the proposed converter station alongside the outdoor electrical equipment. The proposed landscape and SUDS reinstatement features would appear to the north of the permanent buildings and infrastructure. The DC cable route corridor would be reinstated and would have no bearing on views and open distance vistas towards Allhallows would remain clearly distinguishable. The proposed converter station and substation would be immediately visible in mid-range views strongly associated with the existing industrial facilities but would be prominent albeit oblique to the main focus. Taking all of this into account, the magnitude of change is considered to be **Medium**. The magnitude of change assessed alongside the sensitivity would result in a **Moderate Adverse** effect, which is considered **significant**.	**Moderate Adverse (Significant)**

Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
	Operation (Year 15): At year 15 once vegetation has established, there would be a linear belt of low level scrub and woodland edge would extend across part of the horizontal extent of the view to the north-west the proposed converter station and substation. However, the overall scale and extent of change would remain the same as at year 1 and therefore the magnitude of change would be **Medium**. The magnitude of change assessed alongside the sensitivity would result in a **Moderate Adverse** effect, which is considered **significant**.	**Moderate Adverse (Significant)**

Viewpoint 3

Table 3: Viewpoint 3 - Circular Walk 3 - Allhallows Marshes

Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Receptor Group: Recreational Distance to the Project Area: 1.8km Value: Medium Susceptibility: This viewpoint is representative of recreational walkers along this part of the circular walk, whose attention will be in part focussed on the landscape particularly views across the marshland and coastline. Views towards the Project Area are unlikely to be the primary focus of the view. Therefore susceptibility is considered to be **Medium**.	Construction: Construction activity at the proposed converter station and substation would appear in mid-range views between the OHL and the LNG Terminal against the backdrop of more distant industrial complexes. Construction activities would also appear to the north of the OHL at the proposed NGET sealing end compound. The extent of construction activities visible would be more prominent in closer proximity sections of this walk. The movement of plant, earthworks, vegetation clearance, storage of materials, temporary facilities, operation of cranes and temporary laydown areas would be highly noticeable and would distract from the visual amenity across a noticeable horizontal extent of the view. Taller plant and activities related to the building works would all appear to the south of the OHL and pylon towers. Construction activities related to the DC cable route including movement of plant along incremental lengths of 800m across a 30m wide corridor would be perceptible in the background extending from the coast to the substation. However these activities would be temporary in nature. Temporary construction activities at the DC cable route would appear against the backdrop of the distinctive marshland whilst activities at the proposed converter station and substation would be oblique to the main focus. Overall the magnitude of change is considered to be **Medium**. The magnitude of change assessed alongside the sensitivity would result in a **Moderate Adverse** effect, which is considered **significant**.	**Moderate Adverse (Significant)**
	Operation (Year 1): At operation the scale and mass of the proposed converter station and substation would be noticeable across a noticeable horizontal extent contained between the OHL and LNG Terminal which is associated with a lower quality part of the view. The extent of the view occupied by proposed converter station and substation would be greater in closer proximity sections of this walk. The height of the proposed converter station and substation would appear lower than the adjacent LNG terminal and the more distant stacks and turbines associated with other industrial complexes. The proposed NGET sealing end compound would occupy a small area within the field to the north of the existing OHL. The DC cable route would be reinstated and would have no bearing on the view. The proposed converter station substation would appear within the context of the LNG terminal and would increase the swathe of industrial buildings across the background. However, the proposed converter station would not compromise	**Moderate Adverse (Significant)**

Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Visual Sensitivity: Taking into account the value judgements and the susceptibility to change, overall visual sensitivity is considered to be **Medium.**	the more scenic and attractive quality of marshland and seaward views. Overall the magnitude of change is considered to be **Medium**. The magnitude of change assessed alongside the sensitivity would result in a **Moderate Adverse** effect, which is considered **significant**.	
	Operation (Year 15): At year 15 of operation established scrub and woodland edge vegetation would soften the interface of the built edge of the proposed converter station and substation and would help create a sense of separation between the marshland and the building facades. The established vegetation would also reduce the apparent scale and mass of the proposed converter station and substation, whilst the NGET compound would be screened. The most scenic elements of the view, in particular the marshland landscape and seaward views would not be affected. Taking all of this into account, the magnitude of change is considered to be **Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	**Minor Adverse**

Viewpoint 4

Table 4: Viewpoint 4 - Stoke Road

Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Receptor Group: Residential Distance to the Project Area: 3.9km Value: Low Susceptibility: This viewpoint is representative of views from a residential property where the views will be experienced daily and are an important part of the experience. Susceptibility is **High**. Visual Sensitivity: Taking into account the value judgements and the susceptibility to change, overall visual sensitivity is considered to be **Medium**	Construction: Construction activities at the proposed converter station and substation would be noticeable in distant views across a small section of the background mostly between the OHL and the LNG Terminal. The movement of plant, earthworks, vegetation clearance, storage of materials, temporary facilities, operation of cranes and temporary laydown areas would distract from the main focus of views form residential properties during the 3 year construction period. Construction activities related to the DC cable route would be barely perceptible across the distant background. Overall, the open expansive nature of the marshland landscape and the seaward views would remain undisturbed key features. Overall the magnitude of change is considered to be **Medium**. The magnitude of change, assessed alongside the sensitivity would result in a **Moderate Adverse** effect, which is considered **significant**.	**Moderate Adverse (Significant)**
	Operation (Year 1): At operation the proposed converter station and substation would occupy a small but noticeable portion of the background view between the OHL and LNG Terminal however the height and mass would appear smaller than the adjacent LNG storage containers. The proposed NGET sealing end compound would appear north of the OHL. The proposed converter station would distract from the main focus of the view and within the context of and contained by the LNG terminal and other industrial complexes to the south of the OHL, whilst the open marshland landscape that fills the majority of the background view north would remain unaffected. The DC cable route would be reinstated and would have no bearing on the view. Taking all of this into account, the magnitude of change is considered to be **Medium**. The magnitude of change, assessed alongside the sensitivity would result in a **Moderate Adverse** effect, which is considered **significant**.	**Moderate Adverse (Significant)**
	Operation (Year 15): Once established, vegetation would partially screen lower level buildings and compounds which would help to assimilate the proposed converter station and substation into the landscape and subsequently the view. Established vegetation would break up the built facade and therefore reduce the sense of scale and mass of the taller buildings within the proposed converter station platform. Established boundary vegetation would also reinforce the delineation between the open marshland landscape and the industrial complexes. The overall magnitude of change would reduce to **Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	**Minor Adverse**

Viewpoint 5

Table 5: Viewpoint 5 - Ratcliffe Highway

Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Receptor Group: Residential Distance to the Project Area: 4.6km Value: Medium	Construction: Construction activity at the proposed converter station and substation would be limited to a small proportion of the distant background view. The movement of plant, earthworks, vegetation clearance, storage of materials, temporary facilities, operation of cranes and temporary laydown areas would appear in a small portion of this expansive view to the north of the LNG storage containers. The most scenic qualities of the view including the marshland landscape and context of the Thames Estuary remain key features. Construction activities related to the DC cable route would be barely perceptible across the distant background. Taking all of this into account, the magnitude of change is considered to be **Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	**Minor Adverse**
Susceptibility: This viewpoint is representative of views from a residential property where the views will be experienced daily and are an important part of the experience. Susceptibility is **High**. Visual Sensitivity: Taking into account the value judgements and the susceptibility to change, overall visual sensitivity is considered to be **Medium**.	Operation (Year 1): The completed and operational proposed converter station and substation would be notable elements in the view and appear across a small horizontal extent of the overall view adjacent to the LNG storage containers. The scale and mass of the proposed converter station and substation would slightly extend the swathe of industrial complexes in the view but would appear smaller than the LNG storage containers in view. The DC cable route would be reinstated and would have no bearing on the view. The most scenic qualities including the marshland landscape and context of the Thames Estuary remain unchanged. Overall the proposed converter station and substation would result in a slight change to the composition and balance of features within the view. Taking all of this into account, the magnitude of change is considered to be **Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	**Minor Adverse**
	Operation (Year 15): Once established, vegetation would partially screen lower level compounds and help to assimilate the proposed converter station and substation into the landscape and view and partially reduce the sense of scale and mass. However, the overall magnitude of change would remain **Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	**Minor Adverse**

Viewpoint 6

Table 6: Viewpoint 6 - Saxon Shore Way

Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Receptor Group: Recreational Distance to the Project Area: 7.5km Value: Medium Susceptibility: This viewpoint is representative of views from recreational users walking along this national long distance trail where long views across the vast landscape are an important part of the experience but views towards the Project Area are not the primary focus of views. Susceptibility is **Medium**. Visual Sensitivity: Taking into account the value judgements and the susceptibility to change, overall visual sensitivity is considered to be **Medium.**	Construction: Intervening industrial complexes including the large gantry cranes at London Thamesport would largely screen the majority of construction activity. Tall plant such as cranes required to erect buildings within the proposed converter station would be perceptible in the distant background across a very limited extent of the view. Construction activities related to the DC cable route would be entirely screened. Overall construction activity would be barely perceptible and the magnitude of change is considered to be **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant	**Negligible**
	Operation (Year 1): At operation the completed proposed converter station and substation would appear as part of the existing backcloth of industrial complexes. The scale and mass of the proposed converter station and substation would be barely discernible beyond the existing industrial developments across a very limited extent of the background. The DC cable route would have no bearing on the view. Overall the proposed converter station and substation would have little bearing on the balance and composition of the view therefore the magnitude of change is considered to be **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**
	Operation (Year 15): Impacts at year 15 would be the same as those experienced at year 1 of operation and the proposed converter station and substation would be barely discernible. Therefore, the magnitude of change would remain **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**

Viewpoint 7

Table 7: Viewpoint 7 - Queensborough Coastal Path

Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Receptor Group: Recreational Distance to the Project Area: 4.2km Value: Low Susceptibility: This viewpoint is representative of views from recreational users walking along this this coastal path where views across the marshland landscape an important part of the experience but views towards the Project Area are not the primary focus of views. Susceptibility is **Medium**. Visual Sensitivity: Taking into account the value judgements and the susceptibility to change, overall visual	Construction: Construction activities at the proposed converter station and substation would be largely screened by Grain Power Station. Taller plant, including cranes required to construct buildings would be seen in the context of the existing stacks and pylon towers. Construction activities related to the DC cable route would be barely perceptible. Overall, construction activities would occupy a small extent of the background. The magnitude of change is considered to be **Low**. The magnitude of change assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	**Minor Adverse**
	Operation (Year 1): At operation the proposed converter station and substation would be partially screened by intervening development at Grain Power Station and the LNG terminal. The tallest proposed converter station buildings would appear between the LNG storage container and the power station, but at a smaller scale and mass to the existing buildings in view. The small extent of buildings visible would further reinforce the influence of industrial complex within the view but would not increase the horizontal extent of industrial influence across the backcloth of the view. The DC cable route would have no bearing on the view. Although part of the proposed converter station would be visible the overall composition and balance of feature would remain unchanged. The magnitude of change is considered to be **Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	**Minor Adverse**
	Operation (Year 15): There would be no change from the assessment of effects at year 1 of operation. Therefore, the magnitude of change would remain **Low**. The magnitude of change assessed alongside the sensitivity would result in a **Minor Adverse** effect, which is not considered significant.	**Minor Adverse**

Viewpoint 8

Table 8: Viewpoint 8 - Riverside Country Park

Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Receptor Group: Recreational Distance to the Project Area 10.3km Value: Medium Susceptibility: This viewpoint is representative of views from recreational users of the Riverside Country Park and the Saxon Shore Way where views across the landscape are an important but not fundamental given the industrial composition of the background. Susceptibility is **Medium**. Visual Sensitivity: Taking into account the value judgements and the susceptibility to change, overall visual sensitivity is considered to be **Medium**.	Construction: Views of construction activity within the Project Area would appear distant and seen in the context of the industrial complexes north of the Medway Estuary. Taller plant such as cranes associated with the construction of the proposed converter station and would appear beyond the gantry cranes at London Thamesport, would occupy a very small extent of the background view and would represent a barely perceptible change to the overall view. Construction activities related to the DC cable route would be entirely screened. The magnitude of change is considered to be **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**
	Operation (Year 1): At operation the completed proposed converter station and substation would be barely discernible across a very limited extent of the background view. The proposed converter station would not be specifically distinguishable amongst the backdrop of large scale industrial complexes on the Isle of Grain and would not alter the balance composition or focus of the view. The DC cable route would be reinstated and would have no bearing on the view. Therefore, the magnitude of change is considered to be **Very Low**. The magnitude of change assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**
	Operation (Year 15): Impacts at year 15 would be the same as those experienced at year 1 of operation and the proposed converter station and substation would be barely discernible. Therefore, the magnitude of change would remain **Very Low**. The magnitude of change assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**

Viewpoint 9

Table 9: Viewpoint 9 - Furze Hill

Sensitivity of Receptor	Magnitude of Effect	Significance of Effect
Receptor Group: Recreational Distance to the Project Area: 6.2km Value: Low Susceptibility: This viewpoint is representative of recreational users of this PRoW where background views are largely dominated by industrial complexes and is somewhat tolerant of the change proposed. Therefore, susceptibility is **Medium**. Visual Sensitivity: Taking into account the value judgements and the susceptibility to change, overall visual sensitivity is considered to be **Low.**	Construction: Intervening buildings would largely screen relatively distant views of construction activity. Perceptible change would be limited to a very small portion of the background view and would be seen in combination with existing tall plant and structures. Construction activities related to the DC cable route would be mostly screened. Overall construction activities would result in a barely discernible change to the composition of the existing view therefore the magnitude of change is considered to be **Very Low**. The magnitude of change assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**
	Operation (Year 1): At operation the proposed converter station and substation would be partially screened by intervening industrial scale buildings on Grain and the western edge of the Isle of Sheppey. The limited extent of proposed converter station and substation visible would be distant and barely distinguishable amongst the mass of existing industrial complexes in that part of the background view. The DC cable route would be reinstated and would have no bearing on the view. Therefore, the magnitude of change is considered to be **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**
	Operation (Year 15): Impacts at year 15 of operation would be the same as those experienced at year 1 of operation. Therefore, the magnitude of change is considered to be **Very Low**. The magnitude of change, assessed alongside the sensitivity would result in a **Negligible** effect, which is not considered significant.	**Negligible**

Appendix 6.A – Preliminary Ecological Appraisal

NeuConnect, Great Britain to Germany Interconnector: GB Onshore Scheme

Preliminary Ecological Appraisal Report

May 2019

Quality information

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Table of Contents

Tables

1. Introduction

AECOM was instructed by NeuConnect Britain Limited (the 'Applicant') to undertake a Preliminary Ecological Appraisal (PEA) of the terrestrial area (*i.e.* the non-intertidal area) for the proposed development (the 'Proposed Development') of an electricity convertor station and substation at Grain, Isle of Grain. The proposed electricity converter station and substation will form part of a Direct Current (DC) electricity link (referred to as an interconnector) between Great Britain and Germany. As part of the application(s), the Applicant may also seek outline planning permission for underground DC and Alternating Current (AC) cables however this is subject to the Applicant's permitted development status.

1.1 The Project

NeuConnect (the 'Project'), is a 1400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks. The new link will create a connection for electricity to be passed in either direction between Great Britain and Germany. The Project will be formed by over 700 kilometres (km) of subsea and underground High Voltage Direct Current (HDVC) cables, with on-shore converter stations linking into the existing electricity grids in Great Britain and Germany.

The connection points for the interconnector are at the Isle of Grain in Kent, England and the Wilhelmshaven region in Germany. The subsea cables connecting these points will traverse through British, Dutch and German waters.

1.2 Proposed Development

NeuConnect (the 'Project'), is a 1400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks. The new link will create a connection for electricity to be passed in either direction between Great Britain and Germany. The Project will be formed by approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HDVC) cables, with on-shore converter stations linking into the existing electricity grids in Great Britain and Germany.

The Proposed Development will comprise of three structures, a Converter Station, Sub-station and a Direct Current (DC) cable route (see Figure 1).

The footprint of the proposed converter station (green hashed area in Figure 1) is expected to be up to approximately 250 metres (m) by 250 m (to the perimeter security fence), with a maximum height of up to 26 m.

The footprint of the proposed substation (pink hashed areas in Figure 1) is expected to be approximately 80 m by 80 m (to the perimeter security fence), with a maximum height of 14 m.

The proposed DC cable corridor (purple hashed route between the intertidal area and the converter station in Figure 1) will be approximately 1.6 km long (from landfall to the converter station). The preferred installation method will be underground, which will result in a temporary loss of land during installation. The working corridor for the installation of the cable corridor will be 30 m.

Additional laydown areas (blue hashed areas in Figure 1) will be required for construction, comprising 1.5 hectare (ha) for the converter laydown and 0.3 ha for the substation laydown.

1.3 Site Description

The Proposed Development area (the 'Site') is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The Site is located to the west of the village of Grain, Isle of Grain, Kent at Ordnance Survey (OS) central grid reference TQ 88205 76727. Land use comprises a mix of industrial development to the south, the small settlement of Grain to the southeast and undeveloped land, much of which is designated for ecological interests, to the north (along the coastline) and to the west. Land within the Site and in the immediate vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill.

Figure 1 shows the Site boundary (red-line), the cable corridor (purple line) and proposed location of each structure.

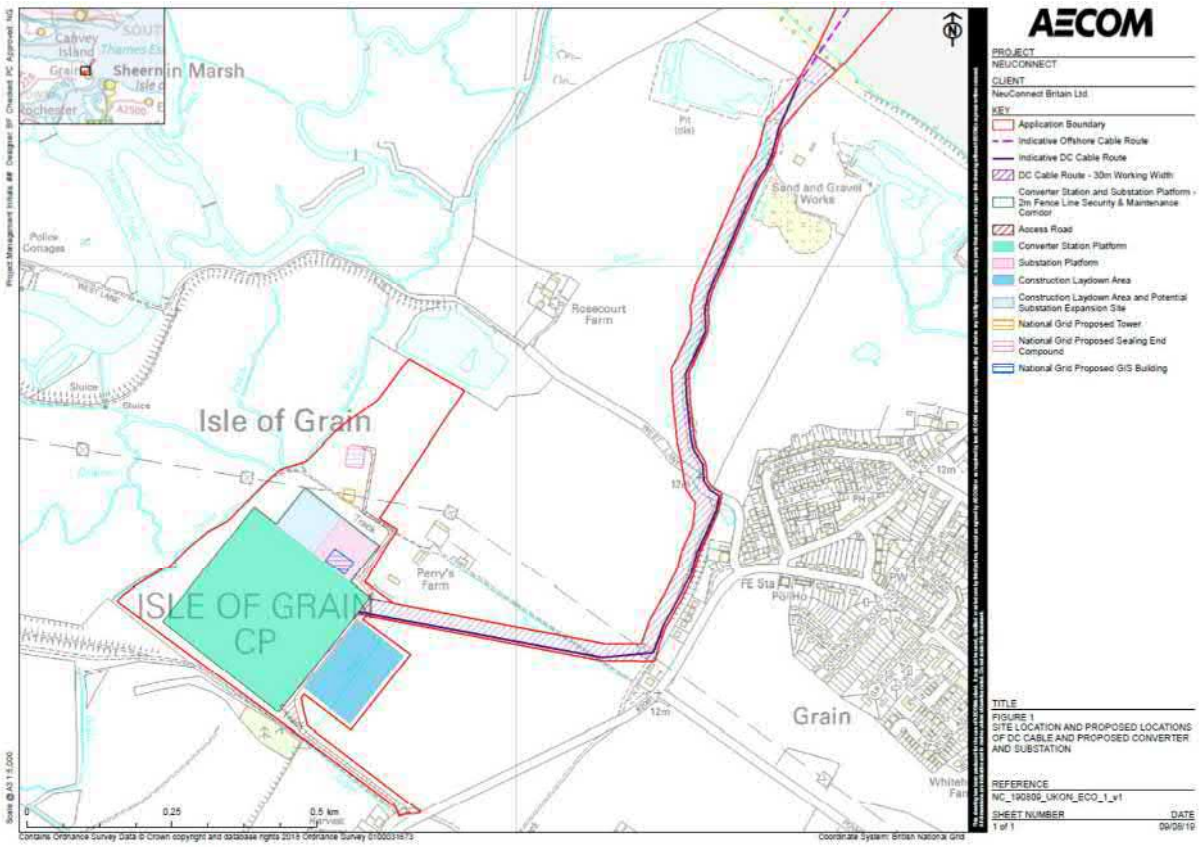


Figure 1 - Site boundary and location of structures

1.4 Purpose and Scope of the Preliminary Ecological Appraisal

This PEA was commissioned to identify whether there are known or potential ecological receptors (nature conservation designations and protected / notable habitats and species) that may constrain or influence the design and implementation of the Proposed Development. The approach applied when undertaking this PEA accords with the Guidelines for Preliminary Ecological Appraisal published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2017)[1]. The PEA addresses relevant wildlife legislation and planning policy as summarised in Section 2 of this report and is consistent with the requirements of British Standard 42020:2013 Biodiversity. Code of Practice for Planning and Development[2].

In order to deliver the PEA, a desk study and an extended Phase 1 Habitat Survey were undertaken by an appropriately experienced ecologist, to identify ecological features within the Proposed Development area (the Site) and the wider potential zone of influence. The potential zone of influence was defined with reference to the red line boundary as shown on Figure 1 and type of development. Additional details are provided in Section 3: Methods.

The purpose of the PEA was to:

- identify and categorise habitats present within the Site and any areas immediately outside of the Site where there may be potential for direct or indirect effects (the “zone of influence”);
- carry out an appraisal of the potential of the habitats recorded to support protected or notable species of fauna and flora; and

[1] CIEEM (2017) Guidelines for Preliminary Ecological Appraisal. https://www.cieem.net/data/files/Publications/Guidelines_for_Preliminary_Ecological_Appraisal_Jan2018_1.pdf [accessed April 2019]
[2] British Standards Institution (2013) BSI Standards Publication 42020:2013. Biodiversity – Code of practice for planning and development.

- provide advice on any potential ecological constraints and opportunities in the zone of influence that should be addressed in any future planning applications for the Site, including the identification (where relevant) of any requirements for follow-up habitat and species surveys and/or requirements for ecological mitigation.

The purpose of this report is to provide a high level appraisal of the ecological risks and opportunities associated with the Proposed Development. The report identifies the scope of further work (where necessary) that would be required to support a planning application and to inform an Ecological Impact Assessment (EcIA). High level recommendations are made on potential options for the avoidance, mitigation or compensation of the potential impacts of the Proposed Development (where known) on the identified ecological receptors, and of potential enhancements to the biodiversity.

2. Wildlife Legislation and Planning Policy

2.1 Wildlife Legislation

The following wildlife legislation is potentially relevant to the Proposed Development:

- Wildlife and Countryside Act (WCA) 1981 (as amended);
- Countryside and Rights of Way (CRoW) Act 2000;
- Natural Environment and Rural Communities (NERC) Act 2006;
- The Conservation of Habitats and Species and Planning (Various Amendments) (England and Wales) Regulations 2018; and
- Natura (2000) including the Birds Directive (2009) and Habitats Directive (1992).

The above legislation has been considered when planning and undertaking this PEA using the methods described in Section 3, when identifying potential constraints to the Proposed Development, and when making recommendations for further survey, design options and mitigation, as discussed in Section 5. Compliance with legislation may require the attainment of relevant protected species licences prior to the implementation of the proposed development.

Further information on the requirements of the above legislation is provided in Appendix A.

2.2 National Planning Policy

2.2.1 The National Planning Policy Framework

The National Planning Policy Framework (NPPF) was originally published on 27th March 2012 and detailed the Government's planning policies for England and how these are expected to be applied. The NPPF was then revised on 24th July 2018 and 19th February 2019.

The NPPF states the commitment of the UK Government to minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity.

It specifies the obligations that the Local Authorities and the UK Government have regarding statutory designated sites and protected species under UK and international legislation and how this it to be delivered in the planning system. Protected or notable habitats and species can be a material consideration in planning decisions and may therefore make some sites unsuitable for particular types of development, or if development is permitted, mitigation measures may be required to avoid or minimise impacts on certain habitats and species, or where impact is unavoidable, compensation may be required.

The NPPF is clear that pursuing sustainable development includes moving from a net loss of biodiversity to achieving net gains for nature, and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution.

Further information on the relevant parts of the NPPF is provided as Appendix A.

2.2.2 The 25 Year Environment Plan

In early 2018 the government published its 25 Year Environment Plan to provide guidance on its intended approach to managing the environment. The plan promotes a 'natural capital' approach that recognises the wider value of the environment and its contribution, such as food, clean water and air, wildlife, energy, wood, recreation and protection from hazards. The plan seeks to embed a 'net environmental gain' principle for development to deliver environmental improvements locally and nationally.

2.2.3 UK Post-2010 Biodiversity Framework

The UK Biodiversity Action Plan (UKBAP) was launched in 1994 and established a framework and criteria for identifying species and habitat types of conservation concern. From this list, action plans for priority habitats and species of conservation concern were published, and have subsequently been succeeded by the UK Post-2010

Biodiversity Framework (July 2012). The UK list of priority species and habitats, however, remains an important reference source and has been used to help draw up statutory lists of priority habitats and species in England, Scotland, Wales and Northern Ireland. For the purpose of this assessment, the UK BAP is still used as one of the criteria to assist in assigning national value to an ecological receptor.

The UK Post-2010 Biodiversity Framework sets a broad enabling structure for action across the UK between now and 2020, including a shared vision and priorities for UK-scale activities to help deliver the Aichi targets and the EU Biodiversity Strategy. A major commitment by Parties to the Convention of Biological Diversity is to produce a National Biodiversity Strategy and/or Action Plan.

The UK Post-Development Framework is relevant within England in the context of Section 40 of the Natural Environment and Rural Communities (NERC Act) 2006, meaning that Priority Species and Habitats are material considerations in planning. These habitats and species are identified as those of conservation concern due to their rarity or a declining population trend. This list encompasses 56 habitats and 943 species.

2.3 Local Planning Policy

2.3.1 Local and Regional Plans

The Site is not supported by a formal allocation in adopted local planning policy, albeit its status is recognised in existing and emerging policy. Summary text for relevant local planning policies is included below. For the precise wording of each specific policy please refer back to the source document. These policies have been considered when assessing potential ecological constraints and opportunities identified by the desk study and field surveys; and, when assessing requirements for further survey, design options and ecological mitigation, as described in Section 5.

Regional Planning Guidance for the South East (RPG9)

RPG9 sets out a number of principles to govern development in the region. One of these requires the fullest possible use to be made of opportunities for redevelopment and recycling of urban land with the aim of securing regeneration and an improvement in the urban environment. The regional guidance also specifies that development should respect the region's valuable environmental features and avoid the wasteful use of land and other natural resources. Within the strategy, the region's environment is considered to be one of its key assets. A significant improvement to the physical environment is sought including promoting good design and building on local distinctiveness. It also indicates that priority should be given to protecting designated areas of national or strategic environmental quality.

The Thames Gateway Planning Framework (RPG9a)

The principles of RPG9 are carried forward into *"The Thames Gateway Planning Framework"* (RPG9a). This Planning Framework is more focused on the locality and the environmental issues of Medway. One of its objectives is to safeguard and enhance natural and man-made environmental assets and, where necessary, improve the quality of the local environment and encourage the highest quality in the design, layout and appearance of new developments. It also recognises that there is scope for environmental improvement and economic regeneration to complement each other.

Kent and Medway Structure Plan 2006

The Kent and Medway Structure Plan was adopted by Kent County Council and Medway Council on 6th July 2006. One of the key themes of the plan is to nurture Kent's environment and resources. Policy SP1: Conserving and Enhancing Kent's Environment and Ensuring a Sustainable Pattern *of Development* states that, *"the primary purpose of Kent' development and environmental strategy will be to protect and enhance the environment and achieve a sustainable pattern and form of development."* The plan also details the importance of nature conservation and provides protection for wildlife. Policy EN6: International and National Wildlife Designations and Policy EN7: County and Local Wildlife Designations both protect International, National, County and Local designated wildlife sites from development. Additionally, Policy EN8: Protection, Conservation and Enhancement of Biodiversity specify that, *"development likely to have an adverse effect, directly or indirectly on important habitats or species will not be permitted unless:*

- *there is an overriding need for the development that outweighs adverse impact on nature conservation; and*

- *adverse impact on an important nature conservation resource can be adequately mitigated and/or compensated."*

Policy EN9: Trees, Woodland and Hedgerows states that, *"provision should be made for the creation of new woodland, especially indigenous broad-leaved species at appropriate locations in Kent, including provision of new habitats as part of development proposals. Additionally tree cover and the hedgerow network should be maintained."*

Medway Local Plan 2003

The plan outlines the importance of protecting Medway's outstanding wildlife. Policy BNE35: International and National Nature Conservation Sites and Policy BNE36: Strategic and Local Nature Conservation Sites both state *"development that would materially harm, directly or indirectly, the scientific or wildlife interest of these sites will not be permitted unless the development is connected with, or necessary to, the management of the site's wildlife interest."* The plan also states that, *"in accordance with Policy BNE6, Medway Council will seek the enhancement and incorporation of new wildlife resources and habitat management within new developments."*

Furthermore, Policy BNE37: Wildlife Habitats states that "*development that would cause a loss, directly or indirectly, of important wildlife habitats or features not protected by policies BNE35 and BNE36 will not be permitted, unless:*

- *there is an overriding need for the development that outweighs the importance of these wildlife resources;*
- *no reasonable alternative site is (or is likely to be) available if ancient woodland, inter-tidal habitats and calcareous (chalk) grassland would be lost;*
- *the development is designed to minimise the loss involved; and*
- *appropriate compensatory measures are provided*".

Policy BNE39: Protected Species details that development will not be permitted if statutorily protected species and/or their habitat will be harmed. Additionally, conditions will be attached, and/or obligations sought, to ensure that protected species and/or their habitats are safeguarded and maintained.

Furthermore, Policy BNE38: Wildlife Corridors and Stepping Stones states that "*development should, wherever practical, make provision for wildlife habitats, as part of a network of wildlife corridors or stepping stones*".

Future Medway Local Plan

The Medway area's environmental quality is of international and national importance with 28% designated as a Special Protection Area (SPA) or Ramsar site, and a third of the land area designated as Sites of Special Scientific Interest (SSSI). Most of the designated land is in favourable condition, but some areas are in unfavourable condition, largely resulting from land management practices. Consequently, Medway Council are currently working on a new Local Plan to replace the 2003 Medway Local Plan and cover the period up to 2035, which, subject to outcome, will be adopted in 2020.

As part of the preparing the new plan, a Development Strategy technical report was drafted to set out the ambitions of the plan. Within Section 7 of the Developmental Strategy report, titled "Natural Environment and Green Belt" the council's vision and strategic objectives for the Local Plan is to place a healthy and attractive environment at the heart of its ambitions for Medway in 2035.

To achieve this, Policy NE 1 details that no development will be permitted which may have an adverse effect on the integrity of a Special Area of Conservation (SAC), SPA or Ramsar site, alone or in combination with other plans or projects.

Policy NE2: Conservation and Enhancement of the Natural Environment also states "*the council will promote the conservation and enhancement of biodiversity in Medway, by restricting development that could result in damage to designated wildlife areas, and pursuing opportunities to strengthen biodiversity networks*".

Furthermore, Policy NE5: Securing strong Green Infrastructure details the protection of the green infrastructure network of parks and paths, watercourses, and farmed, forested and natural environments across rural and urban Medway. The highest protection will be given to securing the ecological and landscape interests of sites designated of international importance as a Special Protection Area, Ramsar site and/or Special Area of Conservation. A high level of protection from damaging impacts of development will be given to Sites of Special Scientific Interest and Ancient Woodland and the council will consider the need to protect the special features of Regionally Important Geological Sites, Local Wildlife Sites and Local Nature Reserves. Additionally, this policy

states that new development should provide for green infrastructure that supports the successful integration of development into the landscape, and contributes to improved connectivity and public access, biodiversity, landscape conservation, design, management of heritage features, recreation and seeks opportunities to strengthen the resilience of the natural environment.

The council will also expect development proposals to demonstrate that they are designed to be resilient to, and can adapt to the future impacts of climate change, in strengthening ecological networks.

2.3.2 Local Biodiversity Action Plans

Kent Biodiversity Action Plan

The Kent Biodiversity Action Plan (1997)[1] sets out Habitat Action Plans for 20 habitat types and 13 Species Action Plans within the county. These are as follows:

- Woodland & Scrub;
- Wood-pasture & Historic Parkland;
- Old Orchards;
- Hedgerows;
- Lowland Farmland;
- Urban Habitats;
- Acid Grassland;
- Neutral & Marshy Grassland;
- Chalk Grassland;
- Heathland & Mire;
- Grazing Marsh;
- Reedbeds;
- River & Streams;
- Standing water;
- Intertidal Mud & Sand;
- Saltmarsh;
- Sand Dunes;
- Vegetated Shingle;
- Maritime Cliffs;
- Marine;
- Water Vole *Arvicola amphibius;*
- Otter *Lutra lutra;*
- Dormouse *Muscardinus avellanarius;*
- Serotine *Eptesicus serotinus;*
- Nightingale *Luscinia megarhynchos;*
- Great Crested Newt *Triturus cristatus;*
- Allis *Alosa alosa* and Twaite Shad *Alosa fallax;*
- White-clawed Crayfish *Austropotamobius pallipes;*

[1] The Kent Biodiversity Action Plan: A framework for the future of Kent's wildlife. Kent Biodiversity Action Plan Steering Group (1997)

- Heath Fritillary *Melitaea athalia*
- Pearl-bordered Fritillary *Boloria euphrosyne;*
- Silver-spotted Skipper *Epargyreus clarus;*
- Early Gentian *Gentianella anglica ssp anglica;* and
- Late Spider Orchid *Ophrys fuciflora.*

Kent Biodiversity 2020 and beyond – a strategy for the natural environment 2015 – 2025.

A more recent strategy for biodiversity in Kent and Medway is the Kent Biodiversity strategy for 2015 to 2025.

This plan sets targets for conservation of Kent's priority habitats and these conservation targets include:

- maintaining the extent and achieving good condition of existing habitat;
- restoring degraded habitat to meet the criteria for the BAP priority habitat description; and
- creating new habitat.

The strategy focuses on 33 priority habitats. These are as follows:

- Lowland Mixed Deciduous Woodland;
- Wet Woodland;
- Lowland Beech and Yew Woodland;
- Wood Pasture and Parkland;
- Traditional Orchard;
- Hedgerows;
- Arable Field Margins;
- Open mosaic habitats on previously developed land;
- Lowland dry acid grassland;
- Lowland meadow;
- Lowland Fen;
- Lowland calcareous grassland;
- Lowland heathland;
- Coastal and floodplain grazing marsh;
- Reedbeds;
- Rivers, including chalk rivers;
- Ponds;
- Maritime cliffs and slopes;
- Coastal sand dunes;
- Coastal vegetated shingle;
- Coastal saltmarsh;
- Intertidal mudflats;
- Intertidal and sub tidal chalk;
- Seagrass beds;
- Intertidal Under boulder communities;

- Peat and Clay Exposures with Piddocks;
- Saline lagoons;
- Sheltered muddy gravels;
- Subtidal sands and gravels;
- *Sabellaria spinulosa* reefs;
- *Sabellaria alveolata* reefs;
- Blue Mussel Beds on Sediment; and
- Fragile Sponge and Anthozoan Communities on Subtidal Rocky Habitats.

3. Methods

3.1 Desk Study

A desk study was carried out to identify nature conservation designations and protected / notable habitats and species potentially relevant to the Proposed Development.

A stratified approach was taken when defining the desk study area, based on the likely zone of influence of the proposed scheme on different ecological receptors; and, an understanding of the maximum distances typically considered by statutory consultees. Accordingly, the desk study identified any international nature conservation designations within 10 km of the Site boundary; other statutory nature conservations designations within 2 km of the Site boundary; and, local non-statutory nature conservation designations and protected and notable habitats and species within 2 km of the Site boundary.

The desk study was carried out using the data sources detailed in Table 1. Protected / notable habitats and species include those listed under Schedules 1, 5 and 8 of the WCA; Schedules 2 and 4 of the Habitats Regulations; species and habitats of principal importance for nature conservation in England listed under section 41 (S41) of the NERC Act; and other species that are Nationally Rare, Nationally Scarce or listed in national or local Red Data Lists and Biodiversity Action Plans.

Table 1. Desk study data sources

Data Source	Accessed	Data Obtained
Multi-Agency Geographic Information for the Countryside (MAGIC) website	July 2018	International statutory designations within 10 km. Other statutory designations within 2 km. Ancient woodlands and notable habitats within 2 km.
Ordnance Survey 1:2500 Pathfinder maps and aerial photography	July 2018	Information on habitats and habitat connections (based on aerial photography) relevant to interpretation of planning policy and assessment of potential protected and notable species constraints.
Kent and Medway Biological Records Centre	July 2018	Sites designated for their nature conservation value (SSSIs, LNRs, LWS) within 2 km of the Site boundary. Protected / notable species within 2 km of the Site boundary.

3.2 Field Survey

3.2.1 Phase 1 Habitat Survey

A Phase 1 Habitat survey was undertaken in accordance with the standard survey method (Joint Nature Conservation Committee, 2010)[1]. Phase 1 Habitat survey is a standard method of environmental audit. It involves categorising different habitat types and habitat features within a survey area. The information gained from the survey can be used to determine the likely ecological value of a site, and to direct any more specific survey work which may need to be carried out prior to the submission of a planning application. The standard Phase 1 Habitat survey method can be “extended” to record target notes on protected, notable and invasive species.

3.2.2 Appraisal of the Potential Suitability of Habitats for Protected and Notable Species

An appraisal was made of the potential suitability of the habitats present to support protected / notable species of plants or animals (as defined in Section 3.1). Field signs, habitat features with potential to support protected species and any sightings or auditory evidence were recorded when encountered, but no detailed surveys were carried out for any particular species.

[1] Joint Nature Conservation Committee (2010) Handbook for phase 1 habitat survey – a technique for environmental audit. Joint Nature Conservation Committee, Peterborough

3.2.3 Great Crested Newt Habitat Appraisal

Prior to undertaking the extended Phase 1 Habitat survey, aerial photography and 1:2,500 Ordnance Survey mapping were examined to attempt to identify all ponds and waterbodies within 500 m of the site (see Figure 2). This process could not guarantee to definitively identify all waterbodies present, but is the best that can be achieved within the limits of available data.

Specific searches were made during the extended Phase 1 habitat survey (as described in Section 3.2.1) for ponds or other waterbodies and watercourses within and adjacent to the site that could support Great Crested Newt

3.3 Desk Study and Field Survey Limitations

The aim of a desk study is to help characterise the baseline context of a Proposed Development and provide valuable background information that would not be captured by a single site survey alone. Information obtained during the course of a desk study is dependent upon people and organisations having made and submitted records for the area of interest. As such, a lack of records for a particular habitat or species does not necessarily mean that the habitats or species do not occur in the study area. Likewise, the presence of records for particular habitats and species does not automatically mean that these still occur within the area of interest or are relevant in the context of the proposed development.

Where habitat boundaries coincide with physical boundaries recorded on OS maps, the resolution is as determined by the scale of mapping. Elsewhere, habitat mapping is as estimated in the field and/or recorded by hand-held GPS. Where areas of habitat are given they are approximate and should be verified by measurement on site where required for design or construction. While indicative locations of trees are recorded this does not replace requirements for detailed specialist arboricultural survey to British Standard 5837:2012 Trees in Relation to Design, Demolition and Construction.

The majority of ecological data is valid only for short periods due to the inherently transient nature of the subject (CIEEM, 2019[1]). On this basis, it is recommended that the PEA and desk study will need repeating in two years (*i.e.* in 2020).

[1] CIEEM: Advice Note on the lifespan of ecological surveys and reports https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf (Accessed May 2019)

4. Results

4.1 Nature Conservation Designations

4.1.1 Statutory Designations

The desk study identified seven statutory sites of International importance within 10 km of the Site, (as per the method in Section 3.1 of this report). These sites, designated for ecological reasons, are detailed in Table 2 and are listed in descending order, with those closest to the Site listed first (see Figure 3). Site designation details are summarised in Table 2 and are taken from citation documents, published online by the Joint Nature Conservation Committee (JNCC) for the individual sites.

Table 2. International Statutory Nature Conservation Designated sites within 10 km of the Site

Site Name and Designation	Reason(s) for Designation	Area (ha)	Approximate distance from the Site (km)	Connectivity to the Site
Thames Estuary and Marshes Ramsar / SPA	The site supports one endangered plant species and at least 14 nationally scarce plants of wetland habitats. The site also supports more than 20 British Red Data Book invertebrates and supports populations and an assemblage of waterbirds occurring at levels of international importance.	5,588.59	0.0	Potential for ecological connections between interest features of the Ramsar / SPA and the Site.
Medway Estuary and Marshes Ramsar / SPA	The site holds several nationally scarce plants and a total of at least twelve British Red Data Book species of wetland invertebrates. The site also holds a significant number of non-wetland British Red Data Book species and supports populations and an assemblage of waterbirds occurring at levels of international importance.	4,696.74	1.1	Potential for ecological connections between interest features of the Ramsar / SPA and the Site.
Outer Thames Estuary SPA	The site qualifies for supporting breeding Common Tern *Sterna hirundo*, Little Tern *Sternula albifrons* and non-breeding Red-throated Diver *Gavia stellata*	392451.66	2.2	No connectivity between the SPA and the Site, although birds associated with the SPA may forage offshore from the Site.
Benfleet and Southend Marshes Ramsar / SPA	The site supports populations and an assemblage of waterbirds occurring at levels of international importance.	2,251.31	4.2	No connectivity between the Site and the Ramsar / SPA, although it is acknowledged that there is likely to be interchange of waterbirds between designated wetland sites in the region.
Essex Estuaries SAC	The site comprise of mainly Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), representing over 10% of the UK resource. The site also includes intertidal and subtidal sediment, mud, rock, sand and seagrass beds.	4,6111.43	4.8	No connectivity between the Site and the SAC.
Foulness (Mid-Essex Coast Phase 5) Ramsar / SPA	The site contains extensive saltmarsh habitat, with areas supporting full and representative sequences of saltmarsh plant communities covering the range of variation in Britain. The site also supports a number of nationally-rare and nationally-scarce plants species and British Red Data Book invertebrates. Furthermore Foulness supports populations of waterbirds occurring at levels of	10,932.95	4.9	No connectivity between the Site and the Ramsar / SPA, although it is acknowledged that there is likely to be interchange of waterbirds between designated wetland sites in the region.

Site Name and Designation	Reason(s) for Designation	Area (ha)	Approximate distance from the Site (km)	Connectivity to the Site
	international importance			
The Swale Ramsar / SPA	The site supports nationally scarce plants and at least seven British Red Data book invertebrates. The site also supports populations of waterfowl occurring at levels of international importance.	6,514.71	7.1	No connectivity between the Site and the Ramsar / SPA, although it is acknowledged that there is likely to be interchange of waterbirds between designated wetland sites in the region.

The desk study identified three statutory sites of national importance within 2 km of the Site, (as per the method in Section 3.1 of this report). These sites, designated for ecological reasons, are detailed in Table 3 and are listed in descending order, with those closest to the Site listed first (see Figure 3). Site designation details are summarised in Table 3 and are taken from citation documents, published online by the JNCC for the individual sites.

Table 3. National Statutory Nature Conservation Designated sites within 2 km of the Site

Site Name and Designation	Reason(s) for Designation	Area (ha)	Approximate distance from the Site (km)	Connectivity to the Site
South Thames Estuary and Marshes SSSI	The site supports outstanding numbers of waterfowl with total counts regularly exceeding 20,000. Many species regularly occur in nationally important numbers and some species regularly use the site in internationally important numbers. The breeding bird community is also of particular interest and the diverse habitats support a number of nationally rare and scarce invertebrate species and an assemblage of nationally scarce plants.	5,449.14	0.0	Potential for ecological connections between interest features of the SSSI and the Site.
Medway Estuary and Marshes SSSI	The site forms the largest area of intertidal habitats which have been identified as value for nature conservation in Kent. The area holds internationally important populations of wintering and passage birds and is also important for its breeding birds. An outstanding assemblage of plant species also occurs on site.	6,840.14	0.5	Potential for ecological connections between interest features of the SSSI and the Site.
Medway Estuary MCZ	Medway Estuary MCZ is an inshore site located on the Kent coast. It encompasses the Medway Estuary from Rochester down to its mouth, and extends seaward to include an area between Sheerness and the Isle of Grain. One species and eight different habitats and their associated wildlife are protected by the Medway Estuary MCZ. Such a range of habitats creates an environment that is capable of supporting some of the most diverse communities of animals in the South-East region.	6,000.00	0.0	Potential for ecological connections between interest features of the MCA and the Site.

4.1.2 Non-statutory Designations

One non-statutory designated site (a Local Wildlife Site (LWS)) was identified during the desk study (based on the method given in Section 3.1 of this report) and more details of this site are presented in Table 4.

Table 4. Site with non-statutory designations for nature conservation

Site Name and Designation	Reason(s) for Designation	Area (ha)	Approximate Distance from the Site (km)	Connectivity to the Site
ME16 Grain Pit LWS	The mosaic of habitats within the LWS site (including neutral grassland and reedbed) are of local importance.	29.56	0.01	ME16 Grain Pit LWS is located immediately adjacent to the east of the Proposed DC cable corridor.

4.2 Habitats

The Phase 1 habitat survey was undertaken on 26th April 2018 and 16th August 2018 by suitably qualified AECOM ecologists who recorded and mapped all habitat types present within the survey area, along with any associated relevant ecological receptors observed.

Where relevant ecological receptors were present, target notes (Appendix B) were recorded and the position of these is shown on the Phase 1 Habitat map (Figure 4). Typical and notable plant species were recorded for different habitat types and reflect the conditions at the time of survey. This was not intended to be a detailed inventory of the plant species present in the survey area, as this is not required for the purposes of Phase 1 Habitat survey.

4.2.1 Phase 1 Habitat Types

The habitats recorded and their extent is shown in Table 5, with the distribution of each habitat shown on Figure 4. Illustrative photographs are provided as appropriate in Appendix C.

Table 5. Broad habitat types present on Site

Habitat	Area (ha)	% of site
Scrub, Scattered	0.22	1.0
Scrub, Dense/continuous	1.76	8.1
Neutral grassland, Semi-improved	0.06	0.3
Improved Grassland	0.48	2.2
Maritime Cliffs and Slopes (Hard Cliff)	0.01	0.0
Swamp	0.11	0.5
Cultivated/disturbed land, Arable	16.59	76.2
Cultivated/disturbed land, Ephemeral/short perennial	0.11	0.5
Other, Tall ruderal	1.37	6.3
Hardstanding	0.73	3.3

4.2.1.1 Scrub

There are a number of areas of scrub, particularly along the DC cable corridor and this consisted of Bramble *Rubus fruticosus agg*., Butterfly-bush *Buddleja davidii*, Common Nettle *Urtica dioica*, Common Ragwort *Senecio jacobaea*, Dog Rose *Rosa canina agg*., Hawthorn *Crataegus monogyna*, Hemlock *Conium maculatum* and Spear Thistle *Cirsium vulgare*.

4.2.1.2 Semi-improved Neutral Grassland

There is a small area of neutral grassland which consists of Cocksfoot, Common Bent, Common Mouse-ear, Creeping Cinquefoil, Cut-leaved Cranesbill, Grass Vetchling, Red Fescue, Ribwort Plantain, Sand Couch, Sheep's Sorrel, Wild Carrot, Yarrow, Yellow Oat-grass and Yorkshire Fog.

4.2.1.3 Swamp

Swamp vegetation, consisting of Common Reed, Common Reed-mace *Typha latifolia* and Sea Club-rush is located in wetland habitats within the DC cable corridor.

4.2.1.4 Arable

In the western part of the Site, within the proposed converter station and substation locations, there are a number of arable fields, this extends to the edge of the fields without arable margins present.

4.2.1.5 Ephemeral/short perennial

There is a large area of ephemeral / short perennial habitat, to the east of the DC cable corridor (but 0.11 ha within the Site boundary) which consists of a very sandy substrate and mound of sand. Plant species within this habitat consisted of Annual beard-grass *Polypogon monspeliensis*, Birds-foot Clover *Trifolium ornithopodioides*, Birds-foot Trefoil *Lotus corniculatus*, Black Medick *Medicago lupulina*, Blue Fleabane *Erigeron acer*, Buckshorn Plantain *Plantago coronopus*, Canadian Fleabane *Erigeron canadensis*, Common Bent *Agrostis capilaris*, Common Knotgrass *Polygonum aviculare*, Common Vervain *Verbena officinalis*, Fern Grass *Catapodium rigidum*, Hop Trefoil *Trifolium campestre*, Narrow-leaved Ragwort *Senecio inaequidens*, Procumbent Pearlwort *Sagina procumbens*, Red Clover *Trifolium pratense* and Ribwort Plantain *Plantago lanceolate*.

4.2.1.6 Tall Ruderal

The DC cable corridor runs through an area of tall ruderal habitat, which comprises of Spear Thistle, Broad-leaved Dock, False Oat-grass, Common Ragwort, Cocksfoot, Creeping Thistle, Red Fescue, Common Bent, Common Fleabane, Goats-rue, Curled Dock *Rumex crispus*.

4.2.1.7 Running Water

There is a small stream which runs from Pond 3 to the large former quarry of Pond 1. This contains small amounts of Sea Club-rush and Annual Beard-grass.

4.3 Notable Habitats

Table 6 provides a summary of notable habitats within the Site boundary based on the results of the Phase 1 Habitat survey and with reference to guidance for the recognition of NERC Act S41 (Maddock, 2010)[1] and LBAP[2]. Further surveys may be required to investigate the value of habitats further, as detailed in Section 5 of this report.

Table 6. Notable habitats within the Site

Habitat	NERC Act	LBAP	Supporting Comments
Reedbeds		✓	An area of reedbed is present within the swamp area along the DC cable corridor. However, it is small in extent (0.11 ha) and does not qualify for County Wildlife Site selection in Kent[3] as it is: • Not >1 ha; and • Is <1 ha, but not contiguous with other habitats which qualify for designation.
Maritime cliffs and slopes		✓	An area of hard cliff is present within the DC cable corridor. However, it is small in extent

[1] Maddock, A. (2010) UK Biodiversity Action Plan Priority Habitat Descriptions. JNCC, Peterborough.
[2] The Kent Biodiversity Action Plan: A framework for the future of Kent's wildlife. Kent Biodiversity Action Plan Steering Group (1997)
[3] Local Wildlife Sites in Kent: Criteria for Selection and Delineation, Version 1.5: August 2015 (Accessed April 2019)

Habitat	NERC Act	LBAP	Supporting Comments
			(0.01 ha) and does not qualify for County Wildlife Site selection in Kent[1] as it is: • Not >2 ha in continuous extent; and • Is <2 ha, but not contiguous with other habitats which qualify for designation.

Key to symbols: ✓= yes, x = no, ? = possible, further survey required to determine this

4.4 Protected and Notable Species

Table 7 provides a summary of potentially relevant species identified through a combination of desk study and field survey. The table summarizes the conservation status of each species and provides comment on the likelihood of presence.

Where species are identified in Table 7 as likely or possible, they are likely to represent legal constraints or may be material to determination of a planning application. Further surveys will or may be required to determine presence or probable absence.

Table 7. Protected and notable species relevant or potentially relevant to the proposed development

Species	Legally Protected Species?	Species of Principal Importance?	Other Notable Species?	Present on Site?	Present / Potentially Present in Wider Zone of Influence?	Supporting Comments
Plants	✓	✓	✓	?	?	The data search returned records of 34 protected / notable plant species recorded within the last ten years and within 2 km from the Site. No legally protected plant species were recorded on the Site. Divided Sedge *Carex divisa* and Sea Buckthorn *Hipphophae rhamnoides,* both Kent Rare Plant Register (RPR) species, were recorded outside of the Site boundary.
Terrestrial invertebrates	x	✓	✓	?	✓	The data search returned a large number of notable terrestrial invertebrate species, including moths, butterflies, beetles and bees. The habitats on the Site were assessed to have limited potential to support a diverse community of terrestrial invertebrates, including notable species. However, better quality habitats were identified outside of the Site boundary.
Freshwater Invertebrates	x	x	✓	?	✓	The data search returned records of protected / notable aquatic invertebrates, including Dainty Damselfly *Coenagrion scitulum* from 2010. The ditch running adjacent to the proposed DC cable route has potential to support notable aquatic invertebrates.
Breeding birds	✓	✓	✓	?	✓	The data search returned records of 148 notable species recorded within the last ten years and within 2 km of the Site. Trees, scrub and wetland habitats occurring on Site are likely to support nesting birds during the breeding season, including notable species.
Non-breeding (wintering and passage) birds	-	✓	✓	✓	✓	The habitat present on Site has the potential to support non-breeding bird species, including over-wintering thrushes including Redwing

[1] Local Wildlife Sites in Kent: Criteria for Selection and Delineation, Version 1.5: August 2015 (Accessed April 2019)

Species	Legally Protected Species?	Species of Principal Importance?	Other Notable Species?	Present on Site?	Present / Potentially Present in Wider Zone of Influence?	Supporting Comments
						Turdus iliacus and Fieldfare *Turdus pilaris*. The intertidal habitat adjacent to the Site forms part of the Thames Estuary and Marshes Ramsar / SPA and is likely to support qualifying species.
Reptiles	✓	✓	-	?	✓	The data search returned nine records of reptiles recorded within 2 km of the Proposed Development area and within the last ten years. These were: • A single record of Adder, c.100 m from the Site, in 2010; • Two records of Grass Snake, with one recorded c. 100 m from the Site in 2010; and • Six records of Common Lizard, with the closest record located c. 60m from the Site in 2010 and the most recent record was found within 200 m of the Site in 2013. The mixture of grassland and scrub habitat on Site is likely to support populations of reptiles, with all species recorded from the data search potentially present.
Badger *Meles meles*	✓	✓	-	✓	✓	No recent records (within the last ten years) of Badger were identified during the data search from within 2 km of the Site. Badger latrines and snuffle holes were recorded on Site during the field survey, although no Badger setts were recorded within the Site boundary or within 50 m of the Site boundary.
Amphibians	✓	✓	-	?	✓	The desk study identified eight waterbodies within 500 m of the Site (excluding rivers / channels). The data search returned three records of Great Crested Newts from 2009. Waterbodies have the potential to support breeding Great Crested Newt. The terrestrial habitat on Site has the potential to support foraging and commuting Great Crested Newt and Common Toad *Bufo bufo*.
Water Vole	✓	✓	-	?	✓	The data search returned 12 records of Water Vole, with 5 records located within 1 km from the Site in 2012 and 2014. The waterbodies and ditches on the Site have potential to support Water Vole.
Bats	✓	✓	-	?	?	The data search returned three records of flying, grounded or dead bat from within 2 km of the Site and within the last ten years. These records were: • a dead Pipistrelle sp. in 2015 -1.5 km to SSW of the proposed converter station; • a grounded Nathusius's Pipistrelle in 2016, 1.5km SSW of the proposed converter station; and • an unidentified bat, in 2014, c. 500m to the east of the proposed DC cable corridor. Additionally, the data search also returned records of historical (>10 years) records of bat roosts within 2 km of the Site, the closest of which was of a Pipistrelle bat *Pipistrellus* sp. roost c. 200 m west of the proposed DC cable corridor, although this was recorded in 1995. There are no features of interest (mature trees,

Species	Legally Protected Species?	Species of Principal Importance?	Other Notable Species?	Present on Site?	Present / Potentially Present in Wider Zone of Influence?	Supporting Comments
						buildings) to support roosting bats within the Site boundary. The mosaic of scrub and wetland habitats around the Site provides foraging resources for bats across the Site.
Invasive Non-native species (INNS)						The data search returned six records of INNS within 2 km of the Site and within the last ten years. These (along with their distances from the Site) were: Bluebell *Hyacinthoides non-scripta x hispanica = H. x massartiana* (1.9 km), Curly Waterweed *Lagarosiphon major* (0.2 km), New Zealand Pigmyweed *Crassula helmsii* (0.3 km), Japanese Rose *Rosa rugosa* (1.2 km), American Slipper Limpet *Crepidula fornicate* (0.5 km) and Portuguese Oyster *Crassostrea gigas* (0.5 km). No INNS were recorded on Site during Ecological survey. Marsh Frog *Pelophylax ridibundus* was recorded within all off-Site waterbodies, including the ditch running adjacent to the proposed DC cable corridor. Marsh Frog is listed on Schedule 9 of the Wildlife and Countryside Act, which makes it illegal to distribute or allow the release of Marsh Frog into the wild.
West European Hedgehog *Erinaceus europaeus*						The data search did not return any recent (within the last ten years) records of Hedgehog from within 2 km from the Site. However, this species is likely to occur on Site within the grassland and scrub habitats.
Brown Hare *Lepus europaeus*						The data search did not return any recent (within the last ten years) records of Brown Hare from within 2 km from the Site. This species is likely to occur in the grassland and arable habitats on Site.

Key to symbols: ✓= yes, x = no, ? = possibly, see Supporting Comments for further rationale.

Species present on site are those for which recent direct observation or field signs confirmed presence. Species which are possibly present are those for which there is potentially suitable habitat based on the results of the Phase 1 Habitat survey, or this combined with desk study records.

Legally protected species are those listed under Schedules 1, 5 and 8 of the Wildlife and Countryside Act 1981 (as amended); and, Schedules 2 and 4 of The Conservation of Habitats and Species and Planning (Various Amendments) (England and Wales) Regulations 2018.

Species of Principal Importance as those listed under Section 41 of the NERC Act. Planning Authorities have a legal duty under Section 40 of the same Act to consider such species when determining planning applications.

Other notable species include native species of conservation concern listed in the LBAP (except species that are also of Principal Importance), those that are Nationally Rare, Scarce or Red Data List, and non-native controlled weed species listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended).

5. Identification of Ecological Constraints and Recommendations

5.1 Approach to the Identification of Ecological Constraints

Relevant ecological receptors that may represent constraints to the Proposed Development, or that provide opportunities to deliver ecological enhancement in accordance with planning policy, are identified in Section 4.

The NPPF and local planning policy (summarised in Section 2 of this report) specify requirements for the protection of features of importance for biodiversity. Planning policy is of material consideration when determining planning applications.

Compliance with planning policy requires that the proposed development considers and engages the following mitigation hierarchy where there is potential for impacts on relevant ecological receptors:

1. Avoid features where possible;
2. Minimise impact by design, method of working or other measures (mitigation) *e.g.* by enhancing existing features; and
3. Compensate for significant residual impacts, *e.g.* by providing suitable habitats elsewhere (whether in the control of NeuConnect Britain Limited or otherwise legally enforceable through planning condition or Section 106 agreement).

This hierarchy requires the highest level to be applied where possible. Only where this cannot reasonably be adopted should lower levels be considered. The rationale for the proposed mitigation and/or compensation should be provided with planning applications, including sufficient detail to show that these measures are feasible and would be provided.

In pursuance of the objective within the NPPF of providing net gains in biodiversity where possible, consideration should be given to the scope for enhancement as part of the proposed development. This should represent biodiversity gain over and above that achieved through mitigation and compensation. Enhancement could be achieved on and / or off the Site.

The likelihood of the relevant ecological receptors constraining the proposed development has been assessed with reference to the scale described in Table 8. The higher the importance of the ecological receptor for the conservation of biodiversity at national and local scales, the more likely it is to be a material consideration during determination of the planning application for the proposed development.

Opportunities for ecological enhancement are not scaled in Table 8, but are identified in the accompanying appraisal (Section 5.5 of this report). There may be scope for ecological enhancement where existing habitat features could be improved or enhanced within the proposed development as designed, or with only minor amendment to the design of the proposed development. Ecological enhancement may not be possible where there is little scope to accommodate enhancement within the proposed development, *e.g.* due to a lack of utilisable space, or where land is required for essential mitigation. Consideration could be given to enhancing biodiversity in the vicinity of the Site.

Table 8. Scale of Constraint to Development

Likelihood	Definition
High	An actual or potential constraint that is subject to relevant legal protection and is likely to be a material consideration in determining the planning application (*e.g.* statutory nature conservation designations and European/nationally protected species). Further survey likely to be required (as detailed in this report) to support a planning application.
Medium	An actual or potential constraint that is covered by national or local planning policy and, depending on the level of the potential impact as a result of the proposed development, may be a material consideration in determining the planning application. Further survey may be required (as detailed in this report) to support a planning application.
Low	Unlikely to be a constraint to development or require further survey prior to submission of a planning application. Mitigation is likely to be covered under a Construction Environmental Management Plan (CEMP) or precautionary working method statement (*e.g.* generic requirements for the management of nesting bird risks).

5.2 Constraints and Requirements for Further Survey: Designations

5.2.1 Statutory Designated Sites

The terrestrial elements of the GB onshore scheme, above the Mean High Water Spring (MHWS), will not result in any direct impacts to statutory designated sites. Surveys of the intertidal areas for waterbirds associated with Natura 2000 sites and the South Thames Estuary and Marshes SSSI will be required to identify whether construction activities may result in disturbance to qualifying species.

Any potential impacts arising from the Proposed Development between the MHWS and Mean Low Water Spring (MLWS) are reported separately within the offshore element for the Proposed Development.

5.2.2 Non-statutory Sites

Grain Pit LWS is located to the immediate east of the Proposed DC cable corridor. The route of the underground DC cable from the converter station to the landfall point will run adjacent to the boundary of the LWS. Providing the working area required during construction to lay the cable avoids the LWS, there will be no direct impacts on Grain Pit LWS. To prevent accidental ingress of construction traffic and personnel into the LWS, it is recommended that Heras fencing is erected along the boundary of the LWS. There is potential for indirect impacts during construction, to the LWS, through disturbance to species or degradation of habitats associated with the LWS. Therefore, avoidance and mitigation of any potential effects to off-site habitats should be formalised through implementation of a Construction Environmental Management Plan and / or precautionary working method statement.

5.3 Constraints and Requirements for Further Survey: Habitats

Providing that the Proposed Development seeks to avoid the hard cliff, above the MHWS, there will be no requirement for mitigation of this notable habitat.

If the DC cable corridor is installed above ground, then there will be a temporary loss of 0.11 ha of reedbed habitat during construction. Post-construction, this habitat can be reinstated.

There will be no impacts upon the reedbed habitat where drilling under wetland habitats is used.

Indirect impacts to notable habitats (such as through dust emissions, lighting and noise) are considered to be minimal and can be adequately mitigated by following standard best practice construction guidelines.

5.4 Constraints and Requirements for Further Survey: Species

5.4.1 Terrestrial Invertebrates

The Site comprises habitats that may support notable terrestrial invertebrates or invertebrate communities, as identified as being present within the wider ZoI during the desk study. However, these habitats are limited in quality and extent and the majority of habitats likely to support notable terrestrial invertebrates / invertebrate communities are outside of the Site boundary. Any unnecessary damage to retained habitats outside the direct footprint of the Proposed Development should be avoided. This might include the use of temporary fencing to protect such habitats and these avoidance measures should be formalised into a Construction Environmental Management Plan. If construction of the DC cable corridor cannot avoid these habitats, then further surveys may be required to determine the potential impacts on terrestrial invertebrates.

5.4.2 Aquatic Invertebrates

The wetland habitats within the Site boundary have the potential to support notable aquatic invertebrate species and assemblages. The Proposed Development, particularly the underground DC cable from the converter station to the landfall point, has the potential to directly impact on minor ditches which may need to be crossed (or directionally drilled underneath). The Proposed Development also has the potential for indirect impacts to ditches / drains in the vicinity of the Site through pollution runoff during construction. Mitigation is likely to be required through implementation of a Construction Environmental Management Plan and / or precautionary working method statement. Further surveys, to determine the assemblages of aquatic invertebrates present are recommended.

5.4.3 Great Crested Newt

The desk study identified eight waterbodies within 500m of the Site boundary and the data search returned records of Great Crested Newt from the wider ZoI. The Proposed Development has the potential to have adverse effects on Great Crested both in terms of loss of habitat (breeding and terrestrial) and connectivity (isolating populations), if present.

Further surveys of waterbodies within the wider ZoI are required to determine the presence (and, if present, the population size) or absence of Great Crested Newt. Should the presence of Great Crested Newt be confirmed, then adequate mitigation may be required and development subject to successful application for a European Protected Species Mitigation Licence (EPSML) from Natural England.

The Proposed Development will seek to avoid direct loss of waterbodies which may support breeding populations of Great Crested Newt. Any indirect impacts may be mitigated through the implementation of a Construction Environmental Management Plan and / or precautionary working method statement.

5.4.4 Reptiles

The habitats present on Site have the potential to support reptiles and three species of reptile (Adder, Grass Snake and Common Lizard) were identified during the desk study as being present in the wider ZoI. The Proposed Development has the potential to result in reptile mortality due to the removal of habitats potentially supporting reptiles. Further surveys following standard guidelines[1] are recommended to determine the presence or absence of reptiles and if present, their distribution, within the Proposed Development area. Depending on the outcomes of these surveys, mitigation may be required to avoid injuring or harming reptiles during construction. The creation of habitats for reptile species may also be required to mitigate any losses.

5.4.5 Breeding Birds

The data search returned records of species included on Schedule 1 of the Wildlife and Countryside Act (1981, as amended), (Barn Owl *Tyto alba,* Marsh Harrier *Circus aeruginosus* and Cetti's Warbler *Cettia cetti*) which have been recorded from within 250 m of the Site. Scrub on the Site is likely to support nesting birds during the breeding season, including those of conservation concern such as Song Thrush *Turdus philomelos*.

The Proposed Development, therefore, may result in the direct loss of habitat potentially used by protected and notable bird species and indirect impacts, such as noise and visual disturbance to sensitive breeding species outside of the Site boundary. Further surveys of the breeding bird assemblage are required to determine appropriate avoidance measures and mitigation.

5.4.6 Non-breeding Birds

The habitats present on Site are likely to support birds during the non-breeding season, including species of conservation concern. Additionally, the adjacent intertidal habitats are likely to support assemblages of non-breeding waterbirds associated with designated sites.

Therefore, surveys to determine the terrestrial and intertidal non-breeding bird assemblages should be undertaken.

5.4.7 Bats

The data search returned three records of flying, grounded or dead bat from within 2 km of the Site and within the last ten years.

There are no buildings or mature trees within the Site boundary. The Proposed Development will not result in the direct loss of features used by roosting bats and is unlikely to indirectly impact upon any features (buildings / mature trees) used by roosting bats in off-site habitats (through habitat severance, lighting, noise). Therefore, further surveys for roosting bats are not considered necessary.

The Site is of limited value for commuting and foraging bats, but the mixture of terrestrial habitats, including scrub and a ditch, does provide some foraging and commuting habitat for bats, if present in the wider area. The Site is of low suitability for commuting and foraging bats, but could be used by small numbers of common and

[1] Gent T and Gibson S (2003). Herpetofauna Workers Manual. JNCC, Peterborough.

widespread species. Surveys of bat activity, in line with current best practice guidelines[1] will be required. If key bat flight lines are identified, these should be retained or mitigated for (if lost).

5.4.8 Badger

The field survey recorded Badger latrines, snuffle holes and mammal paths on Site. A single large hole was found in the bank of the ditch, within the DC cable corridor, but was in use by Rabbit, with no signs of Badger activity. No Badger setts were recorded within the Site boundary or within 50 m of the Site.

Therefore, further surveys for Badger are not required.

5.4.9 Water Vole

A number of waterbodies are located outside the Site boundary and a ditch and one waterbody (small section) is located immediately adjacent to the Proposed DC cable corridor. These habitats have potential to support Water Vole and therefore it is recommended that a survey of these wetland habitats should be carried out to determine presence or absence of Water Vole. The results of these surveys will identify whether mitigation is required should the Proposed Development result in direct loss of habitats used by Water Vole or indirect impacts, such that may occur during construction.

5.4.10 Otter

No records of Otter were returned from the data search, but the waterbodies present outside of the Site have the potential to provide habitats suitable for Otter. Further surveys of waterbodies are recommended to identify whether the Site is used by Otter.

5.4.11 Other species

West European Hedgehog and Brown Hare may use the Site. Both receive limited legal protection but are Species of Principal Importance on S41 of the NERC Act. As such precautions are recommended to ensure they are not harmed during construction through a Construction Environmental Management Plan or precautionary working method statement.

New habitat provision would help mitigate potential losses of Hedgehog habitats.

It is recommended that the Proposed Development is planned to take account of likely mitigation requirements for these species. This will include timing of site clearance to avoid Brown Hare during their breeding season. This is concordant with the requirements for nesting birds. As such, it is recommended that site clearance and preparatory works be undertaken over the autumn/winter period between September and February inclusive.

Any unnecessary damage to retained habitats outside the direct footprint of the Proposed Development should be avoided. This might include the use of temporary fencing to protect such habitats. This is concordant with the expected requirements for any tree protection zones. During construction, any open pits / holes should be covered at night or where not possible a wooden plank positioned at a 45° angle from the base to the top of the hole so that mammals can escape.

[1] Collins, J. (ed.) (2016) Bat surveys for professional ecologists good practice guidelines 3rd Edition. The Bat Conservation Trust, London

6. Conclusions

Overall, the PEA identified notable habitats and species detailed in Section 4.3 and 4.4.

A summary appraisal of ecological constraints and the recommended further requirements can be found in Table 9 below.

Table 9. Summary Appraisal of features of Ecological Constraints and Recommended Further Requirements

						When is action likely to be required?			
Receptor	**Scale of constraint**	**Further requirements, including potential mitigation requirements**	**Number of survey visits required**	**Survey period**	**Driver**	**To inform design**	**Before planning application**		**Pre-constructio**
Freshwater Invertebrates	Medium	Scoping survey to appraise habitats and suitability to support protected / notable aquatic invertebrates / aquatic invertebrate communities	One	March to May, and Autumn: September to November	Habitat Regulations (2017), WCA 1981, NERC Act 2006, UKBAP, LBAP	✓	✓		✓
Great Crested Newt	High	Identify Great Crested Newt presence / absence and, if present, undertake a population size assessment.	Four survey visits to be undertaken and, if present, a further two surveys required for the population size class assessment.	March to June	Habitat Regulations (2017), WCA 1981, NERC Act 2006, UKBAP, LBAP	✓	✓		✓
Reptiles	High	Identify reptile presence / absence and dependent on the survey results, these will be used to determine appropriate mitigation for reptiles, if present.	Seven survey visits and an additional visit to set out refugia	September to October and / or April to May	WCA 1981, LBAP, UKBAP, NERC Act 2006	✓	✓		✓
Breeding birds	High	Further surveys required to determine the breeding bird assemblage on Site and presence of Schedule 1 species (Barn Owl, Marsh Harrier and Cetti's Warbler) in the wider ZoI. Retain habitats used bynesting birds where possible. Where vegetation is to be cleared, this should be done outside of breeding bird season (typically March to August inclusive). Other mitigation potentially required depending on species present on Site.	Six survey visits	March to June	WCA 1981, LBAP, UKBAP, NERC Act 2006	✓	✓		✓
Non-breeding birds	Medium	Further surveys to determine the presence of notable species and the assemblage of non-breeding birds occurring within the Site.	Six survey visits	October to March		✓	✓		✓
Bats	Medium	Surveys to identify important areas on Site	Activity survey required seasonally.	April to October	Habitat Regulations	✓	✓		?

Receptor	Scale of constraint	Further requirements, including potential mitigation requirements	Number of survey visits required	Survey period	Driver	When is action likely to be required? To inform design	Before planning application	Pre-constructio
		used by commuting and foraging bats. Identify potential severance issues and identify and implement requirements for construction phase and / or habitat mitigation to address this.			(2017), WCA 1981, LBAP, UKBAP, NERC Act 2006			
Badger	Low	Pre-commencement survey to confirm that no Badger are present within the Site boundary.	N/A	N/A	Protection of Badger Act 1992	✓	✓	✓
Water Vole	Medium	Survey for Water Vole presence / absence along the banks of the ditch and waterbodeis. Surveys will follow the standard survey methodology of Dean *et al.*, (2016)	Initially, a single survey and dependent on the survey results, a second survey may be required.	April to June and July to September	WCA 1981, LBAP, UKBAP, NERC Act 2006	✓	✓	?
Otter	Low	Survey to look for evidence of Otter within the waterbodies on Site and off-site	At least one per season	Spring is best, but the survey can be undertaken at any time of year	WCA 1981, LBAP, UKBAP, NERC Act 2006	✓	✓	?
Hedgehog / Brown Hare	Low	Retain habitats and ensure that connectivity is maintained throughout the Site and into the wider area.	N/A	-	NERC Act 2006	✓	✓	✓

6.1 Opportunities for Ecological Enhancement

There are opportunities to achieve beneficial ecological enhancement and net biodiversity gain within the Site boundary and adjacent habitats, using guidance within the LBAP. These include:

- retention and enhancement of existing waterbodies off-Site, as well as creation of new waterbodies and wetland areas for biodiversity;
- creation of suitable floristically diverse grassland habitats similar to those in the local environs and identified as priority habitats in the region;
- establishment of new habitats through the planting of suitable native plants and trees to maintain and enhance ecological connectivity, as well as providing shelter and foraging opportunities for a wide range of fauna;
- establish new hedgerows, including such species as Hawthorn *Crataegus monogyna* and Beech *Fagus* to promote connectivity across the site through wildlife corridors; and
- provision of bat and bird boxes.

Appendix A Legislation and Planning Policy

The Conservation of Habitats & Species and Planning Regulations (Various Amendments) (England and Wales) 2018

The Habitats Regulations consolidate all the various amendments made to the Conservation (Natural Habitats, &c.) Regulations 1994 in respect of England and Wales. The 1994 Regulations transposed Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (EC Habitats Directive) into national law. The Regulations came into force on 30th October 1994. In Scotland the Habitats Directive is transposed through a combination of the Habitats Regulations 2010 (in relation to reserved matters) and the 1994 Regulations. The Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995 (as amended) transpose the Habitats Directive in relation to Northern Ireland.

The Regulations provide for the designation and protection of 'European sites', the protection of 'European protected species', and the adaptation of planning and other controls for the protection of European Sites.

Under the Regulations, competent authorities i.e. any Minister, Government department, public body, or person holding public office, have a general duty, in the exercise of any of their functions, to have regard to the EC Habitats Directive.

The Regulations place a duty on the Secretary of State to propose a list of sites which are important for either habitats or species (listed in Annexes I and II of the Habitats Directive respectively) to the European Commission. Once the Commission and EU Member States have agreed that the sites submitted are worthy of designation, they are identified as Sites of Community Importance (SCIs). The EU Member States must then designate these sites as Special Areas of Conservation (SACs) within six years. The Regulations also require the compilation and maintenance of a register of European sites, to include SACs and Special Protection Areas (SPAs) classified under Council Directive 79/409/EEC on the Conservation of Wild Birds (the Birds Directive). These sites form a network termed Natura 2000.

The Regulations enable the country agencies to enter into management agreements on land within or adjacent to a European site, in order to secure its conservation. If the agency is unable to conclude such an agreement, or if an agreement is breached, it may acquire the interest in the land compulsorily. The agency may also use its powers to make byelaws to protect European sites. The Regulations also provide for the control of potentially damaging operations, whereby consent from the country agency may only be granted once it has been shown through Appropriate Assessment that the proposed operation will not adversely affect the integrity of the site. When considering potentially damaging operations, the country agencies apply the precautionary principle' i.e. consent cannot be given unless it is ascertained that there will be no adverse effect on the integrity of the site.

In instances where damage could occur, the appropriate Minister may, if necessary, make special nature conservation orders, prohibiting any person from carrying out the operation. However, an operation may proceed where it is or forms part of a plan or project with no alternative solutions, which must be carried out for reasons of overriding public interest. In such instances the Secretary of State must secure compensation to ensure the overall integrity of the Natura 2000 system. The country agencies are required to review consents previously granted under the Wildlife and Countryside Act 1981 for land within a European site, and may modify or withdraw those that are incompatible with the conservation objectives of the site.

The Regulations make it an offence (subject to exceptions) to deliberately capture, kill, disturb, or trade in the animals listed in Schedule 2, or pick, collect, cut, uproot, destroy, or trade in the plants listed in Schedule 4. However, these actions can be made lawful through the granting of licenses by the appropriate authorities. Licenses may be granted for a number of purposes (such as science and education, conservation, preserving public health and safety), but only after the appropriate authority is satisfied that there are no satisfactory alternatives and that such actions will have no detrimental effect on wild population of the species concerned.

The Regulations make special provisions for the protection of European marine sites, requiring the country agencies to advise other authorities of the conservation objectives for a site, and also of the operations which may affect its integrity. The Regulations also enable the establishment of management schemes and byelaws by the relevant authorities and country agencies respectively, for the management and protection of European marine sites.

Wildlife and Countryside Act 1981 (as amended)

The Wildlife and Countryside Act 1981 is the major domestic legal instrument for wildlife protection in the UK, and is the primary means by which the following are implemented:

- The Convention on the Conservation of European Wildlife and Natural Habitats ('the Bern Convention'); and The Council Directive 79/409/EEC on the Conservation of Wild birds (the 'Bird Directive')

Wild Birds

The Act makes it an offence (with exception to species listed in Schedule 2) to intentionally:

- kill, injure, or take any wild bird,
- take, damage or destroy the nest of any wild bird while that nest is in use or being built (also [take, damage or destroy the nest of a wild bird included in Schedule ZA1] under the Natural Environment and Rural Communities Act 2006), or
- take or destroy an egg of any wild bird.

Special penalties are available for offences related to birds listed on Schedule 1, for which there are additional offences of disturbing these birds at their nests, or their dependent young. The Secretary of State may also designate Areas of Special Protection (subject to exceptions) to provide further protection to birds. The Act also prohibits certain methods of killing, injuring, or taking birds, restricts the sale and possession of captive bred birds, and sets standards for keeping birds in captivity.

Other Animals

The Act makes it an offence (subject to exceptions) to intentionally kill, injure or take any wild animal listed on Schedule 5, and prohibits interference with places used for shelter or protection, or intentionally disturbing animals occupying such places. The Act also prohibits certain methods of killing, injuring, or taking wild animals.

Flora, Fungi and Lichens

The Act makes it an offence (subject to exceptions) to intentionally) pick, uproot or destroy:

- any wild plant listed in Schedule 8, or
- unless an authorised person, to intentionally uproot any wild plant not included in Schedule 8,
- to sell, offer or expose for sale, or possess (for the purposes of trade), any live or dead wild plant included in Schedule 8, or any part of, or anything derived from, such a plant.

Non-native Species

The Act contains measures for preventing the establishment of non-native species which may be detrimental to native wildlife, prohibiting the release of animals and planting of plants listed in Schedule 9 in England and Wales. It also provides a mechanism making any of the above offences legal through the granting of licences by the appropriate authorities.

Countryside and Rights of Way (CRoW) Act 2000

The Countryside and Rights of Way Act 2000 applies to England and Wales only. Part III of the Act deals specifically with wildlife protection and nature conservation.

The Act places a duty on Government Departments and the National Assembly for Wales to have regard for the conservation of biodiversity and maintain lists of species and habitats for which conservation steps should be taken or promoted, in accordance with the Convention on Biological Diversity.

Schedule 9 of the Act amends the SSSI provisions of the Wildlife and Countryside Act 1981, including increased powers for their protection and management of SSSIs. The provisions extend powers for entering into management agreements; place a duty on public bodies to further the conservation and enhancement of SSSIs; increase penalties on conviction where the provisions are breached; and include an offence whereby third parties can be convicted for damaging SSSIs.

Schedule 12 of the Act amends the species provisions of the Wildlife and Countryside Act 1981, strengthening the legal protection for threatened species. The provisions make certain offences 'arrestable', include an offence

of reckless disturbance, confer greater powers to police and wildlife inspectors for entering premises and obtaining wildlife tissue samples for DNA analysis, and enable heavier penalties on conviction of wildlife offences.

Natural Environment and Rural Communities (NERC) Act 2006

The Natural Environment and Rural Communities (NERC) Act came into force on 1st October 2006. Section 41 (S41) of the Act required the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The list was drawn up in consultation with Natural England, as required by the Act.

The S41 list is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under section 40 of the Natural Environment and Rural Communities Act 2006, to have regard to the conservation of biodiversity in England, when carrying out their normal functions.

Fifty-six habitats of principal importance are included on the S41 list. These are all the habitats in England that were identified as requiring action in the (now withdrawn) UK Biodiversity Action Plan (UK BAP) and continue to be regarded as conservation priorities in the subsequent UK Post-2010 Biodiversity Framework. They include terrestrial habitats such as upland hay meadows to lowland mixed deciduous woodland, and freshwater and marine habitats such as ponds and subtidal sands and gravels.

There are 943 species of principal importance included on the S41 list. These are the species found in England which were identified as requiring action under the (now withdrawn) UK BAP and which continue to be regarded as conservation priorities under the UK Post-2010 Biodiversity Framework. In addition, the hen harrier has also been included on the list because without continued conservation action it is unlikely that the hen harrier population will increase from its current very low levels in England.

Protection of Badgers Act 1992

Badgers and their setts (burrows) are protected under the Act. This makes it an offence to kill or take a badger, to cruelly ill-treat a badger, or to interfere with a badger sett, including disturbing a badger while it is occupying a sett.

Licences to permit otherwise prohibited actions can be granted under section 10 of the Act for various purposes. This includes licences to interfere with a badger sett for the purpose of development as defined by section 55(1) of the Town and Country Planning Act 1990.

Licences may be granted in order to close down setts, or parts of setts, prior to development or to permit activities close to a badger sett that might result in disturbance. A licence will be required if a sett is likely to be damaged or destroyed in the course of development or if the badger(s) occupying the sett will be disturbed.

Licences can be applied for at any time, but a licence for development will not normally be issued unless full planning permission has been granted. The closure of setts under licence is normally only permitted during July to November, inclusive.

The Hedgerow Regulations 1997

The intention of the Act is to protect important countryside hedges from destruction or damage. The Act does not apply where planning permission has been granted. There are various other exemptions under the Act, including:

- To make a new opening in substitution for an existing one that gives access to land. For example, a gate. However, the old opening must be filled in within 8 months;
- To obtain access to land where other means are not available or are only available at disproportionate cost;
- For the proper management of the hedgerow. This means real management, such as coppicing. But if the hedgerow is deliberately 'over-managed' this might qualify as removal.

If the proposed works are not exempt or subject to a current planning permission then the landowner must serve a Hedgerow Removal Notice in writing on their local planning authority. The authority then has 42 days (which period can be extended if the applicant agrees) to determine whether or not the hedge is considered 'important' under the regulations, and if so, whether or not to issue a Hedgerow Retention Notice. The local authority does not have to issue a Retention Notice, even if the hedgerow counts as important. If they do not issue a notice for an important hedge this is often on condition that certain things are done, *e.g.* reinstatement or replanting to a certain standard, or creation of an equivalent boundary elsewhere.

National Planning Policy Framework

The latest version of the NPPF came into being in February 2019, relevant sections are as follows:
Section 15 of the NPPF relates specifically to 'Conserving and Enhancing the Natural Environment'. Paragraph 170 states that '*Planning policies and decision should contribute to and enhance the natural and local environment by:*

- *protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);*
- *recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;*
- *maintaining the character of the undeveloped coast, while improving public access to it where appropriate;*
- *minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;*
- *preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and*
- *remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.'*

Paragraph 171 states that '*Plans should: distinguish between the hierarchy of international, national and locally designated sites; allocate land with the least environmental or amenity value, where consistent with other policies in this Framework; take a strategic approach to maintaining and enhancing networks of habitats and green infrastructure; and plan for the enhancement of natural capital at a catchment or landscape scale across local authority boundaries.* '
Paragraph 174 states that '*To protect and enhance biodiversity and geodiversity, plans should:*

- *Identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity; wildlife corridors and stepping stones that connect them; and areas identified by national and local partnerships for habitat management, enhancement, restoration or creation; and*
- *promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity.* '

Paragraph 175 states that '*When determining planning application, local planning authorities should apply the following principles:*

- *if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;*
- *development on land within or outside a Site of Special Scientific Interest, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of Sites of Special Scientific Interest;*
- *development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists; and*
- *development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to incorporate biodiversity improvements in and around developments should be encouraged, especially where this can secure measurable net gains for biodiversity.'*

Paragraph 176 states that *'The following should be given the same protection as habitats sites:*

- *potential Special Protection Areas and possible Special Areas of Conservation;*
- *listed or proposed Ramsar sites; and*
- *sites identified, or required, as compensatory measures for adverse effects on habitats sites, potential Special Protection Areas, possible Special Areas of Conservation, and listed or proposed Ramsar sites.*
  '

Paragraph 177 states that *'The presumption in favour of sustainable development does not apply where the plan or project is likely to have a significant effect on a habitats site (either alone or in combination with other plans or projects), unless an appropriate assessment has concluded that the plan or project will not adversely affect the integrity of the habitats site'*

Appendix B: Target Notes

TN1 Pond 1, with waterfowl present, reeds on some edge as well willows and small area of sea club-rush
TN2 Pond 2, reeds and reedmace, waterfowl present, along northern edge New Zealand Pygmyweed present
TN3 Pond 3, small area of reeds and sea club-rush and many marsh frogs
TN4 Pond 7, reeds present not accessible due to deep ditch and dense scrub
TN5 Pond 5, small areas of reed, waterfowl present and large water pump at eastern end.
TN6 Pond 6, areas of reeds, waterfowl present.
TN7 Pond 4, fishing lake with waterfowl and cloudy, disturbed water
TN8 Badger latrine
TN9 Badger latrine
TN10 Badger latrine
TN11 House with bat roost potential. Tile missing below chimney and damaged soffit boards
TN12 Old barn, with potential for roosting Barn Owl.
TN13 Old barn, with potential for roosting barn owl and bat roost potential.

Appendix C: Photographs

Photo 1 - Pond 1: View from north end

Photo 2 - Pond 1: View from southern end.

Photo 3 - Pond 2

Photo 4 - Pond 3

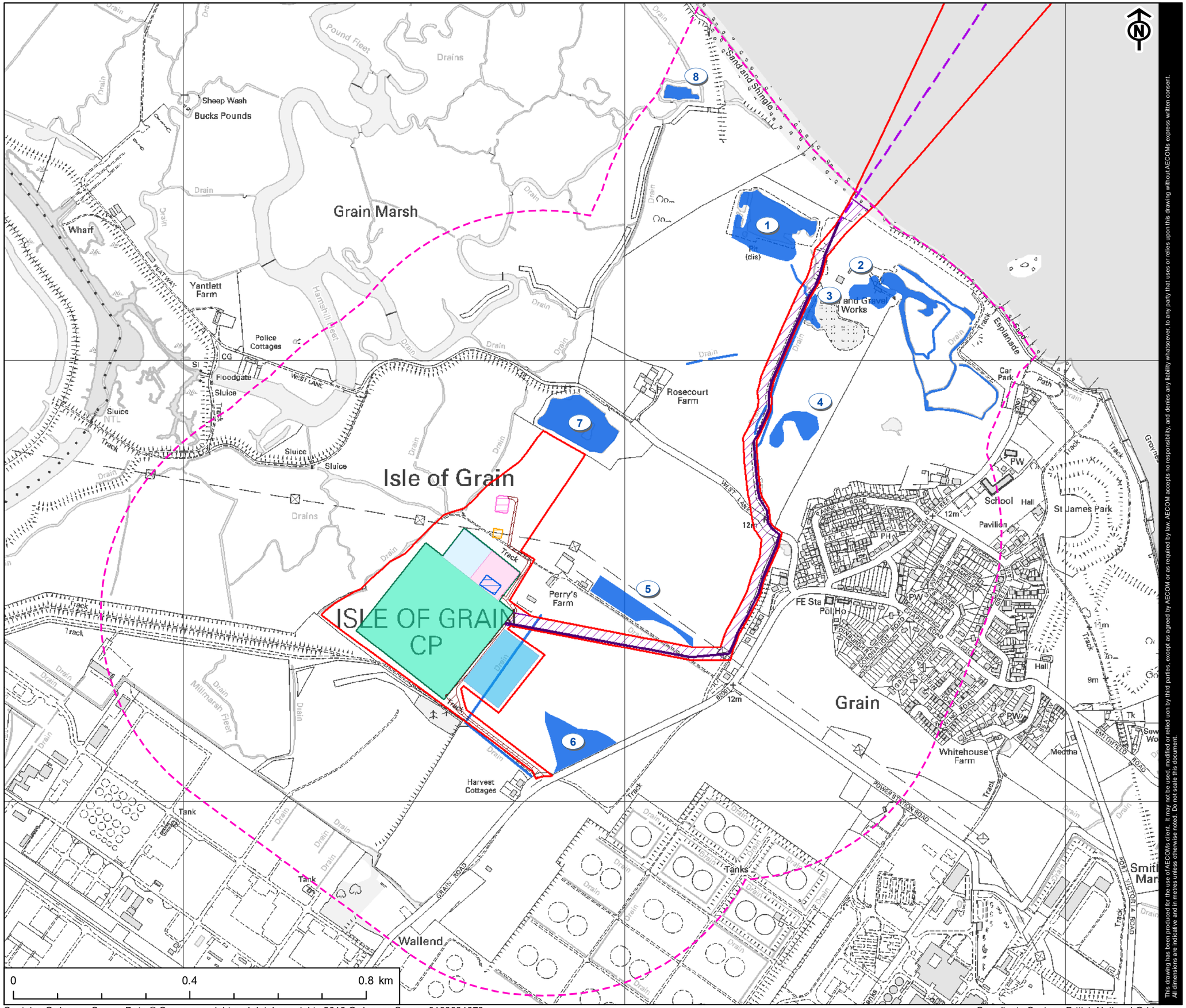
Photo 5 - Pond 4

Photo 6 - Pond 5

Photo 7 – Old ruined barn

Photo 8 – Perry's Farm

Project Management Initials: ## Designer: BF Checked: PC Approved: NG



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Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- 500m site boundary buffer
- Indicative Offshore Cable Route
- Indicative DC Cable Route
- DC Cable Route - 30m Working Width
- Converter Station and Substation Platform - 2m Fence Line Security & Maintenance Corridor
- Access Road
- Converter Station Platform
- Substation Platform
- Construction Laydown Area
- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed Sealing End Compound
- National Grid Proposed GIS Building
- Waterbody, within 500m for the site

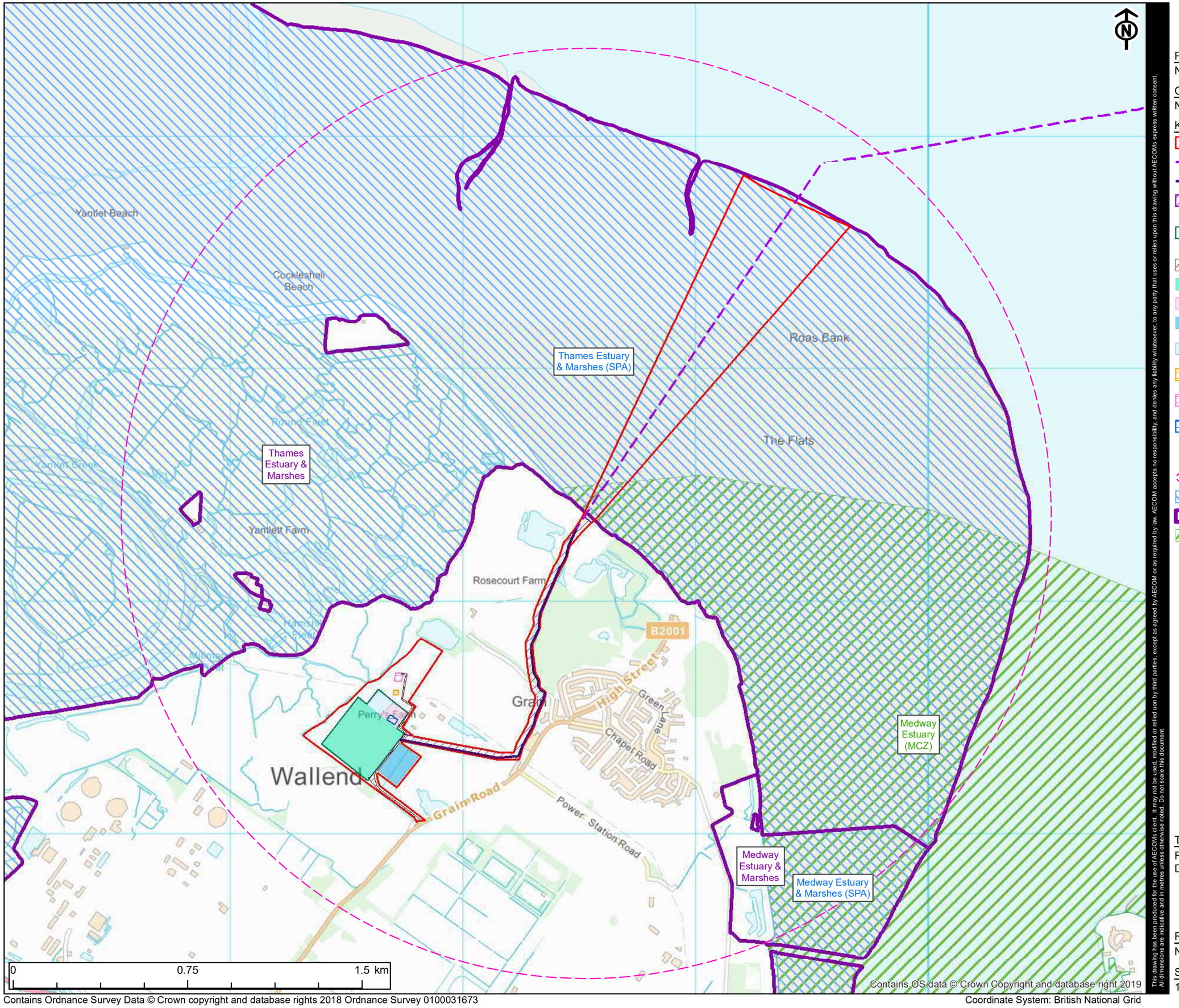
TITLE
FIGURE 2
LOCATIONS OF WATERBODIES WITHIN 500M OF THE SITE

REFERENCE
NC_190808_ECO_2_v1

SHEET NUMBER
1 of 1

DATE
08/08/19

Project Management Initials: ## Designer: BF Checked: PC Approved: NG



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Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- Indicative Offshore Cable Route
- Indicative DC Cable Route
- DC Cable Route - 30m Working Width
- Converter Station and Substation Platform - 2m Fence Line Security & Maintenance Corridor
- Access Road
- Converter Station Platform
- Substation Platform
- Construction Laydown Area
- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed Sealing End Compound
- National Grid Proposed GIS Building
- Search area
- Special Protection Area (SPA)
- Ramsar
- Marine Conservation Zone (MCZ)

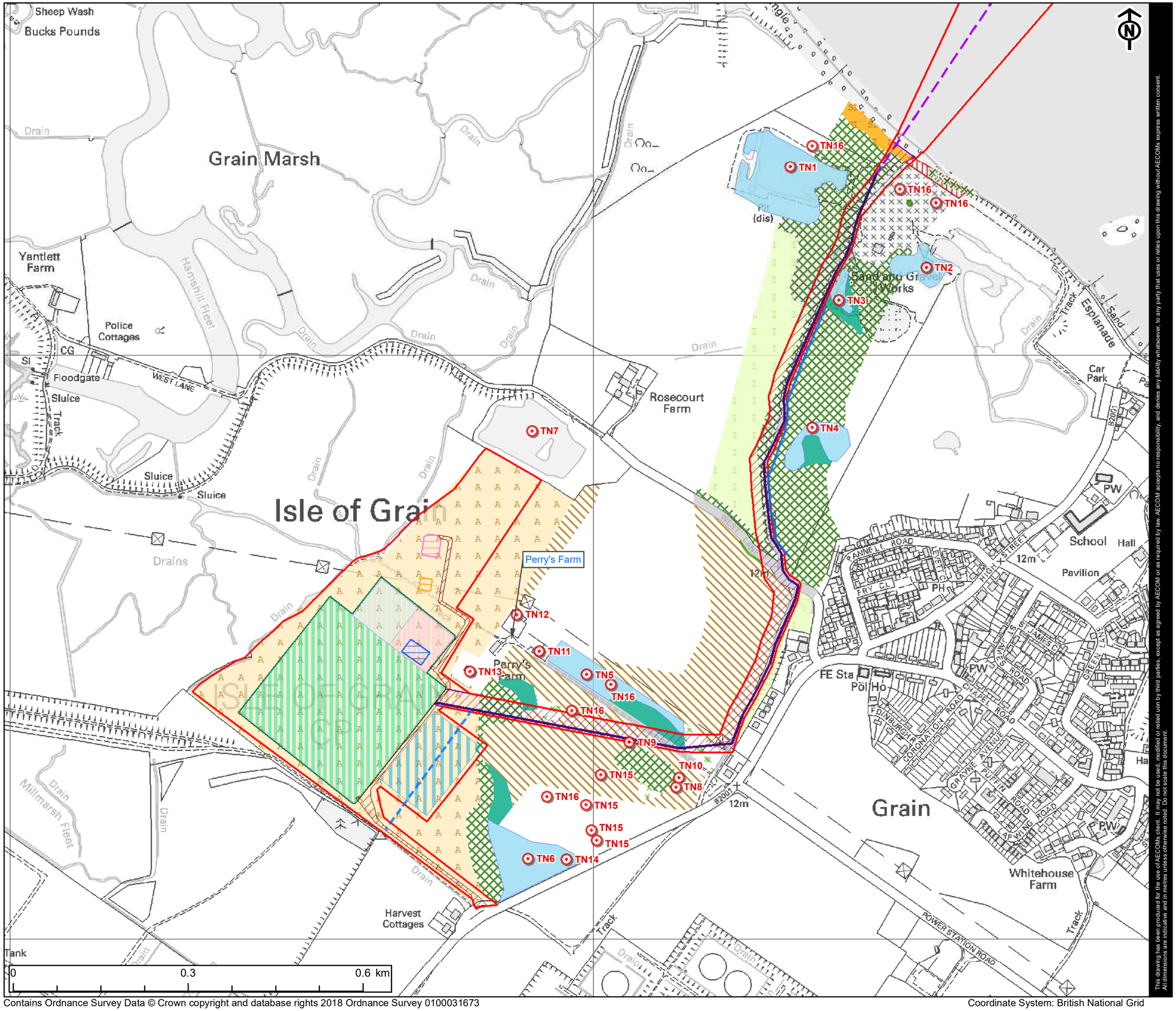
TITLE
FIGURE 3
DESIGNATED SITES WITHIN 2 KM OF THE SITE

REFERENCE
NC_190808_UKON_ECO_3_v1

SHEET NUMBER
1 of 1

DATE
08/08/19

Project Management Initials: ## Designer: BF Checked: PC Approved: NG



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Coordinate System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- Indicative Offshore Cable Route
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- Construction Laydown Area and Potential Substation Expansion Site
- National Grid Proposed Tower
- National Grid Proposed Sealing End Compound
- National Grid Proposed GIS Building

Phase 1 habitat

- Dense/continuous scrub
- Scattered scrub
- SI Semi-improved neutral grassland
- I Improved grassland
- Tall ruderal
- Swamp
- Standing water
- Shingle above high tide mark
- Maritime cliff and slope
- Ephemeral/short perennial
- A Arable
- Hard surface
- Running water
- Species-poor intact hedge
- Dry ditch
- Broad-leaved tree
- Scattered scrub
- Target Note

TITLE
FIGURE 4
PHASE 1 HABITAT

REFERENCE
NC_190808_UKON_ECO_4_v1

SHEET NUMBER
1 of 1

DATE
08/08/19

Appendix 6.B – Report on Surveys of Breeding Birds

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement
Appendix 6B – Report on Surveys for Breeding Birds

NeuConnect Britain Ltd

July 2019

Quality information

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Table of Contents

Figures

Tables

1. Introduction

1.1 AECOM was instructed by NeuConnect Britain Limited (the Applicant) to undertake a survey of breeding birds for the terrestrial area (*i.e.* non-estuarine) for the NeuConnect project (the Proposed Development) at Grain, Isle of Grain. The Preliminary Ecological Appraisal (PEA[1]), undertaken in 2018, identified that the habitat within the Proposed Development area was suitable to support breeding birds and that further surveys were required to determine the presence and, or absence of notable species and the assemblage of any bird species found to be breeding.

1.1 Proposed Development

1.2 NeuConnect (the 'Project'), is a 1400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks. The new link will create a connection for electricity to be passed in either direction between Great Britain and Germany. The Project will be formed by approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HVDC) cables, with on-shore converter stations linking into the existing electricity grids in Great Britain and Germany.

1.3 The Proposed Development will comprise of three structures, a converter station, sub-station and a direct current (DC) cable route (see Figure 1).

1.4 The footprint of the proposed converter station to the perimeter security fence is expected to be up to approximately 250 metres (m) by 250 m with a maximum height of up to 26 m (Figure 1).

1.5 The footprint of the proposed substation to the perimeter security fence is expected to be approximately 80 m by 80 m , with a maximum height of 14 m (Figure 1).

1.6 The proposed DC cable route will be approximately 1.6 km long (from landfall to the converter station). The preferred installation method will be underground, which will result in a temporary loss of land during installation. The working corridor for the installation of the DC cable route will be 30 m, hereby known as DC cable corridor (Figure 1).

1.7 Additional laydown areas will be required for construction, comprising 1.5 hectare (ha) for the converter laydown and 0.3 ha for the substation laydown (Figure 1).

1.2 Site Description

1.8 The Site boundary (the Site) is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The Site is located to the west of the village of Grain, Isle of Grain, Kent at Ordnance Survey (OS) central grid reference TQ 88205 76727. Land use comprises a mix of industrial development to the south, the small settlement of Grain to the south-east and undeveloped land, much of which is designated for ecological interests, to the north (along the coastline) and to the west. Land within the Site and in the immediate vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill.

1.9 The Site boundary and proposed location of each structure are shown in Figure 1.

[1] AECOM, NeuConnect, Isle of Grain: Preliminary Ecological Appraisal Report, 2019.

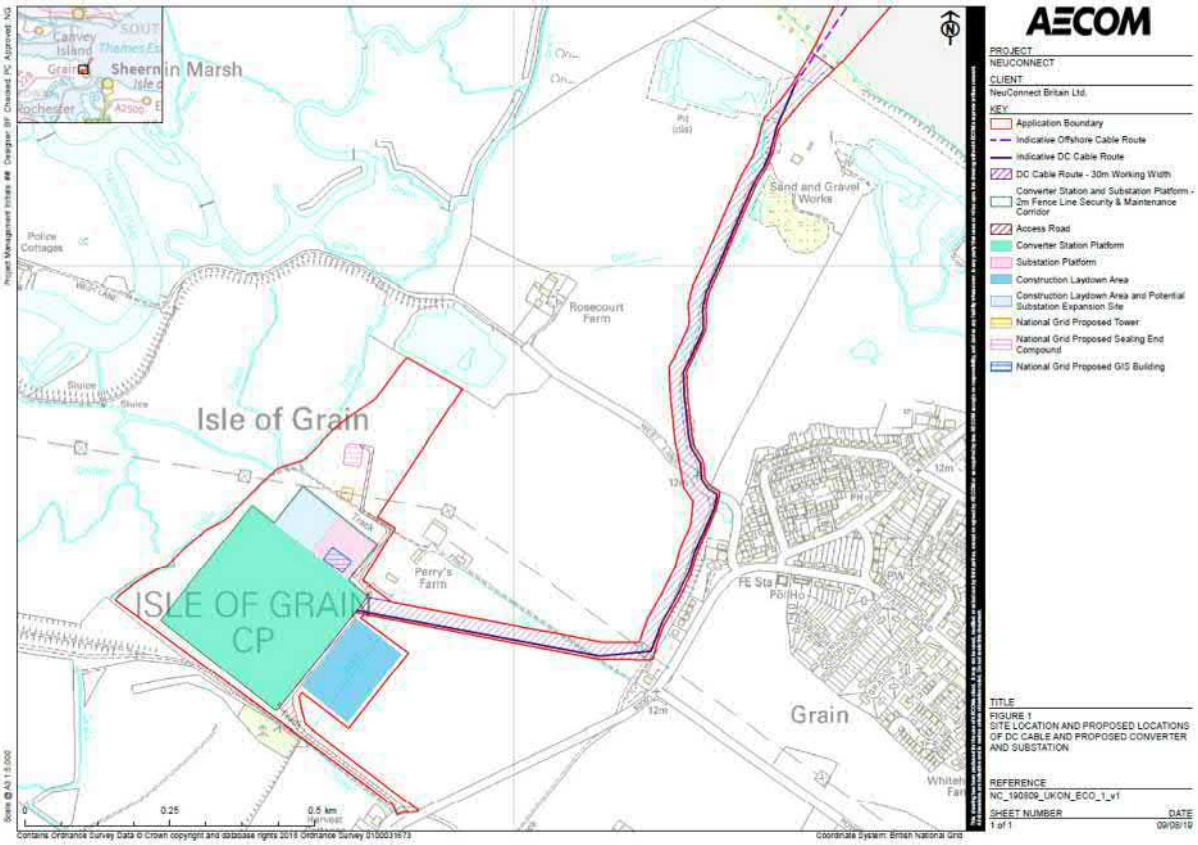

Figure 1 - Site boundary and proposed locations of DC cable corridor, converter station and substation.

1.3 Survey Area

1.10 The survey area included all terrestrial (*i.e.* non-estuarine) habitats within the Site boundary and a 50 m buffer.

1.4 Scope of Report

1.11 The objective of the breeding bird survey, reported in this document, is to determine the presence and assemblage of breeding bird species within the Site boundary and surrounding areas.

2. Conservation Status

2.1 Legislation and Policy

1.12 The legislative provisions for the protection of wild birds in the UK are contained primarily in Sections 1-7 of the Wildlife and Countryside Act (WCA) 1981 (as amended). Under the WCA, a wild bird is defined as any bird of a species that occurs in a wild state as a resident or a visitor to the European Territory of any member state.

1.13 When breeding, all birds, their nest, eggs and nestlings are afforded protection under the WCA 1981, as updated by the Countryside Right of Way Act 2000. Therefore, during the bird breeding season (typically March-August inclusive) it is an offence to:

- intentionally kill, injure or take any wild bird;
- intentionally take, damage or destroy the nest of any wild bird while it is in use or being built; and
- intentionally take or destroy the eggs of any wild bird.

1.14 Additionally, special penalties exist for offences related to species listed on Schedule 1 of the WCA, for which there are additional offences for disturbing these birds at their nest, or their dependent young. Schedule 1 birds cannot be intentionally or recklessly disturbed when nesting and there are increased penalties for doing so. No licences are available for disturbance during a development even in circumstances where that development is fully authorised by consents such as a valid planning permission.

2.2 Assessment Criteria

1.15 An assessment of the ornithological importance of the survey area during the breeding season was also made by evaluating any species afforded special statutory protection or those included on one, or more, of the lists of species of conservation interest. These include:

- species listed on Annex 1 of the EU Birds Directive2;
- species listed on Schedule 1 of the WCA3;
- Natural Environment and Rural Communities (NERC) Species of Principal Importance4;
- species included in the Birds of Conservation Concern (BoCC) Red and Amber Lists (Eaton et al., 20155); and
- those occurring within the survey area in nationally, regionally or locally important numbers.

1.16 The Directive of the Conservation of Wild Birds (EU Birds Directive) lists 194 species, or sub-species, of birds in Annex 1 which are:

- in danger of extinction;
- are rare, or have restricted local distribution;
- are vulnerable to specific changes in their habitat; or
- require particular attention for reasons of the specific nature of habitat.

1.17 These species are afforded enhanced legal protection and EU member states have a responsibility to maintain the populations of these species at a level that corresponds to their

[2] European Commission, 2009. *Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (codified version).* EC, Brussels.
[3] Anon,1981. *The Wildlife & Countryside Act*. HMSO, London.
[4] Anon, 2006. *The Natural Environment and Rural Communities Act.* HMSO, London.
[5] Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D. and Gregory, R., 2015. *Birds of Conservation Concern 4. The population status of birds in the United Kingdom, Channel Islands and Isle of Man*. British Birds 108: 708-746.

ecological, scientific and cultural requirements (Article 2). This Directive is transposed into English law through The Habitats and Species Regulations 2018.

1.18 Species listed on Annex 1 of the Birds Directive are those for which the UK Government is also required to take special measures, including the designation of Special Protection Areas, to ensure the survival and reproduction of these species throughout their area of distribution.

1.19 The Natural Environment and Rural Communities (NERC) list of Species of Principal Importance is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act 2006; under Section 40 every public authority (*e.g.* a local authority or local planning authority) must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity. In addition, with regard to those species on the list of Species of Principal Importance prepared under Section 41 (S41), the Secretary of State must:

> "(a) take such steps as appear to the Secretary of State to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under this Section, or
>
> (b) promote the taking by others of such steps."

1.20 The UK Biodiversity Action Plan (UKBAP)[6] was launched in 1994 and established a framework and criteria for identifying species and habitat types of conservation concern. From this list, action plans for priority habitats and species of conservation concern were published, and have subsequently been succeeded by the UK Post-2010 Biodiversity Framework (July 2012). The UK list of priority species and habitats, however, remains an important reference source and has been used to help draw up statutory lists of priority habitats and species in England, Scotland, Wales and Northern Ireland. For the purpose of this assessment, the UK BAP is still used as one of the criteria to assist in assigning national value to an ecological receptor.

1.21 The Kent Biodiversity Action Plan (1997[7]) includes one bird species, Nightingale *Luscinia megarhynchos.*

1.22 The Kent Red Data Book (Waite, 1999[8]) (KRDB) provides information on Kent's rarest and most threatened flora and fauna. For breeding birds the Kent Red Data Book list includes:

- species for which Kent holds >15% of the British breeding population;
- species that breed in 20 or fewer tetrads in Kent;
- county rare species (25 or fewer breeding pairs in Kent);
- nationally rare species (<1,000 breeding pairs in Britain);
- nationally localised species (breeding in <15% of hectad (i.e. < 406) in Britain) (a hectad is a unit of land area, 10 km x 10 km, i.e. 100 km2);
- red list Birds of Conservation Concern (RSPB 1996); and
- BTO high alert species (Crick 1998).

1.23 Of the 62 bird species listed on the KRDB, 58 are included for their breeding populations and the KRDB is further classified into 1 of 3 categories, depending on their breeding status in Kent. These are as follows:

- KRDB1 - Breeding species with 25 pairs or fewer pairs in Kent;
- KRDB2 - Breeding species with more than 25 pairs in Kent but red listed for their breeding decline (Eaton et al. 2015); or
- KRDB3 - The remaining species on the KRDB list, including the 'high alert' species.

1.24 Species listed on the Birds of Conservation Concern (BoCC) Red List are those that have declined in numbers by 50% over the last 25 years, those that have shown an historical

[6] Anon, 2008. *UK Biodiversity Action Plan.*
[7] Anon, 1997. *The Kent Biodiversity Action Plan*. Kent Biodiversity Action Plan Steering Group, Kent County Council.
[8] Waite, A., 1999. *Kent Red Data Book*. Kent Wildlife Trust.

population decline between 1800 and 1995 and species that are of global conservation concern. There are 67 species on the Red List that are of the most urgent conservation concern.

1.25 Species listed on the BoCC Amber List, of which there are currently 96, include those that have shown a moderate decline in numbers (25%-49%) over the last 25 years and those with total populations of less than 300 breeding pairs. Also included are those species which represent a significant proportion (greater than 20%) of the European breeding or wintering population, those for which at least 50% of the British population is limited to 10 sites or less, and those of unfavourable conservation status in Europe.

1.26 The remaining species are placed on the Green List, indicating that they are of low conservation priority.

2.3 National and Local Planning Policy

1.27 The National Planning Policy Framework (NPPF) was originally published on 27th March 2012 and detailed the Government's planning policies for England and how these are expected to be applied. The NPPF was then revised on 24th July 2018 and 19th February 2019. The NPPF states that the planning system should contribute to and enhance the natural and local environment by minimising impacts on biodiversity and providing net gains in biodiversity where possible.

1.28

1.29 It specifies the obligations that the Local Authorities and the UK Government have regarding statutory designated sites and protected species under UK and international legislation and how this it to be delivered in the planning system. Protected or notable habitats and species can be a material consideration in planning decisions and may therefore make some sites unsuitable for particular types of development, or if development is permitted, mitigation measures may be required to avoid or minimise impacts on certain habitats and species, or where impact is unavoidable, compensation may be required.

1.30 The NPPF is clear that pursuing sustainable development includes moving from a net loss of biodiversity to achieving net gains for nature, and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution.

1.31 National and local planning policy relevant to nature conservation is provided in detail in the Preliminary Ecological Appraisal for the Proposed Development (AECOM, 2019).

3. Methodology

3.1 Desk Study

1.32 A desk study was undertaken in July 2018 through Kent & Medway Biological Records Centre (KMBRC), to obtain records of protected and notable bird species within a 2 km radius of the Site. This data request was limited to records of protected / notable bird species recorded within the last ten years of the request date.

3.2 Field Survey

1.33 The survey was undertaken based on a standard territory mapping methodology for surveying breeding birds as detailed in Gilbert *et al.* (1998[9]) and Bibby *et al.* (2000[10]).

1.34 This method is based on the principle that many species during the breeding season are territorial. This is found particularly amongst passerines, where territories are often marked by conspicuous song, display and periodic disputes with neighbouring individuals.

1.35 The transect route was selected to include the whole survey area, including walking all field boundaries within the survey area to within, where possible, 50 meters from the Site boundary. The whole survey area was covered in each visit, using suitable optical equipment to observe bird behaviour. Survey routes were mapped and the direction walked alternated on each visit, to ensure that all areas were covered at various times of day across the duration of the survey. Surveys were undertaken early in the morning, commencing just after sunrise and finishing before midday.

1.36 Surveys for breeding birds within the DC cable corridor and surrounding area were undertaken between April and June 2018. Surveys for breeding birds within the areas proposed for the Substation and Converter Station were undertaken between April and May 2019. Each survey was undertaken during appropriate weather conditions and avoided, where possible, on days with adverse weather conditions such as heavy rain or strong winds as birds may be harder to detect in such conditions.

1.37 The survey dates and weather conditions for each survey visit are detailed in Table 1.

Table 1. Survey dates and weather conditions during surveys for breeding birds at NeuConnect in 2018 and 2019

Year	Visit number	Survey date	Weather conditions
2018	1	18/04/2018	16°C, cloud 1/8, wind F1S
	2	25/04/2018	11°C, cloud 4/8, wind F3SW
	3	17/05/2018	11°C, cloud 4/8, wind F3NW
	4	24/05/2018	16°C, cloud 7/8, wind F3NE
	5	14/06/2018	16°C, cloud 8/8, wind F5SW
	6	22/06/2018	19°C, cloud 2/8, wind F2NW
2019	1	25/03/2019	6°C, cloud 3/8, wind F3SE

[9] Gilbert, G., Gibbons, D.W. and Evans, J. (1998). Bird Monitoring Methods: A manual of techniques for key species. RSPB/BTO/JNCC/WWT/ITE/The Seabird Group. RSPB/BTO, Sandy, Beds.
[10] Bibby, C.J., Burgess, N.D., Hill, D.A. and Mustoe, S.H. (2000). Bird Census Techniques: 2nd edition. Academic Press, London.

Year	Visit number	Survey date	Weather conditions
	2	08/04/2019	9°C, cloud 7/8, wind F1S
	3	24/04/2019	10°C, cloud 3/8, wind F1S
	4	02/05/2019	10°C, cloud 8/8, wind F1E.
	5	16/05/2019	9°C, cloud 1/8, wind F1S.
	6	28/05/2019	10°C, cloud 4/8, wind F2E.

Notes on Table 1: Wind speed is shown using the Beaufort scale, which is an empirical measure of force 0-12 that relates wind speed to observed conditions. Cloud cover is shown in a scale of 0-8 where the number represents the amount of cloud cover *e.g.* 2/8 is 25% cover, 4/8 is 50% *etc*.

1.38 On each visit, the route was walked at a slow pace with start and finish times noted. All birds seen and heard were recorded directly an ArcGIS base map using ESRI software on hand-held PDA devices, with a 1:10,000 scale Ordnance Survey base map of the survey area. A fresh map was used for each survey. Registrations of birds were recorded using standard British Trust for Ornithology (BTO) two letter species codes. Specific codes were used to record bird behaviour, including singing, calling, flights and movements between areas, carrying food, nest building, aggressive encounters and other bird behaviour.

1.39 All bird species were recorded, whether breeding or not and mapped across the whole survey area.

1.40 The expected outcome from the surveys is that mapped registrations fall into clusters, approximately coinciding with territories. A cluster is generally a spatially distinct group of registrations that represent the activity of not more than one pair. Ideally, clusters include registrations of territorial behaviour across all visits and are clearly demarcated from adjacent clusters by simultaneous recording of neighbouring birds. Where a species has closely packed territories, the mapping of simultaneously singing birds becomes essential. Territory boundaries are assumed to be between such birds.

1.41 Territory mapping methods produce analysis maps of non-overlapping ellipses encircling clusters of records thought to relate to separate pairs of breeding birds. These ellipses may not show the entire extent of the pairs' actual breeding territory which may be significantly larger; however, they are likely to show those areas in which the pair is most active.

1.42 On completion of the surveys, analysis maps were produced for each species, consisting of all registrations recorded during the surveys in 2018 and 2019. From these species maps, the number of territories was calculated by identifying the number of clusters present from both years. Any duplicated territories, where the survey areas overlapped between years, were discounted.

1.43 For late-arriving migrants, *e.g.* Spotted Flycatcher *Muscicapa striata,* for which fewer potential contacts are possible, only one registration is required to form a territory cluster. A number of species are not territorial and are dealt with appropriately, *e.g.* Linnet *Linaria cannabina*, where data represent aggregations or loose colonies.

1.44 Standard registration mapping techniques were also used to record non-breeding species.

1.45 The following definitions have been used to identify the breeding status of the species recorded:

- Confirmed: includes species for which territories were positively identified as a result of the number of registrations recorded; the location of an active nest; or the presence of recently fledged young / downy young
- Probable: includes a species pair observed in suitable nesting habitat during surveys; or agitated behaviour / anxiety calls from adults (suggesting the presence of a nest or young nearby). Behaviour was observed on insufficient occasions to confirm the presence of a territory.

- Possible: includes species observed during surveys in suitable nesting habitat; or a singing male present (or breeding calls heard) in suitable breeding habitat.
- Non-breeding: species-specific information was used to determine fly-over species, or species suspected to be summering non-breeder.

3.3 Assessment of Ornithological Importance

1.46 To support a focussed assessment of the population of breeding birds within the survey area, their biodiversity value has been defined with reference to the geographical level at which it matters. The frames of reference used in this appendix were made using the values presented in the *Guidelines for Ecological Impact Assessment in the United Kingdom: Terrestrial, Freshwater* (CIEEM 2017[11]).

1.47 The evaluation uses a framework, linked to a geographical scale at which the receptor has been valued (*i.e.* international, national, regional, county, local or site) and this method represents best practice guidance. This assessment criteria, set out in Table 2, has been used to assess the biodiversity value of the breeding bird populations recorded during the field surveys.

Table 2. Importance of Ornithological Features

Importance of Ornithological Features	Descriptors and Examples of Criteria
International or European	An internationally designated site or candidate site including Special Protection Area (SPA), potential SPAs (pSPAs)[1]; and Ramsar sites (wetlands of international importance). Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Resident or regularly occurring populations of species which may be considered at an international or European level[2] where: - the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; - the population forms a critical part[3] of a wider population at this scale; or - the species is at a critical phase[4] of its life cycle at this scale.
UK or National	Sites designated at UK or national level e.g. Site of Special Scientific Interest (SSSI). Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Areas of key or priority species identified in the UK Post-2010 Biodiversity Framework *i.e.* UK Biodiversity Action Plan (BAP), including those published in accordance with Section 41 of the Natural Environment and Rural Communities Act (2006) and those considered to be of principal importance for the conservation of biodiversity. Resident or regularly occurring populations of species which may be considered at a UK or a national level[5] where: - the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; - the population forms a critical part of a wider population at this scale; or - the species is at a critical phase[4] of its life cycle at this scale.

[11] CIEEM, 2017. *Guidelines for Ecological Impact Assessment in the United Kingdom: Terrestrial, Freshwater.*

Importance of Ornithological Features	Descriptors and Examples of Criteria
Regional	Populations of species of value at a regional level (*i.e.* South East). Resident or regularly occurring populations of species which may be considered at a regional level[6] where: - the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; - the population forms a critical part of a wider population at this scale; or - the species is at a critical phase of its life cycle at this scale.
County or Unitary Authority or District	Populations of species of value at a County (*i.e.* Kent) level or District (*i.e.* Medway District Council). Designated sites, such as County Wildlife Site (CWS), Local Wildlife Site (LWS) or Sites of Importance for Nature Conservation (SINC) and Local Nature Reserve (LNR) designated in the county or unitary authority area *i.e.* District context. Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Areas of key or priority habitats identified in the Local Biodiversity Action Plan (LBAP). Resident or regularly occurring populations of species which may be considered at a County (or District) level[7] where: - the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; - the population forms a critical part of a wider population at this scale; or, - the species is at a critical phase of its life cycle at this scale.
Local	Species populations of value in a local (*i.e.* within ~ 5 km of the site) context. Designated sites include LNRs designated in the local context. Populations and, or communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange.
Site	Habitats and associated species that is of value in the context of the site only. Populations of common and widespread species.

1. pSPAs are sites which UK Government has been formally advised of but have not yet been submitted to the European Commission. These sites should be valued at an international (European) level on the basis that they meet the relevant selection criteria for a SPA but are not yet designated as such.
2. Such species include those listed within the Directive 2009/147/EC on the Conservation of Wild Birds (*i.e.* EC Birds Directive) (codified version of Council Directive 79/409/EEC as amended) or animal or plant species listed within Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (*i.e.* Habitats Directive).
3. Such populations include sub-populations that are essential to maintenance of meta-population dynamics, *e.g.* critical emigration and, or immigration links between otherwise discrete populations.
4. Seasonal activity or behaviour upon which survival or reproduction depends.
5. Species which may be considered at the UK or national level mean: birds, other animals and plants which receive legal protection on the basis of their conservation interest (those listed within the Wildlife and Countryside Act 1981 (as amended) Schedule 1, 5 and 8); species listed for their principal importance for biodiversity (in accordance with the Natural Environment and Communities Act 2006 Section 41 England), priority species listed within the UK Post 2010 Biodiversity Framework (*i.e.* UK Biodiversity Action Plan (UKBAP)), or species listed within the Red Data Book.
6. Such species include those listed in the appropriate Natural Character Area description.

Importance of Ornithological Features **Descriptors and Examples of Criteria**

7. Such species include those at county level (*i.e.* Kent) including unitary authority area *i.e.* District level (*i.e.* Medway); as listed on the LBAPs; and listed as a county designated site.

*As well as assigning importance there is also a need to identify all legally protected species that could be affected by the Proposed Development in order that measures can be taken to ensure that adherence to the relevant legislation is observed. This may include the adoption of mitigation and appropriate licensing which are acceptable to Natural England.

3.3.1 Species Abundance Assessment

1.48 In addition to evaluating a site based on its populations of breeding birds in relation to legal status, rarity and conservation value, consideration has to be given to the value of the Site for the population of individual species that it supports. This can be done by comparing the population present within the study area with the national and county breeding population for certain species. National estimates for breeding birds are published in *Population estimates of birds in Great Britain and the United Kingdom* (Musgrove *et al*. 2013[12]). The *Bird Atlas 2007-2011* (Balmer *et al*. 2013[13]) was also reviewed for species information on a national level.

1.49 For information on the population status of breeding bird species at a county level in Kent, the *Kent Breeding Bird Atlas 2008 – 2013* (Kent Ornithological Society, 2016[14]) and Rare Breeding Bird Panel (Holling, 2016)[15] provided a useful source of information. Where presented, current county-level estimates on the breeding bird populations of the majority of species in Kent were sourced from county avifauna reports.

3.3.2 Species Diversity Assessment

1.50 The number of species recorded in an area is a simple measure of diversity that can indicate its importance at each season of the year. Table 3 shows the breeding species diversity criteria as outlined in Fuller (1980[16]), which provided a method for assessing the ornithological interest of sites for conservation.

Table 3. Breeding Species Diversity Criteria (Fuller, 1980)

Local	County	Regional	National
25-49	50-69	70-84	85+

1.51 It should be noted that Fuller's analysis was developed in the 1970s and, since then, species diversity has declined significantly. As a result, Fuller's thresholds are, in most circumstances, too high for today's breeding bird populations.

1.52 The '*Guidelines for selection of Biological SSSIs*'(Drewitt *et al*., 2015[17]) provide a scoring system for habitats based on the breeding presence of certain key species which are characteristic of the habitat and give a threshold value for SSSI selection based on the score. Each species listed is given an index of abundance from 0 to 6, which refers to the total numbers of breeding pairs in Britain.

1.53 Local Wildlife Sites (LWS) are among the most important places for wildlife in Kent, together with legally protected land such as Sites of Special Scientific Interest (SSSIs). An individual LWS can

[12] Musgrove, A., Aebischer, N., Eaton, M., Hearn, R., Newson, S., Noble, D., Parsons, M., Risely, K, and Stroud, D. (2013) Population estimates of birds in Great Britain and the United Kingdom. British Birds 106, 64-100.
[13] Balmer, D., Gillings, S., Caffrey, B., Swann, B., Downie, I and Fuller, R., 2013. *Bird Atlas 2007-2011, 2013.*
[14] Kent Ornithological Society., 2016. *Kent Breeding Bird Atlas 2008 – 2013.* Kent.
[15] Holling, M. and the Rare Breeding Bird Panel., 2016. Rare breeding birds in the United Kingdom in 2013. British Birds 108, 373-422.
[16] Fuller, R.J., 1980. A method for assessing the ornithological interest of sites for conservation.
[17] Drewitt, A.L., Whitehead, S. and Cohe, S., 2015. *Guidelines for the Selection of Biological SSSIs, Part 2. Detailed Guidelines for Habitats and Species Groups.* JNCC.

be considered for selection for birds in the county if it meets the criteria within the '*Criteria for Selection and Delineation'* (Kent Wildlife Trust, 2015)[18].

1.54 A site should be selected as a Local Wildlife Site if it can be considered as a single, identifiable unit in terms of its bird fauna and where:

- It is occupied regularly by at least 2.5% of the county population of any one or more bird species, based on the most recent and authoritative data.
- It is occupied regularly as a breeding site by species with a Kent population of 50 or fewer territories.
- It holds ten or more Kent Red Data Book 2 (KRDB2) species in the breeding season.
- It holds three or more Kent Red Data Book 3 (KRDB3) species at the appropriate time of year (normally this should not include a combination of breeding and wintering species). or
- It has been recorded as being regularly used in recent years by at least 50 breeding bird species;

1.55 The LWS selection criteria for Kent, recognises:

- the rarity of certain breeding bird species;
- birds which may be considered vulnerable because their populations are in decline;
- birds which are vulnerable because of their colonial nesting habitats; and
- sites of importance for the presence of a diversity of species.

3.4 Survey Limitations

The breeding bird survey had to be completed over two years, as in 2018 only the northern section of the DC cable route was confirmed. Therefore a further six survey visits had to be completed in 2019, to include the southern section of the Proposed Development where the location of the converter, substation and southern section of the DC cable route had been confirmed. All areas of the Site were subject to six survey visits and so this is not considered a limitation to the survey and will not have affected the outcome.

The majority of ecological data is valid only for short periods due to the inherently transient nature of the subject (CIEEM, 2019[19]). On this basis, it is recommended that the surveys for breeding birds will need repeating in two years (*i.e.* in 2020).

[18] Kent Wildlife Trust, 2015. *Local Wildlife Sites in Kent*, *Criteria for Selection and Delineation.* Kent.
[19] CIEEM: Advice Note on the lifespan of ecological surveys and reports https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf (Accessed July 2019)

4. Results

4.1 Desk Study

1.56 The KMBRC data search returned records of 213 bird species from within 2 km of the Site and within the last ten years. Of these 213 bird species, 150 are protected or notable and a full list of the 150 protected / notable bird species recorded during the data search is included in Appendix A.

4.2 Field Survey

1.57 A total of 74 species were recorded during the survey of breeding birds between April and June 2018 and April and May 2019. Of these 74 species, territories of 26 species were confirmed and territories of a further 12 species were considered to be probable or possible within the survey area, resulting in a breeding bird assemblage of 38 species. Records relating to the remaining 36 species were considered to be of non-breeding species.

1.58 A summary of the breeding and conservation status of the 74 species recorded during the survey, with the numbers of territories identified (or thought likely in the case of probable and possible records) is provided below in Table 4.

Table 4. The breeding and conservation status of bird species recorded during surveys at NeuConnect between April & June 2018 and April & May 2019.

Species (English name)	Scientific name	Breeding Status	Total Number of territories within the survey area (where applicable)	Annex 1	WCA Schedule 1	UKBAP Priority Species	NERC Species	BoCC Species	Kent Red Data Book
Canada Goose	*Branta canadensis*	Non-breeding	0	-	-	-	-	-	-
Greylag Goose	*Anser anser*	Non-breeding	0	-	-	-	-	-	-
Shelduck	*Tadorna tadorna*	Non-breeding	0	-	-	-	-	Amber	-
Gadwall	*Mareca strepera*	Non-breeding	0	-	-	-	-	Amber	-
Wigeon	*Mareca Penelope*	Non-breeding	0	-	-	-	-	Amber	-
Mallard	*Anas platyrhynchos*	Confirmed	2	-	-	-	-	Amber	-
Pochard	*Aythya ferina*	Non-breeding	0	-	-	-	-	Red	KRDB3
Tufted Duck	*Aythya fuligula*	Possible	1	-	-	-	-	-	-
Red-legged Partridge	*Alectoris rufa*	Non-breeding	0	-	-	-	-	-	-
Pheasant	*Phasianus colchicus*	Probable	3	-	-	-	-	-	-
Little Grebe	*Tachybaptus ruficollis*	Confirmed	2	-	-	-	-	-	-
Grey Heron	*Ardea cinerea*	Non-breeding	0	-	-	-	-	-	-
Little Egret	*Egretta garzetta*	Non-breeding	0	✓	-	-	-	-	-
Cormorant	*Phalacrocorax carbo*	Non-breeding	0	-	-	-	-	-	KRDB3
Sparrowhawk	*Accipiter nisus*	Non-breeding	0	-	-	-	-	-	-
Marsh Harrier	*Circus aeruginosus*	Confirmed	1	✓	✓	-	-	Amber	-
Buzzard	*Buteo buteo*	Non- breeding	0	-	-	-	-	-	-
Moorhen	*Gallinula chloropus*	Probable	1	-	-	-	-	-	-
Coot	*Fulica atra*	Confirmed	2	-	-	-	-	-	-
Oystercatcher	*Haematopus ostralegus*	Non-breeding	0	-	-	-	-	Amber	-
Snipe	*Gallinago gallinago*	Non-breeding	0	-	-	-	-	Amber	-
Green Sandpiper	*Tringa ochropus*	Non-breeding	0	-	-	-	-	Amber	-

Species (English name)	Scientific name	Breeding Status	Total Number of territories within the survey area (where applicable)	Annex 1	WCA Schedule 1	UKBAP Priority Species	NERC Species	BoCC Species	Kent Red Data Book
Black-headed Gull	*Chroicocephalus ridibundus*	Non-breeding	0	-	-	-	-	Amber	-
Herring Gull	*Larus argentatus*	Non-breeding	0	-	-	✓	✓	Red	KRDB2
Lesser Black-backed Gull	*Larus fuscus*	Non-breeding	0	-	-	-	-	Amber	-
Stock Dove	*Columba oenas*	Confirmed	1	-	-	-	-	Amber	-
Turtle Dove	*Streptopelia turtur*	Non-breeding	0	-	-	✓	✓	Red	KRDB2
Wood Pigeon	*Columba palumbus*	Confirmed	1	-	-	-	-	-	-
Collared Dove	*Streptopelia decaocto*	Probable	1	-	-	-	-	-	-
Cuckoo	*Cuculus canorus*	Confirmed	2	-	-	✓	✓	Red	KRDB2
Little Owl	*Athene noctua*	Non-breeding	0	-	-	-	-	-	-
Swift	*Apus apus*	Non-breeding	0	-	-	-	-	Amber	-
Great Spotted Woodpecker	*Dendrocopos major*	Confirmed	1	-	-	-	-	-	-
Green Woodpecker	*Picus viridis*	Confirmed	1	-	-	-	-	-	-
Kestrel	*Falco tinnunculus*	Non-breeding	0	-	-	-	-	Amber	-
Peregrine	*Falco peregrinus*	Non-breeding	0	✓	✓	-	-	-	KRDB1
Jay	*Garrulus glandarius*	Non-breeding	0	-	-	-	-	-	-
Magpie	*Pica pica*	Confirmed	1	-	-	-	-	-	-
Jackdaw	*Coloeus monedula*	Non-breeding	0	-	-	-	-	-	-
Rook	*Corvus frugilegus*	Non-breeding	0	-	-	-	-	-	-
Carrion Crow	*Corvus corone*	Probable	3	-	-	-	-	-	-
Blue Tit	*Cyanistes caeruleus*	Confirmed	3	-	-	-	-	-	-
Great Tit	*Parus major*	Confirmed	4	-	-	-	-	-	-
Skylark	*Alauda arvensis*	Confirmed	6	-	-	✓	✓	Red	KRDB2
Swallow	*Hirundo rustica*	Non-breeding	0	-	-	-	-	Amber	-

Species (English name)	Scientific name	Breeding Status	Total Number of territories within the survey area (where applicable)	Annex 1	WCA Schedule 1	UKBAP Priority Species	NERC Species	BoCC Species	Kent Red Data Book
House Martin	*Delichon urbicum*	Non-breeding	0	-	-	-	-	Amber	-
Cetti's Warbler	*Cettia cetti*	Confirmed	6	-	✓	-	-	-	-
Long-tailed Tit	*Aegithalos caudatus*	Non-breeding	0	-	-	-	-	-	-
Willow Warbler	*Phylloscopus trochilus*	Possible	1	-	-	-	-	Amber	-
Chiffchaff	*Phylloscopus collybita*	Confirmed	4	-	-	-	-	-	-
Sedge Warbler	*Acrocephalus schoenobaenus*	Probable	1	-	-	-	-	-	-
Reed Warbler	*Acrocephalus scirpaceus*	Confirmed	2	-	-	-	-	-	KRDB3
Blackcap	*Sylvia atricapilla*	Confirmed	10	-	-	-	-	-	-
Garden Warbler	*Sylvia borin*	Non-breeding	0	-	-	-	-	-	-
Lesser Whitethroat	*Sylvia curruca*	Confirmed	2	-	-	-	-	-	-
Whitethroat	*Sylvia communis*	Confirmed	23	-	-	-	-	-	-
Goldcrest	*Regulus regulus*	Non-breeding	0	-	-	-	-	-	KRDB3
Wren	*Troglodytes troglodytes*	Confirmed	20	-	-	-	-	-	-
Starling	*Sturnus vulgaris*	Non-breeding	0	-	-	✓	✓	Red	KRDB2
Blackbird	*Turdus merula*	Confirmed	7	-	-	-	-	-	-
Song Thrush	*Turdus philomelos*	Possible	1	-	-	✓	✓	Red	KRDB2
Mistle Thrush	*Turdus viscivorus*	Non-breeding	0	-	-	-	-	Red	-
Robin	*Erithacus rubecula*	Confirmed	2	-	-	-	-	-	-
Nightingale*	*Luscinia megarhynchos*	Probable	1	-	-	-	-	Red	-
House Sparrow	*Passer domesticus*	Confirmed	3	-	-	✓	✓	Red	KRDB3(High alert)

Species (English name)	Scientific name	Breeding Status	Total Number of territories within the survey area (where applicable)	Annex 1	WCA Schedule 1	UKBAP Priority Species	NERC Species	BoCC Species	Kent Red Data Book
Dunnock	*Prunella modularis*	Confirmed	11	-	-	✓	✓	Amber	-
Pied Wagtail	*Motacilla alba*	Non-breeding	0	-	-	-	-	-	-
Meadow Pipit	*Anthus pratensis*	Non-breeding	0	-	-	-	-	Amber	-
Chaffinch	*Fringilla coelebs*	Confirmed	5	-	-	-	-	-	-
Greenfinch	*Chloris chloris*	Probable	2	-	-		-	-	-
Linnet	*Linaria cannabina*	Confirmed	3	-	-	✓	✓	Red	KRDB2
Goldfinch	*Carduelis carduelis*	Confirmed	3	-	-	-	-	-	-
Corn Bunting	*Emberiza calandra*	Non-breeding	0	-	-	✓	✓	Red	KRDB2
Reed Bunting	*Emberiza schoeniclus*	Possible	1	-	-	✓	✓	Amber	-

Notes on Table 4: *Kent Biodiversity Action Plan species

1.59 A total of 38 species had breeding territories confirmed or thought probable / possible within the survey area. The number of territories for each species and where they were recorded within the survey area is summarised below in Table 5.

Table 5. Location of breeding bird territories

Species (English name)	Total number of territories within the survey area	Total number of territories within the site boundary	Total number of territories outside of site boundary
Mallard	2	-	2
Tufted Duck	1	-	1
Pheasant	3	-	3
Little Grebe	3	-	3
Marsh Harrier	1	-	1
Moorhen	1	-	1
Coot	4	-	4
Stock Dove	1	1	-
Wood Pigeon	2	-	2
Collared Dove	1	1	
Cuckoo	2	1	1
Great Spotted Woodpecker	1	-	1
Green Woodpecker	2	-	2
Magpie	1	1	-
Carrion Crow	3	3	-
Blue Tit	2	1	1
Great Tit	4	2	2
Skylark	2	2	-
Cetti's Warbler	6	1	5
Willow Warbler	1	1	-
Chiffchaff	4	1	3
Sedge Warbler	1	1	-
Reed Warbler	3	-	3
Blackcap	10	5	5
Lesser Whitethroat	2	2	
Whitethroat	23	15	8
Wren	20	9	11
Blackbird	7	3	4
Song Thrush	1	1	-
Robin	2	1	1
Nightingale	1	-	1
House Sparrow	3	1	2
Dunnock	11	5	6
Chaffinch	5	3	2
Greenfinch	3	1	2
Linnet	3	1	2
Goldfinch	3	2	1
Reed Bunting	1	-	1

5. Evaluation

5.1 Desk Study

1.60 Records of 150 protected and, or notable species were returned from the KMBRC data search. Of these 150 species:

1.61 36 are listed on Annex 1 of the EU Birds Directive;

1.62 51 are listed on Schedule 1 of the Wildlife and Countryside Act, 1981;

1.63 30 are listed as priority species on the UK Biodiversity Action Plan and as a species of principal importance under Section 41 of the NERC Act;

1.64 79 species are included on the Birds of Conservation Concern Amber List;

1.65 43 species are included on the Birds of Conservation Concern Red List;

1.66 21 species are listed as a breeding species with 25 pairs or less in Kent in the Kent Red Data Book (KRDB1);

1.67 15 species are listed as a breeding species with more than 25 pairs in Kent but red listed for their breeding decline (RSPB 1996) – but not the 'high alert' species (KRDB2); and

1.68 13 species are listed on the Kent Red Data Book bird list (KRDB3) for their breeding populations in Kent. These includes House Sparrow and Yellowhammer which are also listed as high alert species.

5.2 Field Survey

1.69 Of the 150 protected and, or notable species returned from the data search, 33 species have the potential to occur (and possibly breed) within the survey area during the breeding season and 15 of those 34 were confirmed as having breeding territories, or were probably or possibly on territory, within the survey area during field surveys. The 18 species that were identified during the desk study that have the potential to breed within the survey area, but were either not recorded during the field surveys or were recorded within the survey area but not breeding were:

- Mute Swan;
- Shelduck;
- Gadwall;
- Pochard;
- Hobby;
- Water Rail;
- Marsh Warbler;
- Grey Partridge;
- Lapwing;
- Turtle Dove;
- Meadow Pipit;
- Yellow Wagtail;
- Grey Wagtail;
- Wheatear;
- Mistle Thrush;
- Goldcrest

- Yellowhammer Emberiza citrinella; and
- Corn Bunting Emberiza calandra.

5.2.1 Specially Protected Species

Annex 1 species

1.70 Marsh Harrier was confirmed to have a breeding territory within the survey area, just east of the DC cable route and south of sand and gravel works.

1.71 Peregrine was recorded within the survey area during surveys for breeding birds in 2018 and 2019, but not confirmed (or thought probable or possible) to be breeding.

1.72 Marsh Harrier and Peregrine are also included on Schedule 1 of the Wildlife and Countryside Act (1981, as amended).

Schedule 1 listed species

1.73 A single Cetti's Warbler territory was confirmed within the Site boundary, with a further five territories confirmed outside the Site boundary and within the survey area. These six territories were confirmed within the swamp and scrub habitat found in the southern section of the survey area.

Species of conservation importance

Priority species (UK Biodiversity Action Plan / Species of Principal Importance)

1.74 Breeding territories of six species (Cuckoo, Skylark, Song Thrush, House Sparrow, Dunnock and Linnet), included as priority species on the UK Biodiversity Action Plan and listed as Species of Principal Importance prepared under Section 41 of the Natural Environment and Rural Communities Act 2006, were confirmed or thought probable or possible within the Site boundary. A single Reed Bunting territory was confirmed outside the Site boundary, within the survey area.

Birds of Conservation Concern

1.75 Breeding territories were confirmed, or thought probable or possible, for five species within the Site boundary and survey area that are included on the Birds of Conservation Concern (BoCC) Red List. Each species and the reason for its placement on the Red List are provided below:

- Cuckoo - severe decline in the UK breeding population size (>50%) over 25 years; and severe decline in the UK breeding population of more than 50% over the entire period used for assessments;
- Skylark - moderate (25-50%) decline in the UK breeding population in the last 25 years and severe (>50%) decline over the entire period used for assessments since the first BoCC review in 1969;
- Song Thrush - severe (>50%) long-term decline in UK breeding population during the entire period used for assessments since the first BoCC review in 1969;
- House Sparrow - moderate (25-50%) decline in the UK breeding population in the last 25 years and severe (>50%) decline over the entire period used for assessments since the first BoCC review in 1969; and
- Linnet - severe decline in the UK breeding population of more than 50% over the entire period used for assessments.

1.76 Breeding territories were confirmed, or thought probable or possible, for five species within the survey area that are included on the Birds of Conservation Concern Amber List. These species and the reasons for their placement on the Amber List are provided below:

- Mallard - moderate decline in the non-breeding population over the last 25 years;

- Marsh Harrier - previously Red-listed species due to historical decline, followed by an increase of at least 100% over 25 years or the longer-term period. Breeding is localised, with > 50% of the UK population found at ten or fewer sites.
- Stock Dove - species breeding in international importance, with 20-30% of the European Population in the UK;
- Dunnock - moderate decline in the UK breeding population of more than 25% but less than 50% over the entire period used for assessments; and
- Reed Bunting - moderate decline in the UK breeding population of more than 25% but less than 50% over the entire period used for assessments.

1.77 Only Marsh Harrier and Dunnock had confirmed (or probable or possible) breeding territories within the Site boundary.

Kent Red Data Book: Birds

1.78 Breeding territories were confirmed, or thought probable or possible for a total of six Kent Red Data Book bird species (Cuckoo, Skylark, Song Thrush, Linnet, Reed Warbler and House Sparrow) within the survey area. Of these six species, Cuckoo, Skylark, Song Thrush and Linnet are listed as KRDB2, a breeding species with more than 25 pairs in Kent but red listed for their breeding decline (RSPB 1996). Reed Warbler and House Sparrow are listed as KRDB3 due to their breeding populations in Kent, with House Sparrow also listed as a high alert species.

1.79 Five of these species, Cuckoo, Skylark, Song Thrush, Linnet and House Sparrow had confirmed (or probable / possible) breeding territories within the Site boundary.

Kent Biodiversity Action Plan Species

1.80 One breeding territory of Nightingale was thought probable within woodland habitat south of the Site boundary within the survey area (see Figure 3 in Appendix B).

5.2.2 Species abundance

1.81 No species were present within the survey area in numbers of national significance, *i.e.* 1% or more of the UK population, when compared to national population estimates as given in Musgrove *et al.* (2013).

1.82 Two species (Marsh Harrier and Cetti's Warbler) were present in number approaching 1% of the county level, when compared to the breeding population estimates for the county as detailed in the Kent Breeding Bird Atlas 2008-2013.

1.83 The Kent Breeding Bird Atlas estimated the breeding population of Marsh Harrier at between 80 – 100 breeding females. Therefore the single Marsh Harrier territory recorded within the survey area, when evaluated against this figure, would represent 1.8% of the minimum number of territories within Kent and 1% of the maximum number of territories, resulting in the Site's population being of county level importance.

1.84 However, the national and county populations of Marsh Harrier from 2015, based on a five-year mean and reported by the Rare Breeding Birds Panel (RBBP) (Hollings *et al.* 2017) is estimated to be 354 breeding pairs and 46-47 pairs respectively. Therefore, one territory or pair present within the survey area would represent 0.3% of the estimated national population and 2.2 % of the minimum Kent population. Therefore, the single territory or pair of Marsh Harrier within the survey area is considered to be of importance, with a population approaching that of district importance based on breeding information as reported by the RBBP (Holling *et al*., 2016).

1.85 Cetti's Warbler was confirmed to have six breeding territories within the survey area. The Kent Breeding Bird Atlas estimates the breeding population of Cetti's Warbler to be between 500 – 1,000 singing males. Therefore the six territories recorded would represent 1.2% of the minimum number of singing males within Kent and 0.6% of the maximum number of singing males, placing

the importance of the population of Cetti's Warbler at a value approaching that of district level, when evaluated against the Kent Breeding Bird Atlas.

1.86 The national and county populations of Cetti's Warbler from 2015, based on a five-year mean and reported by the RBBP (Hollings *et al.* 2017) is estimated to be 1,827 breeding pairs and 315 pairs respectively. Therefore, six territories within the survey area would represent 0.3% of the estimated national population and 1.9 % of the minimum Kent population Whilst the population within the survey area could be considered of district importance, when evaluated against reported data from the RBBP, this species continues to increase across England (the RBBP report notes a 64% national increase in territories between 2014 and 2015) and therefore, exact number of territories both nationally and in Kent is likely to be grossly under-recorded and much higher than those reported. Therefore, the six territories within the survey area are considered to be of local importance only.

1.87 No other species were recorded in figure approaching 1% of the county breeding population estimates, as detailed in Kent Breeding Bird Atlas.

5.2.3 Species diversity

1.88 To measure species diversity, the breeding assemblage recorded during field surveys of the survey area was evaluated against the criteria developed by Fuller (1980), as detailed in Section 3.4.2 of this report. The value of the breeding assemblage score of 38 species would be regarded as being of local importance for breeding birds.

1.89 The Joint Nature Conservation Committee Guidelines have developed a scoring system for the selection of '*Biological Sites of Special Scientific Interest'* which gives a threshold value for SSSI selection based on the total score of species that are characteristic of habitats, using the values within the selection criteria. This can be used as an indicator of the relative importance of habitat within a site, or area, for the breeding assemblage that it supports.

1.90 The score obtained for each habitat type included on the scoring system for the selection of '*Biological Sites of Special Scientific Interest'* that is found within the survey area are detailed in Table 6.

Table 6- Species Assemblage Scores for Habitats within the survey area

Habitat type	SSSI Threshold value	Area A Score
Lowland scrub (exc. heath)	15	8
Lowland open waters and their margins	39	14

1.91 Breeding bird assemblages for each habitat included on the scoring system for the selection of '*Biological Sites of Special Scientific Interest'* found within the Site did not meet the threshold value for SSSI selection.

1.92 Evaluation was made of the breeding species assemblage and numbers recorded during surveys of the survey area, with respect to the criteria for selection of Local Wildlife Sites (as detailed in Section 3.4.2). Using this criterion, the survey area does not meet any of the criteria for selection of a Local Wildlife Site in Kent.

5.2.4 Species distribution

1.93 Breeding bird territories were widely distributed throughout the survey area, with concentrations of birds found within the most suitable habitats to support breeding birds, including: dense / continuous scrub, swamp and tall ruderal (see Figure 2, 3 and 4 in Appendix B).

1.94 The dense and continuous scrub habitat within the survey area supported the most diverse community of breeding birds. This habitat had low (<10) numbers of species of conservation concern plus Wildlife & Countryside Act Schedule 1 species (Marsh Harrier and Cetti's Warbler) and a NERC Species of Principal Importance (Cuckoo), breeding.

1.95 The swamp habitat found next to the waterbodies within the survey area also supported a diverse community of breeding birds. This included Cuckoo, a NERC Species of Principal Importance, and low (<10) numbers of breeding species of conservation concern. Additionally, Marsh Harrier, an Annex 1 and Wildlife Conservation Act Schedule 1 species, was confirmed to be breeding in the swamp habitat surrounding waterbody TN4.

1.96 The tall ruderal habitat east of the Converter Station and Substation, within the southern section of the survey area also had a diverse community of breeding birds, with low (<10) numbers of species of conservation concern breeding, plus Wildlife & Countryside Act Schedule 1 species (Cetti's Warbler) and NERC Species of Principal Importance (Skylark)

1.97 The distribution of species of conservation importance recorded during the surveys for breeding birds are displayed in Figures 2 and 3 in Appendix B.

6. Identification of Constraints and Recommendation

6.1 Potential impacts of development on breeding birds

1.98 In the absence of mitigation, the Proposed Development has the potential to impact on the breeding bird assemblage identified on the Site. These potential impacts are:

- permanent habitat loss, fragmentation and a reduction in foraging opportunities, through construction of the substation and converter station;
- temporary habitat loss and fragmentation, including a reduction in prey assemblages, availability and foraging opportunities, through construction of the DC cable corridor;
- displacement and, or loss of nesting habitat during construction of the substation and converter station;
- temporary displacement and/or loss of breeding populations, during construction of DC cable corridor; and
- temporary disturbance (visual and noise), during construction.

6.2 Outline Mitigation Proposals

1.99 To reduce the potential impacts on the breeding bird assemblage, a number of measures can be included within the design of the Proposed Development. These outline measures are recommended to ensure that the impacts on the breeding bird assemblage are minimised and it is recommended that these proposals are formalised through a Construction Environmental Management Plan (CEMP) or precautionary working method statement for the Site.

Habitat Retention

1.100 During construction, the Proposed Development should seek to retain as much of the existing habitat as possible, outside of the working areas. To avoid unnecessary intrusion of work vehicles and site personnel into habitat outside of the working areas, which would cause unnecessary habitat loss and disturbance, fencing should be erected around the construction areas.

Habitat Loss, Creation and Restoration

1.101 The Proposed Development will incur permanent loss of the arable fields to the south and south-west of Perry's Farm (see Figure 1). This will result in loss of breeding territories for Skylark, a species of conservation concern, confirmed as breeding in this area.

1.102 Therefore, the landscaping for the Site should seek to include suitable habitat creation to alleviate the potential effects on Skylark in these arable fields and to enhance this habitat to create a more diverse breeding bird assemblage, to what is already present on Site. The creation of an area of grassland or dry swale would benefit Skylark and encourage more farmland passerines such as Reed Bunting (already present within the survey area) and Yellowhammer to breed within the Site. The opportunity should be sought to potentially manage any areas of redundant farmland generated by the Proposed Development in this way, as an increase in breeding bird assemblage would provide a net gain in biodiversity as described in Section 2.3 (NPPF, 2019).

1.103 The Proposed Development will also incur temporary habitat loss of scrub and tall ruderal habitat along the extent of the DC cable corridor. Post-construction, any habitat loss within the DC cable corridor should be restored on a like for like basis and habitat creation and, or restoration should include the planting of mixed native species of trees and scrub, including fruiting species such as Hawthorn *Crataegus monogyna* and Blackthorn *Prunus spinosa,* which will provide nesting habitat for breeding birds in the summer and foraging opportunities during the winter months.

1.104 Ideally, where any new habitats are proposed, these should be planted and functional in advance of construction, so that any displaced populations have alternative areas of habitats available.

Legislative Mitigation

1.105 Vegetation clearance works should be timed to be undertaken outside of the bird breeding season (*i.e.* between September and February) to avoid any additional constraints associated with this activity.

1.106 If it is not possible to undertake vegetation clearance outside of the typical bird breeding season (i.e. where works are planned between March and August inclusive), then it will be necessary for a suitably qualified ornithologist, acting as an Ecological Clerk of Works (ECoW) to conduct a survey for nesting birds in advance of planned clearance works. Due to Marsh Harrier and Cetti's Warbler Schedule 1 of the WCA status, it is an offence to intentionally disturb these birds whilst they are building a nest, or in, on or near a nest containing eggs or young. Therefore, as both species have been confirmed to be breeding within the survey area, a licence would need to be granted to determine the exact locations of the nests before any clearance of vegetation is to take place. Typically, this survey will be undertaken 24 hours ahead of any planned clearance works.

1.107 Should active bird nests be discovered by the ECoW, then appropriate measures will be put in place to ensure that any nest found is not disturbed. There is no licence available to damage or destroy an active nest of a breeding bird at any time of year.

1.108 Protective measures, on discovery of an active nest, will involve placing a buffer around the nest within which no works will be undertaken until the nest has been judged, by a suitably qualified ornithologist, to no longer be in use (*i.e.* fledged young have left the nest or the nesting attempt has failed).

1.109 The radius of the protective buffer and duration it is imposed will be dependent on the species present and stage of breeding (*i.e.* with eggs, chicks, etc.). For the majority of birds, this buffer could be in place for up to 30 days (on the assumption of a 'new' nest with recently laid eggs).

1.110 Where no active nests are located, vegetation clearance must proceed immediately and should be completed within 24 hours of the inspection.

Appendix A

Table A.1 - KMBRC Data Search List of protected / notable bird species within 2 km of the Site and within the last 10 years

Common Name	Scientific Name	Conservation Designation
Red-throated Diver	*Gavia stellata*	BirdsDir:A1; WCA1
Black-throated Diver	*Gavia arctica*	BAP; S41; BoCC4:Amber; BirdsDir:A1; WCA1
Great Northern Diver	*Gavia immer*	BoCC4:Amber; BirdsDir:A1; WCA1
Black-necked Grebe	*Podiceps nigricollis*	BoCC4:Amber; KRDB1; WCA1
Fulmar	*Fulmarus glacialis*	BoCC4:Amber
Manx Shearwater	*Puffinus puffinus*	BoCC4:Amber
Leach's Petrel	*Oceanodroma leucorhoa*	BoCC4:Amber; BirdsDir:A1; WCA1
Gannet	*Morus bassanus*	BoCC4:Amber
Shag	*Phalacrocorax aristotelis*	BoCC4:Red
Cormorant	*Phalacrocorax carbo*	KRDB3
Bittern	*Botaurus stellaris*	BAP; BoCC4:Amber; BirdsDir:A1; S41; WCA1
Little Egret	*Egretta garzetta*	BirdsDir:A1;
Great White Egret	*Ardea alba*	BirdsDir:A1
Spoonbill	*Platalea leucorodia*	BoCC4:Amber; BirdsDir:A1; WCA1
Mute Swan	*Cygnus olor*	BoCC4:Amber
Bewick's Swan	*Cygnus columbianus*	BoCC4:Amber
Whooper Swan	*Cygnus cygnus*	BoCC4:Amber; BirdsDir:A1; WCA1
Pink-footed Goose	*Anser brachyrhynchus*	BoCC4:Amber
White-fronted Goose	*Anser albifrons*	BAP; BoCC4:Red; KRDB3; S41
Greylag Goose	*Anser anser*	BoCC4:Amber
Barnacle Goose	*Branta leucopsis*	BoCC4:Amber; BirdsDir:A1
Brent Goose	*Branta bernicla*	BAP; BoCC4:Amber; S41
Ruddy Shelduck	*Tadorna ferruginea*	BirdsDir:A1
Shelduck	*Tadorna tadorna*	BoCC4:Amber
Wigeon	*Anas penelope*	BoCC4:Amber
Gadwall	*Anas strepera*	BoCC4:Amber
Teal	*Anas crecca*	BoCC4:Amber; KRDB1
Mallard	*Anas platyrhynchos*	BoCC4:Amber
Pintail	*Anas acuta*	BoCC4:Amber; WCA1
Garganey	*Spatula querquedula*	BoCC4:Amber; KRDB1; WCA1
Shoveler	*Anas clypeata*	BoCC4:Amber
Pochard	*Aythya ferina*	BoCC4:Red;KRDB3
Scaup	*Aythya marila*	BAP; BoCC4:Red; S41; WCA1; KRDB2
Eider	*Somateria mollissima*	BoCC4:Amber (subsp. Red)

Common Name	Scientific Name	Conservation Designation
Long-tailed Duck	*Clangula hyemalis*	BoCC4:Red; WCA1
Common Scoter	*Melanitta nigra*	BAP; BoCC4:Red; S41; WCA1
Velvet Scoter	*Melanitta fusca*	BoCC4:Red; WCA1
Goldeneye	*Bucephala clangula*	BoCC4:Amber
Honey Buzzard	*Pernis apivorus*	BoCC4:Amber; BirdsDir:A1; KRDB1; WCA1
Black Kite	*Milvus migrans*	BirdsDir:A1
Red Kite	*Milvus milvus*	BirdsDir:A1; WCA1
Marsh Harrier	*Circus aeruginosus*	BoCC4:Amber; BirdsDir:A1; WCA1
Hen Harrier	*Circus cyaneus*	BoCC4:Red; BirdsDir:A1; S41; WCA1
Montagu's Harrier	*Circus pygargus*	BoCC4:Amber; BirdsDir:A1; WCA1
Osprey	*Pandion haliaetus*	BoCC4:Amber; BirdsDir:A1; WCA1
Kestrel	*Falco tinnunculus*	BoCC4:Amber
Merlin	*Falco columbarius*	BoCC4:Red; BirdsDir:A1; WCA1
Hobby	*Falco subbuteo*	WCA1; KRDB3
Peregrine	*Falco peregrinus*	BirdsDir:A1; KRDB1; WCA1
Grey Partridge	*Perdix perdix*	BAP; BoCC4:Red; S41; KRDB2
Water Rail	*Rallus aquaticus*	KRDB3
Oystercatcher	*Haematopus ostralegus*	BoCC4:Amber
Avocet	*Recurvirostra avosetta*	BoCC4:Amber; ; BirdsDir:A1; KRDB3 WCA1
Little Ringed Plover	*Charadrius dubius*	WCA1; KRDB1
Ringed Plover	*Charadrius hiaticula*	BoCC4:Red
Golden Plover	*Pluvialis apricaria*	BirdsDir:A1
Grey Plover	*Pluvialis squatarola*	BoCC4:Amber
Lapwing	*Vanellus vanellus*	BAP; BoCC4:Red; S41; KRDB2
Knot	*Calidris canutus*	BoCC4:Amber;
Sanderling	*Calidris alba*	BoCC4:Amber
Curlew Sandpiper	*Calidris ferruginea*	BoCC4:Amber
Purple Sandpiper	*Calidris maritima*	BoCC4:Amber; WCA1
Dunlin	*Calidris alpina*	BoCC4:Amber; BirdsDir:A1; KRDB2
Ruff	*Caldris pugnax*	BirdsDir:A1; WCA1
Snipe	*Gallinago gallinago*	BoCC4:Amber; KRDB1
Woodcock	*Scolopax rusticola*	BoCC4:Red; KRDB3
Black-tailed Godwit	*Limosa limosa*	BAP; BoCC4:Red; S41; KRDB1; WCA1
Bar-tailed Godwit	*Limosa lapponica*	BoCC4:Amber; BirdsDir:A1
Whimbrel	*Numenius phaeopus*	BoCC4:Red; WCA1
Curlew	*Numenius arquata*	BAP; BoCC4:Red; S41
Spotted Redshank	*Tringa erythropus*	BoCC4:Amber
Redshank	*Tringa totanus*	BoCC4:Amber;KRDB3
Greenshank	*Tringa nebularia*	BoCC4:Amber; WCA1

Common Name	Scientific Name	Conservation Designation
Green Sandpiper	*Tringa ochropus*	BoCC4:Amber; WCA1
Wood Sandpiper	*Tringa glareola*	BoCC4:Amber; BirdsDir:A1; WCA1
Common Sandpiper	*Actitis hypoleucos*	BoCC4:Amber
Turnstone	*Arenaria interpres*	BoCC4:Amber
Arctic Skua	*Stercorarius parasiticus*	BAP; S41; BoCC4:Red
Great Skua	*Stercorarius skua*	BoCC4:Amber
Mediterranean Gull	*Ichthyaetus melanocephalus*	BoCC4:Amber; BirdsDir:A1; WCA1
Little Gull	*Larus minutus*	BirdsDir:A1; WCA1
Black-headed Gull	*Chroicocephalus ridibundus*	BoCC4:Amber
Common Gull	*Larus canus*	BoCC4:Amber; KRDB1
Lesser Black-backed Gull	*Larus fuscus*	BoCC4:Amber
Herring Gull	*Larus argentatus*	BAP; BoCC4:Red; S41; KRDB2
Yellow-legged Gull	*Larus michahellis*	BoCC4:Amber
Glaucous Gull	*Larus hyperboreus*	BoCC4:Amber
Great Black-backed Gull	*Larus marinus*	BoCC4:Amber; KRDB1
Kittiwake	*Rissa tridactyla*	BoCC4:Red;
Sandwich Tern	*Thalasseus sandvicensis*	BoCC4:Amber; BirdsDir:A1;KRDB3
Common Tern	*Sterna hirundo*	BoCC4:Amber; BirdsDir:A1
Arctic Tern	*Sterna paradisaea*	BoCC4:Amber; BirdsDir:A1
Little Tern	*Sterna albifrons*	BoCC4:Amber; BirdsDir:A1; KRDB1; WCA1
Black Tern	*Chlidonias niger*	BoCC4:Amber; BirdsDir:A1; KRDB1; WCA1
Guillemot	*Uria aalge*	BoCC4:Amber
Razorbill	*Alca torda*	BoCC4:Amber
Puffin	*Fratercula arctica*	BoCC4:Red
Stock Dove	*Columba oenas*	BoCC4:Amber;
Turtle Dove	*Streptopelia turtur*	BAP; BoCC4:Red; S41; KRDB2
Cuckoo	*Cuculus canorus*	BAP; BoCC4:Red; S41; KRDB2
Barn Owl	*Tyto alba*	WCA1
Tawny Owl	*Strix aluco*	BoCC4:Amber
Long-eared Owl	*Asio otus*	KRDB1
Short-eared Owl	*Asio flammeus*	BoCC4:Amber; BirdsDir:A1
Swift	*Apus apus*	BoCC4:Amber
Kingfisher	*Alcedo atthis*	BoCC4:Amber (subsp. Red); BirdsDir:A1; WCA1
Marsh Warbler	*Acrocephalus palustris*	BoCC4:Red; WCA1
Wryneck	*Jynx torquilla*	BAP; S41; WCA1
Skylark	*Alauda arvensis*	BAP; BoCC4:Red; S41; KRDB2

Common Name	Scientific Name	Conservation Designation
Shore Lark	*Eremophila alpestris*	BoCC4:Amber; WCA1
House Martin	*Delichon urbica*	BoCC4:Amber
Tree Pipit	*Anthus trivialis*	BAP; BoCC4:Red; S41; KRDB2;
Meadow Pipit	*Anthus pratensis*	BoCC4:Amber
Rock Pipit	*Anthus petrosus*	KRDB1
Water Pipit	*Anthus spinoletta*	BoCC4:Amber
Yellow Wagtail	*Motacilla flava*	BAP; BoCC4:Red; S41; KRDB2
Grey Wagtail	*Motacilla cinerea*	BoCC4:Red
Dunnock	*Prunella modularis*	BAP; BoCC4:Amber; S41
Nightingale	*Luscinia megarhynchos*	BoCC4:Red
Black Redstart	*Phoenicurus ochruros*	BoCC4:Red; KRDB1; WCA1
Redstart	*Phoenicurus phoenicurus*	BoCC4:Amber; KRDB1
Whinchat	*Saxicola rubetra*	BoCC4:Red
Stonechat	*Saxicola rubicola*	KRDB1
Wheatear	*Oenanthe oenanthe*	KRDB1
Ring Ouzel	*Turdus torquatus*	KRDB1
Fieldfare	*Turdus pilaris*	BoCC4:Red; WCA1
Song Thrush	*Turdus philomelos*	BAP; BoCC4:Red; S41; KRDB2
Redwing	*Turdus iliacus*	BoCC4:Red; WCA1
Mistle Thrush	*Turdus viscivorus*	BoCC4:Red
Reed Warbler	*Acrocephalus scirpaceus*	KRDB3
Cetti's Warbler	*Cettia cetti*	WCA1
Dartford Warbler	*Sylvia undata*	BoCC4:Amber; BirdsDir:A1; WCA1
Willow Warbler	*Phylloscopus trochilus*	BoCC4:Amber
Goldcrest	*Regulus regulus*	KRDB3
Firecrest	*Regulus ignicapilla*	WCA1; KRBD1
Spotted Flycatcher	*Muscicapa striata*	BAP; BoCC4:Red; S41; KRDB2
Pied Flycatcher	*Ficedula hypoleuca*	BoCC4:Red
Bearded Tit	*Panurus biarmicus*	WCA1
Starling	*Sturnus vulgaris*	BAP; BoCC4:Red; ; S41; KRDB2
House Sparrow	*Passer domesticus*	BAP; BoCC4:Red; S41; KRDB3(High alert)
Brambling	*Fringilla montifringilla*	WCA1
Siskin	*Spinus spinus*	KRDB1
Linnet	*Linaria cannabina*	BAP; BoCC4:Red; S41; KRDB2
Twite	*Linaria flavirostris*	BAP; BoCC4:Red; S41
Lesser Redpoll	*Ancanthis cabaret*	BAP; BoCC4:Red; S41; KRDB1
Lapland Bunting	*Calcarius lapponicus*	BoCC4:Amber; WCA1

Common Name	Scientific Name	Conservation Designation
Snow Bunting	*Plectrophenax nivalis*	BoCC4:Amber; WCA1
Yellowhammer	*Emberiza citrinella*	BAP; BoCC4:Red; S41; KRDB3(High alert)
Reed Bunting	*Emberiza schoeniclus*	BAP; BoCC4:Amber; S41
Corn Bunting	*Emberiza calandra*	BAP; BoCC4:Red; S41; KRDB2

* BirdsDir:A1 = Species listed on Annex 1 of the Birds Directive; WCA1 = Species listed on Schedule 1 of the Wildlife Countryside Act; S41 = The Natural Environment and Rural Communities (NERC) list of Species of Principal Importance; BAP = UK Biodiversity Action Plan (BAP) priority bird species; BoCC4 = Birds of Conservation Concern; KRDB1 = Kent Red Data Book breeding bird species with 25 pairs or fewer in Kent; KRDB2 = Kent Red Data Book breeding species with more than 25 pairs in Kent but red listed for their breeding decline (RSPB 1996) and KRDB3 = Remaining Kent Red Data Book, including high alert bird species.

Appendix B

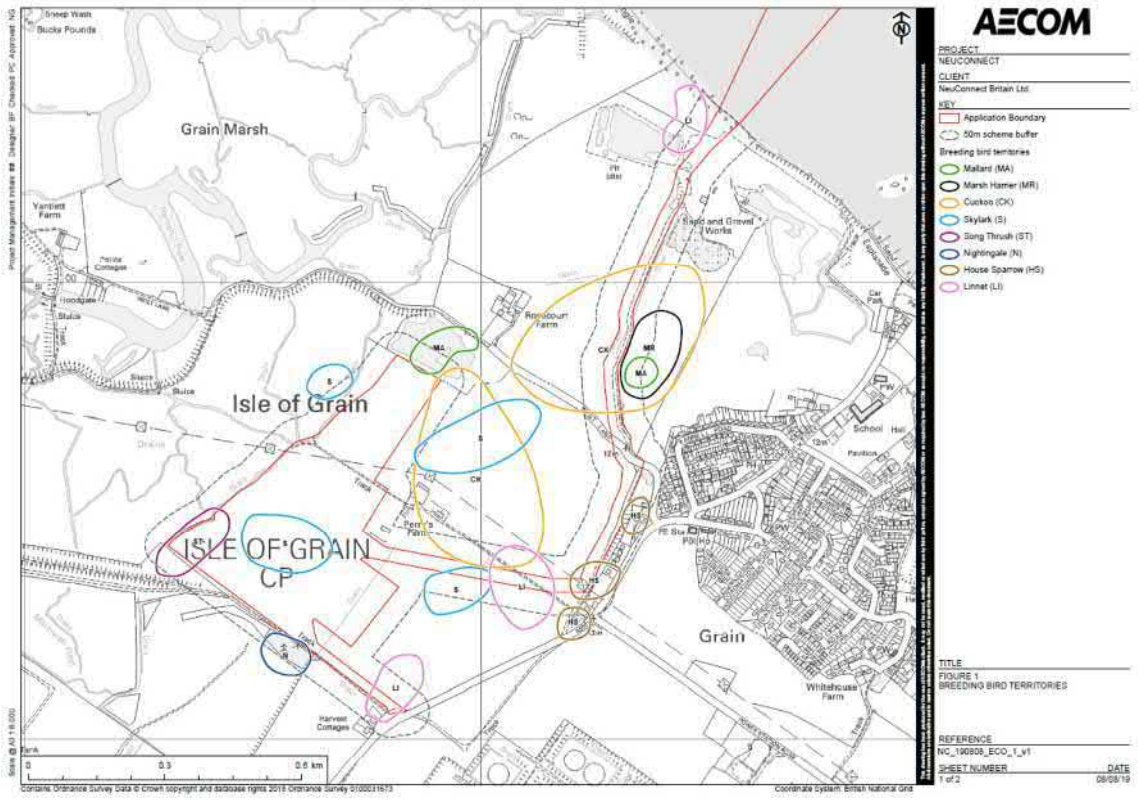

Figure 2 -Distribution of breeding territories for species of conservation concern

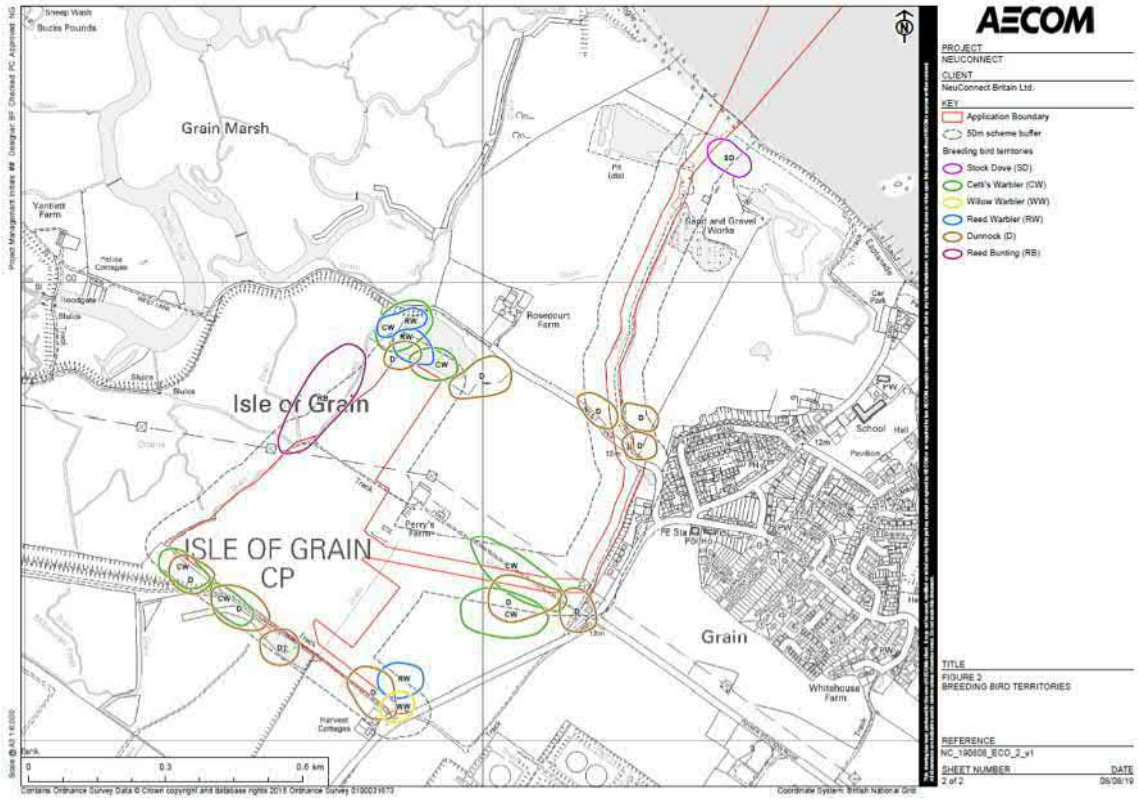

Figure 3 - Distribution of breeding territories for species of conservation concern

Appendix 6.C – Report on Surveys of Wintering Birds

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement

Appendix 6C – Report on Surveys for Wintering Birds

NeuConnect Britain Ltd

September 2019

Quality information

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Table of Contents

Figures

Tables

1. Introduction

1.1 AECOM was instructed by NeuConnect Britain Limited (the 'Applicant') to undertake a survey of wintering birds for the terrestrial area (i.e. non-estuarine) for the Neuconnect project (the 'Proposed Development') at Grain, Isle of Grain. The Preliminary Ecological Appraisal (PEA)[1], undertaken in 2018, identified that the habitat within the Proposed Development area was suitable to support wintering birds and that further surveys were required to determine the presence / absence of notable species and the assemblage of non-breeding (wintering) bird species.

Proposed Development

1.2 NeuConnect (the 'Project'), is a 1400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks. The new link will create a connection for electricity to be passed in either direction between Great Britain and Germany. The Project will be formed by approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HDVC) cables, with on-shore converter stations linking into the existing electricity grids in Great Britain and Germany.

1.3 The Proposed Development will comprise of three structures, a Converter Station, Sub-station and a Direct Current (DC) cable route (see Figure 1).

1.4 The footprint of the proposed converter station is expected to be up to approximately 250 metres (m) by 250 m (to the perimeter security fence), with a maximum height of up to 26 m.

1.5 The footprint of the proposed substation is expected to be approximately 80 m by 80 m (to the perimeter security fence), with a maximum height of 14 m.

1.6 The proposed DC cable corridor will be approximately 1.6 km long (from landfall to the converter station). The preferred installation method will be underground, which will result in a temporary loss of land during installation. The working corridor for the installation of the cable corridor will be 30 m.

1.7 Additional laydown areas will be required for construction, comprising 1.5 hectare (ha) for the converter laydown and 0.3 ha for the substation laydown.

Site description

1.8 The Proposed Development areas (the 'Site') is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The Site is located to the west of the village of Grain, Isle of Grain, Kent at Ordnance Survey (OS) central grid reference TQ 88205 76727. Land use comprises a mix of industrial development to the south, the small settlement of Grain to the southeast and undeveloped land, much of which is designated for ecological interests, to the north (along the coastline) and to the west. Land within the Site and in the immediate vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill.

1.9 Figure 1 shows the Site boundary (red-line), the cable corridor (purple line) and proposed location of each structure.

[1] AECOM, Neuconnect, Isle of Grain: Preliminary Ecological Appraisal Report, 2019.

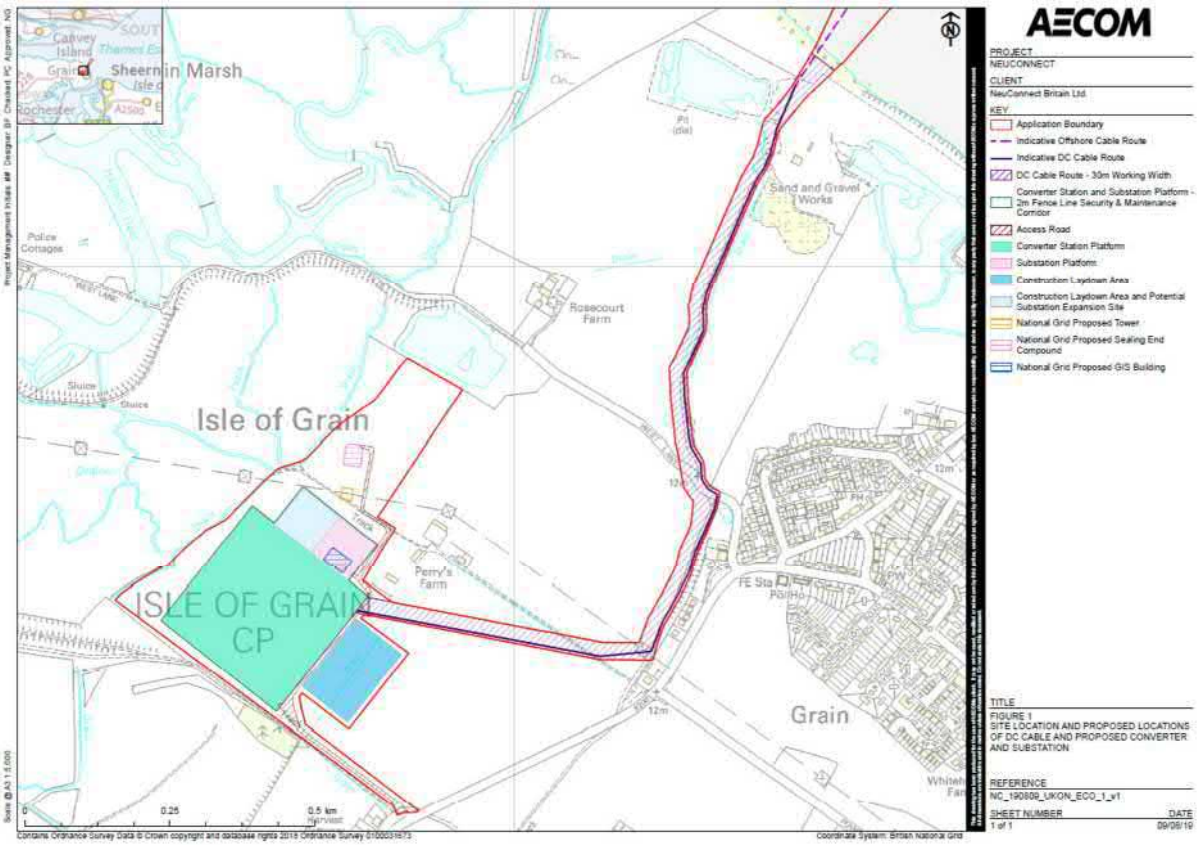

Figure 1 - Site boundary and proposed locations of DC cable route, converter station and substation

Survey Area

1.10 The survey area included all terrestrial (i.e. non-estuarine) habitats within the Site boundary and a 100 metre (m) buffer.

Scope of report

1.11 The objective of the wintering bird survey was to determine the presence and assemblage of wintering bird species, including notable species, within the Site boundary to determine the potential impacts of the Project on wintering birds.

2. Assessment Criteria

Legislation

2.1 The legislative provisions for the protection of wild birds in the UK are contained primarily in Section 1-7 of the Wildlife and Countryside Act (WCA) 1981 (as amended)[2]. Under the WCA, a wild bird is defined as any bird of a species that occurs in a wild state as a resident or a visitor to the European Territory of any member state.

2.2 Reference is not made in this report to species afforded special protection under Schedule 1 of the Wildlife and Countryside Act as the protection measures in this Act only apply to bird species within the breeding season.

2.3 However, a number of bird species recorded within the UK (including those that are resident, overwintering and migratory) are protected under European legislation under The Directive of the Conservation of Wild Birds[3], which lists 194 species, or sub-species, of birds in Annex 1 which are:

- in danger of extinction;
- are rare, or have restricted local distribution;
- are vulnerable to specific changes in their habitat; or
- require particular attention for reasons of the specific nature of habitat.

2.4 These species are afforded enhanced legal protection and EU member states have a responsibility to maintain the populations of these species at a level that corresponds to their ecological, scientific and cultural requirements (Article 2). This Directive is transposed into English law through The Conservation of Habitats and Species and Planning (Various Amendments) (England and Wales) Regulations 2018[4].

2.5 Species listed on Annex 1 of the Birds Directive are those for which the UK Government are also required to take special measures, including the designation of Special Protection Areas, to ensure the survival and reproduction of these species throughout their area of distribution.

2.6 The Natural Environment and Rural Communities (NERC) list of Species of Principal Importance[5] is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act 2006; under Section 40 every public authority (e.g. a local authority or local planning authority) must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity (the biodiversity duty).

National and Local Planning Policy

2.7 The National Planning Policy Framework (NPPF)[6] was originally published on 27th March 2012 and detailed the Government's planning policies for England and how these are expected to be applied. The NPPF was then revised on 24th July 2018 and 19th February 2019. The NPPF states the commitment of the UK Government to minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity.

2.8 It specifies the obligations that the Local Authorities and the UK Government have regarding statutory designated sites and protected species under UK and international legislation and how this is to be delivered in the planning system. Protected or notable habitats and species can be a material consideration in planning decisions and may therefore make some sites unsuitable for

[2] HMSO, The Wildlife & Countryside Act 1981, 1981.
[3] EUROPEAN COMMISSION, The Directive of the Conservation of Wild Birds, 1979.
[4] HMSO, Conservation of Habitats and Species and Planning (Various Amendments) (England and Wales) Regulations 2018.
[5] HMSO, Natural Environment and Rural Communities (NERC) Act 2006.
[6] HMSO, National Planning Policy Framework, 2018

particular types of development, or if development is permitted, mitigation measures may be required to avoid or minimise impacts on certain habitats and species, or where impact is unavoidable, compensation may be required.

2.9 The NPPF is clear that pursuing sustainable development includes moving from a net loss of biodiversity to achieving net gains for nature, and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution.

2.10 Further information on the NPPF and local planning policy relevant to nature conservation is provided in detail in the Preliminary Ecological Appraisal for the Proposed Development (AECOM, 2019)1.

Priority Species

2.11 Species of principal importance for the conservation of biodiversity in England are listed under Section 41 of the NERC Act 2006. This list is used to guide decision-makers in public bodies, in implementing their biodiversity duty. There are 49 species of bird listed as priorities for nature conservation action and therefore for consideration in ecological impact assessment.

2.12 The Joint Nature Conservation Committee (JNCC) UK Biodiversity Action Plan (UKBAP)[7] was launched in 1994 and established a framework and criteria for identifying species and habitat types of conservation concern. From this list, action plans for priority habitats and species of conservation concern were published and, in July 2012 were subsequently succeeded by the UK Post-2010 Biodiversity Framework[8]. The UK list of priority species and habitats, however, remains an important reference source and has been used to help draw up statutory lists of priority habitats and species in England, Scotland, Wales and Northern Ireland. For the purpose of this assessment, the UK BAP is still used as one of the criteria to assist in assigning national value to an ecological receptor.

2.13 The Kent Biodiversity Action Plan 1997[9] sets out action plans within the county, including one bird species, Nightingale Luscinia megarhynchos.

2.14 The Kent Red Data Book[10] (KRDB) provides information on Kent's rarest and most threatened flora and fauna. Of the 62 bird species listed, 58 are included for their breeding populations with two of these (Avocet *Recurvirostra avosetta* and Black-tailed Godwit *Limosa limosa*) also qualifying for their winter populations. Four other species (Red-throated Diver *Gavia stellata*, White-fronted Goose *Anser albifrons*, Pintail *Anas acuta* and Knot *Calidris canutus*) are included for their winter populations alone. For winter bird populations to qualify, Kent needs to hold >20% of the British population and >4% of the relevant international population (Western Europe or East Atlantic flyway). These species are labelled as KRDB3 in the Kent Red Data Book.

Birds of Conservation Concern

2.15 Species listed on the Birds of Conservation Concern (BoCC): Red List (Eaton et. al, 2015)[11] are those that have declined in numbers by 50% over the last 25 years, those that have shown an historical population decline between 1800 and 1995 and species that are of global conservation concern. There are 67 species on the Red List that are of the most urgent conservation concern.

2.16 Species listed on the BoCC: Amber List (Eaton et. al, 2015), of which there are currently 96, include those that have shown a moderate decline in numbers (25%-49%) over the last 25 years and those with total populations of less than 300 breeding pairs. Also included are those species which represent a significant proportion (greater than 20%) of the European breeding or wintering population, those for which at least 50% of the British population is limited to 10 sites or less, and those of unfavourable conservation status in Europe.

[7] JNCC, UK Biodiversity Action Plan (UKBAP), 1994, available at http://jncc.defra.gov.uk/page-5155, accessed April 2019.
[8] JNCC, UK Post-2010 Biodiversity Framework, 2012, available at http://jncc.defra.gov.uk/page-6189, accessed April 2019.
[9] Kent Biodiversity Action Plan Steering Group, The Kent Biodiversity Action Plan, 1997.
[10] Waite, A., 1999. Kent Red Data Book. Kent Wildlife Trust.
[11] Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D. and Gregory, R., Birds of Conservation Concern 4. The population status of birds in the United Kingdom, Channel Islands and Isle of Man, 2015.

2.17 The remaining species, not included on the Red or Amber lists, are placed on the Green List, indicating that they are of low conservation priority.

3. Methods

Desk Study

3.1 A desk study was undertaken in July 2018 through Kent & Medway Biological Records Centre (KMBRC), to obtain records of protected / notable bird species within a 2 km radius of the Proposed Development and from within the last ten years of the request date.

Field Survey

3.2 The wintering bird survey was undertaken based on a transect methodology as detailed in Bibby et al. (2000)[12] and Gilbert et al. (1998)[13].

3.3 A transect route was selected to include the whole survey area including walking all field boundaries within and, where possible, the adjacent 50 m. The whole survey area was covered on each of the six survey visits, using suitable optical equipment to observe bird behaviour. Survey routes were mapped and the direction walked alternated on each visit, to ensure that all areas were covered at various times of day across the duration of the survey. Surveys were undertaken during a range of daylight hours, between sunrise and sunset.

3.4 On each visit, the route was walked at a slow pace with start and finish times noted. All birds seen and heard were recorded directly onto paper maps of the survey area or onto an ArcGIS base map using ESRI software on hand-held PDA devices, with a 1:10,000 scale Ordnance Survey base map of the survey area. A fresh map was used for each survey. Registrations of birds were recorded using standard British Trust for Ornithology (BTO) two letter species codes.

3.5 All bird species were recorded and mapped across the whole survey area.

3.6 Six surveys for wintering birds were undertaken between February / March 2018 and October 2018 and January 2019 (Table 3.1). Each survey was undertaken during appropriate weather conditions and avoided, where possible, days with adverse weather conditions such as heavy rain or strong winds as birds may be harder to detect in such conditions.

3.7 The survey visits and weather conditions are shown below in Table 3.1.

Table 1 – Wintering Bird Survey: Survey Dates and Weather Conditions

Survey Number	Date	Weather Conditions
1	21/02/2018	6°C, cloud 8/8, wind F3 NW
2	13/03/2018	7°C, cloud 8/8, wind F2 W
3	19/10/2018	12°C, cloud 1/8, wind F2 N
4	19/11/2018	7°C, cloud 6/8, wind F5 NW
5	11/12/2018	7°C, cloud 2/8, wind F2 SE
6	16/01/2019	8°C, cloud 8/8, wind F4 SW

Notes on Table 3.1: Wind speed is shown using the Beaufort scale, which is an empirical measure of force (F)

0-12 that relates wind speed to observed conditions. Cloud cover is shown in a scale of 0-8 where the number represents the amount of cloud cover e.g. 2/8 is 25% cover 4/8 is 50% etc.

[12] Bibby, C.J., Burgess, N.D., Hill, D.A. and Mustoe, S.H., Bird Census Techniques: 2nd edition, 2000.
[13] Gilbert, G., Gibbons, D.W. and Evans, J. (1998). Bird Monitoring Methods: A manual of techniques for key species. RSPB/BTO/JNCC/WWT/ITE/The Seabird Group. RSPB/BTO, Sandy, Beds.

Assessment of Ornithological Importance

3.8 To support a focussed assessment of the population of wintering birds within the Site, their biodiversity value has been defined with reference to the geographical level at which it matters. The frames of reference used in this report are made using the values presented in the Chartered Institute of Ecology and Environmental Management Guidelines for Ecological Impact Assessment in the United Kingdom: Terrestrial, Freshwater and Marine (CIEEM 2018)[14].

3.9 The evaluation uses a framework, linked to a geographical scale at which the receptor has been valued (i.e. international, national, regional, county, local or site) and this method represents best practice guidance. This assessment criteria, set out in Table 3.2, has been used to assess the biodiversity value of the wintering bird populations recorded during the field surveys.

Table 2 - Importance of Ornithological Features

Importance of Ornithological Features	Descriptors and Examples of Criteria
International or European	An internationally designated site or candidate site including Special Protection Area (SPA), potential SPAs (pSPAs)[1]; and Ramsar sites (wetlands of international importance). Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Resident or regularly occurring populations of species which may be considered at an international or European level[2] where: - the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; - the population forms a critical part[3] of a wider population at this scale; or - the species is at a critical phase[4] of its life cycle at this scale.
UK or National	Sites designated at UK or national level e.g. Site of Special Scientific Interest (SSSI). Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Areas of key or priority species identified in the UK Post-2010 Biodiversity Framework *i.e.* UK Biodiversity Action Plan (BAP), including those published in accordance with Section 41 of the Natural Environment and Rural Communities Act (2006) and those considered to be of principal importance for the conservation of biodiversity. Resident or regularly occurring populations of species which may be considered at a UK or a national level[5] where: - the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; - the population forms a critical part of a wider population at this scale; or - the species is at a critical phase of its life cycle at this scale.
Regional	Populations of species of value at a regional level (*i.e.* South East England). Resident or regularly occurring populations of species which may be considered at a regional level where: - the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; - the population forms a critical part of a wider population at this scale; or - the species is at a critical phase of its life cycle at this scale.
County or Unitary Authority or District	Populations of species of value at a County (*i.e.* Kent) level or District (*i.e.* Medway). Designated sites, such as County Wildlife Site (CWS), Local Wildlife Site (LWS) or Sites of Importance for Nature Conservation (SINC) and Local Nature Reserve (LNR) designated in the county or unitary authority area i.e. District context.

14

Importance of Ornithological Features	Descriptors and Examples of Criteria
	Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Areas of key or priority habitats identified in the Local Biodiversity Action Plan (LBAP). Resident or regularly occurring populations of species which may be considered at a County (or District) level[6] where: - the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; - the population forms a critical part of a wider population at this scale; or, - the species is at a critical phase of its life cycle at this scale.
Local	Species populations of value in a local (*i.e.* within ~ 5 km of the site) context. Designated sites include LNRs designated in the local context. Populations and, or communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange.
Site	Habitats and associated species that is of value in the context of the site only. Populations of common and widespread species.

* As well as assigning importance there is also a need to identify all legally protected species that could be affected by the Proposed Development in order that measures can be taken to ensure that adherence to the relevant legislation is observed. This may include the adoption of mitigation and appropriate licensing which are acceptable to Natural England.

CIEEM, Guidelines for Ecological Impact Assessment in the United Kingdom: Terrestrial, Freshwater, 2018.

2 pSACs are sites which UK Government has been formally advised of but have not yet been submitted to the European Commission. These sites should be valued at an international (European) level on the basis that they meet the relevant selection criteria for a SAC but are not yet designated as such.

3 Such species include those listed within the Directive 2009/147/EC on the Conservation of Wild Birds (i.e. EC Birds Directive) (codified version of Council Directive 79/409/EEC as amended) or animal or plant species listed within Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (i.e. Habitats Directive).

4 Such populations include sub-populations that are essential to maintenance of metapopulation dynamics, e.g. critical emigration and, or immigration links between otherwise discrete populations.

5 Seasonal activity or behaviour upon which survival or reproduction depends.

6 Species which may be considered at the UK or national level mean: birds, other animals and plants which receive legal protection on the basis of their conservation interest (those listed within the Wildlife and Countryside Act 1981 (as amended) Schedule 1, 5 and 8); species listed for their principal importance for biodiversity (in accordance with the Natural Environment and Communities Act 2006 Section 41 England), priority species listed within the UK Post 2010 Biodiversity Framework (i.e. UK Biodiversity Action Plan (UKBAP)), or species listed within the Red Data Book.

Species Rarity Assessment

3.10 The assessment of the ornithological importance of the Site during the non-breeding (winter) season was made by evaluating any species afforded special statutory protection or those included on one, or more, of the lists of species of conservation interest (as detailed in Section 2 of this report). These are:

- species listed on Annex 1 of the EU Birds Directive;
- UK Biodiversity Action Plan (BAP) priority bird species;

- NERC Species of Principal Importance;
- Kent Biodiversity Action Plan species;
- Kent Red Data Book species;
- species included in the Birds of Conservation Concern (BoCC) Red and Amber Lists (Eaton et al., 2015); and
- those occurring within the survey area in nationally, regionally or locally important numbers.

Species Abundance Assessment

3.11 In addition to evaluating a site based on its populations of wintering birds in relation to legal status, rarity and conservation value, consideration has to be given to the value of the Site for the population of individual species that it supports. This can be done by comparing the population present within the study area with the national and county wintering population for certain species. National estimates for non-breeding birds are published in 'Population Estimates of Birds in Great Britain and the United Kingdom' (Musgrove et al. 2013)[15]. The British Trust for Ornithology (BTO) Bird Atlas 2007-2011 (Balmer et. al. 2013)[16] was also reviewed for species information on a national level.

3.12 Current county-level estimates on the wintering bird populations of the majority of species in Kent, e.g in a county avifauna, are not available. Kent Ornithological Society produces an annual county bird report, with the most recent publication reporting on birds recorded in 2014. However, population estimates for the majority of non-breeding populations in the county are not presented in this report.

Species Diversity Assessment

3.13 Local Wildlife Sites (LWS) are among the most important places for wildlife in Kent, together with legally protected land such as Sites of Special Scientific Interest (SSSIs). An individual LWS can be considered for selection for birds in the county if it meets the criteria within the 'Local Wildlife Sites in Kent: Criteria for Selection and Delineation' (Kent Wildlife Trust, 2015)[17].

3.14 A site should be selected as a Local Wildlife Site if it can be considered as a single, identifiable unit in terms of its bird fauna and where:

- it is occupied regularly by at least 2.5% of the county population of any one or more bird species, based on the most recent and authoritative data; or
- it holds three or more Kent Red Data Book 3 (KRDB3) species at the appropriate time of year (normally this should not include a combination of breeding and wintering species); or
- it is occupied regularly by 5% or more of the county population of any one or more species in non-breeding seasons, based on the most recent and authoritative data; or
- it has been recorded as being regularly used in recent years by at least 60 wintering bird species; or
- It has been recorded as being regularly used in recent years by at least 100 passage bird species.

3.15 The LWS selection criteria for Kent, recognises:

- the rarity of certain wintering bird species;
- birds which may be considered vulnerable because their populations are in decline;

[15] Musgrove, A., Aebischer, N., Eaton, M., Hearn, R., Newson, S., Noble, D., Parsons, M., Risely, K. and Stroud, D., Population estimates of birds in Great Britain and the United Kingdom, 2013.
[16] Balmer, D., Gillings, S., Caffrey, B., Swann, B., Downie, I. and Fuller, R., Bird Atlas 2007-2011, 2013, available at https://www.bto.org/research-data-services/publications/bto-books-and-guides/2013/bird-atlas-2007-11-breeding-and, accessed January 2019.
[17] Kent Wildlife Trust, Criteria for Selection and Delineation, 2015.

- birds which may be considered vulnerable because their non-breeding populations are concentrated in a small number of sites; and
- sites of importance for the presence of a diversity of species.

Desk Study and Survey Limitations

3.16 The aim of a desk study is to help characterise the baseline context of a Proposed Development and provide valuable background information that would not be captured by a single site survey alone. Information obtained during the course of a desk study is dependent upon people and organisations having made and submitted records for the area of interest. As such, a lack of records for a particular species does not necessarily mean that species does not occur in the study area. Likewise, the presence of records for particular species does not automatically mean that these still occur within the area of interest or are relevant in the context of the Proposed Development.

3.17 Within this assessment, data have been collected during the latter period of winter 2017/2018 and early period of winter 2018/2019. A standard survey and analysis of non-breeding (wintering) birds over the winter period would encompass a survey programme within a single winter period but, due to the Proposed Development programme, the surveys commenced in February 2018. However, the weather in the winter period 2017/2018 was relatively settled and similar to that of 2018 / 2019, with no prolonged extreme weather periods that would influence the presence or abundance of wintering bird species on Site. Therefore, these data collected from a 'split' winter in a calendar, rather than biological year are representative of a typical winter period.

3.18 The majority of ecological data is valid only for short periods due to the inherently transient nature of the subject (CIEEM, 2019[18]). On this basis, it is recommended that the surveys for wintering birds will need repeating in two years (i.e. in 2020).

[18] CIEEM: Advice Note on the lifespan of ecological surveys and reports https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf (Accessed May 2019)

4. Results

Desk Study

4.1 The KMBRC returned records of 213 bird species from within 2 km of the Proposed Development area and within the last ten years. Of these 213 bird species, 131 are protected / notable.

4.2 A full list of all protected or notable bird species recorded during the data search is included in Appendix A.

Field Survey

4.3 A total of 43 species were recorded on the Site during the surveys of wintering birds between February and March 2018 and October 2018 to January 2019. A summary of these species, along with the peak and mean counts recorded, are presented in Table 4.1.

Table 3 - Peak and Mean Count Data of Birds Recorded on Site During the Wintering Bird Survey

Species (Common Name)	Scientific Name	Peak Count	Date of Peak Count	Mean Count
Mute Swan	*Cygnus olor*	1	11/12/2018	0.10
Gadwall	*Mareca strepera*	20	19/10/2018	3.80
Mallard	*Anas platyrhynchos*	29	11/12/2018	5.20
Teal	*Anas crecca*	56	19/10/2018	15.20
Tufted Duck	*Aythya fuligula*	1	11/12/2018	0.10
Pheasant	*Phasianus colchicus*	5	11/12/2018	1.00
Little Grebe	*Tachybaptus ruficollis*	3	19/11/2018	1.00
Grey Heron	*Ardea cinerea*	2	13/03/2018	0.30
Marsh Harrier	*Circus aeruginosus*	1	19/10/2018	0.20
Buzzard	*Buteo buteo*	1	19/10/2018	0.10
Moorhen	*Gallinula chloropus*	6	19/10/2018	1.00
Coot	*Fulica atra*	7	19/10/2018	2.30
Black-headed Gull	*Chroicocephalus ridibundus*	1	11/12/2018	0.10
Stock Dove	*Columba oenas*	76	19/10/2018	8.20
Woodpigeon	*Columba palumbus*	104	11/12/2018	24.40
Little Owl	*Athene noctua*	1	19/10/2018	0.30
Great Spotted Woodpecker	*Dendrocopos major*	2	19/10/2018	0.60
Green Woodpecker	*Picus viridis*	1	21/02/2018	0.30
Kestrel	*Falco tinnunculus*	2	19/10/2018	0.60
Jay	*Garrulus glandarius*	2	21/02/2018	0.20
Magpie	*Pica pica*	10	19/11/2018	2.80
Carrion Crow	*Corvus corone*	22	19/10/2018	3.90
Blue Tit	*Cyanistes caeruleus*	2	11/12/2018	0.50
Great Tit	*Parus major*	5	21/02/2018	1.40

Species (Common Name)	Scientific Name	Peak Count	Date of Peak Count	Mean Count
Skylark	*Alauda arvensis*	10	19/10/2018	1.40
Cetti's Warbler	*Cettia cetti*	3	19/10/2018	0.90
Long-tailed Tit	*Aegithalos caudatus*	9	19/11/2018	1.30
Wren	*Troglodytes troglodytes*	5	19/10/2018	1.70
Starling	*Sturnus vulgaris*	12	13/03/2018	2.40
Blackbird	*Turdus merula*	8	11/12/2018	1.80
Fieldfare	*Turdus pilaris*	38	19/11/2018	5.50
Redwing	*Turdus iliacus*	8	19/11/2018	1.90
Song Thrush	*Turdus philomelos*	1	13/03/2018	0.50
Robin	*Erithacus rubecula*	10	19/10/2018	2.70
House Sparrow	*Passer domesticus*	8	13/03/2018	1.90
Dunnock	*Prunella modularis*	2	21/02/2018	0.60
Pied Wagtail	*Motacilla alba*	2	19/10/2018	0.40
Meadow Pipit	*Anthus pratensis*	10	19/10/2018	2.10
Chaffinch	*Fringilla coelebs*	4	19/10/2018	1.40
Greenfinch	*Chloris chloris*	1	16/01/2019	0.10
Linnet	*Linaria cannabina*	3	16/01/2019	0.60
Goldfinch	*Carduelis carduelis*	5	19/10/2018	1.20
Yellowhammer	*Emberiza citrinella*	1	13/03/2018	0.10

5. Evaluation

Desk Study

5.1 Records of 131 protected / notable species were returned from the KMBRC data search. Of these 131 species:

- 36 are listed on Annex 1 of the EU Birds Directive;
- 29 are listed as a priority species on the UK Biodiversity action plan and as a species of principal importance under Section 41 of the NERC Act;
- 42 species are included on the Birds of Conservation Concern Red List;
- 78 species are included on the Birds of Conservation Concern Amber List; and
- six species are listed on the Kent Red Data Book (as detailed in section 2.3).

5.2 Of the 131 protected / notable species returned from the data search, 34 species have the potential to occur on the Site during the non-breeding (wintering) season and 19 of those 34 species were recorded on the Site during field surveys. The 15 species that were identified during the desk study that have the potential to occur within the terrestrial habitat on the Site, but were not recorded during wintering bird surveys were: Little Egret Egretta garzetta, Greylag Goose Anser anser, Shelduck Tadorna tadorna, Wigeon Anas penelope, Merlin Falco columbarius, Grey Partridge Perdix perdix, Golden Plover Pluvialis apricaria, Woodcock Scolopax rusticola, Common Gull Larus canus, Lesser Black-backed Gull Larus fuscus, Herring Gull Larus argentatus, Kingfisher Alcedo atthis, Grey Wagtail Motacilla cinerea, Mistle Thrush Turdus viscivorus and Reed Bunting Emberiza schoeniclus.

Field survey

5.3 A total of 43 bird species were recorded during the wintering bird survey. Of these 43 bird species recorded, 18 species recorded during the survey meet at least one of a range of criteria relating to conservation importance, as listed in section 2 of this report. These 18 species and their relevant list of conservation importance are shown below in Table 5.1.

Table 4 - Conservation Status of Wintering Birds Recorded on Site

Species (Common Name)	Annex 1 EU Birds Directive	Birds of Conservation Concern	UK BAP Priority Species	NERC Species of Principal Importance
Mute Swan	-	Amber	-	-
Gadwall	-	Amber	-	-
Mallard	-	Amber	-	-
Teal	-	Amber	-	-
Marsh Harrier	X	-	-	-
Black-headed Gull	-	Amber	-	-
Stock Dove	-	Amber	-	-
Kestrel	-	Amber	-	-
Skylark	-	Red	X	X
Starling	-	Red	X	X
Fieldfare	-	Red	-	-
Redwing	-	Red	-	-
Song Thrush	-	Red	X	X

Species (Common Name)	Annex 1 EU Birds Directive	Birds of Conservation Concern	UK BAP Priority Species	NERC Species of Principal Importance
House Sparrow	-	Red	X	X
Dunnock	-	Amber	X	X
Meadow Pipit	-	Amber	-	-
Linnet	-	Red	X	X
Yellowhammer	-	Red	X	X

5.4 One species (Marsh Harrier), listed on Annex I of the EC Birds Directive (2009) was recorded flying over the survey area.

5.5 A total of seven priority species (Skylark, Starling, Song Thrush, House Sparrow, Dunnock, Linnet and Yellowhammer) listed on the UK Biodiversity Action Plan and included as Species of Principal Importance on the NERC list, were recorded within the survey area.

5.6 Eight species (Skylark, Starling, Song Thrush, House Sparrow, Linnet, Yellowhammer, Fieldfare and Redwing), included on the BoCC Red List, were recorded within the survey area. Additionally, nine species (Mute Swan, Gadwall, Mallard, Teal, Black-headed Gull, Stock Dove, Kestrel, Dunnock and Meadow Pipit), included on the BoCC Amber List species were also recorded within the survey area.

5.7 None of the six Kent Red Data Book wintering bird species, as detailed in section 2.3, were recorded on Site.

Species abundance

5.8 In addition to evaluating a site based on its populations of wintering birds in relation to legal status, rarity and conservation value, consideration has to be given to the value of the site for the population of individual species that it supports. This can be done by comparing the population present on site with the national and county wintering population for certain species

5.9 No counts of wintering bird species recorded across the Site approaches the 1% level of the national wintering population estimates as detailed in Musgrove et al. (2013).

5.10 Most of the wintering bird species were recorded within the survey area in low numbers during wintering bird surveys and it is unlikely that counts of any species form a significant proportion (i.e. 1% or more) of the county population. Therefore, species' populations across the survey area are considered to be of no more than local importance in winter.

Species diversity

5.11 Evaluation was made of the species assemblage and numbers recorded during surveys, located in Kent, with respect to criteria for selection of Local Wildlife Sites (as detailed in section 3.3.3).

5.12 None of the species, recorded within the survey area during wintering bird surveys, meets any of the criteria for selection of a Local Wildlife Site.

Species distribution

5.13 The location of protected / notable bird species, included on one or more of the lists of conservation importance (see Table 5.1) are shown in Figure 2 (Appendix B). A summary of the distribution of these protected / notable species is also provided in the following text:

- Mute Swan –recorded on the waterbody north west of 'Sand and Gravel Works', outside of the Site boundary;
- Gadwall – recorded on waterbodies outside of the Site boundary;

- Mallard – recorded on waterbodies outside the Site boundary;
- Teal – recorded on waterbodies outside of the Siye boundary and within the ditch adjacent to the DC cable corridor;
- Black-headed Gull - recorded outside of the Site boundary, on the waterbody north west of 'Sand and Gravel Works' and within tall ruderal grassland north east of Perry's Farm;
- Stock Dove – recorded within the proposed converter station site in arable fields and in scrub north west of 'Sand and Gravel Works';
- Kestrel – a mobile species, recorded flying over the DC cable corridor;
- Marsh Harrier - recorded flying over the proposed DC cable corridor;
- Skylark – recorded in arable fields to the south and south west of Perry's Farm, within the proposed converter station location. This species was also recorded outside of the proposed development areas;
- Starling – recorded throughout the Site, with birds observed in tall ruderal grassland north-east of Perry's Farm and within the proposed converter station site in arable fields south west of Perry's Farm. This species was also recorded outside of the proposed development areas;
- Song Thrush - recorded in low numbers in scrub along the DC cable corridor;
- House Sparrow – only recorded south of West Lane and north of residential buildings, just outside of the proposed DC cable corridor;
- Dunnock - recorded in low numbers throughout the Site, including in scrub within the proposed DC cable corridor;
- Linnet – recorded sporadically around the Site in low numbers;
- Yellowhammer – only one recorded, within the proposed DC cable corridor;
- Redwing and Fieldfare - recorded in low numbers throughout the Site, utilising arable fields within the proposed converter station site and on fruiting plant species found in hedgerows and scrub along the proposed DC cable corridor;
- Meadow Pipit – recorded in fields within the temporary DC cable route north of 'Sand and Gravel Works', and in the field south east of Perry's Farm.

6. Identification of Constraints and Recommendations

Potential Impacts of Development on Wintering Birds

6.1 In the absence of mitigation, the Proposed Development has the potential to impact on the wintering bird assemblage identified on Site. These potential impacts are:

- permanent habitat loss and fragmentation, including a reduction in prey assemblages, availability and foraging opportunities, through construction and operation of the substation and converter station;
- temporary habitat loss and fragmentation, including a reduction in prey assemblages, availability and foraging opportunities, through construction of the cable corridor;
- temporary displacement and/or loss of wintering populations, during construction;
- increase in lighting (during operation of the substation and converter station), effecting nocturnal species such as Little Owl; and
- temporary disturbance (visual and noise), during construction.

Outline Mitigation Proposals

6.2 To reduce the potential impacts on the wintering bird assemblage, a number of measures can be included within the design of the Proposed Development. These outline measures are recommended to ensure that the impacts on the wintering bird assemblage are minimised and it is recommended that these proposals are formalised through a Construction Environmental Management Plan (CEMP) or precautionary working method statement for the Site.

Habitat Retention

6.3 During construction, the Proposed Development should seek to retain as much of the existing habitat as possible, outside of the working areas. To avoid unnecessary intrusion of work vehicles / site personnel into habitat outside of the working areas (which would cause unnecessary habitat loss), fencing should be erected around the construction areas.

Habitat Loss, creation and Restoration

6.4 The Proposed Development will incur permanent loss of the arable fields to the south and south west of Perry's Farm (see Figure 1). This will result in habitat loss for a small number of wintering birds, including species of conservation concern such as Skylark and Stock Dove, recorded in these areas.

6.5 Therefore, the landscaping for the Site should seek to include suitable habitat creation to alleviate the potential effects on the wintering bird assemblage in these areas and enhance these areas, where possible, with the objective of conserving a similarly diverse assemblage of wintering birds to what is already present on Site. The creation of an area of set-aside or 'cover crop' would benefit a range of arable farmland passerines present within the Site, including Yellowhammer, Linnet and Skylark. These species are reliant on farmland habitats during winter months for feeding and shelter. The opportunity should be sought to potentially manage any areas of redundant farmland generated by the Proposed Development in this way.

6.6 The Proposed Development will also incur temporary habitat loss of scrub, hedgerows and tall ruderal habitat along the extent of the cable corridor. Post-construction, any habitat loss within the cable corridor should be restored on a like for like basis and habitat creation / restoration should include the planting of mixed native species of trees and scrub, including fruiting species such as Hawthorn Crataegus monogyna and Blackthorn Prunus spinosa, which through the provision of berries will provide foraging and roosting habitat for wintering birds.

6.7 Ideally, where any new habitats are proposed, these should be planted and functional in advance of construction, so that any displaced populations have alternative areas of habitats available.

Lighting

6.8 To minimise the impact of lighting on nocturnal species during both construction and operation, consideration should be made to the location, height, direction, timing and type of lighting that is used to avoid unnecessary light spillage concordant with the requirements to minimise light spill on boundary habitats for bats. Details of lighting should be included in the CEMP.

Appendix A

Table A.1 - KMBRC Data Search List of protected / notable bird species within 2 km of the Site and within the last 10 years

Common Name	Scientific Name	Conservation Designation
Red-throated Diver	*Gavia stellata*	BirdsDir:A1; KRDB3;
Black-throated Diver	*Gavia arctica*	BAP; S41; BoCC4:Amber; BirdsDir:A1
Great Northern Diver	*Gavia immer*	BoCC4:Amber; BirdsDir:A1
Black-necked Grebe	*Podiceps nigricollis*	BoCC4:Amber
Fulmar	*Fulmarus glacialis*	BoCC4:Amber
Manx Shearwater	*Puffinus puffinus*	BoCC4:Amber
Leach's Petrel	*Oceanodroma leucorhoa*	BoCC4:Amber; BirdsDir:A1
Gannet	*Morus bassanus*	BoCC4:Amber
Shag	*Phalacrocorax aristotelis*	BoCC4:Red
Bittern	*Botaurus stellaris*	BAP; BoCC4:Amber; BirdsDir:A1; S41
Little Egret	*Egretta garzetta*	BirdsDir:A1;
Great White Egret	*Ardea alba*	BirdsDir:A1
Spoonbill	*Platalea leucorodia*	BoCC4:Amber; BirdsDir:A1
Mute Swan	*Cygnus olor*	BoCC4:Amber
Bewick's Swan	*Cygnus columbianus*	BoCC4:Amber
Whooper Swan	*Cygnus cygnus*	BoCC4:Amber; BirdsDir:A1
Pink-footed Goose	*Anser brachyrhynchus*	BoCC4:Amber
White-fronted Goose	*Anser albifrons*	BAP; BoCC4:Red; KRDB3; S41
Greylag Goose	*Anser anser*	BoCC4:Amber
Barnacle Goose	*Branta leucopsis*	BoCC4:Amber; BirdsDir:A1
Brent Goose	*Branta bernicla*	BAP; BoCC4:Amber; S41
Ruddy Shelduck	*Tadorna ferruginea*	BirdsDir:A1
Shelduck	*Tadorna tadorna*	BoCC4:Amber
Wigeon	*Anas penelope*	BoCC4:Amber
Gadwall	*Anas strepera*	BoCC4:Amber
Teal	*Anas crecca*	BoCC4:Amber
Mallard	*Anas platyrhynchos*	BoCC4:Amber
Pintail	*Anas acuta*	BoCC4:Amber; KRDB3
Garganey	*Spatula querquedula*	BoCC4:Amber
Shoveler	*Anas clypeata*	BoCC4:Amber
Pochard	*Aythya ferina*	BoCC4:Red
Scaup	*Aythya marila*	BAP; BoCC4:Red; S41
Eider	*Somateria mollissima*	BoCC4:Amber (subsp. Red)

Common Name	Scientific Name	Conservation Designation
Long-tailed Duck	*Clangula hyemalis*	BoCC4:Red
Common Scoter	*Melanitta nigra*	BAP; BoCC4:Red; S41
Velvet Scoter	*Melanitta fusca*	BoCC4:Red
Goldeneye	*Bucephala clangula*	BoCC4:Amber
Honey Buzzard	*Pernis apivorus*	BoCC4:Amber; BirdsDir:A1
Black Kite	*Milvus migrans*	BirdsDir:A1
Red Kite	*Milvus milvus*	BirdsDir:A1
Marsh Harrier	*Circus aeruginosus*	BoCC4:Amber; BirdsDir:A1;
Hen Harrier	*Circus cyaneus*	BoCC4:Red; BirdsDir:A1; S41
Montagu's Harrier	*Circus pygargus*	BoCC4:Amber; BirdsDir:A1
Osprey	*Pandion haliaetus*	BoCC4:Amber; BirdsDir:A1
Kestrel	*Falco tinnunculus*	BoCC4:Amber
Merlin	*Falco columbarius*	BoCC4:Red; BirdsDir:A1
Peregrine	*Falco peregrinus*	BirdsDir:A1
Grey Partridge	*Perdix perdix*	BAP; BoCC4:Red; S41
Oystercatcher	*Haematopus ostralegus*	BoCC4:Amber
Avocet	*Recurvirostra avosetta*	BoCC4:Amber; ; BirdsDir:A1; KRDB3;
Ringed Plover	*Charadrius hiaticula*	BoCC4:Red
Golden Plover	*Pluvialis apricaria*	BirdsDir:A1
Grey Plover	*Pluvialis squatarola*	BoCC4:Amber
Lapwing	*Vanellus vanellus*	BAP; BoCC4:Red; S41
Knot	*Calidris canutus*	BoCC4:Amber; KRDB3
Sanderling	*Calidris alba*	BoCC4:Amber
Curlew Sandpiper	*Calidris ferruginea*	BoCC4:Amber
Purple Sandpiper	*Calidris maritima*	BoCC4:Amber
Dunlin	*Calidris alpina*	BoCC4:Amber; BirdsDir:A1
Ruff	*Caldris pugnax*	BirdsDir:A1
Snipe	*Gallinago gallinago*	BoCC4:Amber
Woodcock	*Scolopax rusticola*	BoCC4:Red
Black-tailed Godwit	*Limosa limosa*	BAP; BoCC4:Red; S41; KRDB3
Bar-tailed Godwit	*Limosa lapponica*	BoCC4:Amber; BirdsDir:A1
Whimbrel	*Numenius phaeopus*	BoCC4:Red
Curlew	*Numenius arquata*	BAP; BoCC4:Red; S41
Spotted Redshank	*Tringa erythropus*	BoCC4:Amber
Redshank	*Tringa totanus*	BoCC4:Amber
Greenshank	*Tringa nebularia*	BoCC4:Amber
Green Sandpiper	*Tringa ochropus*	BoCC4:Amber
Wood Sandpiper	*Tringa glareola*	BoCC4:Amber; BirdsDir:A1

Common Name	Scientific Name	Conservation Designation
Common Sandpiper	*Actitis hypoleucos*	BoCC4:Amber
Turnstone	*Arenaria interpres*	BoCC4:Amber
Arctic Skua	*Stercorarius parasiticus*	BAP; S41; BoCC4:Red
Great Skua	*Stercorarius skua*	BoCC4:Amber
Mediterranean Gull	*Ichthyaetus melanocephalus*	BoCC4:Amber; BirdsDir:A1
Little Gull	*Larus minutus*	BirdsDir:A1;
Black-headed Gull	*Chroicocephalus ridibundus*	BoCC4:Amber
Common Gull	*Larus canus*	BoCC4:Amber
Lesser Black-backed Gull	*Larus fuscus*	BoCC4:Amber
Herring Gull	*Larus argentatus*	BAP; BoCC4:Red; S41
Yellow-legged Gull	*Larus michahellis*	BoCC4:Amber
Glaucous Gull	*Larus hyperboreus*	BoCC4:Amber
Great Black-backed Gull	*Larus marinus*	BoCC4:Amber
Kittiwake	*Rissa tridactyla*	BoCC4:Red
Sandwich Tern	*Thalasseus sandvicensis*	BoCC4:Amber; BirdsDir:A1
Common Tern	*Sterna hirundo*	BoCC4:Amber; BirdsDir:A1
Arctic Tern	*Sterna paradisaea*	BoCC4:Amber; BirdsDir:A1
Little Tern	*Sterna albifrons*	BoCC4:Amber; BirdsDir:A1
Black Tern	*Chlidonias niger*	BoCC4:Amber; BirdsDir:A1
Guillemot	*Uria aalge*	BoCC4:Amber
Razorbill	*Alca torda*	BoCC4:Amber
Puffin	*Fratercula arctica*	BoCC4:Red
Stock Dove	*Columba oenas*	BoCC4:Amber;
Turtle Dove	*Streptopelia turtur*	BAP; BoCC4:Red; S41
Cuckoo	*Cuculus canorus*	BAP; BoCC4:Red; S41
Tawny Owl	*Strix aluco*	BoCC4:Amber
Short-eared Owl	*Asio flammeus*	BoCC4:Amber; BirdsDir:A1
Swift	*Apus apus*	BoCC4:Amber
Kingfisher	*Alcedo atthis*	BoCC4:Amber (subsp. Red); BirdsDir:A1
Wryneck	*Jynx torquilla*	BAP; S41
Skylark	*Alauda arvensis*	BAP; BoCC4:Red; S41
Shore Lark	*Eremophila alpestris*	BoCC4:Amber
House Martin	*Delichon urbica*	BoCC4:Amber
Tree Pipit	*Anthus trivialis*	BAP; BoCC4:Red; S41
Meadow Pipit	*Anthus pratensis*	BoCC4:Amber
Water Pipit	*Anthus spinoletta*	BoCC4:Amber

Common Name	Scientific Name	Conservation Designation
Yellow Wagtail	*Motacilla flava*	BAP; BoCC4:Red; S41
Grey Wagtail	*Motacilla cinerea*	BoCC4:Red
Dunnock	*Prunella modularis*	BAP; BoCC4:Amber; S41
Nightingale	*Luscinia megarhynchos*	BoCC4:Red
Black Redstart	*Phoenicurus ochruros*	BoCC4:Red
Redstart	*Phoenicurus phoenicurus*	BoCC4:Amber
Whinchat	*Saxicola rubetra*	BoCC4:Red
Fieldfare	*Turdus pilaris*	BoCC4:Red
Song Thrush	*Turdus philomelos*	BAP; BoCC4:Red; S41
Redwing	*Turdus iliacus*	BoCC4:Red
Mistle Thrush	*Turdus viscivorus*	BoCC4:Red
Dartford Warbler	*Sylvia undata*	BoCC4:Amber; BirdsDir:A1
Spotted Flycatcher	*Muscicapa striata*	BAP; BoCC4:Red; S41
Pied Flycatcher	*Ficedula hypoleuca*	BoCC4:Red
Starling	*Sturnus vulgaris*	BAP; BoCC4:Red; ; S41
House Sparrow	*Passer domesticus*	BAP; BoCC4:Red; S41
Linnet	*Linaria cannabina*	BAP; BoCC4:Red; S41
Twite	*Linaria flavirostris*	BAP; BoCC4:Red; S41
Lesser Redpoll	*Ancanthis cabaret*	BAP; BoCC4:Red; S41
Lapland Bunting	*Calcarius lapponicus*	BoCC4:Amber
Snow Bunting	*Plectrophenax nivalis*	BoCC4:Amber
Yellowhammer	*Emberiza citrinella*	BAP; BoCC4:Red; S41
Reed Bunting	*Emberiza schoeniclus*	BAP; BoCC4:Amber; S41
Corn Bunting	*Emberiza calandra*	BAP; BoCC4:Red; S41

* BirdsDir:A1 = Species listed on Annex 1 of the Birds Directive; S41 = The Natural Environment and Rural Communities (NERC) list of Species of Principal Importance; BAP = UK Biodiversity Action Plan (BAP) priority bird species; BoCC4 = Birds of Conservation Concern; and KRDB3 = Kent Red Data Book wintering bird species

Appendix B

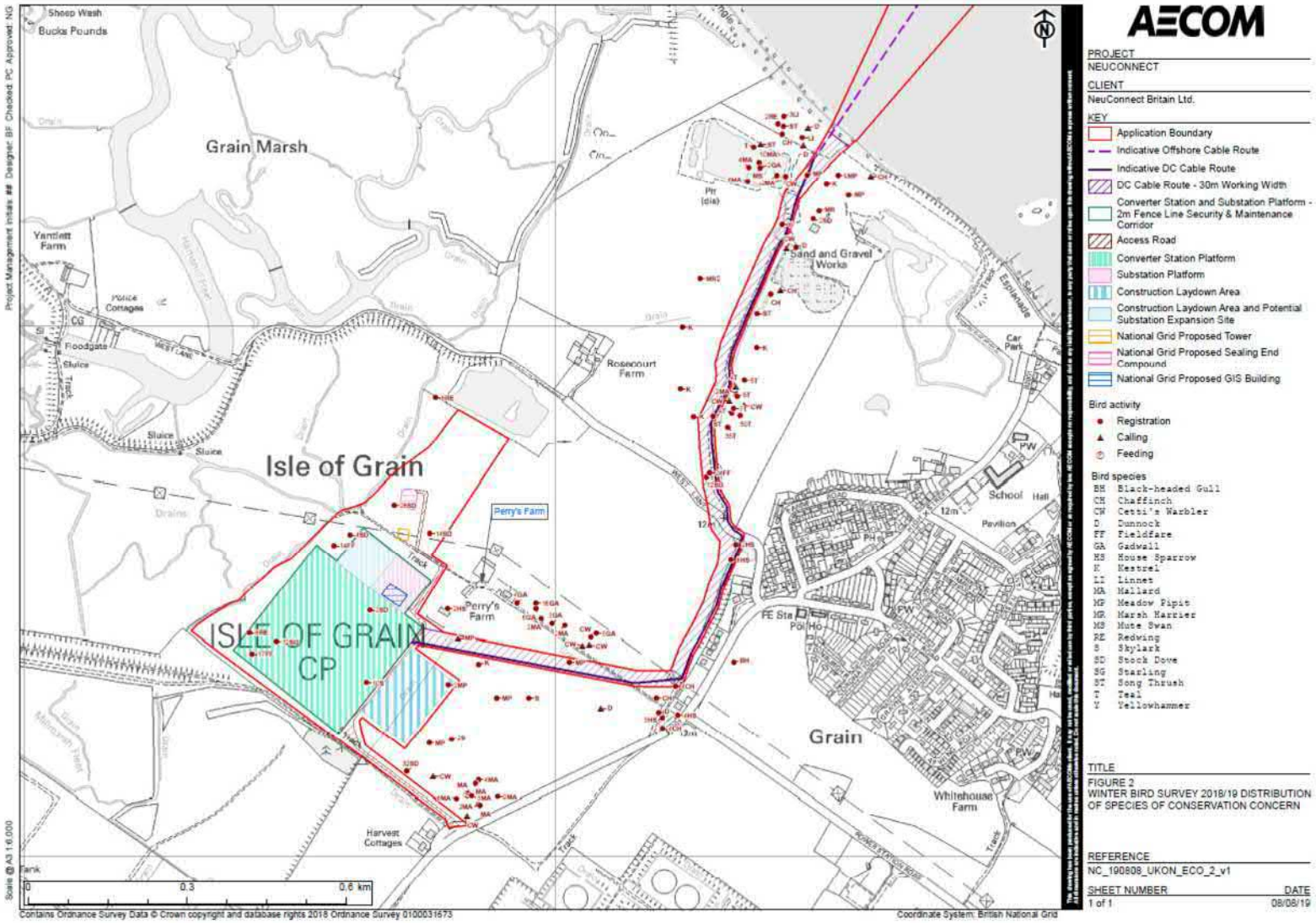

Figure 2 – Location of Protected / Notable Species Recorded on Site

Appendix 6.D – Report on Surveys for Intertidal Waterbirds

NeuConnect GB Onshore Scheme

Environmental Statement

Appendix 6D – Report on Surveys for Intertidal Waterbirds

NeuConnect Britain Limited

September 2019

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Table of Contents

Figures

Tables

1. Introduction

1.1 AECOM was instructed by NeuConnect Britain Limited (the 'Applicant') to undertake intertidal ornithological surveys for the proposed development (the 'Proposed Development') of an electricity convertor station and substation at Grain, Isle of Grain. The proposed electricity converter station and substation will form part of a Direct Current (DC) electricity link (referred to as an interconnector) between Great Britain and Germany. As part of the application(s), the Applicant may also seek outline planning permission for underground DC and alternating current (AC) cables, however this is subject to the Applicant's permitted development status.

The Project

1.2 NeuConnect (the Project) is a 1,400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks. The new link will provide a connection for electricity to be passed in either direction between Great Britain and Germany. The Project will be formed by approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HVDC) cables, with on-shore converter stations linking into the existing electricity grids in Great Britain and Germany.

1.3 The Proposed Development will comprise of three structures, a converter station, sub-station and a direct current (DC) cable route (see Figure 1).

1.4 The footprint of the proposed converter station to the perimeter security fence is expected to be up to approximately 250 metres (m) by 250 metres, with a maximum height of up to 26 m.

1.5 The footprint of the proposed substation to the perimeter security fence is expected to be approximately 80 m by 80 m, with a maximum height of 14 m.

1.6 The proposed DC cable corridor will be approximately 1.6 km long (from landfall to the converter station). The preferred installation method will be underground, which will result in a temporary loss of land during installation. The working corridor for the installation of the cable corridor will be 30 m.

1.7 Additional laydown areas will be required for construction, comprising 1.5 hectare (ha) for the converter laydown and 0.3 ha for the substation laydown.

Site Description

1.8 The Proposed Development area (the Site) is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The Site is located to the west of the village of Grain, Isle of Grain, Kent at Ordnance Survey (OS) central grid reference TQ 88205 76727. Land use comprises a mix of industrial development to the south, the small settlement of Grain to the southeast and undeveloped land, much of which is designated for ecological interests, to the north (along the coastline) and to the west. Land within the Site and in the immediate vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill.

1.9 Figure 1 shows the Site boundary (red-line), the cable corridor (purple line) and proposed location of each structure.

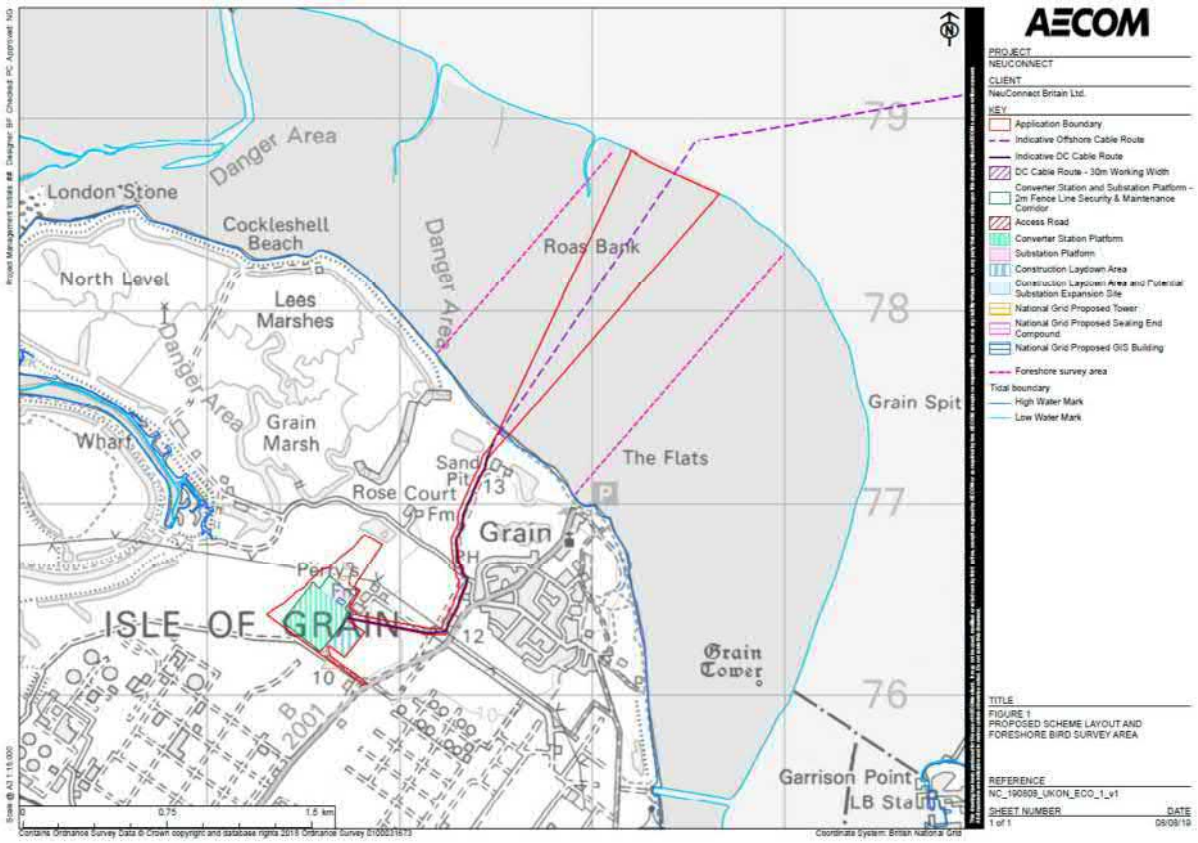

Figure 1 - Intertidal survey area, Site boundary and location of DC cable, proposed substation and proposed converter station

Survey Area

1.10 The survey area is shown in Figure 1 and includes the intertidal areas of the Proposed Development with the addition of a 500 m buffer zone either side.

2. Designated Sites

2.1 The Site sits adjacent to the Thames Estuary and Marshes Ramsar Special Protection Area (SPA) and South Thames Estuary and Marshes Site of Special Scientific Interest (SSSI) and within 2 km of the Medway Estuary and Marshes Ramsar, SPA and SSSI (Figure 2).

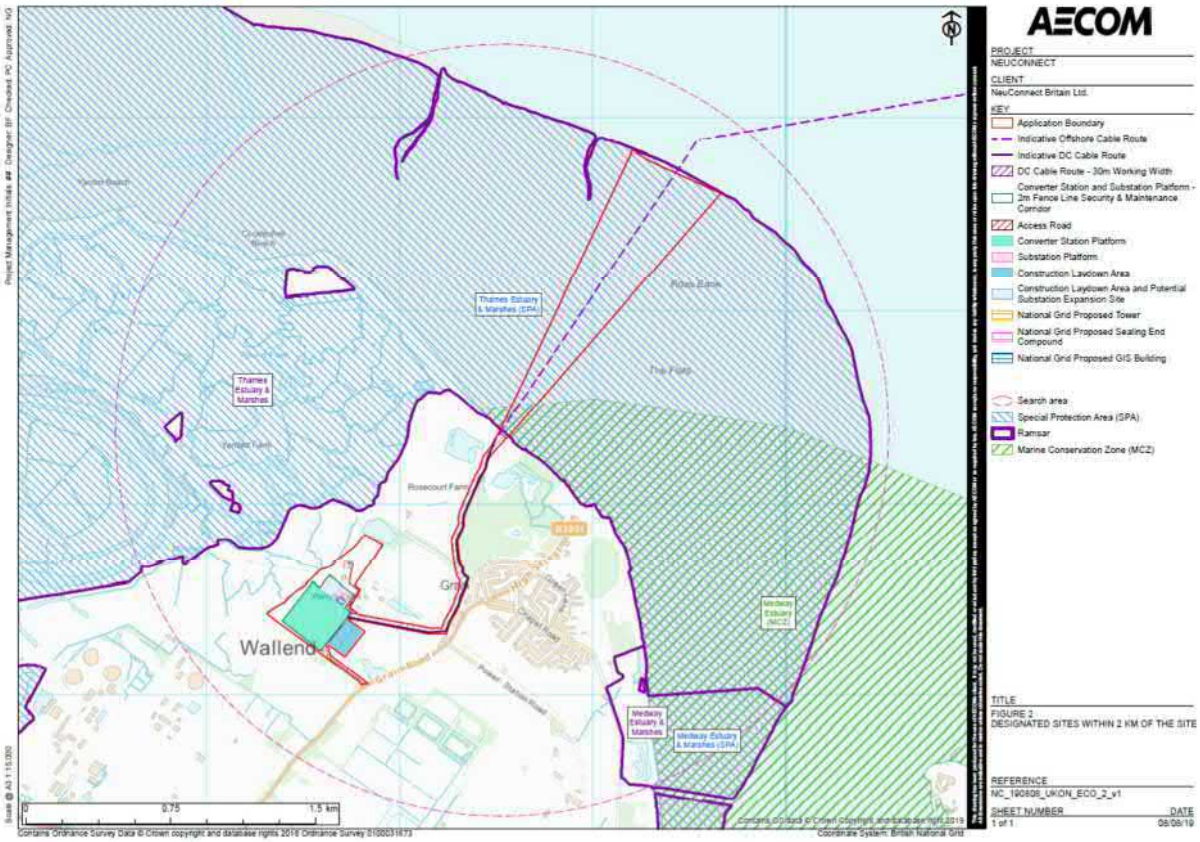

Figure 2 - Designated Sites within 2 km of the Site

2.2 These sites are designated for supporting internationally important waterbird populations and assemblages.

2.3 There are four other statutory sites of international nature conservation importance within 10 km of the Proposed Development, but less than 5 km from the Proposed Development site, designated either solely (or in part) for their ornithological interest. These sites are:

- Outer Thames Estuary SPA (2.2 km north of the Proposed Development site);
- Benfleet and Southend Marshes Ramsar / SPA (4.2 km north of the Proposed Development site);
- Foulness (Mid-Essex Coast Phase 5) Ramsar / SPA (4.9 km north-east of the Proposed Development site); and
- Swale Ramsar SPA (7.1 km south-east of the Proposed Development site.

2.4 For the purposes of this assessment, these designated sites are not considered further, given the distance between these sites and the Proposed Development Site. However, it is acknowledged that there will be interchange of individual waterbirds between designated sites in south-east England, but these individuals will be captured within the assessment of the Thames and Medway Estuaries complex of designated sites.

Designated Site Descriptions

2.5 The following sections in this report summarise the ornithological interest features of the Thames Estuary and Marshes Ramsar and SPA, South Thames Estuary and Marshes SSSI and Medway Estuary and Marshes Ramsar, SPA and SSSI.

2.6 The legal list of qualifying species, for which a SPA is selected and managed, is given on the relevant SPA citation, but a review of the UK network of SPAs was co-ordinated by Joint Nature Conservation Committee (JNCC) in the late 1990s. Following formal submission to, and agreement by, relevant Ministers, the results were published in 2001.

2.7 However, it has taken time to revise all the relevant SPA citations in light of the review. Therefore, where there is a discrepancy between species listed in extant citations and listed in the 2001 Review for the same sites, there has been confusion as to the correct list of qualifying species to be used at any site for purposes of management, assessment and development control.

2.8 At sites where there remain differences between species listed in the 2001 Review and the extant site citation, then the original citations for the relevant sites have been used as the primary source within the evaluation.

Thames Estuary and Marshes SPA

2.9 The Thames Estuary and Marshes SPA is located on the south side of the Thames Estuary in southern England. The marshes extend for about 15 km along the south side of the estuary and also include intertidal areas on the north side of the estuary. To the south of the river, much of the area is brackish grazing marsh, although some of this has been converted to arable use. At Cliffe, there are flooded clay and chalk pits, some of which have been infilled with dredgings. Outside the sea wall, there is a small extent of saltmarsh and broad intertidal mud-flats. The estuary and adjacent grazing marsh areas support an important assemblage of wintering waterbirds including grebes, geese, ducks and waders. The site is also important in spring and autumn migration periods.

2.10 The citation report (2000) for the SPA lists the following qualifying interest features:

2.11 The site qualifies under Article 4.1 of the Wild Birds Directive (2009/147/EC) as it is used regularly by 1% or more of the GB populations of the following species listed on Annex I, in any season:

- Avocet Recurvirostra avosetta, 283 individuals (5 year peak mean for 1993/94 to 1997/98); and
- Hen Harrier Circus cyaneus, seven individuals (5 year peak mean for 1993/94 to 1997/98).

2.12 The site qualifies under article 4.2 of the Directive (79/409/EEC) as it is used regularly by 1% or more of the biogeographical populations of the following regularly occurring migratory species (other than those listed on Annex I), in any season:

- Ringed Plover Charadrius hiaticula, 1,324 individuals (5 year peak mean for 1993/94 to 1997/98).
- Grey Plover Pluvialis squatarola, 2,593 individuals (5 year peak mean for 1993/94 to 1997/98);
- Dunlin Calidris alpina, 29,646 individuals (5 year peak mean for 1993/94 to 1997/98);
- Knot Calidris canutus, 4,848 individuals (5 year peak mean for 1993/94 to 1997/98);
- Black-tailed Godwit Limosa limosa (islandica), 1,699 individuals (5 year peak mean for 1993/94 to 1997/98); and
- Redshank Tringa totanus, 3,251 individuals (5 year peak mean for 1993/94 to 1997/98).

2.13 The site qualifies under article 4.2 of the Directive (79/409/EEC) as it is used regularly by over 20,000 waterfowl in any season:

- Over winter, the area regularly supports 75,019 individual waterfowl (5 year peak mean 1991/92 to 1995/96).

2.14 The JNCC SPA review, although having no current legal standing, also includes information on the Thames Estuary and Marshes SPA and lists the qualifying features as:

2.15 This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

2.16 Over winter:

- Avocet, 276 individuals representing at least 21.7% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6); and
- Hen Harrier, seven individuals representing at least 0.9% of the wintering population in Great Britain (5 year mean 93/4-97/8).

2.17 This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

2.18 On passage:

- Ringed Plover, 559 individuals representing at least 1.1% of the Europe/Northern Africa - wintering population (5 year peak mean 1991/2 - 1995/6)

2.19 Over winter:

- Ringed Plover, 541 individuals representing at least 1.1% of the wintering Europe/Northern Africa - wintering population (5 year peak mean 1991/2 - 1995/6)

2.20 The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl.

2.21 Over winter, the area regularly supports 33,433 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Redshank, Black-tailed Godwit, Dunlin, Lapwing *Vanellus vanellus*, Grey Plover, Shoveler *Anas clypeata*, Pintail *Anas acuta*, Gadwall *Anas strepera*, Shelduck *Tadorna tadorna*, White-fronted Goose *Anser albifrons*, Little Grebe *Tachybaptus ruficollis*, Ringed Plover, Avocet and Whimbrel *Numenius phaeopus*.

2.22 The Standard Natura 2000 Data Form (May 2006) provides further details of the status of the Qualifying Interest Features of the SPA.

Thames Estuary and Marshes SPA Conservation Objectives

2.23 The Conservation Objectives for the SPA were revised and published by Natural England on 21st February 2019 and are as follows:

2.24 "With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change:

- Ensure that the integrity of the site is maintained or restored as appropriate and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;
  - the extent and distribution of the habitats of the qualifying features;
  - the structure and function of the habitats of the qualifying features;
  - the supporting processes on which the habitats of the qualifying features rely;
  - the population of each of the qualifying features; and
  - the distribution of the qualifying features within the site.

2.25 The qualifying features of the SPA are listed as:

- Hen Harrier (Non-breeding);
- Avocet (Non-breeding);
- Ringed Plover (Non-breeding);
- Grey Plover (Non-breeding);
- Knot (Non-breeding);

- Dunlin (Non-breeding);
- Black-tailed Godwit (Non-breeding);
- Redshank (Non-breeding); and
- waterbird assemblage.

Thames Estuary and Marshes Ramsar

2.26 Ramsar sites are wetlands of international importance designated under the International Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention).

2.27 The site qualifies under the following Ramsar criteria:

2.28 Criterion 5 – Assemblages of international importance:

- Species with peak counts in winter: 45,118 waterfowl (5 year peak mean 1998/99-2002/03).

2.29 Criterion 6 – Species / populations occurring at levels of international importance:

- Species with peak counts in spring/autumn:
  - Ringed Plover, 595 individuals (5 year peak mean 1998/99-2002/03); and
  - Black-tailed Godwit, 1,640 individuals (5 year peak mean 1998/99-2002/03).
- Species with peak counts in winter:
  - Grey Plover, 1,643 individuals (5 year peak mean 1998/99-2002/03);
  - Knot, 7,279 individuals (5 year peak mean 1998/99-2002/03);
  - Dunlin, 15,171 individuals (5 year peak mean 1998/99-2002/03); and
  - Redshank, 1,178 individuals (5 year peak mean 1998/99-2002/03).

2.30 The following species are listed as ‘noteworthy fauna’ on the citation - species currently occurring at levels of national importance:

- Species with peak counts in spring / autumn:
  - Little Grebe, 251 individuals (5 year peak mean 1998/99-2002/03);
  - Little Egret Egretta garzetta, 54 individuals (5 year peak mean 1998/99-2002/03);
  - Ruff Philomachus pugnax, 23 individuals (5 year peak mean 1998/99-2002/03); and
  - Greenshank Tringa nebularia, 38 individuals (5 year peak mean 1998/99-2002/03).
- Species with peak counts in winter:
  - Shelduck, 1,238 individuals (5 year peak mean 1998/99-2002/03);
  - Gadwall, 359 individuals (5 year peak mean 1998/99-2002/03);
  - Shoveler, 288 individuals (5 year peak mean 1998/99-2002/03);
  - Water Rail Rallus aquaticus, 6 individuals (5 year peak mean 1998/99-2002/03);
  - Avocet, 607 individuals (5 year peak mean 1998/99-2002/03); and
  - Spotted Redshank Tringa erythropus, 6 individuals (5 year peak mean 1998/99-2002/03).

South Thames Estuary and Marshes Site of Special Scientific Interest

2.31 The statutory nature conservation agencies have a duty under the Wildlife and Countryside Act 1981, as amended, to notify any land which in their opinion is ‘of special interest by reason of any flora, fauna, or geological or physiographical features’. Such areas are known as Sites of Special Scientific Interest.

2.32 The notification for the South Thames Estuary and Marshes SSSI states:

> *'The South Thames Estuary and Marshes SSSI from Gravesend to the eastern end of the Isle of Grain forms a major component of the Greater Thames Estuary. The site consists of an extensive mosaic of grazing marsh, saltmarsh, mudflats and shingle characteristic of the estuarine habitats of the north Kent marshes.*
>
> *The site supports outstanding numbers of waterfowl with total counts regularly exceeding 20,000. Many species regularly occur in nationally important numbers and some species regularly use the site in internationally important numbers. The breeding bird community is also of particular interest. The diverse habitats within the site support a number of nationally rare and scarce invertebrate species and an assemblage of nationally scarce plants.*
>
> *The mudflats attract large numbers of feeding waders and wildfowl with the site being regularly used by Redshank in internationally important numbers. There is evidence from recent winter low-water counts that Knot and Dunlin exceed internationally important numbers when feeding on the mudflats. These counts also indicate that Avocet and Ringed Plover regularly exceed nationally important numbers'.*

Medway Estuary and Marshes SPA

2.33 The Medway Estuary feeds into and lies on the south side of the outer Thames Estuary in Kent, south-east England. It forms a single tidal system with the Swale and joins the Thames Estuary between the Isle of Grain and Sheerness. It has a complex arrangement of tidal channels, which drain around large islands of saltmarsh and peninsulas of grazing marsh. The mud-flats are rich in invertebrates and also support beds of the macro-alga Enteromorpha flexuosa and some Eelgrasses Zostera species. Small shell beaches occur, particularly in the outer part of the estuary.

2.34 The citation report (1993) for the SPA lists the following qualifying interest features:

2.35 The site qualifies under Article 4.1 of the Directive (2009/147/EC) by supporting, in summer, populations of European importance of the following species listed on Annex I of the Directive:

2.36 During the breeding season:

- Avocet, 28 pairs; and
- Little Tern Sternula albifrons, 24 pairs.

2.37 The site also qualifies under Article 4.1 by regularly supporting a nationally important wintering population of:

- Avocet, 70 individuals (5 year peak mean 1986/87 - 1990/1).

2.38 The site also qualifies under Article 4.2 as a wetland of international importance by regularly supporting at least 20,000 waterfowl, with an average peak count of 53,900 birds recorded in the five winter period (1986/87 – 1990/91). This total includes internationally or nationally important wintering populations of the following (with average peak counts recorded in the five winter period 1986/87-1990/91):

- 4,130 Dark-bellied Brent Goose Branta bernicla bernicla;
- 5,900 Shelduck;
- 980 Pintail;
- 740 Ringed Plover;
- 4,810 Grey Plover;
- 3,690 Knot;
- 22,900 Dunlin;
- 4,180 Redshank;
- 250 Great Crested Grebe Podiceps cristatus;

- 5,200 Wigeon Anas penelope;
- 2,400 Teal Anas crecca;
- 150 Shoveler;
- 3,300 Oystercatcher Haematopus ostralegus;
- 390 Black-tailed Godwit;
- 1,900 Curlew Numenius arquata;
- 17 Spotted Redshank;
- 12 Greenshank; and
- 630 Turnstone.

2.39 The site also qualifies under Article 4.2 by regularly supporting, in summer, a diverse assemblage of breeding migratory waterfowl including:

- Oystercatcher;
- Lapwing;
- Ringed Plover;
- Redshank;
- Shelduck;
- Mallard;
- Teal;
- Shoveler;
- Pochard; and
- Common Tern Sterna hirundo.

2.40 The site also qualifies under Article 4.2 by virtue of regularly supporting, in winter, a diverse assemblage of wintering species, including:

- Red-throated Diver Gavia stellata;
- Great Crested Grebe;
- Cormorant Phalacrocorax carbo;
- Shelduck;
- Mallard;
- Teal;
- Shoveler;
- Pochard;
- Oystercatcher;
- Ringed Plover;
- Dunlin;
- Redshank;
- Bewick's Swan Cygnus columbianus;
- Hen Harrier;
- Merlin Falco columbarius ;
- Golden Plover;
- Short-eared Owl Asio flammeus; and

- Kingfisher Alcedo atthis.

2.41 The JNCC SPA review, although having no legal standing, also includes information on the Medway Estuary and Marshes SPA and lists the qualifying features as:

2.42 This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

2.43 During the breeding season:

- Avocet, 28 pairs (5-year peak mean 1988-1992); and
- Little Tern, 28 pairs (5 year peak mean, 1991-1995).

2.44 Over-winter:

- Avocet, 314 individuals (5 year peak mean 1991/92-1995/96).

2.45 This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

2.46 On passage:

- Ringed Plover, 1,337 individuals (5 year peak mean 1991/2 - 1995/6).

2.47 Over winter:

- Black-tailed Godwit, 957 individuals (5 year peak mean 1991/2 - 1995/6);
- Dark-bellied Brent Goose, 3,205 individuals (5 year peak mean 1991/2 - 1995/6);
- Dunlin, 25,936 individuals (5 year peak mean 1991/2 - 1995/6);
- Grey Plover, 3,406 individuals (5 year peak mean 1991/2 - 1995/6);
- Pintail, 697 individuals (5 year peak mean 1991/2 - 1995/6);
- Redshank, 3,690 individuals (5 year peak mean 1991/2 - 1995/6);
- Ringed Plover, 768 individuals (5 year peak mean 1991/2 - 1995/6); and
- Shelduck, 4,465 individuals (5 year peak mean 1991/2 - 1995/6).

2.48 The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl.

2.49 Over winter, the area regularly supports 65,274 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Little Grebe, Dark-bellied Brent Goose, Shelduck, Pintail, Ringed Plover, Grey Plover, Dunlin, Avocet, Redshank, Curlew, Great Crested Grebe, Cormorant, Wigeon, Teal, Oystercatcher, Lapwing, Black-tailed Godwit, Whimbrel.

2.50 The Standard Natura 2000 Data Form (December 2015) provides further details of the status of the Qualifying Interest Features of the SPA.

Medway Estuary and Marshes SPA Conservation Objectives

2.51 The Conservation Objectives for the SPA were revised and published by Natural England on 21st February 2019 and are as follows:

"With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change:

- Ensure that the integrity of the site is maintained or restored as appropriate and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;
  - the extent and distribution of the habitats of the qualifying features;
  - the structure and function of the habitats of the qualifying features;
  - the supporting processes on which the habitats of the qualifying features rely;

  - the population of each of the qualifying features; and
  - the distribution of the qualifying features within the site.

2.52 The qualifying features of the SPA are listed as:

- Dark-bellied Brent Goose (Non-breeding);
- Shelduck (Non-breeding);
- Pintail (Non-breeding);
- Avocet (Breeding);
- Avocet (Non-breeding);
- Ringed Plover (Non-breeding);
- Grey Plover (Non-breeding);
- Knot (Non-breeding);
- Dunlin (Non-breeding);
- Redshank (Non-breeding);
- Little Tern (Breeding);
- waterbird assemblage; and
- breeding bird assemblage.

Medway Estuary and Marshes Ramsar

2.53 The site qualifies under the following Ramsar criteria:

2.54 Criterion 5 – Assemblages of international importance

- Species with peak counts in winter: 47,637 waterfowl (5 year peak mean 1998/99-2002/03).

2.55 Criterion 6 – Species/populations occurring at levels of international importance

- Species with peak counts in spring/autumn:
  - Grey Plover, 3,103 individuals (5 year peak mean 1998/9-2002/3); and
  - Redshank, 3,709 individuals (5 year peak mean 1998/9-2002/3).
- Species with peak counts in winter:
  - Dark-bellied Brent Goose, 2,575 individuals (5 year peak mean 1998/9-2002/3);
  - Shelduck, 2,627 individuals (5 year peak mean 1998/9-2002/3);
  - Pintail, 1,118 individuals (5 year peak mean 1998/9-2002/3);
  - Ringed Plover, 540 individuals (5 year peak mean 1998/9-2002/3);
  - Knot, 3,021 individuals (5 year peak mean 1998/9-2002/3); and
  - Dunlin, 8,263 individuals (5 year peak mean 1998/9-2002/3).

2.56 Criterion 6 – Species/populations identified subsequent to designation for possible future consideration:

- Species with peak counts in spring/autumn:
  - Black-tailed Godwit, 721 individuals (5 year peak mean 1998/9-2002/3).

2.57 The following species are listed as ‘noteworthy fauna’ on the citation - species currently occurring at levels of national importance:

- Species regularly supported during the breeding season:

  - Mediterranean Gull Larus melanocephalus, 10 apparently occupied nests (Seabird 2000 Census);
  - Black-headed Gull Chroicocephalus ridibundus, 7,050 apparently occupied nests (Seabird 2000 Census);
  - Sandwich Tern Thalasseus sandvicensis, 333 apparently occupied nests (Seabird 2000 Census);
  - Common Tern, 228 apparently occupied nests (Seabird 2000 census); and
  - Little Tern, 28 pairs (5 year mean 1991-95).
- Species with peak counts in spring/autumn:
  - Cormorant, 271 individuals (5 year peak mean 1998/9-2002/3);
  - Little Egret, 125 individuals (5 year peak mean 1998/9-2002/3);
  - Avocet, 645 individuals, (5 year peak mean 1998/9-2002/3);
  - Whimbrel, 49 individuals (5 year peak mean 1998/9-2002/3);
  - Curlew, 3,575 individuals (5 year peak mean 1998/9-2002/3);
  - Greenshank, 68 individuals (5 year peak mean 1998/9-2002/3); and
  - Turnstone, 600 individuals (5 year peak mean 1998/9-2002/3).
- Species with peak counts in winter:
  - Shoveler, 241 individuals (5 year peak mean 1998/9-2002/3);
  - Oystercatcher, 3,632 individuals (5 year peak mean 1998/9-2002/3); and
  - Golden Plover Pluvialis apricaria, 4,500 individuals (5 year peak mean 1998/9-2002/3).

Medway Estuary and Marshes Site of Special Scientific Interest

2.58 The notification for the Medway Estuary and Marshes SSSI states:

2.59 ‘The Medway Estuary and Marshes form the largest area of intertidal habitats which have been identified as of value for nature conservation in Kent and are representative of the estuarine habitats found on the North Kent coast.

2.60 The Medway Estuary is now believed to be the most important area in North Kent for wintering wildfowl with Shelduck, Brent Goose, Grey Plover, Ringed Plover, Pintail, Dunlin and Redshank occurring in numbers of international significance. Also present in numbers of national significance are Turnstone, Black-tailed Godwit, Curlew, Great Crested Grebe, Shoveler, Teal, Wigeon and White-fronted Goose. Passage migrants include Ruff, Whimbrel and Avocet.

2.61 The Chetney Peninsula is among the most important wildfowl breeding areas in Kent. Breeding species include Avocet, Shelduck, Shoveler, Pochard, Mute Swan, Tufted Duck, Teal and Gadwall.’

3. Methods

Field Survey

3.1 The intertidal surveys commenced in January 2018 and finished in December 2018, with four intertidal surveys undertaken per month; two over high tide and two over low tide. Where possible, a high water count was then followed on the same day by a low water count (or vice versa). A total of 48 surveys were conducted within the survey period, with 24 low water and 24 high water counts covering a range of tidal heights and times.

3.2 The survey dates / times, weather conditions and tidal details are presented in Table 3.1.

Table 3.1 Intertidal bird survey dates, tide times, tide heights and weather conditions

Date	High/low tide	Tide height (m)	Tide time	Weather conditions
22/01/2018	Low	0.82	09:39	9°C, cloud 6/8, wind F2W.
22/01/2018	High	5.46	15:49	9°C, cloud 4/8, wind F2W.
21/02/2018	Low	0.76	09:52	5°C, cloud 7/8, wind F3NW.
21/02/2018	High	5.51	16:05	6°C, cloud 8/8, wind F3NW.
26/02/2018	High	5.06	08:43	-1°C, cloud 3/8, wind F5E.
26/02/2018	Low	1.27	15:08	0°C, cloud 5/8, wind F5E.
06/03/2018	Low	0.45	09:35	6°C, cloud 4/8, wind F2SW.
06/03/2018	High	5.75	15:34	8°C, cloud 2/8, wind F2SE.
13/03/2018	High	4.77	09:54	7°C, cloud 8/8, wind F2W.
13/03/2018	Low	1.47	15:53	9°C, cloud 8/8, wind F2W.
18/04/2018	Low	0.47	09:10	16°C, cloud 1/8, wind F1S.
18/04/2018	High	5.96	15:06	20°C, cloud 0/8, wind F2SE.
25/04/2018	High	5.18	09:23	11°C, cloud 4/8, wind F3SW.
25/04/2018	Low	1.38	15:37	14°C, cloud 7/8, wind F3SW.
17/05/2018	Low	0.52	08:48	11°C, cloud 4/8, wind F3NW.
17/05/2018	High	5.97	14:46	14°C, cloud 1/8, wind F3NW,
23/05/2018	Low	1.41	13:54	16°C, cloud 8/8, wind F3NE.
24/05/2018	High	5.3	09:02	16°C, cloud 7/8, wind F3NE.
14/06/2018	Low	0.62	07:43	16°C, cloud 8/8, wind F5SW.
14/06/2018	High	5.94	13:46	18°C, cloud 6/8, wind F5SW.
22/06/2018	High	5.32	08:32	19°C, cloud 2/8, wind F2NW.
22/06/2018	Low	1.41	14:32	21°C, cloud 1/8, wind F2N.
13/07/2018	Low	0.71	07:26	17°C, cloud 8/8, wind F2NW
13/07/2018	High	5.89	13:30	23°C, cloud 3/8, wind F2NW.
23/07/2018	High	5.05	10:04	22°C, cloud 0/8, wind F1SW.
23/07/2018	Low	1.49	16:06	29°C, cloud 0/8, F1SW.
14/08/2018	Low	0.68	09:36	20°C, cloud 8/8, wind F2NW.
14/08/2018	High	6.1	15:34	24°C, cloud 8/8, wind F2NW.
21/08/2018	High	4.77	09:18	20°C, cloud 6/8, wind F1SW.
21/082018	Low	1.67	15:29	23°C, cloud 3/8, wind F1SW.
11/09/2018	Low	0.69	08:33	20°C, cloud 1/8, wind F4SW.

Date	High/low tide	Tide height (m)	Tide time	Weather conditions
11/09/2018	High	6.13	14:30	22°C, cloud 5/8, wind F4SW.
19/09/2018	High	4.58	08:23	19°C, cloud 7/8, wind F4SW.
19/09/2018	Low	1.81	14:45	22°C, cloud 7/8, wind F8SW.
11/10/2018	Low	0.71	08:47	18°C, cloud 1/8, wind F4SE.
11/10/2018	High	6.09	14:45	21°C, cloud 1/8, wind F4S.
19/10/2018	High	4.5	08:52	12°C, cloud 1/8, wind F2N.
19/10/2018	Low	1.69	15:31	15°C, cloud 3/8, wind F2N.
12/11/2018	Low	1.02	08:59	15°C, cloud 1/8, wind F2S.
12/11/2018	High	5.51	15:13	15°C, cloud 1/8, wind F2S.
19/11/2018	High	4.92	09:14	9°C, cloud 2/8, wind F2E.
19/11/2018	Low	1.23	15:38	9°C, cloud 2/8, wind F2E.
03/12/2018	High	5.25	09:00	13°C, cloud 6/8, wind F3-4W.
03/12/2018	Low	0.86	15:33	13°C, cloud 6/8, wind F3-4W.
11/12/2018	Low	0.93	08:40	9°C, cloud 2/8, wind F2NE.
11/12/2018	High	5.48	14:53	9°C, cloud 2/8, wind F2NE.

3.3 The survey was undertaken from suitable vantage points to observe all birds without causing undue disturbance. During the survey, one experienced ornithologist, equipped with binoculars and telescope of appropriate magnification recorded and mapped all waterbird species within the survey area. As the site is a linear area with good visibility, birds could be observed from distance to avoid disturbance and to ensure that if any moved they were not double-counted. Surveys were undertaken in the period of two hours prior to high / low water and two hours after.

3.4 All waterbird species and numbers were recorded, along with bird activity (e.g. feeding, loafing and movements). The location and extent of flocks and individual waterbirds were recorded directly into ESRI Arcpad GIS Software on handheld PDA devices, with a 1:10,000 scale Ordnance Survey base map of the study area (and adjacent land). A 50 m x 50 m grid was overlaid on top of the base map to assist with the distributional analysis. The distance from the recorder to a bird flock was assessed through the use of this grid and through the use of landmarks present in the landscape and on the base map, which could be scaled as desired in the field. Birds were either plotted as individual counts at a location or as a flock, the extent of which could be plotted electronically directly onto the base map on the hand held PDAs. The ornithologists were proficient in the use of this method and equipment having undertaken such surveys on numerous occasions previously around the UK on coastal, estuarine and inland terrestrial and wetland sites. This is a robust and reliable method for recording birds and plotting their distribution.

3.5 On returning to the office the collected data, contained on flash memory cards, were downloaded into ESRI ArcGIS software and spatial distribution maps produced.

Wetland Bird Survey (WeBS) Data

3.6 The Wetland Bird Survey (WeBS) is a joint scheme run by the British Trust for Ornithology (BTO), the Wildfowl & Wetlands Trust (WWT), Royal Society for the Protection of Birds (RSPB) and Joint Nature Conservation Committee (JNCC) to monitor non-breeding waterbirds in the UK. The scheme aims to identify population sizes, to determine trends in numbers and distribution, and to identify important sites for waterbirds. Monthly coordinated ‘core’ counts are made during high tide periods, principally from September to March.

3.7 Given, that the populations presented in the designated sites citations are based on data from approaching twenty years old, it is appropriate to consider these cited populations in the context of up to date population information, where available. Current trends, based on the most recent species and assemblage five year

peak means, as presented by WeBS, are considered in relation to species cited on the relevant SPA and Ramsar designations.

3.8 Current WeBS data in the context of the wider area were evaluated to support the results of the field surveys undertaken by AECOM.

Definitions

3.9 The definition of waterbirds used in this study is in accordance with the Ramsar convention upon which the SPA citations are based, i.e. "birds ecologically dependent on wetlands". At the broad level of taxonomic order this is as follows:

- **divers**: *Gaviiformes*;
- **grebes**: *Podicipediformes*;
- **cormorants**: *Pelecaniformes*;
- **herons**, bitterns, storks, ibises and spoonbills: *Ciconiiformes*;
- **swans**, **geese** and **ducks** (wildfowl): *Anseriformes*;
- wetland related **raptors**: *Accipitriformes* and *Falconiformes*;
- wetland related cranes, rails and allies: *Gruiformes*;
- **waders** (or shorebirds), **gulls**, and **terns**: *Charadriiformes*; and
- wetland related owls: *Strigiformes*;

3.10 For the purposes of this analysis, the term ‘spring’ is used to indicate the period April to June; ‘autumn’ to indicate the period of July to October and ‘winter’ includes the data collected in January to March 2018 and November-December 2018.

3.11 For the purposes of the analysis, the tidal cycle is divided into two periods. The term ‘low tide’ is used to indicate the period two hours either side of low tide, ‘high tide’ the period two hours either side of high tide.

Survey Limitations

3.12 Within this assessment, data has been collected during the latter period of winter 2017/2018 and early period of winter 2018/2019. A standard survey and analysis of waterbirds over the winter period would encompass November to March of a single winter but, due to the Proposed Development programme, these surveys commenced in January 2018. However, the weather in the early winter period (January- March) of 2018 was similar to that in the late period (November-December) of 2018. Therefore, these data collected from a spli’ winter in a calendar, rather than biological year are representative of a typical winter period.

3.13 The majority of ecological data is valid only for short periods due to the inherently transient nature of the subject (CIEEM, 2019[1]). On this basis, it is recommended that the surveys for intertidal waterbirds will need repeating in two years (i.e. in 2020 - 2021).

[1] CIEEM: Advice Note on the lifespan of ecological surveys and reports https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf (Accessed May 2019)

4. Results

Abundance of Waterbirds

4.1 A total of 24 waterbird species were recorded using the intertidal survey area between January 2018 and December 2018. Table 5.1 summarises the peak counts by month for each species recorded during the survey period.

Table 4.1 Peak counts of all waterbird species recorded during the surveys of the Site in 2018.

Species	Winter			Spring			Autumn				Winter		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	PEAK COUNT
Dark-bellied Brent Goose	0	38	22	0	0	0	0	0	0	9	240	0	**240**
Shelduck	20	4	4	11	1	2	0	0	0	0	0	2	**20**
Cormorant	1	0	0	0	0	0	0	0	0	0	0	0	**1**
Little Egret	0	0	0	0	0	0	1	1	1	0	0	0	**1**
Grey Heron	0	0	0	0	0	0	0	0	1	0	0	0	**1**
Oystercatcher	385	440	400	422	320	220	180	310	120	210	300	250	**440**
Grey Plover	0	0	0	0	0	0	0	4	0	24	1	0	**24**
Golden Plover	0	1	0	0	0	0	0	0	0	0	0	0	**1**
Ringed Plover	0	0	0	2	14	2	0	0	0	2	0	0	**14**
Lapwing	0	1	0	0	0	0	0	0	0	0	0	0	**1**
Whimbrel	0	0	0	1	0	0	0	0	0	0	0	0	**1**
Curlew	42	22	25	10	0	0	11	6	18	23	23	37	**42**
Black-tailed Godwit	0	0	0	0	0	0	0	38	8	38	120	0	**120**
Bar-tailed Godwit	0	0	0	0	0	0	0	1	0	0	0	0	**1**
Turnstone	0	5	0	0	0	0	0	0	0	0	3	0	**5**
Knot	0	0	0	0	0	0	0	0	0	0	8	0	**8**
Dunlin	30	0	0	3	0	0	0	0	0	24	20	5	**30**
Redshank	11	14	2	0	0	0	1	0	0	2	1	4	**14**
Black-headed Gull	78	17	63	101	11	30	280	683	458	97	93	182	**683**
Mediterranean Gull	0	0	0	2	0	0	0	0	0	0	0	0	**2**
Common Gull	0	1	2	0	0	0	0	0	0	0	0	4	**4**
Lesser Black-backed Gull	0	0	0	2	0	0	0	0	0	0	0	0	**2**
Herring Gull	6	4	11	2	5	0	3	12	3	7	7	8	**12**
Great Black-backed Gull	1	0	0	0	0	0	0	0	0	1	0	0	**1**
Peak Visit Count'	**435**	**448**	**414**	**430**	**320**	**220**	**462**	**1,009**	**461**	**297**	**688**	**314**	**1,009**
Total Assemblage²	**574**	**547**	**529**	**556**	**351**	**254**	**476**	**1,055**	**609**	**437**	**816**	**492**	**1,668**

Notes on Table 5.2: ' = The peak visit count represents the greatest number of waterbirds recorded on a single visit. ² = The total assemblage is the sum of the species peak counts

4.2 The non-breeding waterbird assemblage recorded during the survey period was determined by the summation of each species' peak count, irrespective of the survey in which they occurred. This represents the minimum number of individual waterbirds using the survey area during the monitoring period.

4.3 Therefore, the non-breeding waterbird assemblage for the survey area is 1,668 individuals. The peak seasonal waterbird assemblages (i.e. the sum of the peak counts per season), as recorded by the monitoring in 2018, were as follows (see also Table 6.1):

- Winter: 1,121 individuals;
- Spring: 571 individuals; and
- Autumn: 1,131 individuals.

Spatial and Temporal Distribution of Waterbirds

4.4 The species for which detailed accounts are given were recorded on the intertidal area of the Proposed Development Site during surveys in 2018 and meet one of the following three criteria:

- a waterbird species cited as a qualifying interest feature (in any season) of either the Thames Estuary and Marshes SPA or Medway Estuary and Marshes SPA (using the legal list of qualifying species for each site). These species are: Dark-bellied Brent Goose, Shelduck, Cormorant, Oystercatcher, Grey Plover, Golden Plover, Ringed Plover, Lapwing, Curlew, Black-tailed Godwit, Turnstone, Knot, Dunlin and Redshank;
- a waterbird species cited as a qualifying interest feature (in any season) of either the Thames Estuary and Marshes Ramsar or Medway Estuary and Marshes Ramsar. These species are: Dark-bellied Brent Goose, Shelduck, Cormorant, Little Egret, Oystercatcher, Grey Plover, Golden Plover, Ringed Plover, Whimbrel, Curlew, Black-tailed Godwit, Turnstone, Knot, Dunlin, Redshank, Black-headed Gull and Mediterranean Gull;
- a waterbird species noted on the designation for the South Thames Estuary and Marshes SSSI or Medway Estuary and Marshes SSSI (as mentioned in Section 3 of this report). These species are: Redshank, Knot, Dunlin, Ringed Plover, Shelduck, Dark-bellied Brent Goose, Grey Plover, Turnstone, Black-tailed Godwit, Curlew and Whimbrel; or
- a waterbird species that is considered partly or wholly ecologically dependent upon the intertidal habitat where their numbers exceeded a peak of 25 birds on Site. However, the peak count of species that are not already mentioned as a qualifying interest feature of an SPA or Ramsar (above), exceeded a peak of 25 birds and therefore there are no additional species.

4.5 Spatial distribution figures for these selected species are presented for both high and low water periods (see Appendix A). These maps have been plotted using the raw species counts occurring in each of the grid squares from the surveys. Therefore they do not represent a total of individuals across the site but the peak usage of each 50 m x 50 m grid square by the target species. The maps show the spatial distribution of the individual target species. They are expected to highlight those areas that are important to the target species over the low and high water periods.

4.6 Brief summary text is provided below that presents a commentary on the temporal and spatial distributions of waterbirds, highlighting the key points from the available data for each species.

Dark-bellied Brent Goose

4.7 In winter, birds were widely distributed across the survey area at high tide, ahead of the incoming tide. At low tide, the majority of records of Dark-bellied Brent Goose were in the north and south of the survey area.

4.8 This species was not recorded within the survey area in spring and the sole autumn record was of nine birds recorded over the high water period on 19th October 2018.

Shelduck

4.9 Shelduck was not recorded during surveys over the high water period in any of the seasons.

4.10 At low tide, there were no observations of Shelduck in spring and birds were widely distributed across the survey area in autumn and winter.

Cormorant

4.11 This species was only recorded on a single occasion at low tide in winter.

Little Egret

4.12 Only recorded in autumn, at both high and low tide, on exposed mud within the survey area.

Oystercatcher

4.13 Oystercatcher was recorded in all months of the survey period, with a peak count of 440 individuals over the high water on 26th February 2018.

4.14 The species was recorded across both high and low water periods within the survey area and although widely distributed across the area during both tidal states, higher concentrations of birds were recorded to the north of the survey area at high tide, at the Mean High Water Spring (MHWS) mark within the Ministry of Defence (MoD) land, approximately 200 metres north of the Proposed Development area.

Grey Plover

4.15 Grey Plover was not recorded during surveys in spring and was only recorded on a single occasion at low tide in winter.

4.16 In autumn, at low tide, birds were widely distributed across the survey area. At high tide, birds were observed at the MHWS mark, north of the Proposed Development area.

Golden Plover

4.17 A single Golden Plover was recorded sheltering in high winds on a small patch of grass near the car park at Grain.

Ringed Plover

4.18 This species favoured the sandy areas of the MHWS mark, north of the Proposed Development area, with birds recorded over the high and low water tidal states in spring and during the high tidal state on a single occasion in autumn.

Lapwing

4.19 A single Lapwing was recorded with a Golden Plover, sheltering in high winds on a small patch of grass near the car park at Grain.

Whimbrel

4.20 The species was recorded in spring only. At high tide, a single bird was recorded at the MHWS mark to the north of the survey area within the Ministry of Defence (MoD) land, c. 200 metres north of the Proposed Development area. At low tide, a single bird was foraging on the exposed mud within the survey area.

Curlew

4.21 Curlew was recorded in all seasons.

4.22 At high tide, higher concentrations of birds were recorded at the MHWS mark within the Ministry of Defence (MoD) land, c. 200 metres north of the Proposed Development area and outside the survey area, c. 700 m from the Proposed Development area.

4.23 At low tide, birds were widely distributed across the survey area.

Black-tailed Godwit

4.24 Not recorded in spring, or the early winter period.

4.25 In winter, 120 birds were recorded at the MHWS mark to the north of the Proposed Development area on 19th November 2018.

4.26 Low tide distribution within the survey area in autumn was sporadic, whilst in winter, birds favoured the southern end of the survey area.

Bar-tailed Godwit

4.27 A single Bar-tailed Godwit was recorded foraging on exposed mud during low tide on 21st August 2018.

Turnstone

4.28 Turnstone was recorded at high tide in winter only, along the MHWS mark to the north of the Proposed Development and outside the survey area (c. 700 m from the Proposed Development area).

Knot

4.29 Knot was recorded at high tide, in winter only, along the MHWS mark to the north of the Proposed Development area.

Dunlin

4.30 Dunlin was recorded sporadically over the survey area at low tide, in all seasons.

4.31 At high tide, higher concentrations of Dunlin were recorded along the MHWS mark to the north of the Proposed Development area.

Redshank

4.32 Not recorded in spring and in autumn, just 1-2 birds were recorded over both high and low water.

4.33 In winter, records at high tide were mostly of birds recorded at the MHWS mark, north of the Proposed Development area. At low tide, high concentrations of birds were recorded in the creek in the southern end of the survey area, near Grain village.

Black-headed Gull

4.34 This species was widely distributed across the intertidal mudflats at high tide and at low water.

Mediterranean Gull

4.35 Two birds were recorded at low tide, loosely associating with Black-headed Gulls on the exposed mud within the survey area.

WeBS Core Count Data for the Thames Estuary and Medway Estuary

4.36 The most recent WeBS core count data available (2012/13 – 2016/17) were reviewed for both the Thames Estuary and Medway Estuary (see Table 4.2). These data provide the most up to date populations for waterbirds on the majority of these estuaries although it is important to note that the count sector boundaries do not match exactly the boundaries of the designated sites. It should also be noted that there are a number of count sectors within the Thames Estuary and Medway Estuary which have not been subject to counts in the five year period considered here (2012/13-2016/17), so the 5 year peak means presented here are considered incomplete.

Table 4.2 WeBS Core Count data (2012/13-2016/17) for waterbird species cited on the Thames Estuary and Marshes Ramsar / SPA or Medway Estuary and Marshes Ramsar / SPA

	Thames Estuary 5 year peak mean 2012/13 – 2016/17 (taken from WeBS)	Medway Estuary (5 year peak mean 2012/13-2016/17 – taken from WeBS)
Dark-bellied Brent Goose	17,021	1,688
Shelduck	1,736	2,000
Cormorant	223	31
Little Egret	325	163
Oystercatcher	18,816	1,807
Grey Plover	4,227	236
Golden Plover	3,420	1,725
Ringed Plover	823	187
Lapwing	12,025	5,741
Whimbrel	34	13
Curlew	3,840	729
Black-tailed Godwit	7,023	2,122
Turnstone	578	244
Knot	28,881	1,330
Dunlin	32,063	5,510
Redshank	2,935	1,066
Black-headed Gull	8,376	1,120
Mediterranean Gull	39	468

5. Evaluation

5.1 Given the location of the Site and its proximity to designated sites of international importance, it is appropriate to consider the importance of the Site to birds recorded in the survey area in the context of the waterbird assemblages of these designated sites.

5.2 Table 6.1 summarises the maximum counts recorded for key species as established in section 6.1 of this report. Data are also provided for the International and Great Britain 1% threshold criteria (used to assess the importance of wetlands) and the Ramsar citation.

Table 5.1 Comparison of peak waterbird counts recorded during surveys in 2018 with original Thames Estuary SPA citation figures; alongside Ramsar citation and current 1% thresholds for national and international importance.Main text

	Peak Spring Count	% of SPA Citation Population	Peak Autumn Count	% of SPA Citation Population	Peak Winter Count	% of SPA Citation Population	Thames Estuary and Marshes Ramsar Citation	Great Britain 1% Wintering Threshold	International 1% Threshold
Dark-bellied Brent Goose	22	-	9	-	240	-	-	980	2,400
Shelduck	11	-	0	-	20	-	-	470	3,000
Cormorant	0	-	0	-	1	-	-	620	1,200
Little Egret	0	-	1	-	0	-	54	110	1,300
Oystercatcher	422	-	310	-	440	-	-	2,900	8,200
Grey Plover	0	0.00	24	0.92	1	0.04	1,643	330	2,500
Golden Plover	0	-	0	-	1	-	-	4,000	1,700
Ringed Plover	14	1.06	2	0.15	0	0.00	595	420	730
Lapwing	0	-	0	-	1	-	-	6,200	72,300
Whimbrel	1	-	0	-	0	-	-	1*	6,700
Curlew	25	-	23	-	42	-	-	1,200	8,400
Black-tailed Godwit	0	0.00	38	2.24	120	7.06	1,640	390	610
Turnstone	0	-	0	-	5	-	-	400	1,400
Knot	0	0.00	0	0.00	8	0.17	7,279	2,600	4,500
Dunlin	3	0.01	24	0.08	30	0.10	15,171	3,400	13,300
Redshank	2	0.06	2	0.06	14	0.43	1,178	940	2,400
Black-headed Gull	101	-	683	-	182	-	-	22,000	20,000
Mediterranean Gull	2	-	0	-	0	-	-	40	770

Notes on Table 5.1 – * when the 1% threshold is below 50 birds, 50 is normally used as the minimum qualifying threshold for the designation of sites of importance (Stroud, 2001) The UK SPA Network: its scope and context. JNCC; Citation species are presented in italics

Table 5.2 Comparison of peak waterbird counts recorded during surveys in 2018, with original Medway Estuary SPA citation figures; alongside Ramsar citation and current 1% thresholds for national and international importance.

	Peak Spring Count	% of SPA Citation Population	Peak Autumn Count	% of SPA Citation Population	Peak Winter Count	% of SPA Citation Population	Medway Estuary and Marshes Ramsar Citation	Great Britain 1% Wintering Threshold	International 1% Threshold
Dark-bellied Brent Goose	22	0.53	9	0.22	240	5.81	2,575	980	2,400
Shelduck	11	0.19	0	0.00	20	0.39	2,627	470	3,000
Cormorant	0	0.00	0	0.00	1	?	271	620	1,200
Little Egret	0	-	1	-	0	-	125	110	1,300
Oystercatcher	422	12.8	310	9.39	440	13.33	3,632	2,900	8,200
Grey Plover	0	0.00	24	0.50	1	0.02	3,103	330	2,500
Golden Plover	0	0.00	0	0.00	1	?	4,500	4,000	1,700
Ringed Plover	14	1.89	2	0.27	0	0.00	540	420	730
Lapwing	0	-	0	-	1	-	-	6,200	72,300
Whimbrel	1	-	0	-	0	-	49	1*	6,700
Curlew	25	1.32	23	1.21	42	2.21	3,575	1,200	8,400
Black-tailed Godwit	0	0.00	38	9.74	120	30.8	721	390	610
Turnstone	0	0.00	0	0.00	5	0.79	600	400	1,400
Knot	0	0.00	0	0.00	8	0.22	3,021	2,600	4,500
Dunlin	3	0.01	24	0.10	30	0.13	8,263	3,400	13,300
Redshank	2	0.05	2	0.05	14	0.33	3,709	940	2,400
Black-headed Gull	101	-	683	-	182	-	7,050*	22,000	20,000
Mediterranean Gull	2	-	0	-	0	-	10*	40	770

Notes on Table 5.2 – when the 1% threshold is below 50 birds, 50 is normally used as the minimum qualifying threshold for the designation of sites of importance (Stroud, 2001) The UK SPA Network: its scope and context. JNCC. *=Apparently Occupied Nests (A.O.N)

The importance of the survey area as a discrete wetland for supporting internationally and nationally important waterbird populations

5.3 No waterbird species recorded within the survey area in 2018 represented 1% or more of the international or national population estimates used for assessing populations.

The importance to birds of the survey area in the context of the Thames Estuary and Marshes Ramsar and SPA

5.4 The peak number of the following species recorded in the survey area during the monitoring period equated to over 5% of the Thames Estuary and Marshes Ramsar and SPA populations:

- Black-tailed Godwit:
  - Winter 7.1 % of the cited SPA population and 7.3 % of the cited Ramsar population.

5.5 The following two species recorded in the survey area during the monitoring period had peak counts that represented 1% or more of the Thames Estuary and Marshes Ramsar and SPA populations:

- Ringed Plover:
  - Spring 1.1 % of the cited SPA population and 1.7 % of the cited Ramsar population.
- Black-tailed Godwit:
  - Autumn 2.2 % of the cited SPA population and 2.3 % of the cited Ramsar population.

WeBS core counts for the Thames Estuary

5.6 The numbers of waterbirds recorded during the intertidal surveys in 2018 were evaluated against WeBS Core Count data for the Thames Estuary between 2012/13 and 2016/17. The peak count of Black-tailed Godwit within the survey area in 2018 equates to over 1 % of the Thames Estuary and Marshes Ramsar and SPA population (based on the five year peak mean 2012/13 - 2016/17, taken from WeBS):

- Black-tailed Godwit:
  - Winter 1.7 %.

The importance to birds of the survey area in the context of the Medway Estuary and Marshes Ramsar and SPA

5.7 The peak number of the following species recorded in the survey area during the monitoring period equated to over 5% of the Medway Estuary and Marshes Ramsar and SPA populations:

- Dark-bellied Brent Goose:
  - Winter 5.8 % of the cited SPA population and 9.3 % of the cited Ramsar population.
- Oystercatcher:
  - Spring 12.8 % of the cited SPA population and 11.6 % of the cited Ramsar population.
  - Autumn 9.4 % of the cited SPA population and 8.5 % of the cited Ramsar population.
  - Winter 13. 3 % of the cited SPA population and 12.1 % of the cited Ramsar population.
- Black-tailed Godwit:
  - Autumn 9.7 % of the cited SPA population and 5.3 % of the cited Ramsar population.

  - Winter 30.8 % of the cited SPA population and 16.6 % of the cited Ramsar population.

5.8 The following two species recorded in the survey area during the monitoring period had peak counts that represented 1% or more of the Thames Estuary and Marshes Ramsar and SPA populations:

- Ringed Plover:
  - Spring 1.9% of the cited SPA population and 2.6 % of the cited Ramsar population.
- Curlew:
  - Spring 1.3% of the cited SPA population and 0.7 % of the cited Ramsar population.
  - Autumn 1.2% of the cited SPA population and 0.6 % of the cited Ramsar population.
  - Winter 2.2% of the cited SPA population and 1.2 % of the cited Ramsar population.

WeBS core counts for the Medway Estuary

5.9 The numbers of waterbirds recorded during the intertidal surveys in 2018 were evaluated against WeBS Core Count data for the Thames Estuary between 2012/13 and 2016/17. The peak counts of the following species recorded in the survey area in 2018, equates to over 1 % of the Medway Estuary and Marshes Ramsar / SPA population (based on the five year peak mean 2012/13 - 2016/17, taken from WeBS):

- Dark-bellied Brent Goose:
  - Spring 1.3%
  - Winter 14.2%.
- Shelduck:
  - Winter 1.0%.
- Cormorant:
  - Winter 3.2%
- Oystercatcher:
  - Spring 23.4%
  - Autumn 17.2%
  - Winter 24.4%
- Grey Plover:
  - Winter 10.2%.
- Ringed Plover:
  - Spring 7.5%
  - Autumn 1.1%
- Whimbrel:
  - Spring 7.7%.
- Curlew:
  - Spring 3.4%
  - Autumn 3.2%
  - Winter 5.8%
- Black-tailed Godwit:
  - Autumn 1.8%
  - Winter 5.7%

- Turnstone:
  - Winter 2.1%
- Redshank:
  - Winter 1.3%

WeBS Alerts and SPA Population Trends

5.10 The WeBS Alerts system provides a method of identifying changes in numbers of waterbirds and provides a review of the status of species on sites in the UK which are designated due to their conservation value for non-breeding waterbirds (including The Thames Estuary and Marshes SPA and Medway Estuary and Marshes SPA). Species that have undergone changes in numbers are identified, through the issue of 'alerts'. Species trends are assessed over the short-, medium-, and long-terms (5, 10 and up to 25 year respectively). Where declines exceed 50%, High-Alerts are issued and where declines lie between 25% and 50%, Medium-Alerts are issued. Considering these alerts in the context of the species recorded during AECOM surveys provides important background information on the trends of species populations and the existing pressures that the populations may already be experiencing. This is important as it could determine how sensitive the species may be the potential impacts of the scheme and the reaction of these populations to these impacts.

Thames Estuary and Marshes SPA WeBS Alerts

5.11 The WeBS Alert system evaluated 14 species for the Thames Estuary and Marshes SPA, with alerts triggered for seven species in relation to the SPA.

5.12 Of the 14 species evaluated for WeBS Alerts, eight species were recorded within the intertidal survey area and five species are included as 'alert species' for the SPA. These were: Ringed Plover, Grey Plover, Lapwing, Knot and Dunlin.

5.13 Ringed Plover, included as a WeBS Alert species, was recorded within the survey area in significant (greater than 5%) numbers in relation to the cited SPA population for the Thames Estuary and Marshes SPA.

5.14 One other species, Black-tailed Godwit, was also recorded within the survey area in significant numbers (greater than 5%) in relation to the cited SPA population for the Thames Estuary and Marshes SPA, although this species is not included as a WeBS Alert species.

5.15 Of these two species, present within the survey area in significant numbers:

- Black-tailed Godwit has increased on the SPA by 237% in the short-term, 605 % in the medium-term and 5,067 % in the long-term; and
- Ringed Plover has decreased on the SPA by 37% in the short-term and 24 % in the medium-term, but increased by 41 % in the long-term (the short-term decline triggering a Medium-Alert).

5.16 In consideration of these population changes, as indicated by WeBS Alerts, the populations of Ringed Plover on the SPA could be considered more vulnerable than Black-tailed Godwit and other waterbird species (recorded in lower numbers) to any impacts of development.

Medway Estuary and Marshes SPA WeBS 'Alerts'

5.17 The WeBS Alert system evaluated 17 species for the Medway Estuary and Marshes SPA, with alerts triggered for 12 species in relation to the SPA.

5.18 Of the 17 species evaluated for WeBS Alerts, 11 species were recorded within the intertidal survey area and nine species are included as 'alert species' for the SPA. These were Dark-bellied Brent Goose, Shelduck, Cormorant, Oystercatcher, Ringed Plover, Grey Plover, Dunlin, Curlew and Redshank. Of these 'alert' species, recorded within the survey area in 2018:

- Dark-bellied Brent Goose was recorded within the survey area in significant (>5%) numbers in winter in relation to the cited SPA population for the Medway Estuary and Marshes SPA; and

- Oystercatcher was recorded within the survey area in significant (>5%) numbers in spring, autumn and winter in relation to the cited SPA population for the Medway Estuary and Marshes SPA;
- Ringed Plover was recorded within the survey area in numbers >1% (in spring) of the cited SPA population for the Medway Estuary and Marshes SPA; and
- Curlew was recorded within the survey area in numbers >1% (in spring, autumn and winter) of the cited SPA population for the Medway Estuary and Marshes SPA.

5.19 Shelduck, Cormorant, Grey Plover, Dunlin, Curlew and Redshank were recorded within the survey area in numbers <1% of the cited SPA populations for the Medway Estuary and Marshes SPA.

5.20 In consideration of the four species (Dark-bellied Brent Goose, Oystercatcher, Ringed Plover and Curlew), present within the survey area in significant numbers:

- Dark-bellied Brent Goose has increased on the SPA by 2% in the short-term, but decreased by 39 % in the medium-term and 36 % in the long-term (the medium-term and long-term declines triggering a Medium-Alert);
- Oystercatcher ha increased on the SPA by 39 % in the short-term and 194 % in the long-term, but decreased by 32 % in the medium-term (the medium-term decline triggering a Medium-Alert);
- Ringed Plover has decreased on the SPA by 25% in the short-term, 70% in the medium-term and 88 % in the long-term (the short-term decline triggering a Medium-Alert and the medium-term and long-term declines triggering a High-Alert); and
- Curlew has decreased on the SPA by 29 % in the short-term, 61% in the medium-term and 24 % in the long-term (the short-term decline triggering a Medium-Alert and the medium term decline triggering a High-Alert).

5.21 In consideration of these population changes, as indicated by WeBS Alerts, the SPA populations of these four species could be considered vulnerable to the impacts of development, affecting the overall estuarine waterbird assemblage.

6. Conclusions and Recommendations

6.1 A total of 24 species of waterbird were recorded using the survey area in 2018. Of these, 17 species were recorded using the survey area in winter, 9 species of waterbirds were recorded using the survey area in spring and 14 species were recorded using the survey area in autumn.

6.2 A total of 18 species of waterbird, considered as being of conservation importance due to being listed as wintering and/or passage interest features of The Thames Estuary and Marshes Ramsar and SPA or the Medway Estuary and Marshes Ramsar and SPA were recorded. These species are (SPA species in italics): Dark-bellied Brent Goose, Shelduck, Cormorant, Little Egret, Oystercatcher, Grey Plover, Golden Plover, Ringed Plover, Lapwing, Whimbrel, Curlew, Black-tailed Godwit, Turnstone, Knot, Dunlin, Redshank, Black-headed Gull and Mediterranean Gull.

6.3 No peak counts of any species recorded within the survey area in 2018 represented 1% or more of the international or national population estimates.

6.4 A significant proportion (greater than 5%) of the wintering population of Black-tailed Godwit, cited on The Thames Estuary and Marshes Ramsar / SPA was recorded within the survey area in 2018. However, when evaluating the peak count of Black-tailed Godwit recorded in the survey area in 2018 against the recent five-year peak mean for the whole estuary, taken from WeBs, the peak count represents just over 1% of the population using the estuary.

6.5 The peak count of three species (Dark-bellied Brent Goose, Oystercatcher and Black-tailed Godwit) recorded during the surveys represented over 5% of the cited SPA populations for the Medway Estuary and Marshes Ramsar / SPA. When evaluating the peak count of these species recorded in the survey area in 2018 against the recent five-year peak mean for the whole estuary, taken from WeBs, the peak counts of Dark-bellied Brent Goose (in winter), Oystercatcher (all seasons) and Black-tailed Godwit (in winter) represents over 5% of the population using the estuary.

6.6 Species populations greater than 5% represent a significant proportion of the SPA population for the Thames Estuary and Marshes SPA and Medway Estuary and Marshes SPA.

6.7 When compared to the most recent WeBS core count data, the peak count of four species (not already mentioned above): Grey Plover (winter), Ringed Plover (spring), Whimbrel (spring) and Curlew (winter) were recorded in the survey area in 2018 in peak numbers equating to over 5% of the Medway Estuary and Marshes Ramsar and SPA population (based on the five year peak mean 2012/13-2016/16). For the purposes of assessment, the original species populations at the time of designation should form the basis for determining any impacts arising from a scheme and likely significant effects to key receptors, but recent WeBS data should be used to make an informed conclusion and support a proportionate decision as to any mitigation measures required.

6.8 One species, Ringed Plover, has been identified within the WeBS Alerts system as showing declines on The Thames Estuary and Marshes SPA in the short-term, which may suggest that in the absence of appropriate mitigation, they are more vulnerable to negative impacts of development.

6.9 Four species (Dark-bellied Brent Goose, Oystercatcher, Ringed Plover and Curlew) have been identified within the WeBS Alerts system as showing declines on The Medway Estuary and Marshes SPA in the short-, medium- and long-term that may suggest that in the absence of appropriate mitigation, they are more vulnerable to negative impacts of development.

6.10 Waterbird distribution was evenly distributed at low tide across the survey area. At high tide, larger concentrations of waterbirds were recorded at the MHWS mark, to the north of the Proposed Development area, where birds were recorded roosting. A second high tide roosting site was observed outside of the survey area, c .700 m north of the Proposed Development area.

6.11 Given, the above conclusions, the following recommendations should be used to reduce the likelihood of significant effects occurring on important receptors associated with the Thames Estuary and Marshes Ramsar / SPA during construction of the Proposed Development:

- The installation works in the intertidal area will be completed in as short a period as possible to further reduce disturbance to birds. Works will be undertaken at low tide when there are extensive exposed mudflats within the Project area and wider estuary, meaning that there is an extensive foraging resource available for waterbirds and they are more dispersed across the intertidal area. As a result, if temporarily disturbed from the Project area extensive, alternative foraging areas are available. The intertidal areas to the north-west, in particular, are relatively undisturbed as these areas lie offshore from military land, with no public access.
- Works will avoid high water and the periods running up to and proceeding high water (approximately 2 hours), when roosting waterbirds are concentrated to the north-west of the cable installation area. Should works be required during these sensitive periods then the CEMP will include measures to ensure a watching brief by an experienced ornithologist is in place to monitor waterbird reactions and advise on preventive measures to avoid undue disturbance.

6.12 However, to reduce the likelihood of significant effects occurring on important receptors associated with the Thames Estuary and Marshes Ramsar / SPA during construction of the Proposed Development, if construction works are to be undertaken over high water periods during winter, i.e. two hours either side of high water, then consideration should be given to how any works at the MHWS mark can be screened. In particular, movements of the work force and any noise arising from these activities. However, it is acknowledged that work undertaken at the landfall area (at the MHWS mark) are unlikely to cause disturbance to roosting waterbirds, given:

- the distance between the Proposed Development area and the identified high tide roost; and
- the curvature of the land will screen the visibility of construction from the high tide roost.

Appendix A : Distribution Maps of Waterbirds Recorded within the Survey Area in 2018

Appendix 6.E – Report on Surveys for Reptiles

NeuConnect GB Onshore Scheme

Environmental Statement

Appendix 6E – Report on Surveys for Reptiles

NeuConnect Britain Limited

September 2019

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Table of Contents

Figures

Tables

1. Introduction

1.1 AECOM was instructed by NeuConnect Britain Limited (the 'Applicant') to undertake a survey of reptile presence or absence for the proposed development (the 'Proposed Development') of an electricity convertor station and substation at Grain, Isle of Grain, Kent. The proposed electricity converter station and substation will form part of a Direct Current (DC) electricity link (referred to as an interconnector) between Great Britain and Germany. The Preliminary Ecological Appraisal (PEA), undertaken in April 2018 (AECOM, 2019), recommended surveys to investigate the grassland habitat on the Site for its potential to support reptiles.

Proposed Development

1.2 NeuConnect (the 'Project'), is a 1400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks. The new link will create a connection for electricity to be passed in either direction between Great Britain and Germany. The Project will be formed by approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HDVC) cables, with on-shore converter stations linking into the existing electricity grids in Great Britain and Germany.

1.3 The Proposed Development will comprise of three structures, a Converter Station, Sub-station and a Direct Current (DC) cable route (see Figure 1).

1.4 The footprint of the proposed converter station is expected to be up to approximately 250 metres (m) by 250 m (to the perimeter security fence), with a maximum height of up to 26 m.

1.5 The footprint of the proposed substation is expected to be approximately 80 m by 80 m (to the perimeter security fence), with a maximum height of 14 m.

1.6 The proposed DC cable corridor will be approximately 1.6 km long (from landfall to the converter station). The preferred installation method will be underground, which will result in a temporary loss of land during installation. The working corridor for the installation of the cable corridor will be 30 m.

1.7 Additional laydown areas will be required for construction, comprising 1.5 hectare (ha) for the converter laydown and 0.3 ha for the substation laydown.

Site Description

1.8 The Proposed Development areas (the 'Site') is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The Site is located to the west of the village of Grain, Isle of Grain, Kent at Ordnance Survey (OS) central grid reference TQ 88205 76727. Land use comprises a mix of industrial development to the south, the small settlement of Grain to the southeast and undeveloped land, much of which is designated for ecological interests, to the north (along the coastline) and to the west. Land within the Site and in the immediate vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill.

1.9 Figure 1 shows the Site boundary (red-line), the cable corridor (purple line) and proposed location of each structure.

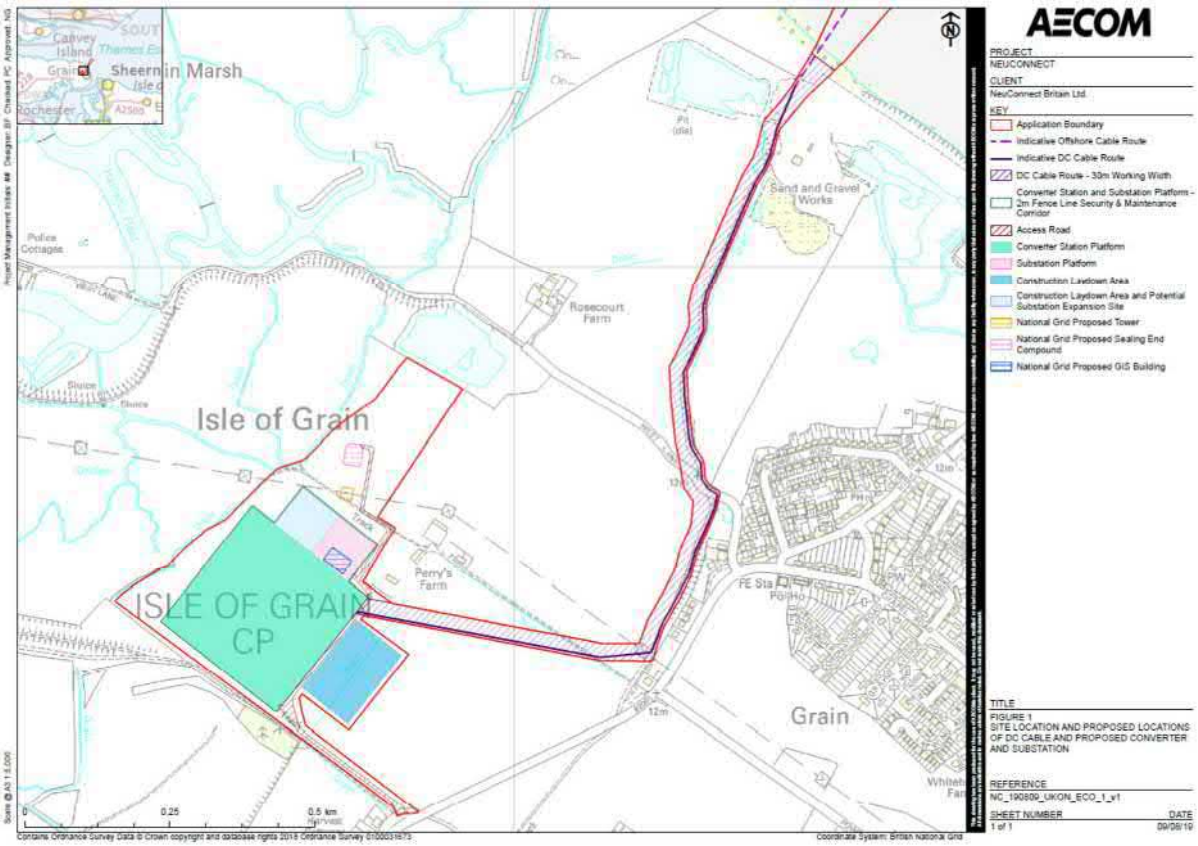

Figure 1 - Site boundary and proposed locations of DC cable route, converter station and substation

Survey Area

1.10 The survey area included suitable terrestrial habitat for reptiles within 100 metres (m) of the cable corridor (which included ephemeral / short perennial, scrub, semi-improved grassland and ditches) and an area of habitat suitable for reptiles, where the cable corridor makes landfall. The survey areas (highlighted in orange) are displayed in Figure 2.

1.11 The total survey area is 9.4 ha, with the northern section measuring 5.7 ha in size and the southern section 3.7 ha.

1.12 The areas proposed for the substation and converter station (see Figure 1) comprise two large arable fields, which are not suitable for reptiles. Therefore, these areas were not surveyed for reptile presence / absence.

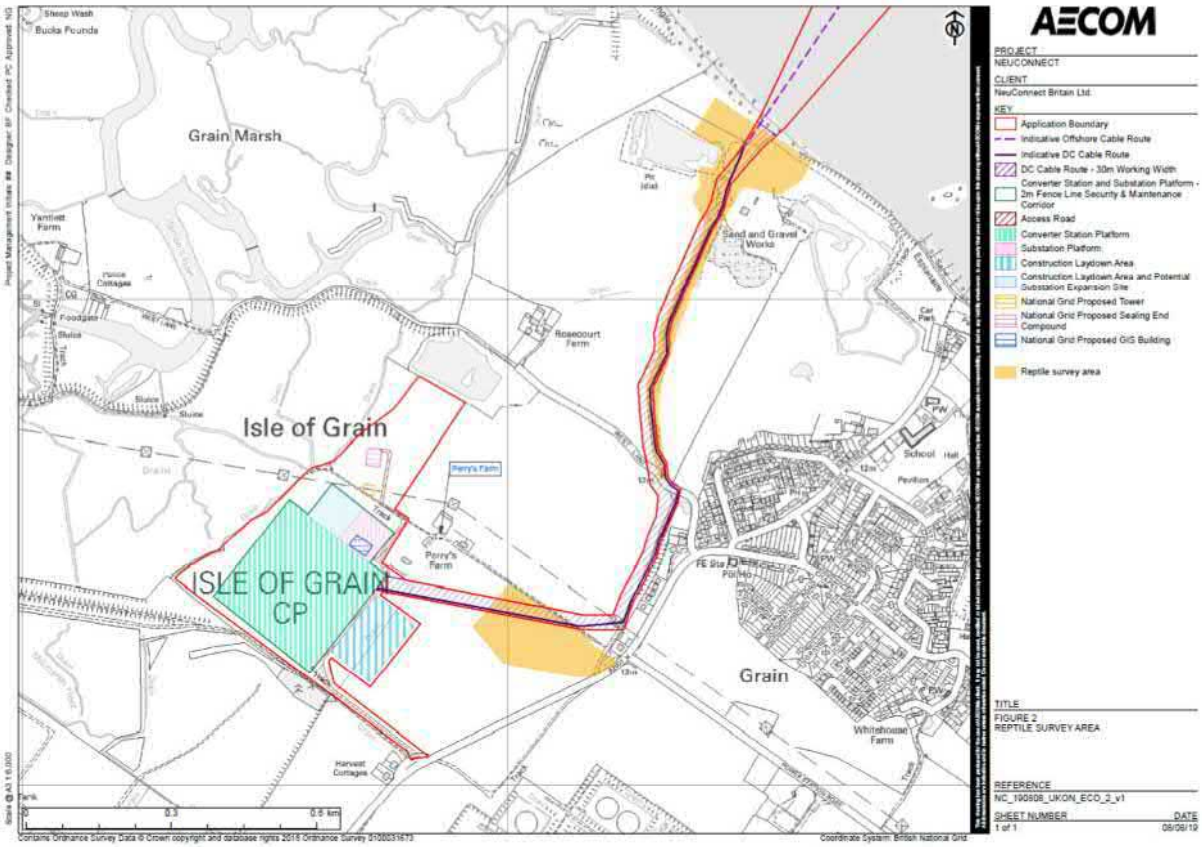

Figure 2 – Reptile Survey Areas (orange filled areas)

Scope of report

1.13 The objective of the reptile survey was to determine the presence or absence of reptiles in areas of suitable habitat located within the Proposed Development areas (Figure 1).

2. Legislative and Policy Framework

Relevant Legislative Context

2.1 All reptiles native to the UK are listed under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended). The four most widespread species of reptile: the Adder Vipera berus, Grass Snake Natrix helvetica, Common Lizard Zootoca vivipara and Slow Worm Anguis fragilis are protected under Section 9 (1 and 5) of the Act. This prohibits:

- intentional injuring or killing of a reptile;
- selling, offering or exposing for sale, or having in possession or transporting a reptile for the purpose of sale, any live or dead wild animal or any part of, or anything derived from, such an animal; or
- publishing or causing to be published any advertisement likely to be understood as conveying, buying or selling, or intending to buy or sell, any of those things.

2.2 There are no licensing provisions within the Act for development activities affecting these species. However, developers are expected to take adequate precautions to avoid breaches of the legislation, including undertaking adequate surveys and mitigation to avoid or minimise the risk of killing or injuring reptiles.

National and Local Planning Policy

2.3 The National Planning Policy Framework (NPPF) was originally published on 27th March 2012 and detailed the Government's planning policies for England and how these are expected to be applied. The NPPF was then revised on 24th July 2018 and 19th February 2019.

2.4 The NPPF states the commitment of the UK Government to minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity.

2.5 It specifies the obligations that the Local Authorities and the UK Government have regarding statutory designated sites and protected species under UK and international legislation and how this it to be delivered in the planning system. Protected or notable habitats and species can be a material consideration in planning decisions and may therefore make some sites unsuitable for particular types of development, or if development is permitted, mitigation measures may be required to avoid or minimise impacts on certain habitats and species, or where impact is unavoidable, compensation may be required.

2.6 The NPPF is clear that pursuing sustainable development includes moving from a net loss of biodiversity to achieving net gains for nature, and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution.

2.7 National and local planning policy relevant to nature conservation and reptile protection is provided in detail in the Preliminary Ecological Appraisal for the Proposed Development (AECOM, 2018).

UK Post-2010 Biodiversity Framework

2.8 The UK Biodiversity Action Plan (UKBAP) was launched in 1994 and established a framework and criteria for identifying species and habitat types of conservation concern. From this list, action plans for priority species of conservation concern were published, and have subsequently been succeeded by the UK Post-2010 Biodiversity Framework (July 2012).

2.9 The UK Post-2010 Biodiversity Framework sets a broad enabling structure for action across the UK between now and 2020, including a shared vision and priorities for UK-scale activities to help deliver the Aichi targets and the EU Biodiversity Strategy. A major commitment by Parties to the Convention of Biological Diversity is to produce a National Biodiversity Strategy and/or Action Plan.

2.10 The UK Post-Development Framework is relevant in the context of Section 40 of the Natural Environment and Rural Communities (NERC Act) 2006, meaning that Priority Species and Habitats are material considerations in planning. These habitats and species are identified as those of conservation concern due to their rarity or a declining population trend.

2.11 The Natural Environment and Rural Communities (NERC) list of Species of Principal Importance is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act (2006); under Section 40 every public authority (e.g. a local authority or local planning authority) must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity. In addition, with regard to those species on the list of Species of Principal Importance prepared under Section 41 (S41), the Secretary of State must:

"(a) take such steps as appear to the Secretary of State to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under this section, or

(b) promote the taking by others of such steps."

2.12 All widespread reptile species were added to the UK Biodiversity Action Plan (UKBAP) as priority species in September 2007 and subsequently were included as Species of Principal Importance in England under Section 41 of the NERC Act (2006) (as well as Sand Lizard (*Lacerta agilis*) and Smooth Snake (*Coronella austriaca*)) meaning that they are of material consideration in planning.

Local Biodiversity Action Plan

2.13 The Kent Biodiversity Action Plan (1997)[1] sets out Action Plans for 13 Species within the county. No reptile species are included as a priority species in Kent.

[1] The Kent Biodiversity Action Plan: A framework for the future of Kent's wildlife. Kent Biodiversity Action Plan Steering Group (1997)

3. Methods

Desk Study

3.1 A desk study was undertaken in July 2018 to obtain ecological records within a 2 km radius of the Proposed Development from Kent & Medway Biological Records Centre. This data request was limited to records of reptiles recorded within the last ten years of the request date.

Field survey

3.2 The field surveys utilised two recognised methods to record reptile presence / absence within the Proposed Development area:

- refugia surveys; and
- visual observation of banks / other suitable habitat within the Proposed Development area.

3.3 Seven refugia surveys were undertaken between 4th September and 4th October 2018, in accordance with Froglife's Advice Sheet 10 for Reptile Surveys (Froglife, 1999) and Natural England's Standing Advice Sheet for Reptiles (https://www.gov.uk/guidance/reptiles-protection-surveys-and-licences, accessed March 2019).

Refugia Surveys

3.4 Artificial refugia, in the form of sheets of bitumen roofing felt, measuring approximately 0.5m² in size, were placed in likely basking spots for reptiles. These areas included un-shaded patches next to cover, in areas of suitable grassland and adjacent to potential hibernation sites such as piles of rubble, logs, rabbit burrows and near vegetation waste such as arisings from grass cutting and wood chips.

3.5 A total of 118 refugia sheets were placed in suitable reptile habitat within the survey area in August 2018 (see Figure 2). The density of sheets was as advised by Froglife (1999)

3.6 The artificial refugia were left in situ for two weeks and were then checked on seven separate occasions, commencing on the 4th September 2018. Existing refugia on site, including pieces of wood and debris, were also searched for reptiles.

3.7 Reptile activity is greatly influenced by weather conditions, with reptiles most likely to use artificial refugia in temperatures of between 9°C and 18°C (Froglife, 1999), in hazy or intermittent sunshine with light winds (Gent & Gibson, 1998). The optimal survey period for reptiles (as recommended in the Herpetofauna Worker's Manual (Gent & Gibson, 1998)) is April, May and September.

3.8 Surveys were undertaken between 4th September and 4th October 2018 under suitable weather conditions on warm, dry days (see Table 4.1 for dates of survey and weather conditions).

Visual Inspections

3.9 Whilst checking artificial refugia, each area of suitable reptile habitat was searched in order to 'spot' basking common lizards. This species will often sit on top of grass tussocks, debris and felts and will quickly move from sight upon disturbance. Consequently, spotting this species can be more effective than searching under roof felt. Common lizards are often very territorial and will often reuse favourite basking sites (Beebee & Griffiths, 2000). Once these sites are known, spotting can become a relatively successful method of lizard recording.

Population Assessment

3.10 Where reptiles are present, estimating population sizes of reptiles can be undertaken using guidance within Froglife's advice sheet Number 10 (Froglife, 1999). This advice sheet provides a simple means of evaluating a species population as 'low', 'good', or 'exceptional' on the basis of the maximum number of adult reptiles (of each species) recorded during a single visit (see Table 3.1).

Table 3.1: Population Estimates of Reptile Species (Froglife, 1999)

Species	Low population	Good population	Exceptional population
Adder	<5	5 -10	>10
Grass Snake	<5	5 -10	>10
Common Lizard	<5	5 -20	>20
Slow Worm	<5	5 -20	>20

3.11 This method of population size estimate uses the assumption of a reptile survey using a density of 10 reptile sheets per hectare, although it can be difficult to determine a population size through interpretation of data using peak counts and densities. An average score across all survey visits will provide a more robust estimate of the population size of each reptile species present within suitable on-site habitat.

Survey Limitations

3.12 There were access limitations to the areas of land proposed for the converter and substation (see Figure 2) during the surveys for reptile presence / absence in September / October 2018 and therefore these areas were not surveyed for reptile presence / absence. However, an evaluation has been made of the potential suitability of the habitat within these areas to support reptiles relative to those areas that were surveyed and this evaluation is included further on in this report. This limitation is not considered to have affected the efficacy of the survey results.

3.13 The majority of ecological data is valid only for short periods due to the inherently transient nature of the subject (CIEEM, 2019[2]). On this basis, it is recommended that surveys for reptiles will need repeating in two years (i.e. in 2020).

[2] CIEEM: Advice Note on the lifespan of ecological surveys and reports https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf (Accessed May 2019)

4. Results

Desk Study

4.1 The desk study returned nine records of reptiles recorded within 2 km of the Proposed Development area and within the last ten years. These were:

- a single record of Adder approximately 100 m from the Proposed Development area in 2010;
- two records of Grass Snake, with one recorded approximately 100 m from the Proposed Development area in 2010; and
- six records of Common Lizard, with the closest record located approximately 60m from the Proposed Development area in 2010 and the most recent record was found within 200 m of the Proposed Development area in 2013.

Field survey

4.2 Field surveys were undertaken between 4th September and 4th October 2018 in suitable weather conditions, with seven survey visits undertaken. Three species of reptile (Common Lizard, Grass Snake and Slow-worm) were recorded during these surveys. No Adder were recorded within the survey area during field surveys. The results of the surveys and weather conditions are presented in Table 4.1.

Table 4.1: Reptile Survey Dates, Numbers of Reptiles found and Weather Conditions

Survey number	Survey Date	Weather Conditions and Temperature (ºC)	Reptile Species (and numbers) Recorded within the Survey Area	Reptile Species (and numbers) Recorded within the Proposed DC cable corridor (Redline Boundary)
1	04/09/2018	Dry, Cloud 7/8. Wind F2. c. 15°C	Eleven Common Lizard and one Slow-worm	Four Common Lizard
2	06/09/2018	Dry, Cloud 4/8. Wind F2. c. 15°C	21 Common Lizard and two Slow-worm	Nine Common Lizard
3	11/09/2018	Dry, Cloud 1/8. Wind F4 SW. c. 18°C	Four Grass Snake and 14 Common Lizard	Five Common Lizard and three Grass Snake
4	19/09/2018	Dry, Cloud 6/8. Wind F4 SW. c. 18°C	36 Common Lizard and two Slow-worm	17 Common Lizard and one Slow-worm
5	21/09/2018	Dry, Cloud 1/8. Wind F6 W. c. 14°C	24 Common Lizard and two Slow-worm	12 Common Lizard and one Slow-worm
6	26/09/2018	Dry, Cloud 0/8. Wind F2 SW. c. 18°C	19 Common Lizard	Seven Common Lizard
7	04/10/2018	Dry, Cloud 2/8. Wind F2 SW. c. 15°C	23 Common Lizard	Seven Common Lizard

Notes on Table 4.1: Wind speed is shown using the Beaufort scale, which is an empirical measure of force 0-12 that relates wind speed to observed conditions. Cloud cover is shown in a scale of 0-8 where the number represents the amount of cloud cover e.g. 2/8 is 25% cover 4/8 is 50% etc.' – the survey area was limited to the DC cable corridor only

4.3 The maximum counts of each reptile species recorded on a single survey within the survey area were as follows:

- 36 Common Lizard on 19th September 2018;
- four Grass Snake on 11th September 2018; and

- two Slow-worm on 19th September 2018.

4.4 The maximum counts of each reptile species recorded on a single survey within the Proposed Development areas were as follows:

- 17 Common Lizard on 19th September 2018;
- three Grass Snake on 11th September 2018; and
- one Slow-worm on 19th September 2018.

4.5 Given that all reptile species native to the UK are protected from injury or killing under the Wildlife and Countryside Act 1981 (as amended), in the absence of any mitigation, the presence of reptiles within the Proposed Development area presents a potential constraint to the Proposed Development and suitable mitigation will be required prior to the commencement of development to avoid any breaches of legislation.

4.6 The distributions of reptiles found within the Proposed Development area is shown in Appendix A.

5. Evaluation

5.1 Three species of reptile were recorded within the Proposed Development area in 2018. These were Common Lizard, Grass Snake and Slow-worm. No Adder were recorded during field surveys, however, the desk study identified that this species was recorded within 100 m of the Proposed Development area in 2010.

Habitat Suitability for reptiles in areas not surveyed

5.2 Access to two compartments, proposed for the location of the substation and converter station (see Figure 1), was granted after the presence / absence surveys were completed in September 2018 and outside of the survey season for reptiles. These areas (Figure 1), therefore, were not surveyed for reptiles using the methods detailed in section 3 of this report, but the habitat quality was appraised for its suitability to support a population of reptiles relative to those areas which were surveyed along the Cable Corridor.

5.3 The habitat within these compartments comprised managed arable farmland, with narrow field margin which were ecologically connected to habitat within the wider survey area, found to support populations of reptiles in 2018.

5.4 Managed arable farmland is largely unsuitable for reptiles as these areas are heavily disturbed, however, the field margins offer potential habitat to support reptiles. On the basis of reptile presence across the wider Site, it is reasonable to assume presence of Common Lizard within the margins of these compartments. Grass Snake may also occur in these margins, particularly where any wet habitat (ditches) occurs. Slow-worm is unlikely to occur in these margins, given the localised population recorded within the survey area in 2018.

5.5 In consideration of the assumed presence of Common Lizard and Grass Snake, outline mitigation in the substation and converter station locations is also proposed on a precautionary basis.

Population distribution and size class estimate

5.6 Table 3.1 is used to obtain a basic evaluation of the size and importance of Proposed Development for reptiles. When determining the population size of reptiles on a site, consideration must be made of other factors that may influence the assessment such as habitat quality and species ecology.

5.7 Estimating the population size of reptiles on a site (see Table 3.1) is difficult to achieve because each survey visit may only reveal a small sample of the population and the proportion of animals that may be detected during surveys will vary according to, for example, weather, migration patterns.

5.8 To allow for focussed estimation of the population size, relevant to the Proposed Development, only the maximum counts of each species on a single visit within the Proposed Development areas have been used. This allows for pertinent assessment of the potential impacts of the Proposed Development on reptiles, rather than considering populations of reptiles outside of these areas.

Common Lizard

5.9 Common Lizard was widely recorded across the Proposed Development area and the maximum count on a single survey visit was of 17 animals. When the maximum count of 17 animals is evaluated against Froglife's 'Key reptile site register' (Froglife, 1999), the population of Common Lizard on site is classified as 'good'.

5.10 The average 'score' of Common Lizard across all survey visits would amount to 8.7 Common Lizards per survey, which would still place the population of Common Lizard at 'good'. When factoring in an assumed population of Common Lizard within suitable habitat of un-surveyed areas of the Site, this 'score' may be higher.

5.11 Therefore, the population of Common Lizard on Site is classified as 'good'.

Grass Snake

5.12 Grass Snake is a transient species, hibernating during winter months and often travelling away from hibernation sites to lay eggs. Grass Snake was recorded in reptile refugia close to ditches and the maximum count on a single survey visit was of three animals. The average 'score' of Grass Snake across all survey visits would amount to 0.43 Grass Snake per survey.

5.13 To estimate population density, when the maximum count of three animals is evaluated against Froglife's 'Key reptile site register' (Froglife, 1999), the population of Grass Snake on site is classified as 'low'. When factoring in the potential for Grass Snake to occur in similar numbers within un-surveyed areas of the Site, the population estimate could increase slightly to 'good'. However, there are limited features of interest for Grass Snake within the arable fields (and their margins) of the un-surveyed areas and these are unlikely to support numbers of Grass Snake, a species that prefers to be close to water.

5.14 Therefore, with all things considered, the population of Grass Snake on site is classified as being 'low'.

Slow-worm

5.15 Records of Slow-worm were confined to single records of animals on two occasions, possibly relating to the same individual. Over seven visits, the average 'score' of Slow-worm amounts to 0.29 Slow-worm per survey.

5.16 To estimate population density, when the maximum count of one animal is evaluated against Froglife's 'Key reptile site register' (Froglife, 1999), the population of Slow-worm on site is classified as 'low'.

5.17 Given the limited distribution of this species across the survey area, it is unlikely that this species occurs in similar numbers within un-surveyed areas.

5.18 Therefore, the population of Slow-worm on site is classified as being 'low'.

6. Conclusions and Recommendations

6.1 The reptile surveys undertaken in 2018 identified the presence of three reptile species (Common Lizard, Grass Snake and Slow-worm) within the Proposed Development area.

6.2 The Proposed Development has the potential to impact on these reptile populations and habitat loss. In the absence of appropriate mitigation, these impacts are:

- risk of incidental injury and mortality during the construction of the development;
- temporary loss of foraging habitat, used by three species of reptile, within the cable corridor;
- temporary loss of areas within the cable corridor used by hibernating reptiles; and
- temporary disturbance of reptiles using arable field margins, during construction and operation of the converter and substation.

6.3 Common Lizard, Grass Snake and Slow-worm are listed under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended), which prohibits intentional injuring or killing of a reptile. Therefore, through the implementation of mitigation, formalised through a Construction and Environment Management Plan (CEMP), the potential for killing and injuring of reptiles is avoidable. Mitigation is required to:

- ensure compliance with relevant legislation; and
- avoid impacts that would give rise to a potential “significant effect”, therefore contrary to planning policy and biodiversity obligations of the NERC Act 2006.

6.4 A significant negative effect is one which undermines nature conservation objectives, or changes the conservation status of a species population (CIEEM, 2016).

6.5 Therefore, outline recommendations for mitigation and / or enhancement of the Proposed Development area are presented further in Section 7 of this report.

7. Outline Mitigation Strategy

7.1 To mitigate for potential incidental killing or injury of animals and for the loss of reptile habitat, the following outline mitigation is proposed:

- clearance of vegetation, under ecological supervision, within the cable corridor to reduce the suitability of habitat for reptiles;
- inclusion of temporary fencing around the Proposed Development, to exclude reptiles from entering the construction areas from adjacent habitat;
- creation of habitat suitable for reptiles in the vicinity of the Proposed Development to mitigate for loss of reptile habitat; and
- avoidance of construction through potential reptile hibernation areas during periods when reptiles are hibernating (typically October to March), or removal of such features during the reptile 'active' periods (typically April to September).

Vegetation clearance within the cable corridor to minimise potential for incidental injury or mortality

7.2 The installation of the cable corridor will lead to temporary habitat loss, with the potential for incidental injury or mortality to reptiles. Therefore, the habitat within the cable corridor will be managed, through vegetation clearance, to reduce the suitability of the habitat and encourage reptile dispersal away from the construction areas.

7.3 The exact prescription of works will be dependent on the time of year within which the construction works will be undertaken and in consideration of how reptiles will be affected during their life cycle.

7.4 Broadly, the vegetation management will comprise:

- strimming vegetation within the cable corridor; and
- removal of arisings from within the cable corridor.

7.5 The vegetation within the cable corridor will be cleared to ground level, using hand strimmers, under the supervision of an Ecological Clerk of Work (ECoW). The vegetation will be cut in two passes, with the first cut of the vegetation cutting to no less than 0.3 m (1 foot) from above ground level. After a period of no less than 24 hours, a second cut of the vegetation will be made to ground level.

7.6 Vegetation strimming will be undertaken during suitable weather conditions, when the weather conditions are dry, with little to no wind and the temperature is between 9°C and 20°C.

7.7 All arisings will be raked by hand and removed from the cable corridor to prevent potential usage by reptiles.

7.8 Where possible, the vegetation clearance should be undertaken during September and October. This inside the active reptile season (March to October), but outside of the breeding bird season, which is typically March to August inclusive.

Inclusion of temporary fencing around working areas

7.9 On completion of the vegetation clearance within the Proposed Development areas, exclusion fencing will be installed around the Proposed Development areas to ensure that no reptiles stray into the working areas.

7.10 Fencing, as detailed within Gent and Gibson, 1998) comprises a 1000 gauge polythene material, buried to a depth of 200 millimetres (mm) and with an above-ground height of 600 mm. The material is fastened to wooden stakes and set at a slight angle at the top, facing away from the Proposed Development area and is pulled tight so that reptiles (particularly Common Lizard) cannot climb up the fence.

7.11 Whilst fencing is being installed, a fingertip search will be undertaken within the Proposed Development areas to ensure that no reptiles are trapped within the construction areas.

7.12 Fencing will remain in place for the duration of construction and will only be removed on completion.

Habitat creation to mitigate for loss of reptile habitat

7.13 To mitigate for the loss of reptile foraging habitat, new habitat will need to be created to offset the loss of current habitat and should be formalised through the landscaping design. Any newly created habitat should be, minimally, like for like in terms of quality and area and should maintain connectivity across the wider area. To follow the principles set out in the NPPF to ensure biodiversity gain, additional habitat would also be created to allow for species population expansion. However, it should be acknowledged that although the footprint of the Proposed Development will lead to a loss of terrestrial habitat available to reptiles, the majority of this habitat does not contain reptiles or is of poor quality to support reptiles. Therefore, the majority of habitat that will be lost is of no value for reptiles.

7.14 The mitigation habitat for foraging reptiles should include the creation of grassland habitat, which will be suitable as foraging habitat for Common Lizard, Grass Snake and Slow-worm.

Avoidance of Hibernating Reptiles

7.15 If construction works, including ground clearance works, are undertaken between November and early March, then these works are likely to affect reptiles during their hibernation period, when reptiles are typically below ground. Reptiles usually hibernate between October/November and March, although this can vary as reptile activity is highly influenced by weather conditions and hibernation is triggered by a response to temperature fluctuations above ground. Hibernation spots for reptiles includes rubble piles, log piles and under large rocks.

7.16 Therefore, supervision by an ECoW of intrusive ground works will be undertaken to locate any areas of hibernacula, or potential hibernacula. Any such areas of hibernacula, or potential hibernacula, will be avoided, where construction occurs during winter months and when reptiles are hibernating. Reptile activity is highly influenced by weather conditions and hibernation is triggered by a response to decreasing temperatures above ground. Typically, the hibernation period for reptiles is October / November to March, although this can vary depending on the weather.

7.17 Alternatively, potential hibernation spots could be removed in advance of construction, within the reptile active period and replaced outside of the Proposed Development area (but within a suitable distance so that reptiles ca find it). Removal would be under the supervision by an ECoW.

8. References

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British Standards (2013) Biodiversity — Code of practice for planning and development. BS42020:2013.

Froglife (1999) Froglife Advice Sheet 10 ‘Reptile Survey – An introduction to planning, conducting and interpreting surveys for snake and lizard conservation’. Froglife. London.

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Appendix A Figures

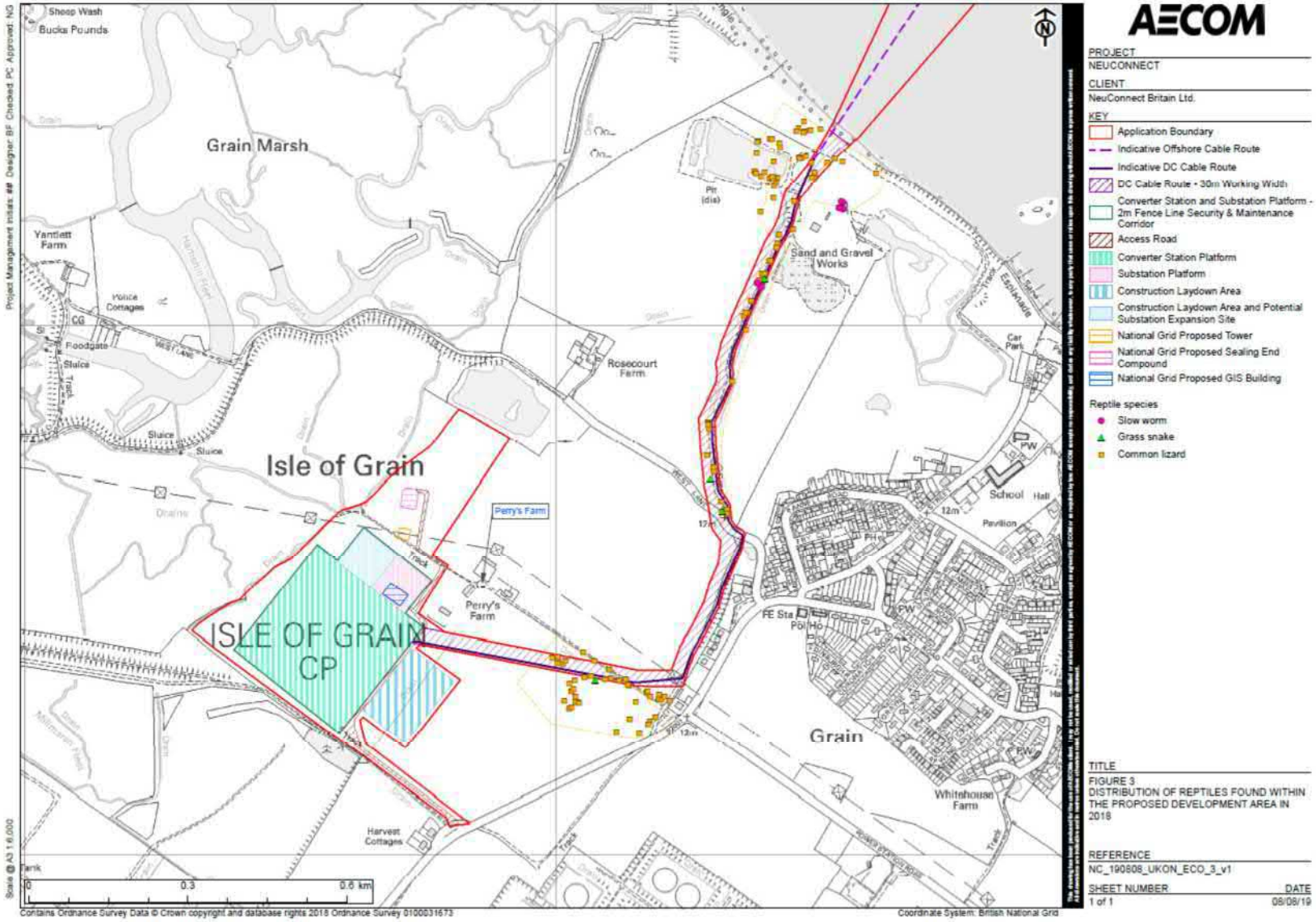

Figure 3 - Distribution of reptiles found within the Proposed Development area in 2018

Appendix 6.F – Report on Surveys for Great Crested Newts

NeuConnect Great Britain to Germany Interconnector

GB Onshore Scheme

Report on Surveys for Great Crested Newt

NeuConnect Britain Ltd

May 2019

Quality information

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Table of Contents

1. Introduction

In 2018, AECOM undertook a Preliminary Ecological Appraisal (PEA)[1] on behalf of Neuconnect Britain Ltd (the 'Applicant'). This PEA survey identified the need for follow-up ecological surveys to determine the potential impacts of the Neuconnect project (hereby known as the 'Proposed Development') on certain protected and, or notable species. Therefore, AECOM was instructed to undertake a survey of Great Crested Newt *Triturus cristatus* presence or absence, as recommended in the PEA report for the Proposed Development and to make any recommendations based on the results of the survey.

Proposed Development

NeuConnect (the Project) is a 1400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between the energy networks in Great Britain and Germany energy networks. The new link will create a connection for electricity to be passed in either direction between Great Britain and Germany. The Project will be formed by approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HVDC) cables, with on-shore converter station at either end linking into the existing electricity grids in Great Britain and Germany.

The Proposed Development will comprise of three structures, a converter station, sub-station and a direct current (DC) cable route (see Figure 1).

The footprint of the proposed converter station to the perimeter security fence is expected to be up to approximately 250 metres (m) by 250 metres, with a maximum height of up to 26 m.

The footprint of the proposed substation to the perimeter security fence is expected to be approximately 80 m by 80 m with a maximum height of 14 m.

The proposed DC cable corridor will be approximately 1.6 km long (from landfall to the converter station). The preferred installation method will be underground, which will result in a temporary loss of land during installation. The working corridor for the installation of the cable corridor will be 30 m.

Additional laydown areas will be required for construction, comprising 1.5 hectares (ha) for the converter laydown and 0.3 ha for the substation laydown.

Site Description

The Proposed Development area (the Site) is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The Site is located to the west of the village of Grain, Isle of Grain, Kent at Ordnance Survey (OS) central grid reference TQ 88205 76727. Land use comprises a mix of industrial development to the south, the small settlement of Grain to the south-east and undeveloped land, much of which is designated for ecological interests, to the north (along the coastline) and to the west. Land within the Site and in the immediate vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill.

Figure 1 shows the site boundary (red-line), the cable corridor (purple line) and proposed location of each structure.

[1] AECOM, Neuconnect, Isle of Grain: Preliminary Ecological Appraisal Report, 2019

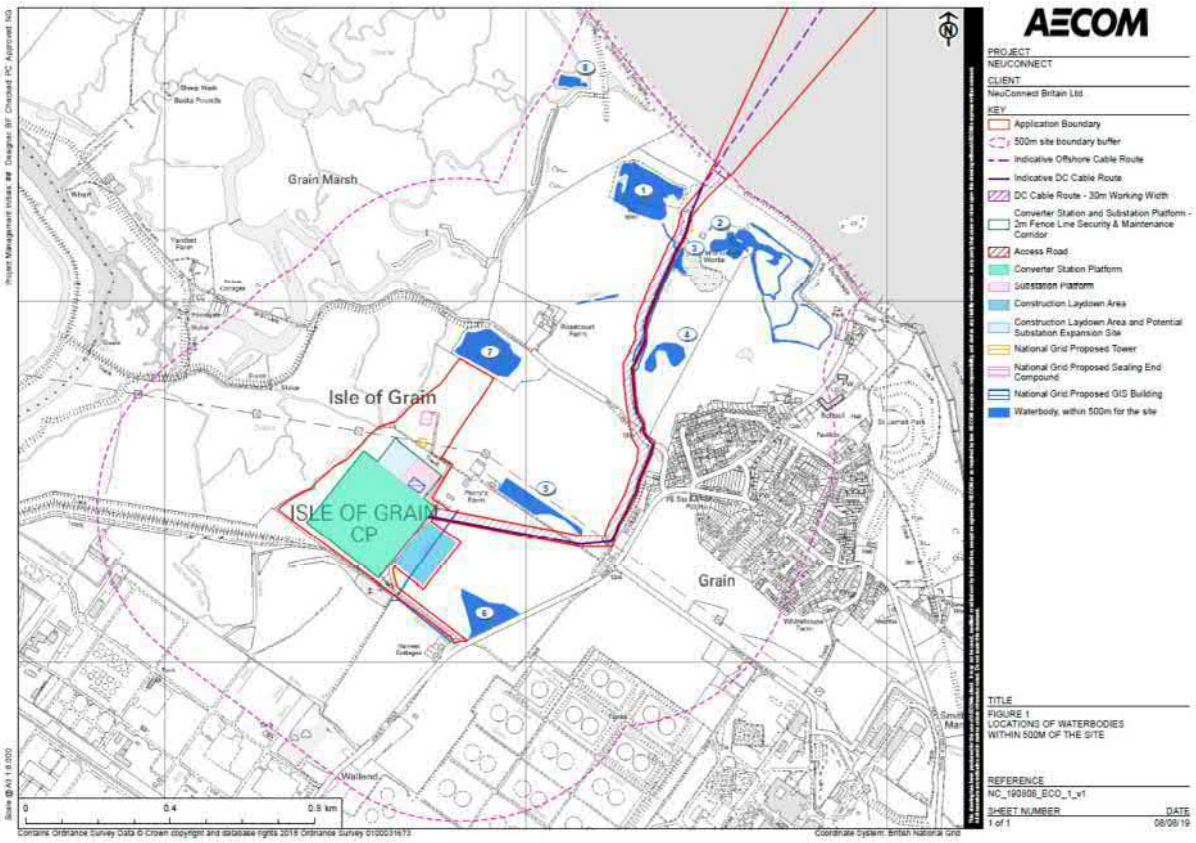

Figure 1 - Proposed locations of DC cable route, converter station and substation and suitable waterbodies within 500 m of the Site Boundary.

Survey Area

The survey area included waterbodies and ditches on the Site and those considered as being potentially suitable for Great Crested Newt within 500 m of the Site (see Figure 1).

Scope of Report

The objective of the Great Crested Newt survey, reported in this document, is to determine the presence or absence of the species within the Proposed Development area and surrounding area and, if present, to determine the population size present and mitigation required.

2. Great Crested Newt Ecology

Great Crested Newt is one of seven species of amphibian considered native to Britain and in common with other UK amphibians, they spend the majority of their lives on land, returning to standing water (water bodies and ditches) in the spring in order to breed.

Temperature Effects on Great Crested Newt Activity

Great Crested Newts are ectothermic, meaning that they regulate their temperature through exchange of heat with the external environment. Gaseous exchange (oxygen/carbon dioxide) is achieved largely by absorption through their permeable skins, which must be moist for this purpose. Behaviour and activity are therefore strongly linked to external environmental conditions, especially daily and seasonal cycles. Great crested newts are mainly active at night (usually when temperatures exceed 5° Celsius (C) and following recent rainfall). With the onset of winter frosts, Great Crested Newts hibernate. Activity recommences when the frosts subside (which may be as early as January / February), with adults migrating to breeding water bodies. Peak breeding activity is usually between mid-March and mid-May.

Reproduction

Breeding takes place within water bodies with males performing a courtship ‘dance’ in order to attract and encourage females to take up a spermatophore (a packet containing sperm). Females deposit eggs (up to 200 per season) on the submerged leaves of aquatic broadleaved plants. Each egg is individually sealed for protection from predators within a folded leaf. Adults begin to leave the water bodies around May, but may return in order to feed.

Larvae hatch after three weeks and feed on small aquatic invertebrates and the larvae/eggs of other amphibians for approximately three months. They metamorphose into land-adapted juveniles called efts and begin to emerge from their water bodies around August.

Habitat Requirements

During their terrestrial phase, Great Crested Newts require a complex habitat structure in order to provide both food and shelter. These are most commonly provided by broadleaved woodland, rough / tussocky grassland and scrub habitats. They also require a secure area in which to hibernate. Hibernacula generally need to provide a stable temperature, be free from frost and provide protection from flooding and predation. These requirements are commonly met by log/rubble piles, underground crevices or mammal burrows.

For breeding, Great Crested Newts require water bodies that provide suitable protection and food for their developing larvae. Generally, such water bodies should be of relatively good water quality so as to provide a diverse range of invertebrate prey. Un-shaded water bodies tend to provide more of the required broadleaf aquatic vegetation, upon which Great Crested Newt eggs can be laid. Water bodies with large fish populations (which can prey on newts) or heavy grazing pressure from waterfowl (which can prey on newts and reduce water quality and egg laying habitat) tend not to support Great Crested Newt. Connectivity between water bodies and good quality terrestrial habitat tend to favour large, viable, populations of Great Crested Newt. In rural landscapes in Britain, such connectivity is often provided by the hedgerow network.

Range

Great Crested Newts are thought to commonly move between water bodies within 250 m of each other, although there are studies showing Great Crested Newt travelling much further than this (Great Crested Newt Mitigation Guidelines, English Nature 2001). The range of Great Crested Newt may be impacted by a range of factors, including the type and quality of habitat surrounding a breeding water body, the availability of hibernation sites and the presence or absence of barriers to dispersal (e.g. large and busy roads with no features that great crested newt could move through).

3. Legislative and Policy Framework

Legislative Context

All stages of the Great Crested Newt life cycle as well as their habitat are fully protected under Schedule 2 of The Conservation of Habitats and Species and Planning (Various Amendments) (England and Wales) Regulations 2018. Great Crested Newt is listed on Schedule 5 of the Wildlife & Countryside Act 1981, which affords them protection under Section 9, as amended by the Countryside Rights of Way Act (2000). They are also listed on Annex II and VI of the EC Habitats Directive, are included as Species of Principal Importance in England under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 and are UK Biodiversity Action Plan Species. In combination, this makes it an offence to:

- intentionally, or recklessly kill, injure or take (capture etc.);
- possess;
- intentionally or recklessly damage, destroy, obstruct access to any structure or place used by a scheduled animal for shelter or protection, or disturb any animal occupying such a structure or place; and, or
- sell, offer for sale, possess or transport for the purpose of sale (live or dead animal, part or derivative) or advertise for buying or selling such things.

Natural England licencing

Where Great Crested Newt habitat, including their breeding sites and resting places, is present on a site and a development has the potential to cause one or more offences under The Conservation of Habitats and Species and Planning (Various Amendments) (England and Wales) Regulations 2018, a European Protected Species Licence (EPSL) is required from Natural England to allow the development to proceed. This licence allows the development to proceed with exemption from offences, provided works are undertaken with strict accordance of the terms of the licence. A licence cannot, however, be obtained to provide protection against offences under the Wildlife and Countryside Act, 1981 (as amended).

In determining whether to grant a licence, Natural England must apply the requirements of Regulation 535 of the Regulations, these being:

> (1) Regulation 53(2)(e) states: a licence can be granted for the purposes of "*preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment*".
>
> (2) Regulation 53(9)(a) states: the appropriate authority shall not grant a licence unless they are satisfied "*that there is no satisfactory alternative*".
>
> (3) Regulation 53(9)(b) states: the appropriate authority shall not grant a licence unless they are satisfied "*that the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range*."

A local planning authority must also apply these tests when determining a planning application, where a proposed development is likely to cause an offence under The Conservation of Habitats and Species and Planning (Various Amendments) (England and Wales) Regulations 2018.

In order for a European Protected Species Licence to be approved by Natural England for works with Great Crested Newt, it must be demonstrated that the proposed development will minimise any potential impacts upon Great Crested Newt and will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

Offences can be avoided through the implementation of appropriate mitigation that will minimise the potential for any offences to be committed. Mitigation can include the undertaking of vegetation clearance works at an appropriate time of the year and completing works in accordance with methods that will minimise or avoid potential disturbance or destruction of habitats. In such circumstance it is sensible for works to be completed using Reasonable Avoidance Measures (RAMs).

National Planning Policy Framework

The National Planning Policy Framework (NPPF) was originally published on 27th March 2012 and detailed the Government's planning policies for England and how these are expected to be applied. The NPPF was then revised on 24th July 2018 and 19th February 2019. The NPPF states the commitment of the UK Government to minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity.

It specifies the obligations that the Local Authorities and the UK Government have regarding statutory designated sites and protected species under UK and international legislation and how this is to be delivered in the planning system. Protected or notable habitats and species can be a material consideration in planning decisions and may therefore make some sites unsuitable for particular types of development, or if development is permitted, mitigation measures may be required to avoid or minimise impacts on certain habitats and species, or where impact is unavoidable, compensation may be required.

The NPPF is clear that pursuing sustainable development includes moving from a net loss of biodiversity to achieving net gains for nature, and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution.

Local Planning Policy

Medway Council's local planning policy relevant to nature conservation and Great Crested Newt is provided in detail in the Preliminary Ecological Appraisal for the Proposed Development (AECOM, 2019).

UK Post-2010 Biodiversity Framework

The UK Biodiversity Action Plan (UKBAP) was launched in 1994 and established a framework and criteria for identifying species and habitat types of conservation concern. From this list, action plans for priority species of conservation concern were published, and have subsequently been succeeded by the UK Post-2010 Biodiversity Framework (July 2012).

The UK Post-2010 Biodiversity Framework sets a broad enabling structure for action across the UK between now and 2020, including a shared vision and priorities for UK-scale activities to help deliver the Aichi targets and the EU Biodiversity Strategy. A major commitment by Parties to the Convention of Biological Diversity is to produce a National Biodiversity Strategy and/or Action Plan.

The UK Post-Development Framework is relevant in the context of Section 40 of the Natural Environment and Rural Communities (NERC Act) 2006, meaning that Priority Species and Habitats are material considerations in planning. These habitats and species are identified as those of conservation concern due to their rarity or a declining population trend.

The Natural Environment and Rural Communities (NERC) list of Species of Principal Importance is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act 2006; under Section 40 every public authority (*e.g.* a local authority or local planning authority) must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity. In addition, with regard to those species on the list of Species of Principal Importance prepared under Section 41 (S41), the Secretary of State must:

"(a) take such steps as appear to the Secretary of State to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under this section, or

(b) promote the taking by others of such steps."

Fifty-six habitats of principal importance are included on the list which includes freshwater habitats such as ponds. Great Crested Newt is included as a Priority Species under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 and is also included as a UKBAP and Local Biodiversity Action Plan (LBAP) priority species.

4. Methods

This section describes the survey methods used to determine the status of Great Crested Newt on the Site, which included:

- a desk study;
- a habitat suitability index (HSI) survey;
- a terrestrial habitat survey; and
- a presence / absence survey using traditional methods (bottle trapping, torching, egg-searching).

Desk Study

A desk study was undertaken in July 2018 to obtain ecological records within a 2 km radius of the centre of the Proposed Development from Kent & Medway Biological Records Centre (KMBRC). This data request was limited to records of Great Crested Newt recorded within the last ten years of the request date.

Aerial photographs and Ordnance Survey (OS) maps were reviewed to identify water bodies of potential value to Great Crested Newt within 1 km of the Proposed Development that were not separated by major barriers to Great Crested Newt dispersal (such as main roads and large rivers). The review of aerial photography and mapping included identifying any key routes of potential connectivity to the Proposed Development and significant barriers to Great Crested Newt dispersal.

Habitat Suitability Index (HSI)

The Habitat Suitability Index (HSI) is a measure of habitat suitability, developed by Oldham *et al.* (2000) for evaluating the suitability of ponds as habitat for Great Crested Newt, which considers ten habitat and ecological suitability indices. Ponds with higher HSI scores are considered more likely to support Great Crested Newt than those with lower scores.

A value is recorded for each parameter and combined to determine an index of breeding suitability for Great Crested Newt (Table 1).

Table 1. Great Crested Newt Suitability Indices and Descriptions

Suitability Indices	Suitability Indices Title	Suitability Indices Description
(SI_1)	Geographic location	Different areas of the UK represent different indices scores
(SI_2)	Water body area	The optimum water body size is between 500 and 750 m^2.
(SI_3)	Water body permanence	The optimal frequency of drying is one year per decade.
(SI_4)	Water quality	The presence of indicator organisms (the same that are used to assess running water) is the water quality indicator.
(SI_5)	Water body shading	Great crested newt occurrence is significantly reduced above a threshold of 75% shade.
(SI_6)	Impact of waterfowl	Waterfowl impact on water body vegetation and water turbidity is a negative indicator for great crested newt.
(SI_7)	Occurrence of fish	The effect of fish presence is related to the species. Some species can have negative impacts and great crested newt hardly ever coexist with larger predatory fish species. Other species (depending on conditions) are not detrimental.
(SI_8)	Water body density	Water body densities above four water bodies/km2 are taken as optimal.
(SI_9)	Terrestrial habitat	In general, scrub, unimproved grassland, woodland (deciduous and coniferous) and gardens are regarded as being suitable terrestrial habitat, unlike improved pasture, arable and hardstanding. The SI_9 is the combination between positive factors (suitable habitat) and negative factors (*e.g.* inherent in

Suitability Indices	Suitability Indices Title	Suitability Indices Description
		barriers to movement such as roads). The surrounding habitat is scored according to the extent of high quality terrestrial newt habitat.
(SI_{10})	Macrophyte content	The highest occurrence of great crested newt is found in water bodies with emergent vegetation cover between 25% and 50% and submerged vegetation between 50% and 75%.

The HSI generates a numerical index which scores ponds and other waterbodies on a scale of between 0 and 1, using a geometric mean of the ten suitability indices, with the following suitability categories for the results:

- <0.5: poor likelihood of Great Crested Newt presence;
- 0.5 – 0.59: below average likelihood of Great Crested Newt presence;
- 0.6 – 0.69: average likelihood of Great Crested Newt presence;
- 0.7 – 0.79: good likelihood of Great Crested Newt presence; and
- >0.8: excellent likelihood of Great Crested Newt presence.

Any waterbody with a HSI score of average or greater, should then be subject to further surveys to determine Great Crested Newt presence or absence.

The HSI survey of waterbodies within 500 m of the Site, where access was permitted, was undertaken in April 2018.

Great Crested Newt survey using traditional methods

Natural England recommends the following methods are used to determine presence or likely absence of Great Crested Newt in ponds (English Nature, 2001):

- three methods (preferably torch surveys, bottle-trapping and egg searching) undertaken during each visit with netting as another technique which can be applied if one of the other techniques is not possible;
- visits must be undertaken in suitable weather conditions, i.e. warm, still evenings without rain;
- four presence or absence surveys should be undertaken and, if Great Crested Newt is confirmed, two additional visits (total of six visits) would be required to estimate population class size; and
- surveys to be undertaken between mid-March and mid-June with at least 2 surveys in peak season (usually mid-April to mid-May) with three surveys required between mid-April to mid-May if Great Crested Newt is confirmed within the waterbody.

All waterbodies within 500 m of the Proposed Development areas, where access was permitted, and with an HSI score of average, or greater, were surveyed using traditional methods, with a total of four surveys undertaken between April and May 2018, which is considered as the optimal survey period for Great Crested Newt and is when this species are most active and abundant within the water. All surveys were carried out by two suitably qualified ecologists, with at least one surveyor holding an appropriate Natural England survey licence and one surveyor used for Health and Safety. The survey dates and weather conditions recorded during surveys are presented in Table 2.

Table 2. Great Crested Newt Survey Dates and Weather Conditions

Survey number	Date of survey	Weather conditions, including night time air temperature (°C)
1	10/04/2018	Dry, Cloud 4/8. Wind F2, S. Temp. 9°C
2	24/04/2018	Dry, Cloud 3/8. Wind F2, SE. Temp. 9 °C
3	18/05/2018	Dry, Cloud, 1/8. Wind F1,E. Temp 10°C
4	23/05/2018	Dry, Cloud, 0/8. Wind F2, NE. Temp 14°C

Bottle Trapping

Prior to sunset, bottle-traps were set at approximately one trap every 2 m of water's edge, where practicable, in accordance with the Great Crested Newt mitigation guidance (English Nature, 2001). Where access was restricted, due to vegetation overgrowth or other factors, this method was amended for the purposes of practicality and safety. The traps were left set overnight and were checked again the following morning, soon after sunrise. No trap was left set for longer than 11 hours. Any animals caught were identified, aged (*i.e.* juvenile or adult) and sexed and then released at the trap location.

Torch Survey

Cluson torches, with 1-million candlepower, were used for the torch counts. Surveyors walked slowly around the water's edge after dark, looking for Great Crested Newt which would have emerged to begin courtship and feeding.

Egg Searching

Aquatic and marginal vegetation (both living and dead vegetation) within the waterbodies were searched for Great Crested Newt eggs. Once an egg is found and confirmed as that of a Great Crested Newt, the search would be terminated to ensure that no damage or further disturbance to eggs would occur. Great crested newt eggs, like those of other newts, are typically laid within a folded leaf. In order to determine the species of newt egg found, the leaf must be unfolded, rendering it more prone to predation or damage. Numbers of eggs present are not indicative of population sizes.

Population size class assessment

If Great Crested Newt was found to be present during surveys, the results of the six survey visits were used to produce an approximate indication of the population size class. Based on the maximum count of adult Great Crested Newt, counted per water body per night, the Great Crested Newt population in each waterbody can be classified as small, medium or large, in line with the Great Crested Newt Mitigation Guidelines (English Nature, 2001).

The assessment was based on a spring survey of adult numbers of Great Crested Newt found during bottle trapping and torching methods. Egg searches and larval and juvenile counts may give a misleading indication of overall population size without complex interpretation and were not be used.

A population of Great Crested Newt is classified using the following indices:

- 'small': for maximum counts up to 10;
- 'medium': for maximum counts between 11 and 100; and
- 'large': for maximum counts over 100.

Survey Limitations

There were difficulties encountered with safely accessing two of the Lagoons (Lagoons 3, and 5) for bottle trapping, egg-searching and netting, due to steep sided banks and therefore these were not accessed during the survey due to health and safety concerns. However, both lagoons were accessible at some points along the banks to allow a torch survey.

There were limitations with accessing all banks of Lagoons 1, 2 and 6 and therefore, for bottle-trapping and egg-searching, these were only surveyed where access allowed. However, the surveys undertaken were robust enough to determine whether Great Crested Newt were present within these lagoons and this limitation did not have a significant impact on the efficacy of the survey.

Waterbodies to the west of the Site (deep channels and waterbody 8) are within Ministry of Defence (MoD) land and therefore there was no access to these waterbodies during surveys.

Waterbody 7 was not surveyed as there was no access to this waterbody at the time of the surveys. However, this waterbody is a used by anglers and the presence of large fish, which would prey on Great Crested Newt, means that it is unlikely that Great Crested Newt would be present within this waterbody.

The majority of ecological data is valid only for short periods due to the inherently transient nature of the subject (CIEEM, 2019[2]). On this basis, it is recommended that the surveys for Great Crested Newt will need repeating within two years (*i.e.* in 2020).

[2] CIEEM: Advice Note on the lifespan of ecological surveys and reports https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf (Accessed May 2019)

5. Results

Desk Study

The desk study returned a count of three Great Crested Newts from 2009, c. 600m to the south-east of the Proposed Development areas.

A total of eight waterbodies, within 500 m of the Site which were not separated from the Site by major roads or large rivers were identified from aerial photography. These waterbodies are summarised below in Table 3.

Table 3. Summary of identified waterbodies within 500 m of the Site (see Figure 1 for location of lagoons).

Waterbody number / reference	Within the site boundary?	Within the footprint of the Proposed Development?	HSI index score
Lagoon 1	X	X	Good (0.75)
Lagoon 2	X	X	Good (0.78)
Lagoon 3	✓	✓	Good (0.72)
Lagoon 4	X	X	Poor (0.48)
Lagoon 5	✓	✓	Good (0.75)
Lagoon 6	X	X	Good (0.76)
Lagoon 7	X	X	Not surveyed due to access
Lagoon 8	X	X	Not surveyed due to access

Habitat Suitability Index

Six waterbodies (see Figure 1) were assessed for their potential to support a breeding population of Great Crested Newt, using HSI methods, as described in Section 4.2 of this report.

Using the calculated values for the ten HSI indices, an HSI value was calculated for each water body within 500 m of the Site and where access allowed and these are presented, in full in Tables A.1-A.6 in Appendix A. The 500 m buffer was used as Great Crested Newt typically occur within this distance from a breeding site. The HSI value was then categorised against the criteria within Section 4.2 to describe the suitability of the water body for Great Crested Newt on a scale of poor to excellent.

The HSI survey concluded that five lagoons (Lagoons 1, 2, 3, 5 and 6) were of ‘good’ suitability to support breeding Great Crested Newt. Lagoon 4 was of ‘poor’ suitability to support Great Crested Newt.

Great Crested Newt survey using traditional methods

Four survey visits, using traditional methods, were undertaken between April and May 2018 to determine Great Crested Newt presence / absence within 500 m of the Site. Surveys were undertaken on five of the lagoons with a score of ‘average’ suitability (or higher) for Great Crested Newt (see Section 5.2) and where there were no limitations with safely accessing the waterbodies. Details of the survey methods used on these waterbodies are presented in Table 4.

Table 4. Summary of survey effort on each waterbody within 500 m of the Site.

Waterbody number / reference	Torching	Bottle-trapping	Egg Searching
Lagoon 1	✓	✓	✓
Lagoon 2	✓	✓	✓

Waterbody number / reference	Torching	Bottle-trapping	Egg Searching
Lagoon 3	✓	X	X
Lagoon 5	✓	X	X
Lagoon 6	✓	✓	✓

No Great Crested Newts were recorded during any of the surveys on the five waterbodies.

Smooth Newt *Lissotriton vulgaris* was recorded in Lagoon 1. Marsh Frog *Pelophylax ridibundus* was located across the Site in all waterbodies.

6. Conclusions and Recommendations

Eight waterbodies were identified within 500 m of the Site and detailed Great Crested Newt presence or absence surveys were completed on five waterbodies. The remaining three waterbodies were either not accessible due to land access restrictions, or in the case of Lagoon 4, classified as unsuitable due to 'poor' HSI classification.

The surveys did not record any Great Crested Newt in any of the surveyed waterbodies (Lagoons 1, 2 and 6) using traditional methods. Great Crested Newt was not recorded in Lagoons 3 and 5 using torching methods.

However, Great Crested Newt was recorded during the desk study, within 600 m of the Site. Great Crested Newt is also known to be widespread across much of the Isle of Grain (Max Wade (AECOM), personal communication).

Therefore, given the known presence of Great Crested Newt in the wider area and in consideration of the limitations with surveying all waterbodies within 500 m of the Proposed Development, a Precautionary Method of Working (PMW) will be employed to minimise and avoid any adverse impacts to Great Crested Newt and to reduce the risk of offences being committed under wildlife law during construction of the Proposed Development.

7. Potential Impacts of Development

7.1 Construction Impacts

Great Crested Newt was not recorded during surveys in 2018. However, there were limitations with accessing all waterbodies within 500 m of the Proposed Development and Lagoons 3 and 5 could only be surveyed by torch and even then from only a few locations. A single record of three Great Crested Newts was returned during the desk study. This was from 2009, c. 600m to the south-east of the Proposed Development areas and this species has been known from across the Isle of Grain for at least the last 20 years (personal communication Max Wade, AECOM). Therefore the potential impacts arising from construction of the Proposed Development on Great Crested Newt are based on potential presence from the development proposals, namely:

- the construction of the DC cable will be within 100 m of Lagoons, 1, 2, 3, 4 and 5 but will not lead to the loss of these habitats nor any part of them; and
- the footprint of the Proposed Development will necessitate the removal of terrestrial habitat on site, potentially used by Great Crested Newt.

Therefore, the following impacts on Great Crested Newt, if present, are envisaged:

- Water Bodies: No waterbodies, potentially used by breeding Great Crested Newt, would be lost as a result of the Proposed Development.
- Terrestrial Habitat (loss and fragmentation): Great Crested Newt will disperse across the landscape from their breeding water bodies to other water bodies and hibernation sites. All suitable terrestrial habitats within the footprint of the DC cable corridor, which will be temporarily lost during construction, and within the footprint of the proposed converter and substation, which will be permanently lost through land take from the Proposed Development should all be considered for their suitability to support foraging Great Crested Newt. ; and
- Hibernation Features: The Site contains features such as mammal burrows and log and brash piles which offer good potential sites for Great Crested Newt hibernation. Some of these features are likely to be lost as part of the vegetation clearance process.

In summary, in the absence of mitigation, the Proposed Development has the potential to negatively impact on any Great Crested Newt population that might be present on the Site or within 500 m of it during the construction of the development, through loss of terrestrial habitats and incidental mortality.

However, the potential for killing and injuring of Great Crested Newts and permanent loss of habitat is avoidable through the appropriate implementation of a Great Crested Newt Strategy. Therefore, in habitats on site where G-reat Crested Newt is potentially present, mitigation is required to:

- ensure compliance with relevant legislation; and
- avoid impacts that would give rise to a potential “significant effect”, therefore contrary to planning policy and biodiversity obligations under the NERC Act 2006.

A significant effect can be considered one which supports or undermines nature conservation objectives, or changes the conservation status of a species population (CIEEM, 2016).

7.2 Operation impacts

The Proposed Development, when operational, will introduce additional lighting and noise. However, with the implementation of mitigation during construction, these will not have any impact on Great Crested Newt during operation of the Proposed Development.

8. Approach and justification to Precautionary Working Methods and defining a zone of potential impact

For European Protected Species, such as Great Crested Newt that are subject to the Conservation of Habitats and Species and Planning (Various Amendments) (England and Wales) Regulations 2018, Natural England's view is that: "*If the consultant ecologist, on the basis of survey information and specialist knowledge of the species concerned, considers that on balance the proposed activity is reasonably unlikely to result in an offence under Regulation 41 or 45 then no licence is required*" (European Protected Species Guidance Note WML-G12 (Natural England, 2013).

A range of factors are taken into consideration when assessing whether the Proposed Development can proceed in the absence of a licence. These include: the nature of the proposals, the suitability of habitats within the site to support protected species, evidence of such species' presence and the proximity of existing known populations.

In cases where a licence is not required, Natural England urges that reasonable precautions be taken to avoid affecting European Protected Species during works and that an audit trail is kept on the decision-making process.

At this stage, the presence of a Great Crested Newt population on site is considered as possible, on the basis of desk study records from within 500 m of the Site and knowledge of the presence of this species across the Isle of Grain. Therefore, a zone of potential impact has been determined on the Site which comprises the areas of the Proposed Development that could impact upon Great Crested Newt, or the habitat within which they might be present. The zone of potential impact has been used to determine whether works associated with the construction of the Proposed Development require a European Protected Species Licence or can proceed using Risk Avoidance Measures.

To inform the definition of the zone of potential impact at Kings Lynn, reference is made to research undertaken by Natural England (then English Nature) in 2004. Research Report number 576 assessed the value of different habitats for great crested newt and the efficiency of capture techniques. The non-technical summary states that:

'By far the most captures were recorded within 50m of ponds and few animals were captured at distances greater than 100 m.'

and that:

'*Captures on fences (and by other methods) at distances between 100m and 200 - 250m from breeding ponds tended to be so low as to raise serious doubts about the efficacy of this as an approach, although a small number of projects did report captures on significant linear features at distances approximately 150 – 200m from ponds.*'

Therefore, there is an indication in that report that the risk of Great Crested Newt being present at distances greater than 100 m from a waterbody is low and that the risk of their presence at this distance is greatest where populations of Great Crested Newt are large or present within favourable habitat. As outlined previously, the no evidence of Great Crested was found on the Site, but conservatively it is assumed that there is a low population.

The Proposed Development area comprises good quality aquatic habitat that could be used for breeding (Lagoons 1, 2, 3, 5 and 6) and moderate quality terrestrial habitat (rubble piles and brash piles), interspersed with smaller areas of high quality habitat, that could be used for foraging and hibernating. The ditch running adjacent to the DC cable corridor could act as a commuting route around the Site for Great Crested Newt and offer potential connectivity to off-site habitat.

It is considered extremely unlikely that Great Crested Newt occur in habitats greater than 100 m from any of the lagoons. The rationale for this being:

- the population of Great Crested Newt in Lagoon 1, 2, 3, 5 and 6 (of good HSI suitability) is considered to be 'low', owing to the absence of Great Crested Newt during field surveys in 2018;
- the amount of high quality terrestrial habitat that is potentially suitable for Great Crested Newt is predominantly within 100 m of the lagoons on site. Habitat beyond 100 m of these areas is of moderate quality, with largely tall ruderal habitat and scrub in these areas; and
- there are few suitable off-site waterbodies for Great Crested Newt from within 500 m of the Site.

When considering the habitats present within the footprint of the Proposed Development in areas more than 100 m from the lagoons on site, it is therefore considered unlikely that the works will result in **deliberate capture, injury or killing** of Great Crested Newt.

Due to the limited potential for Great Crested Newt to be using the terrestrial habitats in the habitats more than 100 m from Lagoons 1, 2, 3, 5 and 6, it is also reasonably unlikely that the commencement of enabling works of the Proposed Development in areas more than 100 m from these areas will result in **deliberate disturbance** to Great Crested Newt in such a way as to be likely to impair their ability to survive, breed, reproduce, rear or nurture their young, hibernate or migrate; or to affect significantly the local distribution or abundance of the species. It is also unlikely that the proposed works will result in **damage or destruction of their resting places**, provided appropriate mitigation is implemented**.**

As the works would avoid any waterbodies on site and therefore will not affect a breeding pond during the breeding season, they will not involve **deliberate taking or destroying the eggs of Great Crested Newt.**

Therefore, on the basis of specialist knowledge and experience working with the species concerned, it is considered, on balance, that the construction of the Proposed Development in in areas >100m from any waterbodies on site is unlikely to result in an offence under Regulation 41 of the Conservation of Habitats and Species and Planning (Various Amendments) (England and Wales) Regulations 2018 and no development licence is required for these works.

Similarly it is reasonably unlikely that works will result in **disturbing a Great Crested Newt in its place of shelter** or **obstructing access to such a place** and therefore the proposed works described in this section are reasonably unlikely to result in an offence under the Wildlife & Countryside Act 1981 (as amended).

Construction works are therefore proposed without a Natural England licence, but using the Precautionary Methods of Work outlined in Section 8.1.

8.1 Precautionary method of working

The risk of affecting Great Crested Newt during construction of the Proposed Development is low, but the following approaches to mitigation would be used during its construction

Such methods can be used during minor vegetation clearance and involve clearance of vegetation to encourage any amphibians to move away from any affected areas into adjacent areas using habitat manipulation. To mitigate against harm to any amphibians present, the following precautionary methods of working are deemed appropriate for the works on site for Great Crested Newt and other amphibians.

Habitat manipulation should be overseen by a suitably qualified ecologist (SQE) acting as an Ecological Clerk of Works (ECoW) and will comprise the following general principles:

- the on-site vegetation is cut short during winter (when amphibians are hibernating) if possible. If not possible (*i.e.* works during active season), the vegetation will be cut in a phased approach, firstly cutting to 30 cm, then, following a period of no less than 24 hours, can be cut to 15 cm and then to ground level, after another 24 hours;
- the vegetation should then be kept short to displace any amphibians, which may be present, away from the works when they emerge in the early spring, and discourage amphibians from moving into the Site from the surrounding habitat;
- vegetation (including top soil) should be carefully removed using an excavator using a toothed bucket. These works should be supervised by an SQE if this is deemed appropriate to do so;
- any habitat features which may conceal sheltering amphibians (*e.g.* log piles, rubble mound bunds or any other debris etc. will be dismantled by hand under supervision of the SQE; and
- dismantling of any on-site rubble piles should be conducted during the amphibian active season (*i.e.* April to October) during warm weather conditions (*i.e.* above 5 °C) to avoid killing or injuring potential hibernating amphibians.

In the unlikely event that any Great Crested Newt is discovered during these works, then such works must cease immediately and a SQE must be consulted to determine how to proceed. If other amphibians are discovered during vegetation clearance it is proposed that these are translocated to suitable habitat nearby in suitable weather conditions.

9. References

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10. Appendices

Appendix A: HSI scores

Table A.1. HSI score for Lagoon 1

Index	Description	HSI Score
Pond Location	A (optimal)	1.00
Pond Approximate Area (m²)	10500	-
Pond Permanence	Never dries	0.90
Water Quality	Good	1.00
Percentage Shade	20%	1.00
Waterfowl Presence	Minor	0.67
Fish Presence	Minor	0.33
Ponds within 1 km	1.27	0.70
Terrestrial Habitat Quality	Good	1.00
Percentage Macrophyte Cover	10%	0.40
	HSI Score	0.75

Table A.2. HSI score for Lagoon 2

Index	Description	HSI Score
Pond Location	A (optimal)	1.00
Pond Approximate Area (m²)	10000	-
Pond Permanence	Never dries	0.90
Water Quality	Good	1.00
Percentage Shade	10%	1.00
Waterfowl Presence	Minor	0.67
Fish Presence	Minor	0.33
Ponds within 1 km	1.27	0.70
Terrestrial Habitat Quality	Good	1.00
Percentage Macrophyte Cover	30%	0.60
	HSI Score	0.78

Table A.3. HSI score for Lagoon 3

Index	Description	HSI Score
Pond Location	A (optimal)	1.00
Pond Approximate Area (m²)	1200	0.92
Pond Permanence	Never dries	0.90
Water Quality	Moderate	0.67
Percentage Shade	10%	1.00

Waterfowl Presence	Minor	0.67
Fish Presence	Minor	0.33
Ponds within 1 km	1.27	0.70
Terrestrial Habitat Quality	Good	1.00
Percentage Macrophyte Cover	10%	0.40
	HSI Score	0.72

Table A.4. HSI score for Lagoon 4

Index	Description	HSI Score
Pond Location	A (optimal)	1.00
Pond Approximate Area (m²)	14000	-
Pond Permanence	Never dries	0.90
Water Quality	Moderate	0.67
Percentage Shade	70%	0.90
Waterfowl Presence	Minor	0.67
Fish Presence	Major	0.01
Ponds within 1 km	1.91	0.80
Terrestrial Habitat Quality	Moderate	0.67
Percentage Macrophyte Cover	5%	0.35
	HSI Score	0.48

Table A.5. HSI score for Lagoon 5

Index	Description	HSI Score
Pond Location	A (optimal)	1.00
Pond Approximate Area (m²)	4000	-
Pond Permanence	Never dries	0.90
Water Quality	Good	1.00
Percentage Shade	30%	1.00
Waterfowl Presence	Minor	0.67
Fish Presence	Minor	0.33
Ponds within 1 km	1.27	0.70
Terrestrial Habitat Quality	Good	1.00
Percentage Macrophyte Cover	10%	0.40
	HSI Score	0.75

Table A.6. HSI score for Lagoon 6

Index	Description	HSI Score
Pond Location	A (optimal)	1.00
Pond Approximate Area (m²)	5000	-
Pond Permanence	Never dries	0.90
Water Quality	Good	1.00

Percentage Shade	40%	1.00
Waterfowl Presence	Minor	0.67
Fish Presence	Minor	0.33
Ponds within 1 km	0.64	0.55
Terrestrial Habitat Quality	Good	1.00
Percentage Macrophyte Cover	30%	0.60
	HSI Score	0.76

Appendix 6.G – Report on Surveys for Water Vole

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement

Appendix 6G – Report on Surveys for Water Vole

NeuConnect Britain Ltd

June 2019

Quality information

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Table of Contents

Figures

Tables

1. Introduction

1.1 In 2018, AECOM undertook a Preliminary Ecological Appraisal (PEA)[1] on behalf of Neuconnect Britain Ltd (the Applicant). This PEA survey identified the need for follow-up ecological surveys to determine the potential impacts of the Neuconnect project (hereby known as the Proposed Development) on certain protected / notable species. Therefore, AECOM was instructed to undertake a survey of Water Vole Arvicola amphibius presence / absence, as recommended in the PEA report for the Proposed Development and to make any recommendations based on the results of the survey.

Proposed Development

1.2 NeuConnect (the Project) is a 1,400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between the energy networks in Great Britain and Germany. The new link will create a connection for electricity to be passed in either direction between Great Britain and Germany. The Project will be formed by approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HVDC) cables, with an on-shore converter station at either end linking into the existing electricity grids in Great Britain and Germany.

1.3 The Proposed Development will comprise of three structures: a converter station, a sub-station and a direct current (DC) cable route (see Figure 1).

1.4 The footprint of the proposed converter station to the perimeter security fence is expected to be up to approximately 250 metres (m) by 250 metres, with a maximum height of up to 26 m.

1.5 The footprint of the proposed substation is expected to be approximately 80 m by 80 m (to the perimeter security fence), with a maximum height of 14 m.

1.6 The proposed DC cable corridor will be approximately 1.6 km long (from landfall to the converter station). The preferred installation method will be underground, which will result in a temporary loss of land during installation. The working corridor for the installation of the cable corridor will be 30 m.

1.7 Additional laydown areas will be required for construction, comprising 1.5 hectare (ha) for the converter laydown and 0.3 ha for the substation laydown.

Site Description

1.8 The Proposed Development area (the Site) is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The Site is located to the west of the village of Grain, Isle of Grain, Kent at Ordnance Survey (OS) central grid reference TQ 88205 76727. Land use comprises a mix of industrial development to the south, the small settlement of Grain to the south-east and undeveloped land, much of which is designated for ecological interests, to the north (along the coastline) and to the west. Land within the Site and in the immediate vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill.

1.9 Figure 1 shows the site boundary (red-line), the cable corridor (purple line) and proposed location of each structure.

[1] AECOM, Neuconnect, Isle of Grain: Preliminary Ecological Appraisal Report, 2019

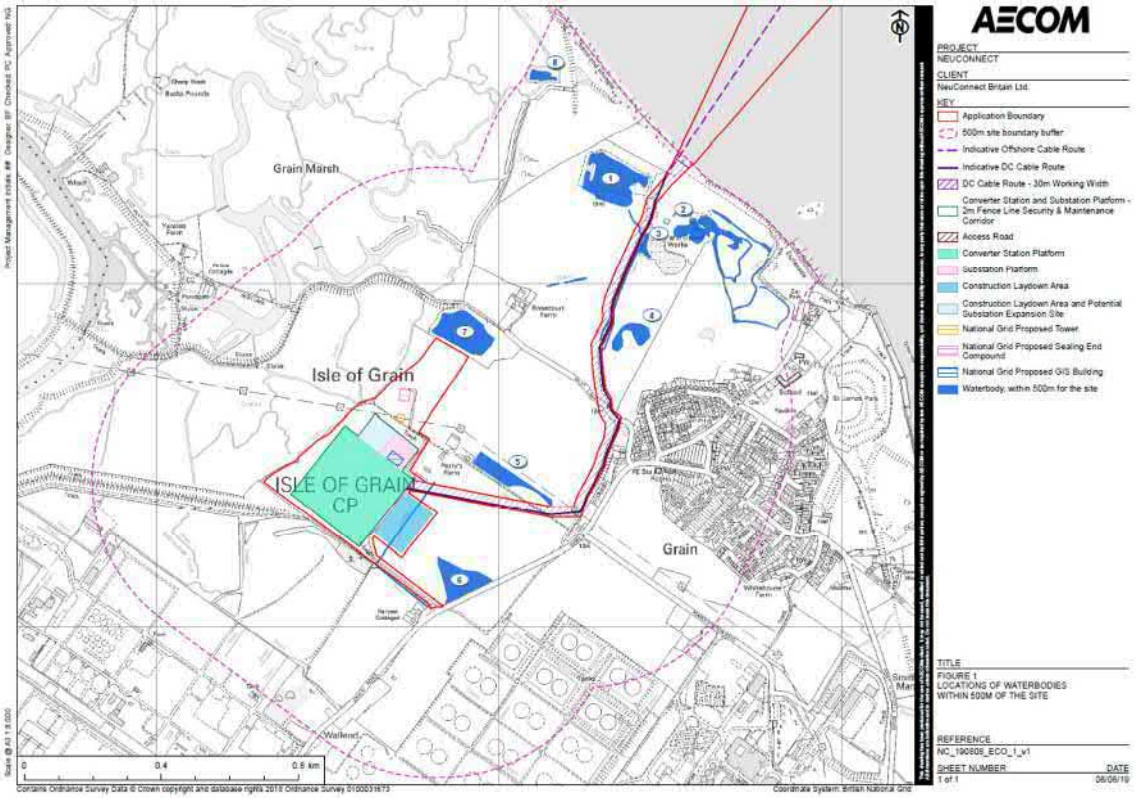

Figure 1 - Site boundary, waterbody locations and proposed locations of DC cable route, converter station and substation

Survey Area

1.10 The survey area included waterbodies and ditches within 100 m of the site boundary, considered as being potentially suitable for Water Vole.

Scope of Report

1.11 The objective of the Water Vole survey was to determine the presence / absence of Water Vole on the Site, within (and adjacent to) the Proposed Development areas, for their potential to support Water Vole and, if present, to determine the population size present and mitigation required.

2. Water Vole Ecology

2.1 The Water Vole is the UK's largest native vole, weighing between 140-350 grams (males being generally larger than females) and measuring 20 centimetres (cm) long plus a 10 cm long tail.

Habitat Requirements

2.2 Water Voles prefer sites with wide strips of vegetation along the banks or in the water which provide useful cover from predators as well as an abundant supply of food throughout the year. They require waterbodies with soft, but stable, banks for their burrows with a preference for steep, tall banks so that nest chambers can be situated above high water.

2.3 They can be found in slow moving rivers and streams, or water-bodies such as ditches, dykes, ponds and moats. While they can occur in brackish waters of coastal borrow dykes, they are not commonly found in estuarine habitat or salt marsh except where there are relatively stable, reed fringed lagoons.

2.4 Water Vole colonies have been found in the leachate ditches of landfill sites or in roadside ditches next to busy trunk roads, where rubbish and surface water runoff is regularly deposited. However, clean and good quality water should always be considered the ideal.

2.5 Where water channels dry out completely, Water Voles are exposed to increased chance of predation and may either be killed directly, or choose to relocate to more optimal habitat nearby. Rapid depopulation of dry channels is almost always a given. Water Vole are susceptible to flooding and although adults can escape from rising water, it may be impossible for mothers to remove young to safety if the whole burrow system becomes inundated.

Breeding

2.6 The Water Vole breeding season starts in March and continues until October, with the peak season being between mid-April and mid-September. Water Voles live in colonies with breeding females having territories of 30-150 m and males having larger home ranges of 60-300 m that overlap several females. Females mark their territories using discrete latrine sites, close to the burrows and at the boundaries. Latrines are flattened piles of old droppings topped up with fresh ones.

2.7 Water Voles are mostly active during the day. They do not hibernate over winter, but do spend more time in their burrows, often cohabiting with members of the same colony and so are less visible above ground.

3. Legislative and Policy Framework

Legislative Framework

3.1 The Water Vole is a fully protected species under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended) and is afforded protection under Section 9 parts 9 (1)(2)(4) and (5) of the Act, making it an offence to:

- intentionally kill, injure or take these species;
- possess or control live or dead individuals of these species or their derivatives;
- intentionally or recklessly damage, destroy or obstruct access to any structure or place used for their shelter or protection;
- intentionally or recklessly disturb these species whilst occupying a structure or place of shelter used for that purpose;
- sell these species or offer or expose for sale or transport for sale; and
- publish or cause to be published any advertisement which conveys the buying or selling of these species.

3.2 It is generally regarded that a place of shelter or protection includes a network of active burrows and/or any nests that have been constructed within the burrow system or above ground amongst dense vegetation.

Natural England Licensing

3.3 A licence is required from Natural England to intentionally damage or destroy burrows or displace Water Voles from their burrows for lawful development. There is no provision for licencing development or other construction activities under the Wildlife and Countryside Act. Such works should therefore be undertaken under a conservation licence. This licence requires demonstration of a conservation benefit for Water Voles and this benefit can be achieved by delivering a net gain in the amount of habitat available to the Water Vole population.

National Planning Policy Framework

3.4 The National Planning Policy Framework (NPPF) was originally published on 27th March 2012 and detailed the Government's planning policies for England and how these are expected to be applied. The NPPF was then revised on 24th July 2018 and 19th February 2019. The NPPF states the commitment of the UK Government to minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity.

3.5 It specifies the obligations that the Local Authorities and the UK Government have regarding statutory designated sites and protected species under UK and international legislation and how this is to be delivered in the planning system. Protected or notable habitats and species can be a material consideration in planning decisions and may therefore make some sites unsuitable for particular types of development, or if development is permitted, mitigation measures may be required to avoid or minimise impacts on certain habitats and species, or where impact is unavoidable, compensation may be required.

3.6 The NPPF is clear that pursuing sustainable development includes moving from a net loss of biodiversity to achieving net gains for nature, and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution.

Local Planning Policy

3.7 Medway Council's local planning policy relevant to nature conservation and Water Vole is provided in detail in the Preliminary Ecological Appraisal for the Proposed Development (AECOM, 2019).

UK Post-2010 Biodiversity Framework

3.8 The UK Biodiversity Action Plan (UKBAP) was launched in 1994 and established a framework and criteria for identifying species and habitat types of conservation concern. From this list, action plans for priority species of conservation concern were published, and have subsequently been succeeded by the UK Post-2010 Biodiversity Framework (July 2012).

3.9 The UK Post-2010 Biodiversity Framework sets a broad enabling structure for action across the UK between now and 2020, including a shared vision and priorities for UK-scale activities to help deliver the Aichi targets and the EU Biodiversity Strategy. A major commitment by Parties to the Convention of Biological Diversity is to produce a National Biodiversity Strategy and/or Action Plan.

3.10 The UK Post-Development Framework is relevant in the context of Section 40 of the Natural Environment and Rural Communities (NERC Act) 2006, meaning that Priority Species and Habitats are material considerations in planning. These habitats and species are identified as those of conservation concern due to their rarity or a declining population trend.

3.11 The Natural Environment and Rural Communities (NERC) list of Species of Principal Importance is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act 2006; under Section 40 every public authority (e.g. a local authority or local planning authority) must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity. In addition, with regard to those species on the list of Species of Principal Importance prepared under Section 41 (S41), the Secretary of State must:

> *"(a) take such steps as appear to the Secretary of State to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under this section, or*
>
> *(b) promote the taking by others of such steps."*

3.12 Water Vole is included as a Priority Species under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 and is also included as a UKUKBAP and Local Biodiversity Action Plan (LBAP) priority species.

4. Methods

Desk Study

4.1 A desk study was undertaken in July 2018 to obtain ecological records within a 2 km radius of the Proposed Development from Kent & Medway Biological Records Centre. This data request was limited to records of Water Vole recorded within the last ten years of the request date.

Field Survey

4.2 Water Voles typically inhabit slow-moving streams, canals, ditches, dykes and rivers, feeding mostly on waterside vegetation. They are active in daylight hours and leave several indications of their presence and these signs can be used to identify the presence of Water Vole and, by quantifying the presence of certain signs, can be used to estimate the population size.

4.3 Six waterbodies (labelled 1-6 on Figure 1) and a single ditch, adjacent to the proposed DC cable corridor, were identified during the PEA of the Site as being potentially suitable for Water Vole. However, due to health and safety considerations with accessing three of the waterbodies, only three waterbodies and the ditch were surveyed for Water Vole presence or absence.

4.4 The Water Vole survey involved identification of evidence of Water Vole activity up to 5 m from the bank of each of the three waterbodies and the ditch surveyed. The Water Vole survey of the waterbodies was undertaken on 16th and 17th August 2018, whilst the ditch was surveyed on the 3rd May 2019. Field surveys applied the standard methodologies as described by Strachan et al. (2011)[2] and Dean et al. (2016)[3]. Field signs searched for included:

- latrine sites – distinct piles of Water Vole droppings found near burrows, at the ranges of territorial boundaries and where the animals enter and leave the water;
- feeding stations – areas with distinct neat piles of chewed lengths of vegetation along pathways or haul out platforms along the water's edge;
- burrows – burrow entrances are typically wider than high with a diameter between 4 and 8 cm. Burrow entrances are generally located at the water's edge;
- lawns – short grazed areas at the entrances to burrows;
- prints – identifiable prints in soft margins of the watercourse; and
- runways – low tunnels that are pushed through the vegetation and often leading to burrows or feeding stations.

Survey Limitations

4.5 The following factors meant that there were limitations to the survey for Water Vole:

4.6 • Dense vegetation (including reed growth and brambles) made surveying for Water Vole field signs difficult, meaning some sections of accessed waterbodies and the ditch were not surveyed. However, these areas were considered unlikely to support Water Vole, based on professional judgement. This limitation did not impact significantly on the efficacy of the survey.

4.7 • Fluctuating water levels meant that some sections of the ditch did not contain water at the time of survey. This limitation did not considered to have an impact on the efficacy of the survey.

4.8 • There were difficulties encountered with safely accessing three of the lagoons due to steep sided banks and deep water and these were not accessed during the survey due to health and safety concerns. However, an assessment, based on professional judgment, on whether these

[2] Strachan, R, Moorhouse, Y & Gelling, M. (2011) *The Water Vole Conservation Handbook (Third Edition).*
[3] Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016). *The Water Vole Mitigation Handbook* (The Mammal Society Mitigation Guidance Series). Eds Fiona Mathews and Paul Chanin. The Mammal Society, London.

were likely to support Water Vole was made at the time of surveys and has been considered within this report.

4.9 The majority of ecological data is valid only for short periods due to the inherently transient nature of the subject (CIEEM, 2019[4]). On this basis, it is recommended that the surveys for Water Vole will need repeating in two years (i.e. in 2020).

Population Size Class Assessment

4.10 The number of Water Vole latrines recorded by the survey can provide an indication of the relative population of Water Vole present (Dean et al., 2016[3]) and the survey areas can be subdivided by density which can be interpreted as follows:

Table 4.1: Estimating Populations of Water Vole (Dean et al., 2016)

Relative Population Density	Approximate number of latrines per 100 m of bankside habitat	
	Survey in first half of the season (mid-April to end of June)	Survey in second half of the season (July to September)
High	10 or more	20 or more
Medium	3 – 9	6 – 19
Low	< 2 (or none, but with other field signs)	< 5 (or none, but with other field signs)

4.11 It is not possible to make robust estimates of the number of Water Voles from latrine counts, but latrines do provide an indication of activity suitable for assessment of impacts and designing mitigation (Dean et al. (2016)).

[4] CIEEM: Advice Note on the lifespan of ecological surveys and reports https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf (Accessed July 2019)

5. Results and Evaluation

Desk Study

5.1 The desk study returned 12 records of Water Vole, with five records received from within 1 km of the Proposed Development area (in 2012 and 2014).

Water Vole Survey Results

5.2 Three waterbodies and a single ditch on Site were surveyed for Water Vole presence or absence, the results of which are presented in the following sections of this report.

Lagoon 1

5.3 Lagoon 1 was situated in the north-west corner of the Site, approximately 25 m to the west of the proposed DC cable corridor and maintained high levels of water throughout the year. The north and west banks consisted of Common Reed, Common Reed-mace and Sea Club-rush, with areas of scrub. The east and south banks were inaccessible due to steep banks. Waterfowl were present in low numbers.

5.4 The distance between Lagoon 1 and the closest point of the Site (the proposed DC cable corridor) is 125 m.

Table 5.1: Water Vole signs found at Lagoon 1.

Point	Grid Reference	Number of Latrines	Number of Feeding Areas	Number of Burrows	Notes
A	TQ 88397 77273	1	1	0	
B	TQ 88371 77284	1	2	0	
C	TQ 88382 77286	3	2	0	Snail remains found suggesting presence of rat or water shrew
D	TQ 88395 77276	1	8	0	
E	TQ 88383 77342	0	5	0	Field vole activity
F	TQ 88364 77350	0	8	0	

Lagoon 2

5.5 Lagoon 2 was situated in the north-east corner of the Site, approximately 70 m to the east of the proposed DC cable corridor and was dominated by Common Reed, Common Reed-mace and Sea Club-rush. Only the north bank was accessible due to dense vegetation, deep water and steep banks. Fish were also present in this lagoon.

5.6 The distance between Lagoon 2 and the closest point of the Site (the proposed DC cable corridor) is 70 m.

Table 5.2: Water Vole signs found at Lagoon 2.

Point	Grid Reference	Number of Latrines	Number of Feeding Areas	Number of Burrows
A	TQ 88573 77184	3	5	0
B	TQ 88577 77166	1	0	0

Lagoon 6

5.7 Lagoon 6 was situated in the south-east corner of the Site and maintained low levels of water throughout the year with some parts of the lagoon drying completely. The lagoon was dominated by Common Reed, Common Reed-mace and Sea Club-rush, with patches of open water. Only the northern section of the lagoon was accessible due to dense vegetation, steep banks and deep water.

5.8 The distance between Lagoon 6 and the closest point of the Site (laydown areas) is 87 m. Lagoon 6 is 175 m from the proposed DC cable corridor.

Table 5.3 - Water Vole signs found at Lagoon 6.

Point	Grid Reference	Number of Latrines	Number of Feeding Areas	Number of Burrows	Notes
A	TQ 87944 76127	5	3	0	
B	TQ 87926 76136	2	3	0	
C	TQ 87912 76141	1	1	0	
D	TQ 87895 76144	0	2	0	
E	TQ 87874 76146	3	1	0	
F	TQ 87865 76148	0	2	0	
G	TQ 87856 76164	0	2	0	
H	TQ 87847 76177	1	3	0	
I	TQ 87834 76200	0	0	0	Mammal runs present

Ditch 1

5.9 This ditch runs north alongside the access track from West Lane towards the sea, is approximately 510 m in length and was ecologically and hydrologically connected to Lagoon 1. Vegetation within the ditch consisted of Common Reed, Sea Club-rush and Common Reed-mace, with steep sides covered in scrub and grasses.

5.10 The distance between this ditch and the closest point of the Site (the proposed DC cable corridor) is 1 m.

Table 5.4 - Water Vole signs found at Ditch 1

Point	Grid Reference	Number of Latrines	Number of Feeding Areas	Number of Burrows	Notes
A	TQ 88395 77066	1	0	0	
B	TQ 88381 77038	0	1	0	
C	TQ 88380 77035	2	0	0	
D	TQ 88372 77017	1	0	0	

Point	Grid Reference	Number of Latrines	Number of Feeding Areas	Number of Burrows	Notes
E	TQ 88361 76989	1	0	0	
F	TQ 88334 76904	1	1	0	
G	TQ 88340 76893	1	2	0	
H	TQ 88298 76804	1	1	0	

Population Size Class Assessment

5.11 The ditch adjacent to the proposed DC cable corridor was found to contain eight latrines. No Water Vole burrows were recorded. The population size in the ditch, using the population size class assessment as described in Section 4.4 of this report (Dean et al.), would be low, based on a total of eight latrines recorded along 510 metres of ditch (1.2 kilometres of bankside habitat).

5.12 Lagoon 5 was not surveyed for Water Vole presence or absence and is within the proposed DC cable corridor. However, based on the presence of small numbers of Water Vole that occur in lagoons 1, 2 and 6, which are of similar size and habitat quality to Lagoon 5, it is considered that Lagoon 5 supports a low population of Water Vole.

5.13 Therefore, an overall population size estimate of a low population of Water Vole present within the Proposed Development areas has formed the basis for production of the mitigation strategy that follows within this document.

6. Outline Mitigation Strategy

6.1 The outline mitigation strategy aims to minimise impacts of the Proposed Development on the identified population of Water Vole present on the Site.

6.2 The installation of the DC cable has the potential to impact on the Water Vole population through temporary habitat loss and accidental mortality or injury, in the ditch adjacent to the proposed DC cable and within Lagoon 5.

6.3 There are no waterbodies or ditches within the footprint of the proposed converter and substation and therefore, there are no predicted impacts on any Water Vole in these locations.

6.4 Mitigation, during installation of the DC cable, is required to:

- ensure compliance with relevant legislation; and
- avoid impacts that would give rise to a potential "significant effect" and would, therefore, be contrary to planning policy and the biodiversity obligations of the NERC Act 2006.

6.5 A significant effect can be considered one which supports or undermines nature conservation objectives, or changes the conservation status of a species population (CIEEM, 2016).

6.6 Whilst this mitigation strategy outlines the requirements of mitigation to protect the population of Water Vole present on the Site, the detailed methods for delivery of the strategy would be written up in a formal Method Statement, detailing the exact requirements for delivery and submitted as part of a licence application to Natural England, if required.

Potential Impacts

Ditch adjacent to the DC cable corridor

6.7 If construction works (including vegetation clearance) are required within 5 m from the ditch that runs alongside the DC cable, then the installation of the DC cable has the potential to result in the temporary displacement and accidental killing or injury of Water Voles. These impacts, however, are avoidable during construction by ensuring that the DC cable is not installed within 5 m of the top of any bankside habitat and through retention of vegetation within 5 m of the ditch.

6.8 However, if construction works involve vegetation clearance or ground works greater than 5 m from the ditch bankside habitat, then no impacts on Water Vole are likely as Water Voles and, in case any were missed in the survey, their burrows will not be affected by construction.

6.9 Where the proposed DC cable corridor crosses the ditch, the installation of the DC cable may result in the temporary displacement of Water Vole, if present in these areas, from any such crossing point.

Lagoon 5

6.10 If the construction of the DC cable is above ground and will involve habitat removal from Lagoon 5, the Proposed Development will result in the temporary loss of Water Vole habitat in Lagoon 5 and, in the absence of mitigation, has the potential to kill or injure Water Voles during the construction phase. However, should the DC cable be installed underground, therefore underneath Lagoon 5, with no impacts upon the above ground vegetation within 5 m of the lagoon, then there will be no impacts upon any Water Vole population present in this lagoon. If the installation of the DC cable underneath Lagoon 5 cannot be achieved, then relocation of Water Vole out of the Proposed Development areas, through displacement or live trapping, will be required.

6.11 Any potential for killing and injuring of Water Vole, during construction of the DC cable corridor, is avoidable through avoidance or the appropriate implementation of this strategy to prevent such incidences occurring.

Proposed Mitigation

6.12 To mitigate for any loss of Water Vole habitat and potential for incidental killing of animals, the following mitigation options are proposed:

6.13 avoidance of construction of the DC cable within 5 m of the bankside of any waterbody / ditch supporting Water Vole; and

6.14 displacement of Water Vole, through habitat reduction at any crossing (for sections less than 50 m in length).

6.15 Where these mitigation options cannot be met and the construction of the DC cable is within 5 m of the bankside habitat of the ditch or Lagoon 5, then relocation of Water Vole from affected areas (through live capture trapping) may be required, including the creation of on-site receptor habitat to receive relocated Water Vole.

7. Implementation of mitigation

Avoidance of bankside habitat

7.1 Construction of the DC cable should avoid any habitat supporting Water Vole. To avoid accidental killing or injury of Water Vole, construction of the DC cable (including ground disturbance and vegetation clearance) should be more than 5 m from the bank of Lagoon 5 and the ditch running adjacent to the DC cable route.

Displacement of Water Vole through habitat reduction

7.2 The ditch running alongside the DC cable is approximately 510 m in length and supports a low population of Water Vole. No Water Vole burrows were recorded in this ditch.

7.3 Lagoon 5 was not surveyed for Water Vole presence or absence due to health and safety concerns with accessing this area. However, based on habitat quality and the presence of Water Vole in the immediate area, a precautionary principle has been adopted and a low population of Water Vole estimated to be present within this lagoon.

7.4 Providing that the installation of the DC cable, particularly vegetation clearance and ground disturbance, is further than 5 metres from any ditch and, or lagoon that supports Water Vole and that impacts to the ditch and, or lagoon are limited to crossing points only (more than 50 m in length), then displacement of Water Vole through habitat reduction is a viable option. Where this is not possible and the installation of the DC cable is less than 5 m from the bankside habitat of the ditch or Lagoon 5, or where any crossing points would impact upon any length of habitat greater than 50 m in the ditch or Lagoon 5, then relocation of Water Vole from these areas would need to be implemented.

7.5 Displacement of Water Vole from the ditch and Lagoon 5 would be undertaken using habitat reduction measures, using the guidance as described in the Water Vole Mitigation Guidelines (Dean et al., 2016).

7.6 Prior to displacement, a brief update survey of the ditch and, if possible, Lagoon 5 will be undertaken to confirm that the population of Water Vole in these areas remains low and that there are no burrows within the affected areas. All Water Vole activity will be recorded in these areas to inform the displacement and if there is a population change and it is apparent that there are new and numerous burrows present, mitigation may have to revert to trapping and relocating. Displacement will focus on any crossing points within the ditch and Lagoon 5, or known burrows and will be undertaken and, or overseen under a Natural England Class Licence, held by a suitably licenced ecologist between 15th February and 15th April. Vegetation removal will be undertaken along the length of both banks (no more than 50 m) where the DC cable crosses the ditch / Lagoon 5 and around any Water Vole burrows. Vegetation removal can only be undertaken during appropriate weather conditions, .i.e. works will not be undertaken in very cold weather. Once vegetation removal to bare soil has taken place, the area will be left undisturbed for 5-10 days. After this, the areas where vegetation removal was undertaken will be resurveyed to check for any active signs of Water Vole presence. After this stage, where burrows were located within the areas of vegetation removal, a destructive search using an excavator will be undertaken under the watching brief of the licence holder or trained and named agents.

Relocation of Water Vole through live trapping

7.7 Where avoidance of bankside habitat or displacement is not viable during construction of the DC cable then relocation of Water Vole, through live trapping, will be undertaken and a licence will be required from Natural England in order to do this. The trapping of Water Vole can only be undertaken by licenced and experienced ecologists and at the appropriate time of year.

7.8 Relocation, through trapping, requires the capture and removal of Water Voles from within a development area and release into a suitable receptor site that is away from potential harm.

7.9 The following guidance, drawn together from the Water Vole Conservation Handbook (Strachan et.al, 2011[2]) and the Water Vole Mitigation Guidelines (Dean et al., 2016) applies for trapping and relocating Water Vole:

- the relocation of Water Vole can only be undertaken under a licence issued by Natural England;
- any receptor site(s) should be well established and suitable for Water Vole ahead of the relocation;
- relocation of Water Vole by trapping should ideally be undertaken in the spring, between 1st March and 15th April inclusive (depending on the weather, it may be appropriate to commence trapping in mid-February) or during the autumn period (between 15th September and 30th November inclusive).

7.10 No trapping of Water Vole will be undertaken between 16th April and 14th September as this is the peak breeding season and there is a high likelihood that mortality of dependent young may occur with the trapping and relocation of breeding females (Dean et al., 2016)).

7.11 The precise methods for trapping Water Vole will follow the guidelines for trapping and displacement of Water Vole, as described within the *Water Vole Mitigation Handbook* (Dean et al., 2016) and will be detailed within any supporting documents for the licence application to relocate Water Vole.

7.12 To prevent any relocated animals from returning to the capture site, Water Vole resistant fencing will be required along the length and width of the capture receptor sites. The detailed specifications for Water Vole fencing will follow those as described as Appendix 5 in the Water Vole Mitigation Handbook. This fencing will be installed after receipt of the licence to relocate Water Vole, prior to the commencement of trapping.

7.13 The chosen receptor site will be checked for the presence of American Mink Neovison vison before the relocation of Water Vole, to confirm that Mink is absent.

7.14 On site soft release pens for Water Vole will be used to allow for slow-release of Water Vole into receptor sites. Trapping will continue until a period of five days has elapsed with no captured animals and there are no field signs of water vole around the capture sites.

7.15 Water Vole trapping will avoid extreme weather conditions. Such conditions are:

- where night-time temperatures fall below 0°C;
- where day-time temperatures exceed 20°C; or
- where severe rainfall (that could cause flooding) is predicted.

7.16 Therefore, the weather forecast will be monitored daily and no trapping will occur if adverse weather is forecast.

7.17 As soon as the capture sites have been confirmed as having no remaining Water Vole, a destructive search of the area will commence. This involves the removal of vegetation and top soils from the capture site and destructive search, using excavation machinery of bankside habitat and Water Vole burrows.

Appendix 6.H – Aquatic Ecology Report

NeuConnect GB Onshore Scheme

Environmental Statement

Appendix 6H – Report on Aquatic Ecology

NeuConnect Britain Limited

September 2019

Quality information

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Table of Contents

Figures

Tables

1. Introduction

Background

1.1 In 2018, AECOM undertook a Preliminary Ecological Appraisal (PEA)[1] on behalf of Neuconnect Britain Ltd (the 'Applicant'). This PEA survey identified the need for follow-up ecological surveys to determine the potential impacts of the Neuconnect project (hereby further known as the 'Proposed Development') on aquatic ecology. Therefore, AECOM was instructed by the Applicant to undertake a River Habitat Survey (RHS) and aquatic (freshwater) invertebrate survey on an unnamed ditch (the 'Ditch') in the area required for the Proposed Development of an electricity converter station, substation and underground DC cable. The construction of the proposed underground DC cable will require a working corridor of 30 m to allow for the cable trench or duct, excavated spoil storage and plant operation. No other waterbodies outside of the footprint of the Proposed Development will be impacted upon and therefore these and the other scheme components (electricity converter station and substation) are not considered further within this report.

The Project

1.2 NeuConnect (the Project) is a 1400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks. The new link will create a connection for electricity to be passed in either direction between Great Britain and Germany. The Project will be formed by approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HDVC) cables, with on-shore converter stations linking into the existing electricity grids in Great Britain and Germany.

1.3 The Proposed Development will comprise of three structures, a Converter Station, Sub-station and a Direct Current (DC) cable route (see Figure 1).

1.4 The footprint of the proposed converter station is expected to be up to approximately 250 metres (m) by 250 metres (to the perimeter security fence), with a maximum height of up to 26 m.

1.5 The footprint of the proposed substation is expected to be approximately 80 m by 80 m (to the perimeter security fence), with a maximum height of 14 m.

1.6 The proposed DC cable corridor will be approximately 1.6 km long (from landfall to the converter station). The preferred installation method will be underground, which will result in a temporary loss of land during installation. The working corridor for the installation of the cable corridor will be 30 m.

1.7 Additional laydown areas will be required for construction, comprising 1.5 hectare (ha) for the converter laydown and 0.3 ha for the substation laydown.

Site Description

1.8 The Proposed Development areas (the 'Site') is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The Site is located to the west of the village of Grain, Isle of Grain, Kent at Ordnance Survey (OS) central grid reference TQ 88205 76727. Land use comprises a mix of industrial development to the south, the small settlement of Grain to the southeast and undeveloped land, much of which is designated for ecological interests, to the north (along the coastline) and to the west. Land within the Site and in the immediate vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill.

1.9 Figure 1 shows the Site boundary (red-line), the cable corridor (purple line) and proposed location of each structure.

[1] AECOM, Neuconnect, Isle of Grain: Preliminary Ecological Appraisal Report, 2019

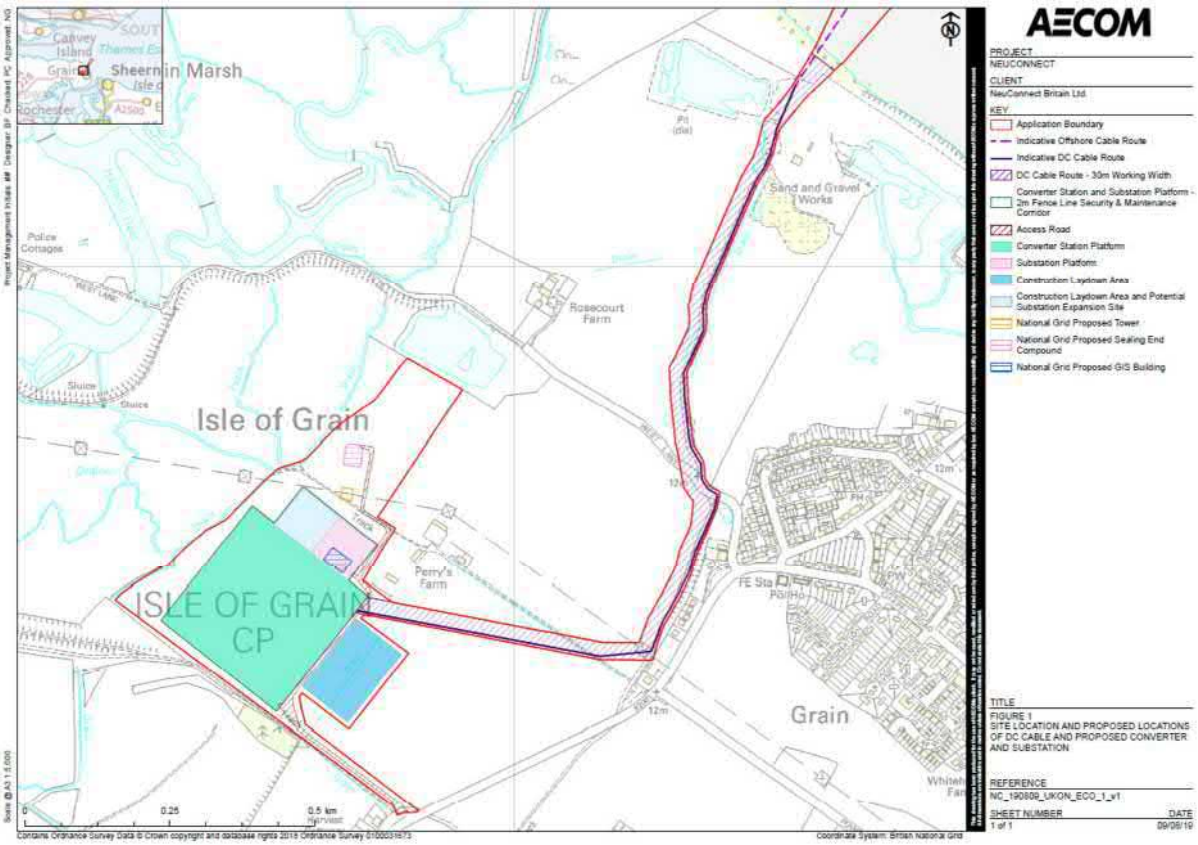

Figure 1 - Site Boundary and Proposed Locations of DC cable route, converter station and substation

Purpose and Scope of Aquatic Surveys

1.10 A desk study was carried out to identify any designated sites or records of notable freshwater species within up to 5 km of the Proposed Development. Results of the desk study and the Preliminary Ecological Appraisal (PEA) (AECOM, 2019) informed the scope of aquatic surveys that were completed at the site.

1.11 A RHS was commissioned to provide detail of the characteristics of the watercourse in terms of its physical structure, vegetation types, basic geomorphology, valley form, land use in the watercourse corridor, degree of watercourse modification, and corresponding ecological potential.

1.12 Aquatic invertebrate samples were collected to identify the conservation value of the aquatic invertebrate community within the Ditch, and to record the presence of any notable and/or protected species.

1.13 This baseline information can be used to inform options for impact avoidance, mitigation and/or compensation to be considered.

2. Methods

Desk Study

2.1 A desk study was undertaken through Kent and Medway Biological Records Centre (KMBRC) as part of the PEA (AECOM, 2019) that was completed in advance of the aquatic surveys and informed the scoping of requirements for further survey.

2.2 Desk study results of relevance to the assessment have been carried forward into this report, and where appropriate these data are presented in more detail or re-interrogated for the needs of the current assessment.

2.3 Further to this, information relevant to this assessment was sought from The Environment Agency and online resources. These were accessed to identify historical fish catches within a 5 km radius of the Site. The search radius was limited to areas of terrestrial and freshwater aquatic habitats.

River Habitat Survey

Survey Conditions

2.4 A River Habitat Survey (RHS) was carried out on the 2nd May 2019 by two experienced aquatic ecologists (Peter Cowley MSc BSc Hons ACIEEM, Environment Agency RHS accreditation code FA061, and Louise Levins BSc Hons MCIWEM) on the Ditch within the Site.

2.5 A 500 m stretch of the Ditch was surveyed from downstream of the proposed DC cable crossing to a point close to the start of the access track, where the Ditch originates.

2.6 For lowland watercourses May and June are considered optimal periods for RHS as the presence of key diagnostic features such as flowers and fruiting bodies facilitate the identification of macrophytes, but vegetation cover remains insufficient to obscure bank and channel features. Weather conditions were good during the survey (warm, overcast, breezy, dry) and flow conditions were low.

Methodology

2.7 RHS is a method designed to characterise and assess the physical structure of freshwater streams and rivers, including recognition of vegetation types and basic geomorphological principles and processes. RHS is carried out along a standard 500 m stretch of river channel, with observations made at ten equally-spaces ‘spot-checks’, with additional context provided by observations of land-use and valley form in the river corridor. Surveyor training and accreditation facilitates accurate and consistent recording of features to allow standardised conclusions to be drawn.

2.8 The RHS methodology includes a mandatory health and safety risk assessment component, stringent requirements for the recording of grid references and photographic evidence and recording of any unusual features with special notes and photographs as supporting evidence. RHS is not designed to provide the level of detail needed for specialist surveys for specific flora or fauna; however, RHS can support recommendations for and findings of surveys for aquatic invertebrates, macrophytes, fish and hydro-geomorphology.

2.9 RHS surveys may be utilised to ‘benchmark’ top quality sites based on their catchment characteristics, investigate species-habitat relationships (with fish passage as an example), contribute to Environment Impact Assessment, or as in this case to inform proposed works alongside the watercourse.

2.10 RHS methodology includes the following:

- Desk study preparatory work – maps and analysis of online data, including historic maps, provides context on landscape characteristics and river planform over time to assist in identifying historic channel management; however, this does not override field observations.

- Field survey and RHS survey form completion – the presence/absence of features, and in some cases the number and extent thereof, is recorded at ten spot checks and the whole 500 m site, including natural and artificial features, and channel measurements.
- General site information is collected on page 1 of the survey form.
- Spot check information is collected on the survey form, including predominant channel, bank and river corridor features at ten locations evenly spaced along the 500 m RHS site. This includes predominant channel substrate types (where visible), flow type, habitat features, channel and bank modifications, channel vegetation types, bank and banktop vegetation structure, and adjacent land use. Physical features are assessed using a 1 m wide transect across the channel; all other elements are assessed using a 10 m wide transect across the river.
- Sweep-up information – general information is recorded on the survey form by means of a 'sweep-up' checklist. This allows information not occurring in the spot checks to be recorded over the whole 500 m, length, thus allowing a broad picture of river character to be established.
- Channel dimensions are recorded on the survey form – these are measured at one representative location in the 500 m survey stretch, normally across a riffle, if present, otherwise a straight, uniform location with clearly defined banks. Also recorded is the presence of features of interest including nuisance plant species and alders.

2.11 The RHS locations are indicated in the Site in Appendix A.

Hydromorphological Indices

2.12 RHS data can be used to provide an assessment of habitat quality and the extent of channel modification, and this can then inform physical quality objectives for river works and restoration. Hydromorphological indices were calculated using the RHS Toolbox software (Riverdene Consultancy, 2019). These include the Habitat Modification Score (HMS) and Habitat Quality Assessment (HQA) as follows:

2.13 ***Habitat Modification Score (HMS)*** – HMS scoring criteria are derived from an earlier scoring system developed by the Environment Agency in 1998, and were developed by Riverdene Consultancy (2016). The scoring criteria indicated the degree of modification of the river habitat, with a higher score indicating a higher degree of modification. HMS results in a Habitat Modification Class (HMC) with each river stretch allocated a HMC Description ranging from Pristine/Semi-Natural to Severely Modified. The HMS scoring criteria are summarised in Table 1 below.

Table 1: HMS scoring criteria

HMS Scoring Criteria	Recorded in RHS Survey Form	HMS Score
Culverts sub-score	Spot check Channel Modification – Culverts (CV) Sweep-up Artificial Features – Culvert	+ 400, + 50 for additional criteria + 400 for each remaining feature
Bank and Bed Reinforcement sub-score	Spot check Bank Material Spot check Bank Modification – Reinforced (RI) Sweep-up Bank Profiles – Reinforced Spot check Channel Substrate Spot check Channel Modification – Reinforcement (RI)	Specific scores for bank materials + 20 for additional bank reinforcement Additional score for extensive reinforcement + 200 for artificial substrate + 200 for channel modification
Bank and Bed Re-sectioning sub-score	Spot check Bank Modification – Re-sectioned (RS) Sweep-up Bank Profiles – Re-sectioned Spot check Channel Modification – Re-sectioned (RS) Sweep-up Channel Modification – Over-deepened	+ 40-160 for re-sectioned spot check Additional score for re-sectioned sweep-up + 200 for spot check RS (channel mod.) + 40-160 for over-deepened

Berms & Embankments sub-score	Spot check Bank Modification – Berms (BM) Spot check Bank Modification – Embankments (EM) Sweep-up Bank Profiles – Artificial two-stage Sweep-up Bank Profiles – Embanked Sweep-up Bank Profiles – Set-back Embankment	+ 20 each spot check BM + 20 each spot check EM + 20-80 for artificial two-stage channel + 20-80 for embankment in sweep-up + 4-16 for set-back embankment
Weirs/Dams/Sluices sub-score	Sweep-up Artificial Features – Weirs/dams/sluices	Specific scores for impoundment by weir/dam and each weir/sluice feature
Bridges sub-score	Sweep-up Artificial Features – Bridges	+ 100-250 for each sweep-up bridge
Poaching sub-score	Spot check Bank Modification – Poaching (PC or PC(B)) Sweep-up Bank Profiles – Poached	+ 10 for each spot check PC or PC(B) + 10-40 for sweep-up poaching
Fords sub-score	Sweep-up Artificial Features – Fords	+ 40-200 for each sweep-up ford
Outfalls/Deflectors sub-score	Sweep-up Artificial Features – Outfalls Sweep-up Artificial Features – Deflectors	+ 25-100 for each sweep-up outfall + 50-150 for each sweep-up deflector
Habitat Modification Class (HMC)	**HMC Description**	**HMS Score**
1	**Pristine/semi-natural**	**0-16**
2	**Predominantly unmodified**	**17-199**
3	**Obviously modified**	**200-499**
4	**Significantly modified**	**500-1399**
5	**Severely modified**	**1400+**

2.14 ***Habitat Quality Assessment (HQA) –*** HQA provides a broad indication of river quality and habitat diversity by collating natural features assessed through the field survey. The HQA score is allocated based on features including point, side and mid-channel bars. Eroding cliffs, large woody debris, waterfalls, backwaters and floodplain wetlands. Additional points are scored for variety of channel substrata, flow-types, in-channel vegetation, and also the distribution of bank-side trees and the extent of near natural land-use adjacent to the river, resulting in a total HQA score. HQA scores can only be used to compare sites of a similar river type or character. For example, river stretches in lowland floodplains should not be compared with those in upland wooded valleys.

2.15 A more diverse site in terms of natural river habitats will result in a higher HQA score, converse to the HMS score where a higher score indicates a less natural state. Therefore, HMS and HQA in combination provide an assessment of the influences of natural variation and the extent of human intervention in the river corridor and adjacent land covered by the RHS survey.

2.16 HQA scoring criteria are summarised in Table 2 below:

Table 2 - HQA scoring criteria

HQA Scoring Criteria	Description	HQA Scoring Criteria	Description
Flow Types	Score for variety of flow types; additional sweep-up types score extra	Point Bars	Total number of un-vegetated and vegetated point bars
Channel Substrates	Score for variety of natural substrate types: bedrock, boulder, cobble, gravel/pebble, sand, silt, clay, peat	In-Stream Channel Vegetation	Score for channel vegetation grouped into six categories for scoring purposes

HQA Scoring Criteria	Description	HQA Scoring Criteria	Description
Channel Features	Natural channel features: exposed bedrock/boulders, un-vegetated mid-channel bar, vegetated mid-channel bar, mature island	Land-Use Within 50m	Score allocated on sweep-up only: broadleaf woodland (or native pinewood), moorland/heath, and wetland score
Bank Features	Score for each natural feature: eroding earth cliff, stable earth cliff, un-vegetated point bar, vegetated point bar, un-vegetated side-bar, vegetated side-bar	Trees And Associated Features	Score allocated for bankside trees, Overhanging boughs, exposed bankside roots, underwater tree roots, coarse woody debris and fallen trees
Bank Vegetation Structure	Score for banktop and bankface simple and complex vegetation structure	Special Features	Score if recorded: waterfall more than 5m high, braided or side channel, debris dams, natural open water, fen, carr, flush, bog

Notes on Table 2: Due to the nature of HQA score and within the limitations of this study, HQA scores herein have been used to provide an assessment of habitat quality in the study area only. Further interpretation of HQA scores would require comparison of the survey area against those with similar physical characteristics (*e.g.* gradient, distance from source, geology etc.) via the Environment Agency RHS Database.

Aquatic Invertebrate Survey

Field Survey

2.17 Aquatic macroinvertebrate sampling of the Ditch was carried out on 2nd May 2019 in conjunction with the River Habitat Survey.

2.18 Three macroinvertebrate samples were taken at strategic locations along the Ditch, two upstream and one downstream of the potential crossing point of the DC cable, and similarly located in relation to the crossing point of the existing access track, beneath which the Ditch is culverted. These locations were sampled to ensure that this assessment would remain relevant in case of future design changes and to ensure that the full range of habitat conditions within the Ditch were sampled. Locations of these sites are provided in Table 3 below and in Appendix A.

Table 3 Macroinvertebrate Sample Sites

Site Name	Relation to Crossing Point of current access track	National Grid Reference
Site 01	2-10 m downstream of the crossing point	TQ 88415 77143
Site 02	0-10 m upstream of the crossing point	TQ 88430 77143
Site 03	75-85 m upstream of the crossing point	TQ 88409 77091

2.19 The survey methods followed the aquatic invertebrate sampling procedures standardised by the Environment Agency (Environment Agency, 2014). These methods allow characterisation of aquatic invertebrate communities and can be used to determine whether rare or notable species or communities are present. The samples were taken using a standard FBA pattern pond net (mesh size: 1 mm). The habitats present were collected through a combination of kick sampling and sweep sampling for three minutes followed by a one-minute hand search of larger substrates in accordance with the standard methods. The samples collected were subsequently preserved in Industrial Methylated Spirit (IMS) for laboratory processing.

Analysis of Aquatic Macroinvertebrate Samples

2.20 Each of the samples collected was sorted and analysed in a laboratory setting by suitably trained and experienced aquatic ecologists. Lists of the aquatic invertebrate taxa present were produced in line with Environment Agency guidance (Environment Agency, 2014). The aquatic invertebrate samples were identified to 'mixed taxon level' using stereo-microscopes. Most groups were identified to species level (where practicable), with the exception of the following:

- Mites (Hydracarina) which were identified to order;
- worms (Oligochaeta) which were identified to order;
- marsh beetles (Scirtidae) which were identified to family;
- butterfly / moth larvae (Lepidoptera), which were identified to order;
- springtails (Collembola) which were identified to order;
- truefly larvae, which were identified to the maximum resolution possible; and
- immature or damaged specimens, which were identified to the maximum resolution possible on a case-by-case basis.

2.21 The survey data was then used to calculate metrics that can be used to inform an assessment of relative nature conservation value.

2.22 A Community Conservation Index (CCI) (Chadd & Extence, 2004) was calculated for each site. The CCI classifies many groups of freshwater invertebrates according to their scarcity and nature conservation value in England as understood at the time that the classification was developed. Species scores range from 1 to 10, with 1 being very common and 10 being Endangered (see Table 4). Since its initial publication, in some cases the references used in the CCI classification to define scarcity and value have been superseded by more recent assessments. Due to this, the author has provided AECOM with updated species scores to take account of this new information (Chadd, pers. comm., 2018). These updated scores have been used within this assessment.

Table 4 Conservation Scores from the Community Conservation Index

Conservation Score	Conservation Status
10	RDB1 (Endangered)
9	RDB2 (Vulnerable)
8	RDB3 (Rare)
7	Notable (but not RDB status)
6	Regionally notable
5	Local
4	Occasional (species not in categories 10-5, which occur in up to 10% of all samples from similar habitats)
3	Frequent (species not in categories 10-5, which occur in up to >10-25% of all samples from similar habitats)
2	Common (species not in categories 10-5, which occur in up to >25-50% of all samples from similar habitats)
1	Very common (species not in categories 10-5, which occur in up to >50-100 % of all samples from similar habitats)

2.23 The overall CCI derived provides an indication of the conservation value of the community sampled, based on a combination of the rarity of the different aquatic invertebrate taxa present and overall community richness, as shown in Table 5 below. As indicated above, in some cases expert judgment may be needed to moderate these assessments with reference to current information on status and distribution.

Table 5 Community Conservation Index Interpretation Guidance (Chadd & Extence, 2004)

Community Conservation Index (CCI)	Expected conservation value
< 5	Low conservation value
5 to 10	Moderate conservation value
10 to 15	Fairly high conservation value
15 to 20	High conservation value
> 20	Very high conservation value

2.24 Calculations were also made to determine the proportion of sediment sensitive macroinvertebrates present using the Proportion of Sediment-sensitive Invertebrates (PSI) index (Extence et al., 2013). Using this approach, individual taxa of aquatic macroinvertebrate are assigned a Fine Sediment Sensitivity Rating (FSSR) ranging from A to D, as detailed in Appendix F. The PSI score for each aquatic macroinvertebrate sample was derived from individual species scores and abundances. The derived PSI score corresponds to the percentage of fine sediment-sensitive taxa present in a sample and ranges from 0 to 100, where low scores correspond to watercourses with high fine sediment cover. The PSI score therefore provides an indication of the extent to which watercourses are influenced by fine sediments, and therefore by inference the potential sensitivity of the associated aquatic macroinvertebrate community to changes in silt load and deposition.

2.25 Lotic-invertebrate Index for Flow Evaluation (LIFE) indices were also calculated (Extence et al., 1999). This is an index that links benthic macroinvertebrate data to flow regimes prevailing in UK waters. Flow scores have been allocated to various macroinvertebrates based on species/family abundance and ecological association with different flows. The overall LIFE score for a site is calculated as the sum of the individual scores divided by the number of scoring species/families. LIFE scores increase with current velocity, scores <6.00 generally indicating sluggish or still water conditions and score >7.5 indicating fast flows. LIFE allows the mean flow preference of invertebrates colonising a site to be determined so that effect of habitat changes such as sediment accumulation can be monitored.

2.26 The macroinvertebrate data were analysed to generate Whalley, Hawkes, Paisley & Trigg (WHPT) indices and Average Score Per Taxon (ASPT) values (WFD-UKTAG, 2014), which provides an indication of the ecological quality in the watercourse. This assigns numerical value to taxa according to their sensitivity to organic pollution. The average of the values for each taxon in a sample, known as ASPT is a stable and reliable index of organic pollution. Therefore, these assessments can indicate to what extent an aquatic macroinvertebrate community is exposed to organic pollution (further information is provided in Appendix C. It is important to note that these indices can vary between geological regions and habitat types. Ditches for example are unable to support many of the high-scoring taxa associated with fast flowing habitats. Therefore the resultant metrics should be reviewed with an awareness of their potential limitations, and the site-specific context, as described in this report.

Nature Conservation Evaluation Approach

2.27 An essential prerequisite step to allow ecological impact assessment of the Proposed Development is an evaluation of the relative nature conservation value of the identified ecological features (encompassing nature conservation designations, ecosystems, habitats and species).

2.28 The method of evaluation that has been utilised has been developed with reference to the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland – Terrestrial, Freshwater and Coastal – Second Edition. These give advice on scoping and carrying out environmental assessments and place appraisal in the context of relevant policies. Data received through consultation, desk-based studies and field-based surveys are used to allow ecological features of nature conservation value or potential value to be identified, and the main factors contributing to their value described and related to available guidance. These data can also be used to identify other relevant values e.g. socio-economic or ecosystem services values, but this is beyond the remit of this report and requires the involvement of other relevant specialists.

2.29 Aquatic macroinvertebrate communities and individual macroinvertebrate species can be of nature conservation value for a variety of reasons, and their relative value should always be determined on a case

by case basis to demonstrate a robust assessment process. Value may relate, for example, to the uniqueness of the assemblage, or to the extent to which species are threatened throughout their range, or to their rate of decline. The value of the aquatic macroinvertebrate assemblages and species recorded by the survey has been defined with reference to the geographical level at which the feature being assessed is considered relevant (Table 6). Relevant published national and local guidance and criteria can be used, where available, to inform the assessment of nature conservation value and to assist consistency in evaluation. Guidance and criteria of potential relevance to the aquatic macroinvertebrate features being assessed is summarised in Table 6. The identified guidance and criteria is not definitive and other criteria have been applied as relevant and appropriate to reach a decision on relative nature conservation value. For example, the previously described CCI index has been used to inform assessment of nature conservation value.

Table 6 Geographic Scale Used to Qualify Relative Nature Conservation Value of Features

Geographic scale of value	Definition	Example supporting guidance and assessment criteria
International	Europe	Guidelines for the selection of Special Areas of Conservation (SACs) (McLeod *et al.* 2005)
National	Great Britain/ England	Guidelines for the selection of biological Sites of Special Scientific Interest (SSSIs) for Terrestrial and Freshwater Invertebrates (Curson *et al.* 2019)
Regional	South East	No specific guidance available, professional judgement is to be used. It will encompass features clearly of greater than county value but not of sufficient merit to demonstrate national value.
County	Kent	Criteria for selection and delineation for local wildlife sites in Kent (Kent Wildlife Trust, 2015).
District	North Kent	No specific guidance available, professional judgement is to be used.
Local	Below district value	No specific guidance available, professional judgement is to be used.

Limitations

2.30 There are no limitations to the work undertaken. The survey was undertaken within an optimal season for survey (spring, defined as March to May for the purpose of aquatic macroinvertebrate survey, and May-June for RHS) and during good weather conditions and low flow conditions.

2.31 Given the nature of biological survey it is not possible to be certain that all of the species present in a waterbody will be detected. Where juvenile or damaged specimens were collected, species level identification is not always possible. Not all macroinvertebrate species that use waterbodies are present at all times of year and therefore some may be overlooked when surveying. Other species that may be present at other times of year, sporadically and/or in low numbers may not have been recorded. This is not considered a limitation as standard methods were applied and the data collected is considered representative of the conditions present and appropriate for assessment of value.

2.32 The majority of ecological data is valid only for short periods due to the inherently transient nature of the subject (CIEEM, 2019[2]). On this basis, it is recommended that the surveys for Water Vole will need repeating in two years (i.e. in 2021).

[2] CIEEM: Advice Note on the lifespan of ecological surveys and reports https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf (Accessed June 2019)

3. Results

Desk Study

3.1 There were two designated statutory sites of international importance located within 5 km of the Site. These sites are designated for ecological reasons and summarised in Table 7 below. Site designation details are summarised in Table 7 and are taken from citation documents published online by the Joint Nature Conservation Committee (JNCC) for the individual sites.

Table 7: International Statutory Nature Conservation Designated sites within 5 km of the Site

Site Name and Designation	Reason(s) for Designation	Area (ha)	Approximate distance from the Site (km)	Connectivity to the Site
Thames Estuary and Marshes Ramsar / SPA	The site supports one endangered plant species and at least 14 nationally scarce plants of wetland habitats. The site also supports more than 20 British Red Data Book invertebrate species.	5,588	0.1 West (for the purpose of freshwater aquatic habitats)	Potential for ecological connections between interest features of the Ramsar/SPA and the Site.
Medway Estuary and Marshes Ramsar / SPA	The site holds several nationally scarce plants and a total of at least twelve British Red Data Book species of wetland invertebrates. The site also holds a significant number of non-wetland British Red Data Book species.	4,696	1.5 South West	Potential for ecological connections between interest features of the Ramsar/SPA and the Site.

3.2 There were two national statutory nature conservation designated sites within 2 km of the Site and they are listed in Table 8 below.

Table 8: National statutory nature conservation designated sites within 2 km of the Site

Site Name and Designation	Reason(s) for Designation	Area (ha)	Approximate distance from the Site (km)	Connectivity to the Site
South Thames Estuary and Marshes SSSI	The diverse habitats support a number of nationally rare and scarce invertebrate species and an assemblage of nationally scarce plants.	5,449	0.1 West (for the purpose of freshwater aquatic habitats)	Potential for ecological connections between interest features of the SSSI and the Site. A section of this ditch occurs within the Impact Risk Zones for the SSSI
Medway Estuary and Marshes SSSI	The site forms the largest area of intertidal habitats which have been identified as value for nature conservation in Kent. An outstanding assemblage of plant species also occurs on site.	6,840	0.7 South West	Potential for ecological connections between interest features of the SSSI and the Site.

3.3 For this assessment, the desk study records were restricted to those collated over the last 10 years, to reflect the current (rather than historic) baseline conditions associated with the site. The only relevant species record provided by the records centre was of the Dainty Damselfly *Coenagrion scitulum*. However,

this species is thought to be extinct in Britain, but was rediscovered at a couple of sites in North Kent in 2010 and 2011, but was not recorded thereafter.

3.4 The EA provided no records of fish, while online resources recorded 3-spined stickleback *Gasterosteus aculeatus*, 9-spined stickleback *Pungitius pungitius*, smelt *Osmerus eperlanus*, perch *Perca fluviatilis* and minnow *Phoxinus phoxinus*, in low numbers 280m north east of the Site. There were no records of fish for the ditch within the Site, including no records of species that would be considered notable such as European Eel *Anguilla anguilla*.

River Habitat Survey

3.5 The River Habitat Survey forms are located in Appendix G.

General River Characteristic

3.6 The Ditch is an artificial drainage channel which originates at the border of the Site with West Lane (Ordnance Survey (OS) Grid Reference TQ 88300 76697). The Ditch flows for around 630 m before entering a large pond to the north-west of the site (approximate OS Grid Reference TQ 88379 77217). The surveyed stretch represents a lowland ditch on superficial river terrace deposits (sand and gravel) over bedrock London Clay Formation (clay and silt).

3.7 The Ditch and surrounding ponds are artificial features and a product of sand and gravel quarrying within the Site. The Ditch flows through land that is predominately formed of scrub, tall herbs and suburban/urban development. There is an expanse of open water to the eastern side of the Ditch and there are some areas utilised for rough pasture. There were no obvious valley sides and a distinct flat floodplain, typical of lowland coastal areas.

3.8 Analysis of historical maps of the Site identified that in 1988 the Ditch was a small drain which fed directly into the estuary. The channel has since been realigned and lengthened, and now feeds into a large pond. Maps prior to this show there was no drain or ditch present in this location.

River Habitat Survey Results

3.9 The RHS comprised of a 500 m stretch starting downstream of the indicative underground DC crossing point on the Ditch (approximate OS Grid Reference TQ 88419 77146), heading upstream. The survey was completed from both the left and right banks, and from within the channel. The entire 500m stretch was considered to be re-sectioned and over-deepened when compared to historical maps. The channel was homogeneous, with no riffles, pools, point bars or meanders and the substrate composed entirely of silt. There was no perceptible flow other than within a culverted section, and at spot check 9 where rippled flow was recorded through dense vegetation. Water depth was generally low (approximate average 0.1 m) but was deeper (average 0.6 m) between spot checks 1 and 2, partly due to impoundment upstream of the access track culvert.

3.10 The indicative location where the DC cable corridor crosses the Ditch is located next to a track crossing where the Ditch is culverted beneath it (see Figure 2). The culvert appeared to have been recently installed or upgraded, however historical maps show the track was present prior to construction of the Ditch. It is therefore likely the watercourse has been always had a crossing since it was created. There was very little flow through the culvert as the upstream end of the pipe invert was only partially below the water level. As a result, water was impounded upstream of the culvert and there was little flow downstream. One minor outfall was observed on the Ditch and was dry at the time of surveying.

3.11 Channel dimensions were recorded at a representative uniform section of the watercourse. Bank full width was 3 m and water width 1 m, with the right bank slightly elevated above the left bank, making the left bank top height the bankfull height; i.e. the Ditch would overtop the left bank before the right bank at this location. This was due to the presence of an embankment along the right bank top, likely as a result of previous dredging of the Ditch. Water depth was 0.1 m and the bed material was unconsolidated.

3.12 The dominant bank material was gravel and sand, with no other material types observed. Semi-continuous embankments were present on both the left and right banks. The bank profile was steep on both banks (>45o) in most locations, with stable cliffs observed at spot checks 2 and 3, and eroding cliffs present at

spot checks 8 and 9. Bank-face vegetation was generally of simple structure and dominated by herbaceous species with scrub also present (see Figures 3, 4 and 5).

3.13 The majority of the channel was choked with vegetation (see Figures 3, 4 and 5). Where emergent vegetation was absent, filamentous algae was dominant on the surface (Figure 5). Emergent reeds, sedges and rushes were the most abundant group, dominated by Slender-tufted Sedge *Carex acuta* with patches of Bulrush Typha sp., with filamentous algae, emergent broad-leaved herbs and amphibious species also present.

3.14 Land use adjacent to the bank top was dominated by scrub and shrub, with tall herbs and patches of broad-leaved woodland present. Wider land use was dominated by scrub and shrub, tall herbs, broad-leaved mixed woodland, rough pasture and suburban/urban development. The main track in the Site runs parallel to the Ditch for much of its length.

3.15 A Water Vole *Arvicola amphibius* latrine was located close to spot check 2 (TQ 88407 77108) and Marsh Frog *Pelophylax ridibundus*, a non-native species, was also observed. See the Target Notes in Appendix B for further details.

Hydromorphological Indices

3.16 Based on the criteria set out in Section 2, Table 1 and Table 2, a Habitat Modification Score (HMS) and Habitat Quality Assessment (HQA) score for the survey stretch were calculated. The Ditch is classified as severely modified with a HMS score of 3960 and HMS class of 5. The HQA score was 42.

Figure 2: Culvert beneath track crossing at spot check 1 (looking upstream)

Figure 3: The Ditch at spot check 1 with Typha sp. (looking downstream)

Figure 4: Typical example of channel chocked with vegetation and riparian scrub (looking downstream)

Figure 5: Filamentous algae cover on Ditch and adjacent body of open water (NGR TQ 88409 74102) (looking downstream)

Aquatic Invertebrates

3.17 The aquatic macroinvertebrate species recorded are detailed in Appendix H.

3.18 No aquatic macroinvertebrate species were recorded that receive specific legal protection via Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), or that are listed on Section 41 of the NERC Act as being of principal importance for nature conservation in England. This does not remove the need to further assess the species assemblage and species recorded for their nature conservation importance. There are other criteria for nature conservation value (see Table 6 for example), and legal protections do not always provide a true or current reflection of all species of nature conservation concern.

Site 01

3.19 A high diversity of species was recorded (26 species) and the community is considered to be a good example of a ditch community supporting a diverse range of true bug and beetle species. The CCI score (see Section 2.3.2 of this report) was 24 indicating that this section of the ditch is of very high conservation value in terms of the CCI index. This site supported a range of species of Local[3] to Very Common status and a number of notable beetle taxa including the diving beetles, *Hygrotus parallelogrammus*, *Dytiscus circumflexus* and the water scavenger beetles *Helophorus alternans*, *Limnoxenus niger* and *Berosus affinis*. Further information on these species is provided in Table 9.

3.20 The biological water quality of the site was good (WHPT 97.3; APST 4.6). It supported three pollution-sensitive macroinvertebrates (the beetle Gyrinidae and the true flies Dixidae and Tabanidae) in addition to a range of taxa defined as having moderate tolerance to pollution. The community was dominated by taxa that are adapted to slow and/or standing waters (LIFE: 5.0) and the species present are tolerant of fine sediments (PSI: 3.2).

[3] Those species not uncommon enough to fall within any of the preceding categories (Regionally Notable to Endangered (RDB1)), but which are nonetheless of some interest. A species may qualify, for example, by being very widely distributed but nowhere common, by being restricted to a specialized habitat such as brackish pools but being a common component of this habitat, or simply by being uncommon but not uncommon enough to be Notable.
Species with few records but which are suspected of being badly under-recorded are likely to be placed in the Local category. Local species may also be Regionally Notable (Chadd & Extence, 2004)

Site 02

3.21 A high diversity of species was recorded (21 species) and the community is considered to be a good example of a ditch community supporting a diverse range of true bug, caddisfly and beetle species. The CCI score was 37.6 indicating that this section of the ditch is of very high conservation value. This site supported a range of species of Local to Very Common status and a number of notable beetle taxa including the diving beetles, *Agabus conpersus*, *Dytiscus circumflexus* and the water scavenger beetles *Helophorus alternans*, *Limnoxenus niger*, and the Great Silver Water Beetle, *Hydrophilus piceus*. Further information on these species is provided in Table 9.

3.22 The biological water quality of the site was good (WHPT 111.8; APST 4.9). It supported two pollution-sensitive macroinvertebrates (the true flies *Dixidae* and *Tabanidae*) in addition to a range of taxa defined as having moderate tolerance to pollution. The community was dominated by taxa that are adapted to slow and/or standing waters (LIFE: 5.3) and the species present are tolerant of fine sediments (PSI: 0).

3.23 Site 03

3.24 A low diversity of species was recorded (10 species) however the community is still considered to be a good example of a ditch community supporting a range of true bug and beetle species. The CCI score was 28.8 indicating that this section of the ditch is of very high conservation value. This site supported a range of species of Local to Very Common status and two notable beetle taxa, the water scavenger beetles *Limnoxenus niger* and B*erosus signaticollis*. Further information on these species is provided in Table 9.

3.25 The biological quality of the site was moderate/good (WHPT 53.4; APST 4.5). It supported a single pollution-sensitive macroinvertebrate taxon (the true fly, Tabanidae) in addition to a range of taxa defined as having moderate tolerance to pollution. The community was dominated by taxa that are adapted to slow and/or standing waters (LIFE: 5.2) and the species present are all tolerant of fine sediments (PSI: 0).

Table 9 Summary of the notable species recorded (Conservation Scores > 6)

Species	Habitat and distribution	Current Status
Great Silver Water Beetle *(Hydrophilus piceus)*	It favours permanent, vegetated drains, ponds and dykes (Foster *et al*., 2014) where its larvae feed on water snails (Foster, 2010).	Near Threatened, Regarded as RDB3 Rare (Conservation Score 8) in the CCI system, but with no statutory designation or protection.
	This species has been recorded from 50 hectads and currently has a southern distribution in the UK but appears to have contracted in range historically. It is well established in some areas, including along the coastal levels of Kent (Foster, 2010).	It is mostly threatened by habitat loss either through destruction or by poor management (Foster, 2010).
A diving beetle (*Hygrotus parallelogrammus*)	This brackish species is found around much of the coastline from the Severn to the Humber (Foster & Friday, 2011).	Regarded as Regionally Notable (Conservation Score 7) in the CCI system but with no statutory designation or protection.
A diving beetle (*Dytiscus circumflexus)*	It is found in well vegetated permanent still water sites. It has a scattered distribution and has been previously recorded along the coastal levels of Kent (Foster & Friday, 2011).	Regarded as Regionally Notable (Conservation Score 7) in the CCI system but with no statutory designation or protection.
		This species was formerly confined to coastal districts in the south and south east, however recently it has spread further north, and can now be found in south-west Scotland (Foster & Friday, 2011).
A diving beetle *(Agabus conpersus)*	This species is largely confined to brackish waters in coastal lagoons and ditches. It is found in many coastal sites all across England (Foster & Friday, 2011).	Regarded as Regionally Notable (Conservation Score 7) in the CCI system but with no statutory designation or protection.
A water scavenger beetle	This coastal species has a southern distribution (Foster *et al.*, 2014).	Regarded as Regionally Notable (Conservation Score 7) in the CCI

Species	Habitat and distribution	Current Status
(Helophorus alternans)		system but with no statutory designation or protection.
A water scavenger beetle *(Limnoxenus niger)*	This coastal species occurs in well vegetated ponds and ditches. This species has a southern distribution in the UK, with the most northerly record being Norfolk (Foster *et al*., 2014).	Regarded as Regionally Notable (Conservation Score 7) in the CCI system but with no statutory designation or protection.
A water scavenger beetle *(Berosus affinis)*	This species is found in ponds and drains with exposed sediments (Hammond, 2017). Modern records highlight that this species has a predominately southern distribution with records south of the line from the Wash to Pembrokshire (Foster *et al.*, 2014).	Regarded as Regionally Notable (Conservation Score 7) in the CCI system but with no statutory designation or protection.
A water scavenger beetle *(Berosus signaticollis)*	This species is found in silty pools and ditches favouring coastal wetlands and brownfield sites. This species is predominately found south of the line between the Humber and the Wirral (Foster *et al*., 2014).	Regarded as Regionally Notable (Conservation Score 7) in the CCI system but with no statutory designation or protection. This species is believed to be expanding in range with new records within Cumbria (Hammond, 2017).

4. Nature Conservation Evaluation

4.1 This section provides an assessment of the aquatic macroinvertebrate species and assemblage recorded in association with the Ditch, to determine their relative nature conservation value using the approach detailed in Section 2.3.3 of this report. There is no reasonable likelihood of the features present being of international nature conservation importance, so this can be discounted. This is on the basis that the site does not support any species considered notable in an international context (e.g. species for which Great Britain holds a substantial part of the international population, or species which are restricted to Great Britain).

Desk Study Records

4.2 Records of Dainty Damselfly were returned by KMBRC. Although this species does not benefit from any statutory protection, it is of note given that it was previously thought extinct in the UK and recolonised a site in north Kent in 2010 and 2011, but was not recorded thereafter.

4.3 Although it was not recorded within the field samples, unidentified juveniles and damaged individuals of the family *Coenagrionidae*, of which the Dainty Damselfly is a member, were recorded and therefore its presence within the Ditch cannot be fully discounted although is considered highly unlikely to be of this species.

Aquatic Macroinvertebrate Species and Assemblages

4.4 Although slight differences were recorded between the three sites sampled, the aquatic macroinvertebrate communities are largely comparable and as such, the assemblage and species recorded are assessed together. In addition, the sampling sites are in very close proximity to each other and therefore the dispersal of species between them is likely.

4.5 A range of notable and uncommon species were recorded within the ditch. The most notable was the Great Silver Water Beetle, which is Near Threatened. However none of the species recorded are rare, threatened or legally protected. Many of the notable species recorded are species of coastal wetlands and as such they can reasonably be expected to occur wherever there are comparable habitats, which are fairly common in the wider landscape, most notably in the nearby statutorily designated sites (refer to Section 3.1). Therefore, there are no individual species present that can be considered to be of any more than Local value.

4.6 The criteria established to allow the identification of habitats and sites of county nature conservation value does not define specific thresholds for the identification of Wildlife Sites on the basis of invertebrate communities. However, given the diverse assemblage and the large number of notable species, it is possible that the Ditch may be of District value, especially given its close proximity to statutorily designated sites of similar habitats and the likely dispersal of species between the Ditch and those sites.

4.7 However, the Ditch is not considered to be of greater than District value at this time. The desk study undertaken for the PEA identified a large number of drains and other watercourses in the local area, many associated with the international and national designated sites. Therefore the Ditch associated with the site only represents a very small proportion of the available habitat resource and habitats within the wider landscape are likely to support a similar or better aquatic macroinvertebrate assemblage.

5. Conclusions and Recommendations

5.1 The River Habitat Survey classed the Ditch as severely modified which is a consequence of being an artificial drainage channel. Despite its artificial nature, the watercourse provides habitat for a variety of notable and protected species including the near threatened Great Silver Water Beetle and aquatic invertebrate assemblage of very high conservation value (according to the CCI index).

5.2 The existing culvert is impounding water upstream of the track crossing, which appears to be beneficial for aquatic ecosystem in the Ditch as it is resulting in deeper, slow-flowing water upstream of the culvert. It is likely that without impoundment the Ditch could run dry in sections, which is evidenced at its upstream extent. It is recommended that any construction works aim to maintain a similar quantity of water in the upstream section of the Ditch comparable with the current situation.

5.3 Records of Dainty Damselfly were returned by the records centre, which has only recently recolonised the UK and has a very limited distribution in the south east of the UK; its presence within the Ditch cannot be fully discounted although is highly unlikely. Given that no direct impacts to the Ditch are proposed, in the unlikely event that this species was present on Site, they would not be impacted upon by the Proposed Development.

5.4 A range of notable and uncommon species were recorded within the Ditch and CCI scores indicate that it is of very high conservation value. However none of the species recorded are rare, threatened or legally protected. Given that across the wider landscape there are a number of similar waterbodies and habitats, many within the international and national designated sites, this Ditch is considered to only represent a very small proportion of the available habitat resource and these are likely to support a similar or better aquatic macroinvertebrate assemblage. As such it is judged that the Ditch is of District value for its aquatic macroinvertebrate assemblage, and therefore the existing habitats should be protected and retained through the course of the proposed works. This will include retaining the existing culvert beneath the access track, and therefore the impoundment behind it.

5.5 If possible, works should be limited to the western side of the Ditch and access track, including excavation, spoil storage, vehicle movements etc., and thereby direct and indirect impacts to the Ditch avoided.

5.6 Due to the high biological water quality and value of the Ditch, pollution prevention measures such as temporary silt fencing, Sustainable Drainage System (SuDS) features and attenuation ponds are recommended for construction works. Further mitigation measures to limit and/or prevent any potential impacts during construction and operation will be provided in the impact assessment.

6. References

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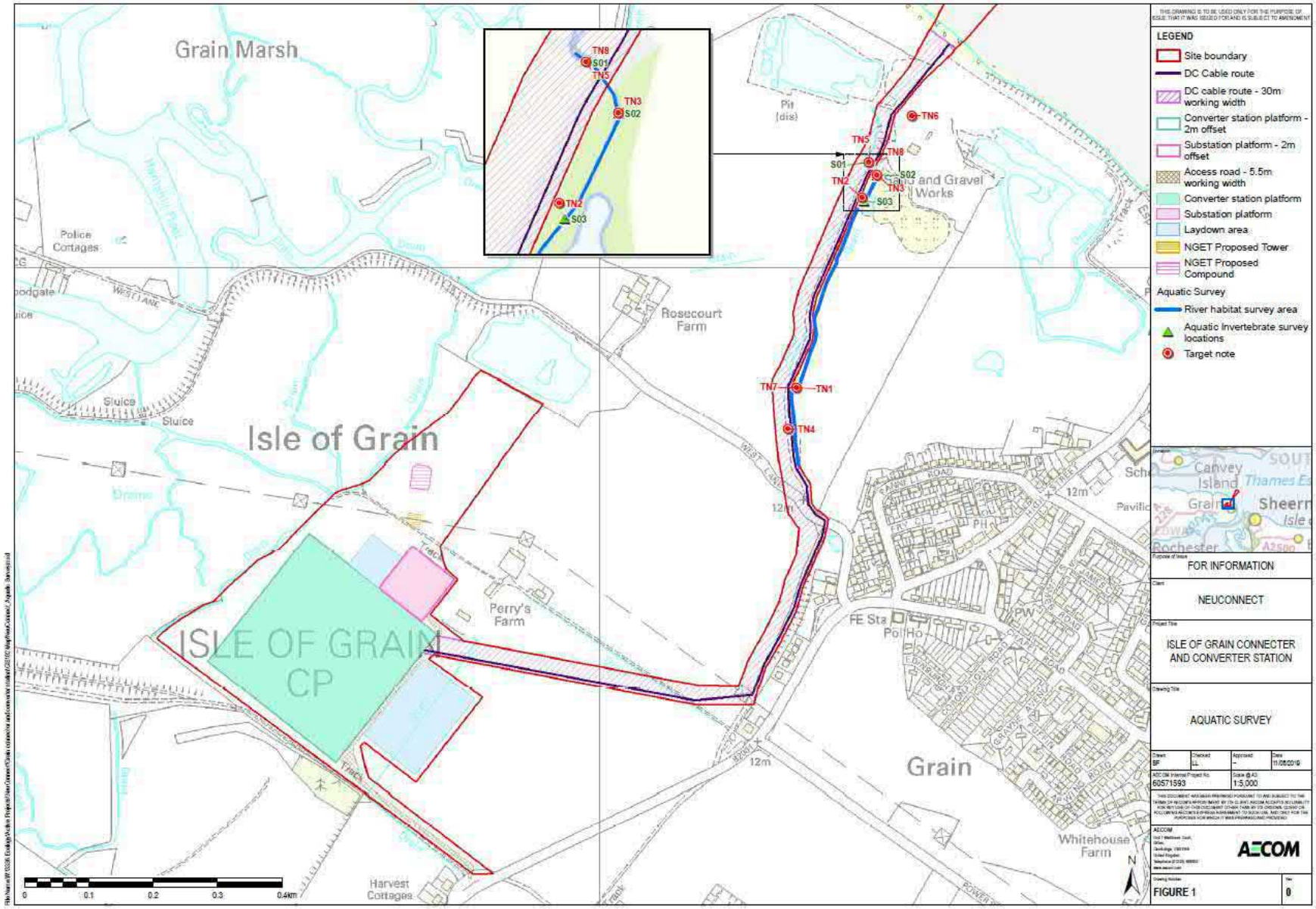
Appendix A Site Plan


Grain Marsh
Isle of Grain
ISLE OF GRAIN CP
Grain
Police Cottages
Sluice
Sluice
Rosecourt Farm
Perry's Farm
Harvest Cottages
Whitehouse Farm
Pit (dis)
Sand and Gravel Works
FE Sta
Pol Ho
TN1
TN2
TN3
TN4
TN5
TN6
TN7
TN8
S01
S02
S03
12m
0
0.1
0.2
0.3
0.4km
N
LEGEND
Site boundary
DC Cable route
DC cable route - 30m working width
Converter station platform - 2m offset
Substation platform - 2m offset
Access road - 5.5m working width
Converter station platform
Substation platform
Laydown area
NGET Proposed Tower
NGET Proposed Compound
Aquatic Survey
River habitat survey area
Aquatic Invertebrate survey locations
Target note
FOR INFORMATION
NEUCONNECT
ISLE OF GRAIN CONNECTER AND CONVERTER STATION
AQUATIC SURVEY
60571593
1:5,000
AECOM
FIGURE 1
0

Appendix B Target Notes

Target Note	Description	Grid Reference
TN1	Badger *Meles meles* sett	TQ 88305 76813
TN2	Water vole *Arvicola amphibius* latrine	TQ 88407 77108
TN3	Great silver diving water beetle *Hydrophilus piceus*	TQ 88430 77143
TN4	Common lizard *Zootoca vivipara*	TQ 88292 76749
TN5	Smooth newt *Lissotriton vulgaris*	TQ 88415 77143
TN6	Cuckoo *Cuculus canorus*	TQ 88484 77235
TN7	Reed warbler *Acrocephalus scirpaceus* nest	TQ 88305 76813
TN8	Marsh frog *Pelophylax ridibundus*	TQ 88415 77143
TN9	Dragonflies/damselflies	Various locations across the Site

Appendix C Appendix C Whalley, Hawkes, Paisley & Trigg (WHPT) Metric

There are approximately 4,000 species of aquatic macroinvertebrates in the British Isles. To simplify the analysis of the samples and the data we do not identify individual species but only the major types (taxa), mostly at the family taxonomic level. A key piece of information is the number of different taxa at a site. A fall in the number of taxa indicates ecological damage, including pollution (organic, toxic and physical pollution such as siltation, and damage to habitats or the river channel).

The WHPT scoring system (WFD-UKTAG, 2014) is based upon the sensitivity of macroinvertebrate families to organic pollution. It replaces the Biological Monitoring Working Party (BMWP) system (Hawkes, 1997) previously used in the UK.

The WHPT system assigns a numerical value to about 100 different taxa (known as the WHPT-scoring taxa) according to their sensitivity to organic pollution. In addition to the presence of macroinvertebrate taxa at a sampling site, as in the BMWP scoring system, the WHPT system also uses another type of information, this being the abundances of different scoring taxa.

Taxa abundances are classified in four categories (Class 1: 1 to 10 individuals, Class 2: 11 to 100 individuals, Class 3: 101 to 1,000 individuals, and Class 4: > 1,000 individuals). A score (Pressure Sensitivity Scores (PSs) is then assigned to each taxa, depending of the taxa sensitivity and abundances recorded.

The total WHPT score for a sample corresponds to the sum of PSs of scoring taxa recorded. The Average Score Per Taxon (ASPT) values are calculated as the Sum PSs divided by the number of scoring taxa (NTAXA). As such, three metrics are calculated:

- WHPT score
- NTAXA
- ASPT

Some animals are more susceptible to organic pollution than others, and the presence of sensitive species indicates good water quality. This fact is taken into account by the WHPT metrics.

The most useful way of summarising the biological data was found to be one that combined the number of taxa and the ASPT. The best quality is indicated by a diverse variety of taxa, especially those that are sensitive to pollution. Poorer quality is indicated by a smaller than expected number of taxa, particularly those that are sensitive to pollution. Organic pollution sometimes encourages an increased abundance of the few taxa that can tolerate it. However, maximum achievable values will vary between geological regions. For example, pristine lowland streams in East Anglia will always score lower than pristine Welsh mountain streams because they are unable to support many of the high-scoring taxa associated with fast flowing habitat. WHPT scores and ASPT for different types watercourse are dependent on the quality and diversity of habitat, natural water chemistry (associated with geology, distance from source etc.), altitude, gradient, time of year the sample was taken and other factors.

Appendix D Community Conservation Index (CCI)

The Community Conservation Index (Chadd & Extence, 2004) allows a classification of the nature conservation value associated with a macroinvertebrate community. The CCI score for one sample is derived from individual Conservation Scores (CS), assigned to some species of aquatic macroinvertebrates and relating closely to the available published Red Data Books (Bratton, 1991a, 1991b; Shirt, 1987). Conservation Scores assigned to individual species vary from 1 to 10, as detailed on the Table B1 below. The derived CCI scores generally vary from 0 to > 20, as detailed in the Table B2 below. The Table B3 below provides a guide to interpreting CCI scores.

Table D1: Conservation Scores from the Community Conservation Index (from Chadd & Extence, 2004)

Conservation Score	Relation to Red Data Books
10	RDB1 (Endangered)
9	RDB2 (Vulnerable)
8	RDB3 (Rare)
7	Notable (but not RDB status)
6	Regionally notable
5	Local
4	Occasional (species not in categories 10-5, which occur in up to 10% of all samples from similar habitats)
3	Frequent (species not in categories 10-5, which occur in up to >10-25% of all samples from similar habitats)
2	Common (species not in categories 10-5, which occur in up to >25-50% of all samples from similar habitats)
1	Very common (species not in categories 10-5, which occur in up to >50-100 % of all samples from similar habitats)

Table D2 - General guide to CCI scores (from Chadd & Extence, 2004)

CCI Score	Description	Interpretation
0 to 5.0	Sites supporting only common species and/or community of low taxon richness	Low conservation value
> 5.0 to 10.0	Sites supporting at least one species of restricted distribution and/or a community of moderate taxon richness	Moderate conservation value
> 10.0 to 15.0	Sites supporting at least one uncommon species, or several species of restricted distribution and/or a community of high taxon richness	Fairly high conservation value
> 15.0 to 20.0	Sites supporting several uncommon species, at least one of which may be nationally rare and/or a community of high taxon richness	High conservation value
> 20.0	Sites supporting several rarities, including species of national importance and/or a community of very high taxon richness	Very high conservation value

Appendix E Appendix E Lotic-Invertebrate Index for Flow Evaluation (LIFE)

The Lotic-Invertebrate Index for Flow Evaluation (LIFE) provides an assessment of the impact of variable flows on benthic macroinvertebrate communities. Under the assessment, individual species of aquatic macroinvertebrates are assigned to a flow group varying from I to VI, as detailed on the Table C1 below. The LIFE score for a macroinvertebrate sample is then derived (mean of individual scores) from individual species scores and abundances, as detailed on the Table C3 below. LIFE scores for a macroinvertebrate sample ranges from 1 to 12, where highest scores describe communities adapted to rapid flows.

Table E1: Flow groups used to derive LIFE scores (from Extence, Balbi and Chadd, 1999)

LIFE score Group	Description	Mean current velocity
I	Taxa primarily associated with rapid flows	Typically > 100 $cm.s^{-1}$
II	Taxa primarily associated with moderate to fast flows	Typically 20 to 100 $cm.s^{-1}$
III	Taxa primarily associated with slow or sluggish flows	Typically < 20 $cm.s^{-1}$
IV	Taxa primarily associated with (usually slow) and standing waters	
V	Taxa primarily associated with standing waters	
VI	Taxa frequently associated with drying or drought impacted sites	

Table E2: Abundance categories used to derive LIFE scores (from Extence, Balbi and Chadd, 1999)

Abundance category	Description
A	1 to 9
B	10 to 99
C	100 to 999
D	1000 to 9999
E	> 10000

Table E4: A guide to interpreting LIFE scores (from Extence, Balbi and Chadd, 1999)

Flow groups	Abundance categories			
	A	B	C	D/E
I	9	10	11	12
II	8	9	10	11
III	7	7	7	7
IV	6	5	4	3
V	5	4	3	2
VI	4	3	2	1

Appendix F Appendix F Proportion of sediment-sensitive invertebrates (PSI)

The Proportion of Sediment-sensitive Invertebrates (PSI) index (Extence et. Al, 2013) provides an assessment of the extent to which the river bed is composed of, or covered by, fine sediments.

Under the assessment, individual species of aquatic macroinvertebrates are assigned a Fine Sediment Sensitivity Rating (FSSR) raging from A to B, as detailed in the Table D1 below. The PSI score for a macroinvertebrate sample is then derived from individual species scores and abundances, as detailed on the Table D2 below. The PSI score corresponds to the percentage of fine sediment-sensitive taxa present in a sample. PSI score for a sample ranges from 0 to 100 where lowest scores correspond to watercourses with high fine sediment cover.

Table F1 Fine Sediment Sensitivity Rating (FSSR) groups used to derive PSI scores (from Extence et al., 2013)

FSSR group	Description
A	Highly sensitive
B	Moderately insensitive
C	Moderately insensitive
D	Highly insensitive

Table F2 Abundance categories used to derive PSI scores (from Extence, et al., 2013)

FSSR group	Abundance			
	1-9	10-99	100-999	>999
A	2	3	4	5
B	1	2	3	4
C	1	2	3	4
D	2	3	4	5

Table F3 Interpretation of PSI scores (from Extence et al., 2013)

PSI	Description
81-100	Minimally sedimented
61-80	Slightly sedimented
41-60	Moderately sedimented
21-40	Sedimented
0-20	Heavily sedimented

Appendix G River Habitat Survey Forms

River Habitat Survey Data for Site 3

A FIELD SURVEY DETAILS

Site reference:	Isle of Grain
CoordinateSystem:	OSGB36 (British National Grid)
Spot-check 1 coordinates:	TQ8841077157
Spot-check 6 coordinates:	TQ8833276916
End of site coordinates:	TQ8830876692
Reach Reference:	Unnamed ditch
River name:	Unnamed Ditch
Date:	02/05/2019 13:11
Surveyor Name:	Pete Cowley
Surveyor code:	FA061

Project Name:

Is the site part of a river or an artificial channel?: ARTIFICIAL

Are adverse conditions affecting survey?: ○ Yes ◉ No

If yes, state:

Is bed of river visible?: PARTIALLY

Is health and safety assessment form attached?: YES

Number of photographs taken: 22

Photo references: See project folder

Site surveyed from: BOTH BANKS

B PREDOMINENT VALLEY FORM (within the horizon limit)

○ shallow vee ○ concave/bowl ◉ No obvious valley sides

○ deep vee ○ asymmetrical floodplain

○ gorge ○ U-shaped valley

Distinct flat valley bottom?: YES

Terraced valley floor?: NO

C NUMBER OF RIFFLES, POOLS AND POINT BARS (indicate total number)

Riffle(s): 0 Pool(s): 0 Unvegetated point bar(s) 0 Vegetated point bar(s) 0

D ARTIFICIAL FEATURES (indicate total number or tick appropriate box)

If none, tick box ☐

	Maior	Intermediate	Minor		Major	Intermediat	Minor
Weirs/sluices	0	0	0	Outfalls/intakes	0	0	1
Culverts	1			Fords	0	0	0
Bridges	0	0	0	Deflectors/groynes/croys	0	0	0
Other					0	0	0

Is channel obviously realigned? YES, >=33%

Is channel obviously over-deepened? YES, >=33%

Is water impounded by weir/dam? YES, <33%

RHS report for site 3, 08/05/2019 Page 1

H LAND USE WITHIN 50m OF BANKTOP Use *(present) or E (> 33% banklength)

	L	R		L	R		L	R
Broadleaf/mixed woodland (semi-natural)	PRESE	EXTEN	Moorland/heath	NONE	NONE	Rock and scree	NONE	NONE
Broadleaf/mixed plantation	NONE	NONE	Artificial open water	PRESEN	PRESE	Suburban/urban development	EXTENSI	PRESE
Coniferous woodland (semi-natural)	NONE	NONE	Natural open water	NONE	NONE	Tilled land	NONE	NONE
Coniferous plantation	NONE	NONE	Rough pasture	PRESEN	NONE	Irrigated land	NONE	NONE
Scrub	EXTEN	EXTEN	Improved/semi-improved grass	NONE	NONE	Parkland or gardens	NONE	NONE
Orchard	NONE	NONE	Tall herbs rank vegetation	EXTENS	EXTEN	Not visible	NONE	NONE
Wetland (eg bog,marsh,fen)	NONE	NONE						

I BANK PROFILES Use *(present) or E (> 33% banklength)

Natural/unmodified	L	R	Artificial/modified	L	R		L	R
Vertical/undercut	NONE	NONE	Resectioned	EXTENS	EXTENSI	Embanked	EXTEN	EXTEN
Vertical + toe	NONE	NONE	Reinforced - whole bank	NONE	NONE	Set-back embankments	NONE	NONE
Steep (>45)	NONE	NONE	Reinforced - top only	NONE	NONE			
Gentle	NONE	NONE	Reinforced - toe only	NONE	NONE			
Composite	NONE	NONE	Artificial two-stage	NONE	NONE			
Natural berms	NONE	NONE	Poached	NONE	NONE			

J EXTENT OF TREES AND ASSOCIATED FEATURES (tick one box per feature) *record even if <1%

Left	Occasional clumps	Right	Semi-continuous	Shading of channel	PRESENT	* Overhanging boughs	NONE
* Exposed bankside roots	NONE	* Underwater tree roots	NONE	Fallen trees	NONE	Large woody debris	PRESENT

K EXTENT OF CHANNEL FEATURES (tick one box per feature) *record even if <1%

* Free fall	NONE	Smooth flow	PRESE	Exposed bedrock	NONE	Unvegetated side bar(s)	NONE
Chute	NONE	No perceptible flow	EXTEN	Exposed boulders	NONE	Vegetated side bar(s)	NONE
Broken standing waves	NONE	No flow	NONE	Vegetated Bedrock Or Boulders	NONE	Unvegetated Point Bar(s)	NONE
Unbroken standing waves	NONE	Marginal deadwater	NONE	Unvegetated mid-channel bar(s)	NONE	Vegetated Point Bar(s)	NONE
Rippled flow	PRESE	Eroding Cliffs	PRESE	Vegetated mid-channel bar(s)	NONE	* Discrete unvegetated silt deposit(s)	NONE
* Upwelling	NONE	Stable Cliffs	PRESE	Mature island(s)	NONE	* Discrete unvegetated sand deposit(s)	NONE
						* Discrete unvegetated gravel deposit(s)	NONE

E PHYSICAL ATTRIBUTES (to be assessed across channel within a 1m wide (transect)

Spot check 1 is at DOWNSTREAM END *Additional substrate* P, SA, CO

Description	1	2	3	4	5	6	7	8	9	10	Catch All
Left Bank Material	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	
Left Bank Modification	RS	EM	RS	RS	RS	RS	RS	RS	RS	RS	
Left Bank Modification #2	EM	RS	EM	EM	EM	EM	EM	EM			
Left Bank Modification #3											
Left Bank Modification #4											
Left Bank Features	NO	SC	NO	NO	NO	NO	NO	EC	EC	NO	
Left Bank Features #2											
Left Bank Features #3											
Channel Substrate	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	
Flow Type	NP	NP	NP	NP	NP	NP	NP	NP	RP	NP	
Channel Modification(s)	RS	RS	RS	RS	RS	RS	RS	RS	RS	RS	
Channel Modification(s) #2											
Channel Feature(s)	NO	NO	NO	NO	NO	NO	NO	RO	NO	NO	
Channel Feature(s) #2											
Channel Feature(s) #3											
Number of sub-channels											
Right Bank Material	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	
Right Bank Modification	RS	RS	RS	RS	RS	RS	RS	RS	RS	RS	
Right Bank Modification #2	EM		EM					EM	EM	EM	
Right Bank Modification #3											
Right Bank Modification #4											
Right Bank Features	EC	NO	SC	NO	NO	NO	NO	NO	NO	SC	
Right Bank Features #2											
Right Bank Features #3											
Land use within 5m of bank top (Left)	BL	TH	SH	TH	SH	SH	TH	SH	TH	SH	
Left bank-top vegetation structure	C	S	S	S	S	S	S	S	S	S	
Left bank face vegetation structure	C	S	S	S	S	S	S	U	U	S	
Right bank face vegetation structure	S	S	S	U	U	S	S	S	S	S	
Right bank-top vegetation structure	S	S	S	S	S	S	S	S	S	S	
Land use within 5m of bank top (Right)	SH	SH	SH	SH	SH	SH	SH	SH	SH	SH	
Channel Vegetation: NONE											
Bryophytes/lichens	N	N	N	N	N	N	N	N	N	N	N
Emerg broad-leaved herbs	N	N	N	N	N	N	N	N	N	N	P
Emerg reeds/sedges/rushes	E	P	E	E	E	E	E	E	E	E	E
Floating-leaved (rooted)	N	N	N	N	N	N	N	N	N	N	N
Free-floating	N	N	N	N	N	N	N	N	N	N	N
Amphibious	N	N	N	N	N	N	N	P	N	N	P
Submerged broad-leaved	N	N	N	N	N	N	N	N	N	N	N
Submerged linear-leaved	N	N	N	N	N	N	N	N	N	N	N
Submerged fine-leaved	N	N	N	N	N	N	N	N	N	N	N
Filamentous Algae	E	E	N	P	P	N	N	P	N	N	P

L CHANNEL DIMENSIONS (to be measured at one side on a straight uniform section, preferably across a riffle)

Left banktop height (m)	1.50	Bankfull width (m)	3.00	Right banktop height (m)	2.00
Left banktop height is also bankfull height? (Y or N)	YES	Water width (m)	1.00	Right banktop height is also bankfull height? (Y or N)	NO
Left embanked height (m)	0.00	Water depth (m)	0.10	*Right embanked height (m)*	0.50

If trashline lower than banktop , indicate height above water (m) *and width from bank to bank (r*

Bed material at site is consolidated ○ unconsolidated ◉ unknow ○ missing value ○

Location of measurement is: OTHER *Other state* Uniform section

M FEATURES OF SPECIAL INTEREST Use (present) or E (> 33% banklength) *record even if <1%

If none, tick box ☐

Braided channels	NONE	Very large boulders (>1m)	NONE	Backwater(s)	NONE	Marsh(es)	NONE
Side channels	NONE	* Debris dams	NONE	Floodplain boulder deposits	NONE	Flush(es)	NONE
* Waterfalls > 5m high	NONE	* Leafy debris	PRESE	Water meadow(s)	NONE	Natural open water	NONE
* Waterfalls < 5m high	NONE	Fringing reed bank(s)	NONE	Fen(s)	NONE	Other	PRESE
Natural cascade(s)	NONE	Quaking bank(s)	NONE	Bog(s)	NONE	*State:*	Artificial open water - sand and
		*Sink hole(s)	NONE	Wet woodland(s)	NONE		

N CHOKED CHANNEL (tick one box)

Is 33% or more of the channel choked with vegetation? Yes

O NOTABLE NUISANCE PLANT SPECIES

If none, tick box ☐

Hogweed banktop	NONE	Himalayan Balsam banktop	NONE	Japanese Knotweed banktop	NONE	Other banktop	NON
Hogweed bankface	NONE	Himalayan Balsam bankface	NONE	Japanese Knotweed bankface	NONE	Other bankface	NON

Other name:

P OVERALL CHARACTERISTICS (Add appropriate words)

Major impacts:	Culverting, Dredging, Embankments, Realignment
Recent management	None
Animals:	Badger, Cuckoo, Dragon/Damselflies, Frog Marsh, Great Silver Divin

COMMENTS:

Badger sett located at spot check 9. Smooth newt present at spot check 1.

Q ALDERS (tick appropriate box(es))

Alders? NONE Diseased Alders? NONE

Map Data

Altitude (m):	7
Slope (m/km):	4
Distance to source (km):	0
Height of source (m):	9
Solid geology:	
Drift geology:	
Planform:	
Tributary:	No
Navigation:	No
Qmed (cubic-m/s):	

PCA1:	-1.1622
PCA2:	-2.6785
PCA3:	0.3953
PCA4:	-0.4559

Mid-site easting:	588332
Mid-site northing:	176916
Latitude SC1:	51.46
Longitude SC1:	0.71
Latitude SC6:	51.46
Longitude SC6:	0.71
Latitude end of site:	51.46
Longitude end of site:	0.71

Photographs

Photograph File Name	Photo link	Description
Unnamed Ditch, Isle of Grain_201905	C:\River Habitat Survey\Isle of Grain\Unname	
Unnamed Ditch, Isle of Grain_201905	C:\River Habitat Survey\Isle of Grain\Unname	
Unnamed Ditch, Isle of Grain_201905	C:\River Habitat Survey\Isle of Grain\Unname	
Unnamed Ditch, Isle of Grain_201905	C:\River Habitat Survey\Isle of Grain\Unname	

RHS indices

Habitat Modification Score	
Habitat Modification Class:	5
Habitat Modification Score:	3960
HMS Culverts subscore:	400
HMS Reinforced Bank Bed subscore:	0
HMS Resectioned Bank Bed subscore:	2800
HMS Realigned subscore:	400
HMS Berms Embankments subscore:	260
HMS Weirs dams and sluices subscore:	75
HMS Bridges subscore:	0
HMS Poaching subscore:	0
HMS Fords subscore:	0
HMS Outfall/ Deflector subscore:	25

Hydromorphological Indices			
Channel Substrate Index:	-2.3280	CSI Weight:	10
Geomporphic Activity Index:	-0.4170	GAI Weight:	10
Flow Regime Index:	-1.0330	FRI Weight:	10
Chanel Vegetation Index:	-0.4170	CVI Weight:	10
Banktop Vegetation Index:	0.5300	BTV Weight:	20
Bankface Vegetation Index:	0.1320	BFV Weight:	20

Stream Power (Watts/m):	
Specific Stream Power (Watts/m2):	
Shear stress (Newtons/m2):	30.3
Width/depth ratio:	1.88

Habitat Quality Assessment	
HQA Score:	42
HQA 1994 adjusted:	39
Baseline HQA class:	
HQA class position:	
River Habitat Quality class:	
HQA flow type 95-97:	6
HQA flow type 94:	5
HQA channel substrate:	4
HQA channel features:	0
HQA bank features:	6
HQA bank vegetation structure:	12
HQA channel vegetation 95-97:	4
HQA channel vegetation 94:	3
HQA land use:	3
HQA trees:	6
HQA special features 95-97:	1

Riparian Quality Index	
Riparian Quality Index class:	2
Riparian Quality Index score:	77
Complexity subscore:	37
Naturalness subscore:	20
Continuity subscore:	20

Appendix H Aquatic Macroinvertebrate Data

Family	Species	BMWP score	WHPT score	Conservation Score	Flow group	FSSR Score	Site 01	Site 02	Site 03
Mites									
Hydracarina		-	-					1	
Mayflies									
Baetidae	Baetidae (juvenile / damaged)	4	5.5		II	A	1		
Damselflies									
Coenagrionidae	Coenagrionidae (juvenile / damaged)	6	3.5		IV	D	2	8	
Coenagrionidae	*Ischnura elegans*	6	3.5	1	IV			2	
Dragonflies									
Libellulidae	Libellulidae (juvenile / damaged)	8	4.1		IV	C		1	
True bugs									
Veliidae	Veliidae (nymph / damaged)	-	4.5		IV			3	1
Nepidae	*Nepa cinerea*	5	2.9	3	V	D	2		
Pleidae	*Plea minutissima*	5	3.3	4	IV		3	4	1
Corixidae	Corixidae (nymph / damaged)	5	3.8		IV	D	14		1
Corixidae	*Hexperocorixa linnei*	5	3.8	4	V	D		4	
Corixidae	*Sigara lateralis*	5	3.8	2	V	D	1	1	
Notonectidae	Notonectidae (nymph / damaged)	5	3.4		IV		27	10	
Notonectidae	*Notonecta glauca*	5	3.4	1	IV		4		
Beetles									
Haliplidae	*Haliplus lineaticollis*	5	3.6	1	III	C	8	1	
Haliplidae	*Haliplus ruficollis*	5	3.6	1	V	D		1	

Family	Species	BMWP score	WHPT score	Conservation Score	Flow group	FSSR Score	Site 01	Site 02	Site 03
Haliplidae	*Haliplus ruficollis* group	5	3.6						2
Gyrinidae	Gyrinidae (larvae / damaged)	5	8.2		IV		1		
Dytiscidae	Dytiscidae (larvae / damaged)	5	4.5		IV	D	9	15	5
Dytiscidae	*Liopterus haemorrhoidalis*	5	4.5	4		D		1	
Dytiscidae	*Laccophilus minutus*	5	4.5	2	IV	D	33		
Dytiscidae	*Hygrotus inaequalis*	5	4.5	2	IV	D	20		
Dytiscidae	*Hygrotus impressopunctatus*	5	4.5	4	V	D			1
Dytiscidae	*Hygrotus parallelogrammus*	5	4.5	7	V	D	2		
Dytiscidae	*Hydroporus sp.*	5	4.5			D	1		
Dytiscidae	*Hydroporus planus*	5	4.5	2	V	D	1		
Dytiscidae	*Agabus bipustulatus*	5	4.5	1	IV	D	1		
Dytiscidae	*Agabus conpersus*	5	4.5	7	V	D		1	
Dytiscidae	*Agabus nebulosus*	5	4.5	1	V	D	2		
Dytiscidae	*Ilybius fuliginosus*	5	4.5	1	IV	C	1		
Dytiscidae	*Rhantus suturalis*	5	4.5	5	V	D	1		
Dytiscidae	*Acilius sulcatus*	5	4.5	5	V		2		
Dytiscidae	*Dytiscus circumflexus*	5	4.5	7	V	D	1	1	
Noteridae	*Noterus clavicornis*	5	3.2	2		D	2	3	
Hydrophilidae	Hydrophilidae (larvae / damaged)	5	6.2		IV	D		5	
Hydrophilidae	*Helophorus sp.*	5	6.2			D	3		
Hydrophilidae	*Helophorus alternans*	5	6.2	7	V	D	12	7	
Hydrophilidae	*Helophorus grandis*	5	6.2	2	IV	D			1
Hydrophilidae	*Helophorus minutus*	5	6.2	2	V	D	33		
Hydrophilidae	*Coelostoma orbiculare*	5	6.2	5	VI	D	1	1	

Family	Species	BMWP score	WHPT score	Conservation Score	Flow group	FSSR Score	Site 01	Site 02	Site 03
Hydrophilidae	*Hydrobius fuscipes*	5	6.2	1	V	D	42	1	5
Hydrophilidae	*Limnoxenus niger*	5	6.2	7	V	D	10	3	2
Hydrophilidae	*Anacaena bipustulata*	5	6.2	5	IV	D	1	1	
Hydrophilidae	*Laccobius sp.*	5	6.2			D	13		
Hydrophilidae	*Laccobius bipunctatus*	5	6.2	2	VI	D	1		
Hydrophilidae	*Laccobius minutus*	5	6.2	2	V	D	3	7	2
Hydrophilidae	*Helochares lividus*	5	6.2	5	V	D	1		1
Hydrophilidae	*Enochrus testaceus*	5	6.2	3	IV	D		1	
Hydrophilidae	*Cymbiodita marginella*	5	6.2	5	V	D		2	1
Hydrophilidae	*Hydrophilus piceus*	5	6.2	8	V	D		1	
Hydrophilidae	*Berosus sp.*	5	6.2		V	D	13	95	
Hydrophilidae	*Berosus affinis*	5	6.2	7	V	D	7		
Hydrophilidae	*Berosus signaticollis*	5	6.2	7	V	D			1
Scirtidae	Scirtidae (larvae / damaged)	5	6.9		IV	B		1	
Curculionidae	Curculionidae	-	-				3		
Chrysomelidae	Chrysomelidae	-	-				1		
Caddisflies									
Limnephilidae	Limnephilidae (juvenile / damaged)	7	6.2		IV	B		1	
Limnephilidae	*Limnephilus sp.*	7	6.9			C		10	
Limnephilidae	*Limnephilus marmoratus*	7	6.9	2	V	C		21	
Leptoceridae	Leptoceridae (juvenile / damaged)	10	6.7		IV		1		
Leptoceridae	*Athripsodes aterrimus*	10	6.7	1	IV	D		1	
Trueflies									
Chironomidae	Chironomidae (damaged / pupea)	2	1.1				360		6

Family	Species	BMWP score	WHPT score	Conservation Score	Flow group	FSSR Score	Site 01	Site 02	Site 03
Chironomidae	Tanypodinae	2	1.1					35	83
Chironomidae	Orthocladiinae	2	1.1					138	12
Chironomidae	Chironomini	2	1.1					33	68
Tipulidae	*Tipula sp.*	5	5.9		IV	B	3		
Limoniidae	Limoniidae	5	5.9			B	26	18	6
Simuliidae	*Simulium* sp.	5				B	1		
Dixidae	*Dixella* sp.	-	7.0				4	5	
Psychodidae		-	4.4			D	1	1	
Ceratopogonidae		-	5.5					1	1
Stratiomyidae	Stratiomyidae	-	3.6			C	14	36	10
Stratiomyidae	*Stratiomys* sp.	-	3.6			D			3
Ptychopteridae	*Ptychoptera sp.*	-	6.4		II	D		1	
Tabanidae		-	7.1			D	4	21	2
Chaoboridae		-	3.0		V		6	1	
Ephydridae		-	4.4				2	4	3
Other Taxa									
Lepidoptera		-	-					1	
Collembola		-	-				1		
WHPT score							**97.3**	**111.8**	**53.4**
ASPT (WHPT)							**4.6**	**4.9**	**4.5**
PSI Score (species)							**3.2**	**0.0**	**0.0**
LIFE Score (species)							**5.0**	**5.3**	**5.2**
CCI Score							**24.0**	**37.6**	**28.8**
Total number of taxa							**50**	**45**	**23**

Family	Species	BMWP score	WHPT score	Conservation Score	Flow group	FSSR Score	Site 01	Site 02	Site 03
Total Number of species							**26**	**21**	**10**

Appendix 6.I – Report on Survey for Bats

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement

Appendix 6I – Report on Survey for Bats

NeuConnect Britain Ltd

September 2019

Quality information

Prepared by	Checked by	Verified by	Approved by
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Table of Contents

Figures

Tables

1. Introduction

1.1 In 2018, AECOM undertook a Preliminary Ecological Appraisal (PEA) on behalf of Neuconnect Britain Ltd (the 'Applicant'). This PEA survey identified the need for follow-up ecological surveys to determine the potential impacts of the NeuConnect project (hereafter known as the 'Proposed Development') on protected and, or notable species. Therefore, AECOM was instructed to undertake further surveys for the presence or absence of roosting bats and to determine whether the site was used by bats for foraging and, or commuting, as recommended in the PEA report (AECOM, 2019[1]). The PEA identified one building with low potential for bat roosts, an old barn (Photo 1), outside of the Proposed Development area. There were no other buildings or structures within the Proposed Development area and none of the trees were found to have bat roost potential.

Proposed Development

1.2 NeuConnect (the Project) is a 1,400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between the energy networks in Great Britain and Germanywith electricity being passed in either direction between Great Britain and Germany. The Project will be formed by approximately 700 kilometres (km) of subsea and underground High Voltage Direct Current (HVDC) cables, with an on-shore converter station at either end linking into the existing electricity grids in Great Britain and Germany.

1.3 The Proposed Development will comprise of three structures, a converter station, sub-station and a direct current (DC) cable route (see Figure 1).

1.4 The footprint of the proposed converter station to the perimeter security fence is expected to be up to approximately 250 metres (m) by 250 m, with a maximum height of up to 26 m.

1.5 The footprint of the proposed substation to the perimeter security fence is expected to be approximately 80 m by 80 m with a maximum height of 14 m.

1.6 The proposed DC cable corridor will be approximately 1.6 km long (from landfall to the converter station). The preferred installation method will be underground, which will result in a temporary loss of land during installation. The working corridor for the installation of the cable corridor will be 30 m.

1.7 Additional laydown areas will be required for construction, comprising 1.5 hectares (ha) for the converter laydown and 0.3 ha for the substation laydown.

Site Description

1.8 The Proposed Development area (the Site) is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The Site is located to the west of the village of Grain, Isle of Grain, Kent, at Ordnance Survey (OS) central grid reference TQ 88205 76727. Land use comprises a mix of industrial development to the south, the small settlement of Grain to the south-east and undeveloped land to the north (along the coastline) and to the west, much of which is designated for ecological interests. Land within the Site and in the immediate vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill.

1.9 Figure 1 shows the site boundary (red-line), the cable corridor (purple line) and proposed location of each structure.

[1] AECOM, Neuconnect, Isle of Grain: Preliminary Ecological Appraisal Report, 2019

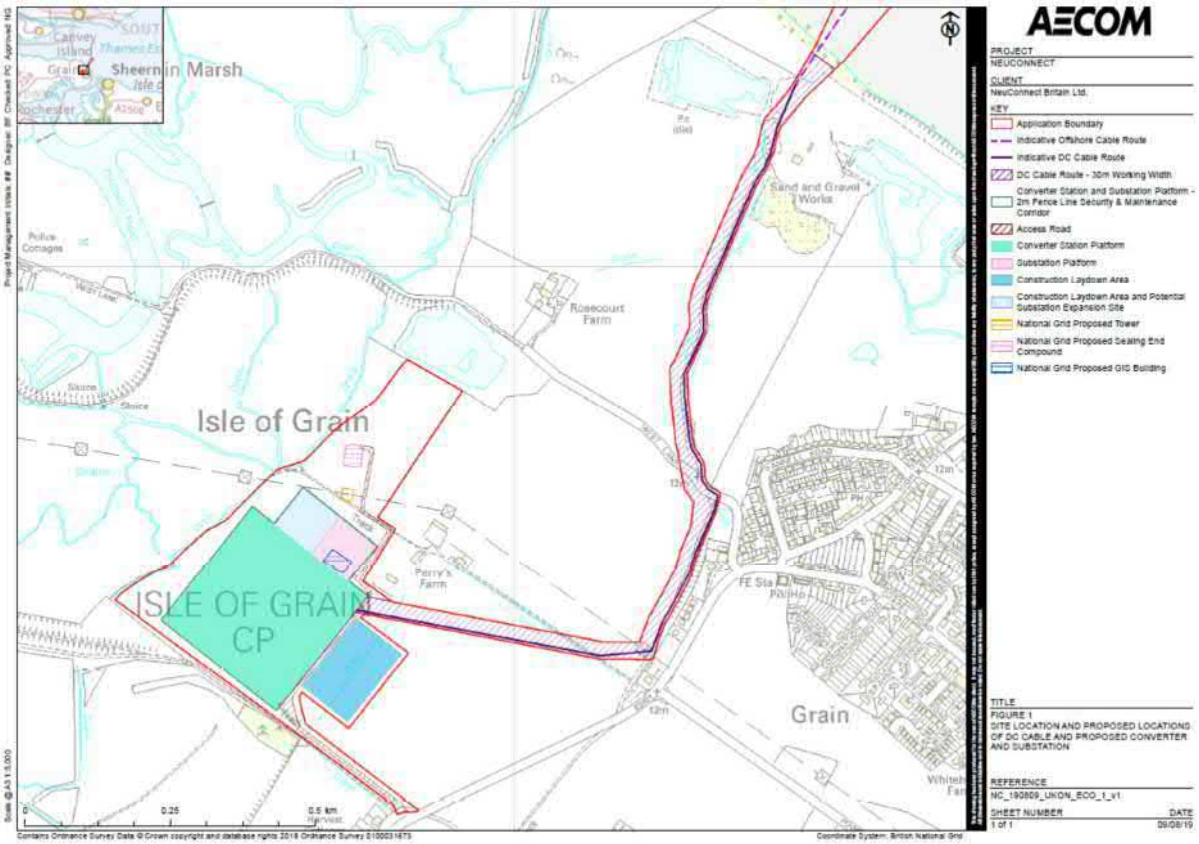

Figure 1 - Site boundary and proposed locations of DC cable corridor, converter station and substation.

Survey Area

1.10 The survey area included all habitats within the Site boundary and a 100 m buffer, considered as being potentially suitable for roosting and, or foraging and commuting bats.

Scope of Report

1.11 The objectives of the bat surveys, reported in this document, are to determine the:

- presence and assemblage of bat species within 100 m of the Site boundary;
- extent and pattern of use of the Site by roosting, commuting and foraging bat species; and
- potential impacts of the Proposed Development on bats and any subsequent mitigation.

2. Legislative and Policy Framework

Legislative Framework

2.1 All bat species and their roosts are legally protected in the UK under the Habitats Regulations, which implements the EC Directive 92/43/EEC (the Habitats Directive)[2]. In addition, Barbastelle *Barbastellus barbastellus*, Lesser Horseshoe *Rhinolophus hipposideros*, Greater Horseshoe *Rhinolophus ferrumequinum* and Bechstein's *Myotis bechsteinii* bat are listed in Annex II of the Habitats Directive, which requires sites to be designated in member states for their protection. Bats and their roosts are also protected under the Wildlife and Countryside Act 1981 (the WCA)[3].

2.2 Taken together, the Habitats Regulations and the WCA make it illegal to:

- deliberately capture or intentionally take a bat;
- deliberately or intentionally kill or injure a bat;
- be in possession or control of any live or dead bat or any part of, or anything derived from a bat;
- damage or destroy a breeding site or resting place of a bat;
- intentionally or recklessly obstruct access to any place that a bat uses for shelter or protection;
- intentionally or recklessly disturb a bat while it is occupying a structure or place that it uses for shelter or protection; and
- deliberately disturb bats, in particular any disturbance which is likely to (i) impair their ability to survive, breed, reproduce or to rear or nurture their young; or in the case of hibernating or migratory species, to hibernate or migrate; or (ii) to affect significantly the local distribution or abundance of the species to which they belong.

2.3 A bat roost is defined as any structure a bat uses for breeding, resting, shelter or protection. It is important to note that since bats tend to re-use the same roost sites, current legal opinion is that a bat roost is protected regardless of whether or not the bats are present at a specific point in time.

European Protected Species Mitigation Licences

2.4 Although the law provides strict protection to bats, it also allows this protection to be set aside (derogated) under Regulation 53 of the Habitats Regulations through the issuing of European Protected Species Mitigation Licences (EPSML) for the purpose of preserving public health, public safety, and other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment. However, in accordance with the requirements of the Habitats Regulations, a licence can only be issued where the following requirements are satisfied:

- there is no satisfactory alternative; and
- the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

2.5 In England, EPSML applications are currently determined by Natural England and take up to five working days to acknowledge receipt and then at least a further 30 working days to determine. Certain types of low value roosts in structures only can be mitigated for under a Low Impact Class Licence, and involve a simpler process with a shorter determination time.

[2] Anon. (1992). The Habitats Directive. European Commission.
[3] Anon. (1981). The Wildlife & Countryside Act. HMSO, London.

National Planning Policy Framework

2.6 The National Planning Policy Framework (NPPF) was originally published on 27th March 2012 and detailed the Government's planning policies for England and how these are expected to be applied. The NPPF was then revised on 24th July 2018 and 19th February 2019. The NPPF states the commitment of the UK Government to minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity.

2.7 It specifies the obligations that the Local Authorities and the UK Government have regarding statutory designated sites and protected species under UK and international legislation and how this is to be delivered in the planning system. Protected or notable habitats and species can be a material consideration in planning decisions and may therefore make some sites unsuitable for particular types of development, or if development is permitted, mitigation measures may be required to avoid or minimise impacts on certain habitats and species, or where impact is unavoidable, compensation may be required.

2.8 The NPPF is clear that pursuing sustainable development includes moving from a net loss of biodiversity to achieving net gains for nature, and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution.

Local Planning Policy

2.9 Local planning policy relevant to nature conservation and bats is provided in detail in the Preliminary Ecological Appraisal for the proposed development (AECOM, 2019).

UK Post-2010 Biodiversity Framework

2.10 The UK Biodiversity Action Plan (UKBAP)[4] was launched in 1994 and established a framework and criteria for identifying species and habitat types of conservation concern. From this list, action plans for priority species of conservation concern were published, and have subsequently been succeeded by the UK Post-2010 Biodiversity Framework (July 2012)[5].

2.11 The UK Post-2010 Biodiversity Framework sets a broad enabling structure for action across the UK between now and 2020, including a shared vision and priorities for UK-scale activities to help deliver the Aichi targets and the EU Biodiversity Strategy. A major commitment by Parties to the Convention of Biological Diversity is to produce a National Biodiversity Strategy and/or Action Plan.

2.12 The UK Post-Development Framework is relevant in the context of Section 40 of the Natural Environment and Rural Communities (NERC Act 2006)[6], meaning that Priority Species and Habitats are material considerations in planning. These habitats and species are identified as those of conservation concern due to their rarity or a declining population trend.

2.13 The Natural Environment and Rural Communities (NERC) list of Species of Principal Importance is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act 2006; under Section 40 every public authority (e.g. a local authority or local planning authority) must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity. In addition, with regard to those species on the list of Species of Principal Importance prepared under Section 41 (S41), the Secretary of State must:

> *"(a) take such steps as appear to the Secretary of State to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under this section, or*
>
> *(b) promote the taking by others of such steps."*

[4] Anon. (2008). UK Biodiversity Action Plan. HMSO
[5] Anon. (2012). UK Post-2010 Biodiversity. HMSO.
[6] Anon. (2006). The Natural Environment and Rural Communities Act. HMSO, London.

2.14 All widespread reptile species were added to the UK Biodiversity Action Plans (UKBAP) as priority species in September 2007 and subsequently are included as Species of Principal Importance in England under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 meaning that they are of material consideration in planning.

2.15 The following bat species are listed under Section 41 as being of Principal Importance for the conservation of biodiversity in England: Barbastelle, Bechstein's, Noctule *Nyctalus noctula*, Soprano Pipistrelle *Pipistrellus pygmaeus*, Brown Long-eared *Plecotus auritus*, Lesser Horseshoe and Greater Horseshoe.

Local Biodiversity Action Plan

2.16 Kent Biodiversity Action Plan[7] sets out a species action plan for the Serotine Bat *Eptesicus serotinus,* where its objectives and targets include:

- to maintain this building-dependent bat as a widespread species in Kent;
- to maintain and enhance, and where possible extend, the available feeding habitat;
- to maintain and increase opportunity for roosting in buildings; and
- to continue and extend monitoring counts at summer roosts and to develop bat detector monitoring of feeding habitat use in line with national protocols.

[7] Kent Biodiversity Action Plan Steering Group (1997). The Kent Biodiversity Action Plan.

3. Methods

Desk Study

3.1 A desk study was undertaken in July 2018 to obtain bat records within a 5 km radius of the Site from Kent Bat Group, Kent & Medway Biological Records Centre. This data request was limited to records of bats recorded within the last ten years of the request date.

Preliminary Roost Appraisal

3.2 A preliminary roost appraisal was undertaken of buildings and structures and mature trees within the Site to appraise, from ground level, potential roosting features (PRFs) for bats, following guidance as described in the Bat Conservation Trust (BCT) '*Bat Surveys for Professional Ecologists: Good Practice Guidelines 3rd Edition*' (Collins, J. (ed.), 2016[8]). An experienced ecologist surveyed all relevant buildings and structures and trees externally for their suitability for roosting bats. This survey was undertaken in July 2018.

3.3 The aim of the preliminary roost appraisal survey was to identify features on buildings and structures and trees that are suitable for roosting bats and for which further surveys were required to determine the presence or absence of bats and their roosts. .

3.4 All buildings and structures and trees were inspected from ground level, as much as possible, for evidence of bat use. Such evidence included bat droppings, 'clean' gaps that may indicate the movement of animals in and out of the space, scratch marks and staining (from animals' fur). The equipment used included binoculars, a high-powered torch and a digital camera.

3.5 All features of potential interest to bats were annotated onto paper maps and recording forms.

3.6 For reference, each building and structure and tree was assigned a label for identity and any features found on each were used to assess the roost potential and determine the likelihood of use by bats.

3.7 A grade of habitat suitability and risk was assigned to buildings and structures and trees as a whole, based on the suitability of the identified features for bats. In accordance with BCT guidance (Collins, 2016), each of the buildings and structures and trees surveyed were assigned a category of roost habitat suitability or 'risk' corresponding to the likelihood that bats could be present and this information was used to inform the need for follow-up surveys. These categories are described below:

- **Negligible roost suitability** - Negligible habitat features on site likely to be used by roosting bats
- **Low roost suitability** - A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation). A tree of sufficient size and age to contain Potential Roosting Features (PRFs) but with none seen from the ground or features seen with only very limited roosting potential.
- **Moderate roost suitability** – A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status.
- **High roost suitability** – A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.

[8] Collins, J. (ed.) (2016). Bat Surveys for Professional ecologists: Good Practice Guidelines (3rd edition). The Bat Conservation Trust, London

3.8 Where the potential presence of roosting bats was suspected, based on the features recorded and 'risk', dusk emergence and, or dawn re-entry surveys on structures / buildings and trees were then recommended. These surveys aimed to confirm presence or absence of bats, identify species, the numbers of bats and access and egress points to characterise the roost and inform any potential mitigation requirements.

Emergence Surveys

3.9 Dusk emergence and dawn re-entry surveys were undertaken in accordance with BCT guidance (Collins, 2016).

3.10 The preliminary roost appraisal identified one building, an old barn (Photo 1) south of Perry's Farm (see Figure 2), within the survey area with low potential to support roosting bats and this was surveyed using the guidance for surveys visits, based on the assessed habitat suitability and risk category of each building, structure or tree (see Table 1). As there were no other buildings or structures and all the trees had been assessed as having negligible habitat suitability, no further emergence surveys were needed.

Table 1 - Minimum number of survey visits required to determine presence / absence of roosting bats (Collins, 2016)

Low Habitat Suitability / Risk	Moderate Habitat Suitability / Risk	High Habitat Suitability / Risk
Buildings and structures - One survey visit during dusk or dawn, May to August. Trees – no further surveys required	Two separate survey visits – one dusk and one dawn, May to September (with 1 survey May to August)	Three separate survey visits – dusk or dawn (at least one dawn), May to September (with 2 of the surveys May to August)

3.11 A single emergence survey of the building with low suitability to support roosting bats was undertaken in May 2019 during appropriate weather conditions when bats are likely to be active.

3.12 The emergence surveys started approximately 15 minutes before sunset and ended 1.5 to 2 hours after sunset. The survey was undertaken during suitable weather conditions, in dry conditions, with a temperature of 10°C and a wind speed of Beaufort Scale 4.

3.13 The survey was undertaken by suitably experienced bat surveyors located at suitable viewpoints adjacent to the building / structure. Equipment used during the surveys included Bat box duet and Petterson D240x detectors connected to Edirol R05 recording devices. Sound recordings were made to allow subsequent verification of species or species groups, where required.

3.14 All bat contacts were recorded and all bats were identified to species level on site, where possible. Notes on emergence / re-entry locations (where observed) and direction of flight were recorded onto paper maps of the survey area.

Roost Types

3.15 Where bat roosts were found these were categorised as follows based on guidance in Collins, (2016):

- **Day roost** - A place where individual bats, or small groups of males, rest or shelter in the day but are rarely found by night in the summer.
- **Night roost** - A place where bats rest or shelter in the night but are rarely found in the day. May be used by a single individual occasionally or it could be used regularly by the whole colony.
- **Feeding roost** - A place where individual bats or a few individuals rest or feed during the night but are rarely present by day.

- **Transitional / occasional roost** - Used by a few individuals or occasionally small groups for generally short periods of time on waking from hibernation or in the period prior to hibernation.
- **Swarming site** - Where large numbers of males and females gather during late summer to autumn. Appear to be important mating sites.
- **Mating site** - Where mating takes place from late summer and can continue through winter.
- **Maternity roost** - Where female bats give birth and raise their young to independence.
- **Hibernation roost** - Where bats may be found individually or together during winter. They have a constant cool temperature and high humidity.
- **Satellite roost** - An alternative roost found in close proximity to the main nursery colony used by a few individual breeding females to small groups of breeding females throughout the breeding season.

Habitat Suitability for Commuting and Foraging Bats

3.16 The habitat suitability on Site was assessed in August 2017 as being of overall low suitability for commuting and foraging bats, due to the majority of the Proposed Development areas (in particular, the areas proposed for the converter and substation) comprising of arable farmland with limited connectivity to better quality habitats.

3.17 It is acknowledged that the tree and scrub along the length of the proposed DC cable corridor provides a discrete habitat feature of better quality habitat for commuting and foraging bats. However, this linear habitat is not located near known bat roosts, offers no connectivity to more suitable (woodland / lakes) habitat off-site and is likely to be used by small numbers of commuting and foraging bats only.

Bat Activity Surveys

3.18 Surveys for bat activity were based on standard methodology for bat activity transect surveys as described in the BCT guidelines (Collins, 2016) and the number of bat activity surveys required to achieve a reasonable survey effort was assessed in relation to habitat suitability, following the BCT guidelines (Collins, 2016) (see Table 2).

Table 2 - Summary of guidelines on bat activity survey effort based on suitability of habitat for bats (Collins, 2016)

Low suitability habitat for bats	Moderate suitability habitat for bats	High suitability habitat for bats
One transect survey per season (spring, summer and autumn). One static detector per transect on five consecutive nights per season	One transect survey per month (April to Oct (weather permitting)). One survey to comprise dusk and pre-dawn or dusk to dawn. Two static detectors per transect on five consecutive nights per month.	Up to two transect surveys per month (April to Oct (weather permitting)). One survey to comprise dusk and pre-dawn or dusk to dawn. Three static detectors per transect on five consecutive nights per month.

Note on Table 2: April, September and October may be weather and location-dependent. If weather conditions are unsuitable, the length of the survey season is reduced

Manual Surveys for Bat Activity

3.19 Following an evaluation of the habitat suitability for commuting and foraging bats being low, one activity survey per season (spring (April / May), summer – (June / July / August), autumn – (September / October)) was undertaken in appropriate weather conditions.

3.20 These surveys were carried out in July and September 2018 and in May 2019, with two surveys conducted each month. The number of bat activity surveys required to achieve a reasonable survey effort was assessed in relation to habitat suitability; following the BCT guidelines (Collins, 2016) (see Table 2). Bat activity is highly dependent on weather conditions and therefore surveys were undertaken in favourable weather conditions, consisting of a temperature above 8°C, wind strength of Beaufort Force 3 or less and with precipitation not exceeding light drizzle. The weather conditions were recorded during all surveys (see Table 3).

Table 3 - Transect survey dates and weather conditions

Survey number	Date	Weather conditions and temperature (°C)
1	31/07/2018	Dry, 2/8 cloud, Wind F1, 20°C
2	26/09/2018	Dry, Cloud 0/8, Wind F1, 19°C
3	02/05/2019	Dry, Cloud 6/8, Wind NW F2, 10°C

Notes on Table 3: Wind speed is shown using the Beaufort scale, which is an empirical measure of force 0-12 that relates wind speed to observed conditions. Cloud cover is shown in a scale of 0-8 where the number represents the amount of cloud cover *e.g.* 2/8 is 25% cover 4/8 is 50% etc

3.21 A single transect route was selected through the Site (see Figure 3) to cover as much of the survey area as possible. The transect route included 15 wait points located at potentially important features with regard to bat activity. The survey route was designed to include potential flight paths or foraging areas within the site, and also potential roost sites. The direction of the transect routes was altered on each visit to avoid any bias with survey data and ensure that different parts of the survey area were surveyed at different times.

3.22 The surveys were carried out by two surveyors from sunset to at least 2 hours after dusk and dawn surveys commenced two hours before sunrise, finishing at sunrise. The surveyors walked the transect route at an even pace across the length of the Site and at each wait point, surveyors stopped and recorded bat activity for three minutes before continuing along the route.

3.23 During surveys, all bat activity was noted and, where possible, all bats were identified to species level on site. The time, location, numbers, species (where possible) and direction of flight of bats were recorded for each bat pass (discrete burst of echolocation heard, or bat activity observed) during the survey. Echolocation calls that were identified by Batbox Duet and recorded on Anabat Express detectors, were then recorded onto these digital storage devices on site and then subsequently analysed when in the office using AnalookW software (version 4) computer software to confirm identification, where necessary.

3.24 A bat pass is defined as a sequence of greater than two echolocation calls made as a single bat flies past the microphone of ultrasonic equipment. Additional notes, such as the number of bats, flight height and particularly type of flight (*e.g.* commuting, foraging, fast or slow) were also recorded. The direction of flight was also recorded to help establish a picture of commuting routes and flight lines.

3.25 The foraging and commuting data collected for each species group (depending on the level of identification possible from the recordings made) was then used to assess the value of the Site for bats using a geographical frame of reference. This assessment uses a range of variables such as species, number of bats, roosts / potential roosts nearby and the type and complexity of the linear features to derive an overall geographical value of the Site for each species using guidance in Wray *et al.* (2010[9]).

[9] Wray, S. Wells, D, Long, E Mitchell-Jones, T (2010). Valuing bats in ecological impact assessment. CIEEM In Practice Issue 70 (December 2010).

Automated / Static Monitoring Surveys for Bat Activity

3.26 To provide supplementary information on bat activity across the Site, automated bat detectors were deployed following automated static monitoring techniques, as described in BCT guidelines (Collins, 2016).

3.27 Automated ultrasound recording equipment was placed in two locations on site, in areas that were likely to be used by foraging or commuting bats.

3.28 The automated detectors were placed in the same location during each survey period to allow for quantitative analysis to be undertaken. The automated detectors, when deployed, were *in-situ* for the recommended minimum five consecutive nights per season (based on the habitat quality assessment as defined in Table 2) and the locations of these detectors can be found in Figure 4.

3.29 The automated detectors were in operation for May, August and September, covering spring, summer and autumn respectively.

3.30 Each Anabat, when in operation, was set to begin recording from 30 minutes before sunset and terminate recording 30 minutes after sunrise. This time period covered the peak time bats would be commuting to and from their roosts to foraging areas, mating sites and breeding roosts. It also covered peak activity times for foraging.

3.31 Each automated detector, when in operation, was set to begin recording from sunset and terminate recording at sunrise. This time period covered the peak time bats would be commuting to and from their roosts to foraging areas, mating sites and breeding roosts. It also covered peak activity times for foraging.

3.32 Automated detectors record bat data by generating a data file each time a bat passes the device and each call was automatically recorded to a compact flash memory card with large storage capacity.

3.33 Potential call files were downloaded and extracted from data files using CFCread software. The default settings were used during this file extraction process, as the software screens all data recorded by the bat detector and extracts call files using an automatic filter. Using the default setting for this also ensures comparability between data sets.

3.34 Following downloading of the data from each automated detector, the recordings were firstly analysed for presence of bat calls, using AnalookW software (version 4), and then each bat call was subsequently analysed to identify the bat to species level, where possible, following the call parameters outlined in '*British Bat Calls, A Guide to Species Identification'* (Russ, 2013[10]).

Bat Data Analysis

Automated Data

3.35 The automated or static detector data collected were analysed to determine the total number of bat passes for each species or species group (depending on the level of identification possible from the recordings made) and then used to derive a metric - the Bat Activity Index (BAI) (see Section 3.6.2) for the bat activity at each survey location. The transect data were described in relation to species, observed behaviour, temporal and spatial trends. These analyses provide an indication of:

- seasonal variation in species activity and composition at each survey location;
- relative levels of bat activity across the Site; and
- potential roosting sites, important foraging areas and commuting routes.

[10] Russ, J. 2013. British Bat Calls, A Guide to Species Identification. Pelagic Publishing.

Bat Activity Index (BAI)

3.36 Bat activity index (BAI) values from the static monitoring surveys were calculated by averaging the number of bat passes per hour, between sunset and sunrise, for each static detector unit. The term 'pass' is defined as a single file made up of bat pulses of a single species *i.e.* this may be one bat in a file or many bats in a single file.

3.37 No guidance is available on what constitutes low, moderate or high bat activity based on number of passes. As such a relative scale is used by AECOM in this report where:

- Very Low Activity is a mean of less than 2 passes per hour (at each survey location);
- Low Activity is a mean of 2 to 25 passes per hour;
- Moderate Activity is a mean of 26 to 99 passes per hour; and
- High Activity is a mean of over 100 passes per hour.

Survey Limitations

3.38 Some sonograms recorded were too weak to identify, with confidence, to species level. Therefore these calls, where recorded, were simply identified to a species group (*e.g. Myotis.* species) unless the sonogram could be identified to species level.

3.39 The automated detector at Location 1 malfunctioned during the May survey and therefore no bats were recorded during the spring period at Location 1. However, the automated detector in Location 2 functioned properly during this period and the data recorded is considered sufficient to determine both the species assemblage present on Site in the spring season and the levels of bat activity on Site.

3.40 Bats are a group of species with a range of dynamic behaviours with patterns of behaviour changing in response to physical and environmental factors. This can result in changes to roost sites (and sporadic use of such sites) and changes in foraging and commuting areas. Surveys for bats provide a snapshot of what bats are doing at that time and given that the majority of ecological data are valid only for short periods due to the inherently transient nature of the subject. On this basis, it is recommended that the surveys will need repeating within two years.

Explanation of Abbreviations

3.41 Presented within the tables in Section 4 and the appendices, the following abbreviations for bats have been used:

- **PIP**: Common Pipistrelle Pipistrellus pipistrellus;
- **SOP**: Soprano Pipistrelle;
- **NTP**: Nathusius' Pipistrelle Pipistrellus nathusii;
- **UNPIP**: Unidentified Pipistrelle Pipistrellus species;
- **NOC**: Noctule;
- **LEI**: Leisler's Nyctalus leisleri;
- **MYO**: Unidentified Myotid Myotis species;
- **BLE**: Brown Long-eared Plecotus auritus; and
- **UN**: Unknown bat.

4. Results

Desk Study

4.1 The data search, undertaken through Kent Bat Group returned three records of flying, grounded or dead bats from within 2 km of the Site and within the last ten years. These records were:

- a dead Pipistrelle in 2015, 1.5 km to the SSW of the proposed converter station;
- a grounded Nathusius's Pipistrelle in 2016, 1.5 km to the SSW of the proposed converter station; and
- an unidentified bat, in 2014, approximately 500 m to the east of the proposed DC cable corridor.

4.2 Additionally, the data search also returned records of historical (>10 years) records of bat roosts within 2 km of the Site, the closest of which was of a Pipistrelle bat *Pipistrellus* species roost from 1995, approximately 200 m west of the proposed DC cable corridor.

Preliminary Roost Appraisal

4.3 The preliminary roost appraisal of the one building within the survey area was undertaken in July 2018. This building was an old barn (Photo 1) at approximate Ordnance Survey (OS) grid reference: TQ878765, approximately 40 m from the Site (labelled TN13 on Figure 2; see also Photo 1, Appendix C). The barn had been assessed as having low suitability for roosting bats

4.4 There were no other buildings or structures or and trees within the survey area that had been assessed as having any potential to support roosting bats.

Emergence Survey

4.5 The single emergence survey, undertaken on TN13 (see Figure 2) in May 2019 did not record any bats emerging from this structure. However, during the survey both Common and Soprano Pipistrelles were recorded flying past the structure.

Activity Surveys

4.6 Three bat species (Common Pipistrelle, Soprano Pipistrelle and Nathusius' Pipistrelle) and a myotid bat (*Myotis* species) were confirmed using the survey area during the surveys for bat activity.

4.7 The transect route and locations of wait (or listening) points are shown on Figure 3. (A wait point is a location at which the surveyor stops and listens for any bat activity.) A summary of the bat contacts recorded during the transect surveys is provided in Table 4.

4.8 Both foraging and commuting activity was recorded during the transect surveys. The level of bat activity during the surveys, using the BAI described in Section 3.6.2, was all very low.

4.9 The following tables detail the results of the activity surveys and show the number of bat contacts recorded for each species identified. It is important to note that the number of contacts does not equate to the number of individual bats, as several contacts can be generated by an individual bat flying past the survey point several times. However, the number of contacts does provide an index of bat activity and this can be used to identify areas of habitat that is of importance to bats.

Table 4 - Summary of bat contacts recorded during transect surveys of the Site

Survey number	Season / date / period	Sunset time	Time of first bat record	PIP	NTP	SOP	MYO	UN	Total Passes	Passes per hour
1	Spring, May 2019, dusk	20:21	20:47	2	1	0	0	2	5	2.5
2	Summer, July 2018, dusk	20:48	21:49	12	0	2	0	0	14	7
3	Autumn, September 2018, dusk	19:40	20:17	6	0	2	1	0	9	4.5

Static Monitoring

4.10 Three bat species, Common Pipistrelle, Soprano Pipistrelle and Noctule were confirmed through static monitoring surveys at two locations. One nyctalid bat (*Nyctalus* species) was also confirmed using the Site.

4.11 A summary of the bat contacts recorded during the static monitoring is detailed below in Tables 5 and Table 6.

Table 5 - Summary of bat contacts recorded during static monitoring of the Proposed Development from Location 1

Date	Number of Bat Contacts				
	PIP	SOP	NOC	NOC/LEI	UNPIP
16th-20th August 2018	2	136	1	1	-
26th – 30th September 2018	102	515	6	-	3
17th – 21st May 2019	0	0	0	0	0
Total	**104**	**651**	**5**	**1**	**3**

Table 6 - Summary of bat contacts recorded during static monitoring of the Proposed Development from Location 2

Date	Number of Bat Contacts				
	PIP	SOP	NOC	NOC/LEI	UNIDPIP
16th-21st August 2018	61	66	4	5	2
26th-30th September 2018	0	13	1	1	-
17th-21st May 2019	60	48	8	0	5
Total	**121**	**127**	**13**	**6**	**7**

4.12 The most numerous species of bat recorded were Soprano and Common Pipistrelle with 778 and 224 contacts respectively recorded throughout the entire survey period, at both static monitoring locations. Unidentified Pipistrelle bats were also recorded (seven contacts), but the peak frequency of calls was in the overlap (50 Khz) for both Common and Soprano Pipistrelle. As a result, these have been recorded as 'Pipistrelle species' within this report.

4.13 Noctule with a total of 18 contacts was the next most numerous species recorded. Seven contacts of a *Nyctalus* species, either Noctule or Leisler's bat, were recorded at both static locations throughout the survey period. However, due to the contacts recorded being too brief or weak on the sonograms, it was not possible to identify these sonograms to species level.

5. Evaluation

Roosting bats

5.1 No bat roosts were found within the survey area. Therefore, roosting bats do not pose a constraint on the Proposed Development.

Commuting and foraging bats

5.2 Four species of bat were recorded during the activity surveys, through a combination of transect and automated survey techniques. These species were: Common Pipistrelle, Soprano Pipistrelle, Nathusius' Pipistrelle and Noctule. One species group (*Myotis* sp.) was also recorded during transect surveys. Other contacts, belonging to the *Nyctalus* genus were also recorded but could not be identified to species level.

Species abundance

5.3 None of the nationally rarest species, with populations under 10,000 (Wray et. al., 2010[11]), (see Appendix B) were recorded within the survey area.

5.4 Three of the nationally rarer species (Noctule, Nathusius' Pipistrelle and myotid bats (*Myotis* sp), with populations between 10,000 and 100,000 (Wray et. al., 2010), were recorded within the survey area. Noctule is considered generally uncommon and declining in Kent and Nathusius' Pipistrelle is scarce, often recorded as a migrant (Kent Bat Group, 2018[12]). No formal assessment can be made on the recorded species of myotid bat as the abundance of *Myotis* bats in Kent varies between species (Kent Bat Group, 2018[13]).

5.5 Common Pipistrelle and Soprano Pipistrelle are common and widespread species, both nationally and within the county and both were, by a long way, the most recorded within the survey area.

5.6 None of the bat species recorded in the survey area is listed on the Kent Biodiversity Action Plan (Kent Biodiversity Action Plan Steering Group, 1997).

Species distribution

5.7 The transect surveys indicate that the two most commonly recorded species, Common Pipistrelle and Soprano Pipistrelle, are widely distributed across the Site and both species were recorded foraging and commuting and were mainly associated with linear landscape features.

5.8 During the static monitoring surveys, Soprano Pipistrelle was found to be more numerous within the northern section with 535 more contacts recorded at Location 1, compared to Location 2 (Figure 4). In contrast, Common Pipistrelle was found to be more numerous in the southern section, with 11 additional contacts recorded at Location 2 compared to Location 1. Noctule was also found to be more numerous at Location 2 with 12 contacts, compared to seven contacts at Location 1.

Seasonal variation

5.9 The transect surveys recorded higher levels of bat activity during summer, with seven bat passes per hour compared to 4.5 bat passes per hour in autumn and 2.5 bat passes per hour in spring.

[12] Kent Bat Group (2018). UK and Kent bats distribution table 2018. http://www.kentbatgroup.org.uk/bats-in-kent/ (accessed July 2019)
[13] Kent Bat Group (2018). UK and Kent bats distribution table 2018. http://www.kentbatgroup.org.uk/bats-in-kent/ (accessed July 2019)

5.10 The static monitoring surveys recorded higher levels of bat activity during autumn, resulting in 641 contacts in September, compared to 277 bat contacts in summer (August). Static monitoring in May resulted in 121 bat contacts.

5.11 Therefore the results of the surveys would suggest that the survey area is of more value to commuting and foraging bats during summer and autumn than in spring.

Value of commuting and foraging habitat

5.12 Overall, the BAI within the Site (see Section 3.6.2) for commuting and foraging bats ranged from no activity to low activity (see Table 7).

Table 7 - The BAI value for commuting and foraging bats within the survey area

Month	Detector Location	Total Number of Bat contacts recorded over five consecutive night	Bat Activity Index (bat passes per hour)	Bat Activity Value
May	**1**	0	0	**No Activity**
	2	121	2.64	**Low Activity**
August	**1**	140	3.38	**Low Activity**
	2	137	3.31	**Low Activity**
September	**1**	626	9.51	**Low Activity**
	2	15	0.23	**Very Low Activity**

5.13 The foraging and commuting evaluation for the survey area has been derived from the results of all the survey methods employed and has been used along with published species distribution and population trends to assess the overall value of the survey area for commuting and foraging bat species.

5.14 Overall, the habitat within the survey area is of **Local** importance to foraging and commuting bats, including Noctule, Nathusius' Pipistrelle, Common Pipistrelle and Soprano Pipistrelle, on the basis of the numbers of each species recorded, location of known roosts and the foraging and commuting habitat characteristics (See Tables 8 and 9).

Table 8 - The foraging value of habitat within the survey area

Species	National Rarity	Number of bats	Site/Nearby Roost Potential	Foraging habitat characteristics	Total Score	Value
Noctule	5	5	0	3	13	**Local**
Nathusius' Pipistrelle	5	5	0	3	13	**Local**
Common Pipistrelle	2	10	3	3	18	**Local**
Soprano Pipistrelle	2	10	3	3	18	**Local**

Table 9 - The commuting value of habitat within the survey area

Species	National Rarity	Number of bats	Site/Nearby Roost Potential	Type & Complexity of Linear Features	Total Score	Value
Noctule	5	5	0	2	12	**Local**
Nathusius' Pipistrelle	5	5	0	2	12	**Local**
Common Pipistrelle	2	10	3	2	17	**Local**
Soprano Pipistrelle	2	10	3	2	17	**Local**

6. Mitigation and Enhancement Measures

6.1 In order to reduce the potential impacts on bats, a number of measures can be included within the design of the Proposed Development. These outline measures are recommended to ensure that the impacts on the bats are minimised and it is recommended that these proposals are formalised through a Construction Environmental Management Plan (CEMP) or precautionary working method statement for the Site.

6.2 The Proposed Development will incur permanent loss of the arable fields to the south and south-west of Perry's Farm (see Figure 1). However, no bat activity was recorded in this area and therefore no foraging or commuting habitat of importance to bats will be lost.

6.3 The Proposed Development may incur temporary loss of scrub, used by commuting bats, along the extent of the DC cable corridor. Post-construction, any habitat loss within the DC cable corridor should be restored on a like for like basis and habitat creation and, or restoration should include the planting of mixed native species of trees and scrub, including Hawthorn *Crataegus monogyna* and Blackthorn *Prunus spinosa,*

6.4 No bat roosts were recorded within the survey area. However, artificial bat boxes should be provided on retained trees and in the wider area, which would provide roosting opportunities for bats.

6.5 Lighting during construction and operation of the Proposed Development should be designed sympathetically to avoid light spill into off-site habitats to avoid directly impacting on commuting and foraging bats. Being nocturnal and adapted to forage in low light conditions, increases in artificial lighting can cause disturbance to bats or disrupt existing flight paths. To minimise potential impacts from lighting, it is recommended that the Proposed Development ensures:

- no illumination of retained boundary features;
- use of light sources that emit minimal ultraviolet light and avoid white or blue wavelengths to avoid attracting lots of insects (attracting insects to lamps may reduce their abundance in darker foraging areas favoured by bats); and
- individual lamps are hooded and directed where needed to avoid unnecessary light spillage.

Appendices

Appendix A: Figures

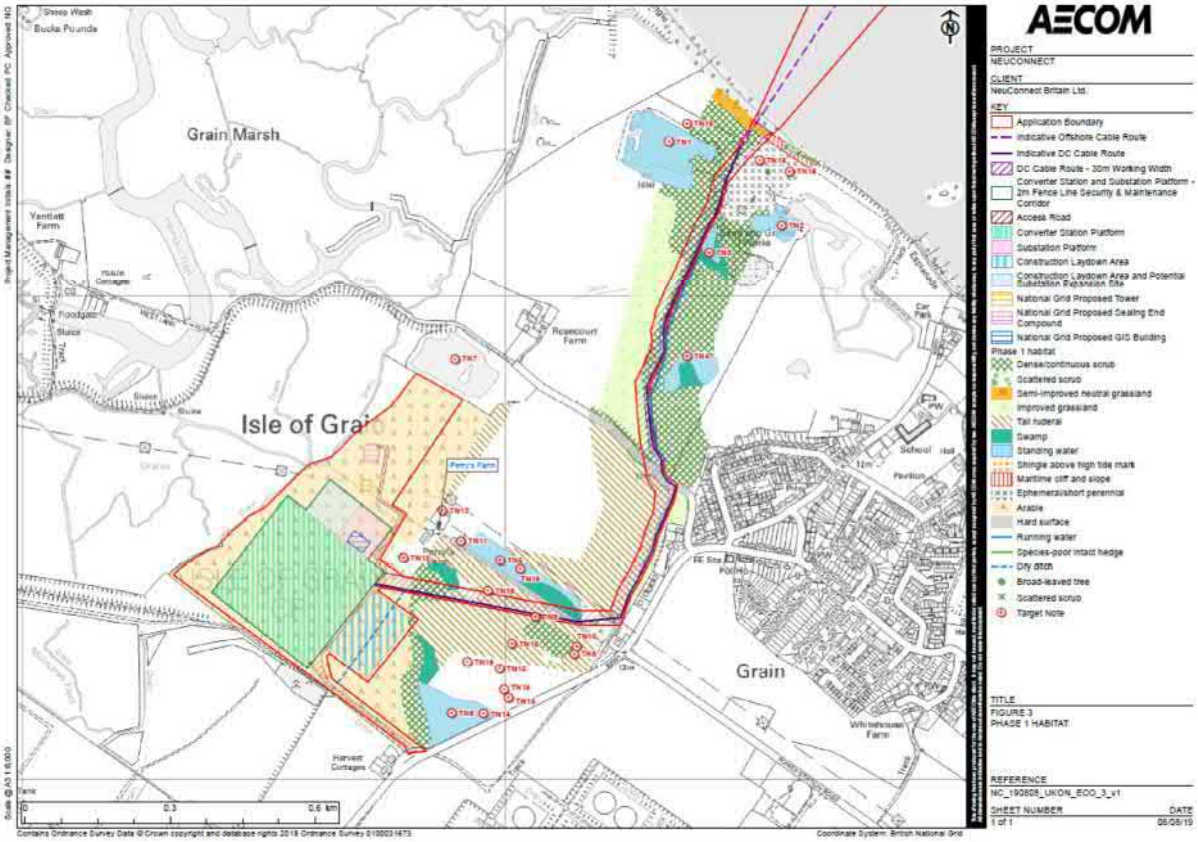

Figure 2 - Habitat within survey area and location (TN13) of surveyed barn

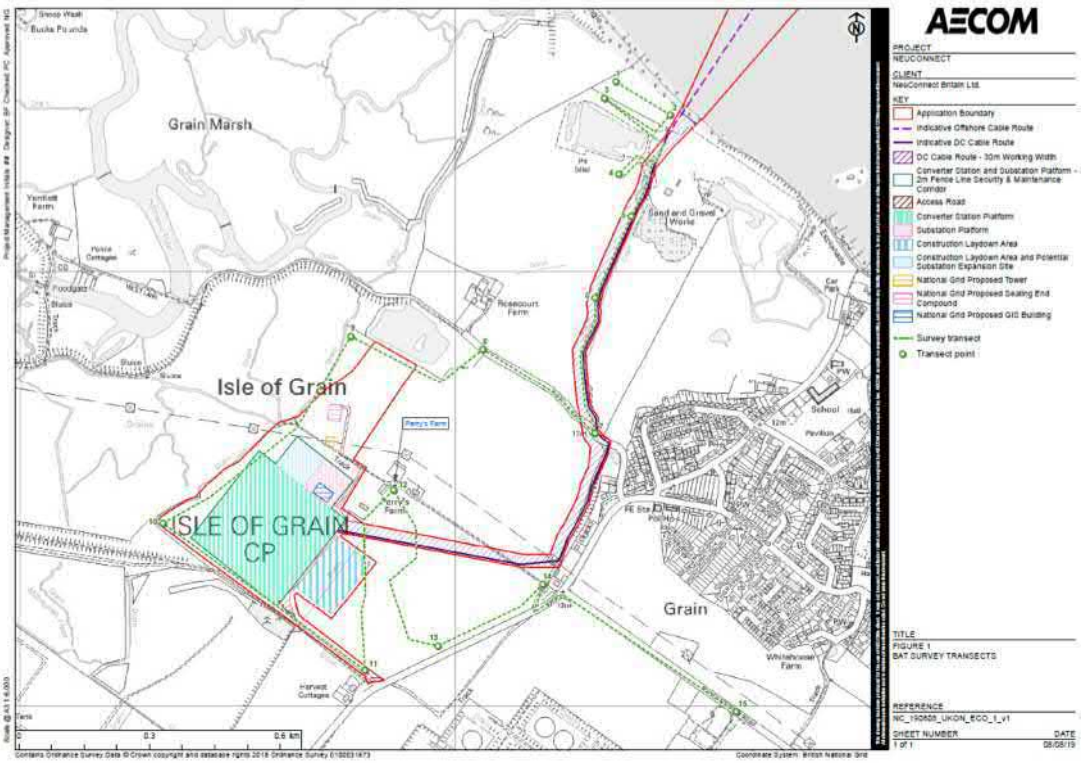

Figure 3 - Transect route and location of wait points

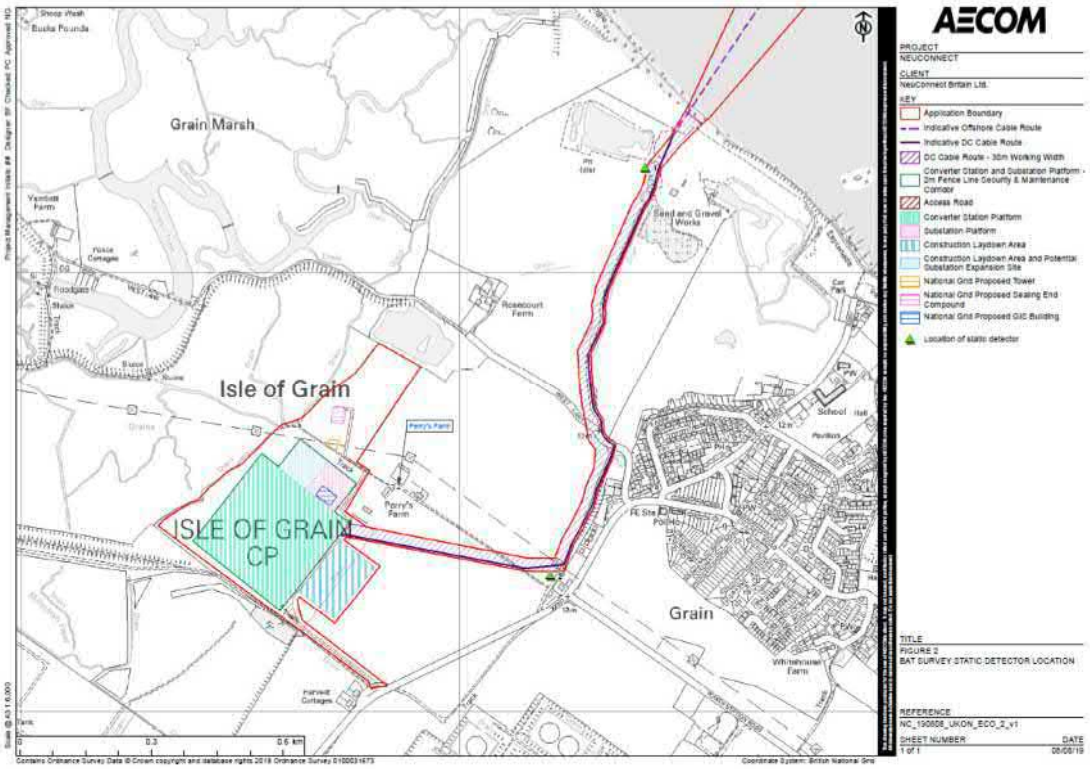

Figure 4 - Location of each static within the survey area

Appendix B: Valuing Bat Foraging Habitats

Tables and valuation method for bat roosts, foraging and commuting habitats are all taken from Wray *et al* (2010).

Categorising bats by distribution and rarity

Rarity within range	England
Rarest (population under 10,000)	Greater Horseshoe (*Rhinolophus ferrumequinum*) Bechstein's (*Myotis bechsteinii*) Alcathoe (*Myotis alcathoe*) Greater mouse-eared (*Myotis myotis*) Barbastelle (*Barbastella barbastellus*) Grey long-eared (*Plecotus austriacus*)
Rarer (population 10,000 – 100,000)	Lesser horseshoe (*Rhinolophus hipposideros*) Whiskered (*Myotis mystacinus*) Brandt's (*Myotis brandtii*) Daubenton's (*Myotis daubentonii*) Natterer's (*Myotis nattereri*) Leisler's (*Nyctalus leisleri*) Noctule (*Nyctalus noctula*) Nathusius' Pipistrelle (*Pipistrellus nathusii*) Serotine (*Eptesicus serotinus*)
Common (population over 100,000)	Common pipistrelle (*Pipistrellus pipistrellus*) Soprano pipistrelle (*Pipistrellus pygmaeus*) Brown long-eared (*Plecotus auritus*)

When valuing commuting and foraging routes (see the following tables), the rarity of the bat species involved, the approximate numbers of bats using them (based on survey data), the proximity of known roosts, and the nature and complexity of linear features in the landscape are all taken into account to put the bat activity recorded into context. One 'score' is taken from each column, depending on the 'best fit' for the situation and they are added together in order to arrive at a total score.

Valuing commuting routes

Species	Number of bats[1]	Roosts/potential roosts nearby	Type and complexity of linear features
Common (2)	Individual bats (5)	None (1)	Absence of (other) linear features (1)
		Small number (3)	Unvegetated fences/walls and large field sizes (2)
Rarer (5)	Small number of bats (10)	Moderate number/Not known (4)	Walls, gappy or flailed hedgerows, isolated well grown hedgerows, and moderate field sizes (3)
		Large number of roosts, or close to a nationally important/protected site for the species (5)	Well-grown and well-connected hedgerows/tree lines, small field sizes (4)

Species	Number of bats[1]	Roosts/potential roosts nearby	Type and complexity of linear features
Rarest (20)	Large number of bats (20)	Close to or within an internationally important/ protected site for the species(20)	Complex network of mature well-established hedgerows, tree line, small fields and rivers/streams (5)

Individual bats 1 or 2, Small numbers 3 to 10, Large numbers>10 bats

Valuing foraging areas

Species	Number of bats	Roosts/potential roosts nearby	Foraging habitat characteristics
Common (2)	Individual bats (5)	None (1)	Industrial or other site without established vegetation (1)
		Small number (3)	Suburban areas or intensive arable land (2)
Rarer (5)	Small number of bats (10)	Moderate number/Not known (4)	Isolated woodland patches, less intensive arable and/or small towns and villages (3)
		Large number of roosts, or close to a nationally important site for the species (5)	Larger or connected woodland blocks, mixed agriculture, and small villages/hamlets (4)
Rarest (20)	Large number of bats (20)	Close to or within a SAC for the species (20)	Mosaic of pasture, woodlands and wetland areas (5)

Scoring system for valuing commuting and foraging bats

Geographic frame of reference	Score
International	>50
National	41-50
Regional	31-40
County	21-30
District, local or parish	11-20
Not important	1-10

Appendix C: Potential roost feature

Photo 1: Old run down barn, south of Perry's Farm (TN13 on Figure 2)

Appendix 6.J – Benthic Characteristics Survey

NeuConnect Interconnector

Benthic Characterisation and Habitat Assessment Survey (UK)

Technical Report

Ref: OEL_AECNEU0818_TCR

Prepared for

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03	03/05/2019	Revised following client review	Joseph Turner	Ross Griffin
04	07/05/2019	Revised following client review	Joseph Turner	Ross Griffin
05	08/05/2019	Revised following client review	Joseph Turner	Ross Griffin
06	29/05/2019	Revised following client review	Joseph Turner	Ross Griffin
07	14/06/2019	Final	Joseph Turner	Ross Griffin

CONTENTS

LIST OF ABBREVIATIONS

AL	Action Level
BC	Baseline Concentration
BAC	Baseline Assessment Concentration
BEIS	Department for Business, Energy and Industrial Strategy
BSH	Broad-Scale Habitats
cSAC	Candidate Special Area of Conservation
DC	Direct Current
DDC	Drop-Down Camera
DDV	Drop-Down Video
DTI	Department of Trade and Industry
DVR	Digital Video Recording
ED50	European Datum 50
EMODnet	European Marine Observation and Data Network
ESP	Environmental Sampling Plan
EU	European Union
EUNIS	European Nature Information System
FOCI	Features of Conservation Importance
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HA	Habitat Assessment
HOCI	Habitats of Conservation Interest
HVDC	High Voltage Direct Current
JNCC	Joint Nature Conservation Committee
KM	Kilometre
KP	Kilometre Point
LAT	Lowest Astronomical Tide
LED	Light-Emitting Diode
MBES	Multi-Beam Echo Sounder
MEDIN	Marine Environmental Data and Information Network
MHWS	Mean High Water Springs
MW	Megawatt
NMBAQC	NE Atlantic Marine Biological Quality Control
OEL	Ocean Ecology Limited
OSPAR	Oslo and Paris Convention for the Protection of the North East Atlantic
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PEL	Probable Effect Level
PRP	Processing Requirement Protocol

PSD	Particle Size Distribution
QMS	Quality Management System
ROV	Remote Operated Vehicle
SAC	Special Area of Conservation
SCI	Site of Community Importance
SOP	Standard Operating Protocol
SPA	Special Protection Area
SSL	Seabed Survey Licence
SSS	Side Scan Sonar
STR	Subsea Technology and Rentals
TEL	Threshold Effect Level
THC	Total Hydrocarbons
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association
USBL	Ultra-Short Baseline
UTM	Universal Transverse Mercator
WoRMS	World Register of Marine Species

1. EXECUTIVE SUMMARY

Ocean Ecology Limited (OEL) was contracted by AECOM to conduct a benthic characterisation survey of the UK section of the proposed NeuConnect Interconnector subsea cable. Environmental sampling was undertaken from 25th September to 16th October 2018 and from 13th February to 15th February 2019. The data collected during this survey was intended to characterise the seabed sediments and benthic communities to inform the various applications and assessments that are being undertaken by AECOM on behalf of NeuConnect. This was achieved through a combination of grab sampling and acquisition of seabed imagery followed by detailed laboratory analysis and statistical analysis of the resulting biological and physico-chemical datasets.

1.1. Sediments

A wide variety of sediment types were observed along the cable route. A trend towards increased mud content was apparent at inshore stations while the offshore stations were almost entirely composed of sand, forming either ripples or megaripples. Most samples comprised of sand (S), representing EUNIS Broad Scale Habitat (BSH) A5.2 (sublittoral sand), while a number of stations were classified as mud and sandy mud (mS) or gravelly mud (gM) and gravelly muddy sand (gmS) which represent a mixture of EUNIS BSH A5.2 (sublittoral sand), A5.3 (sublittoral mud), and A5.4 (sublittoral mixed sediments). Coarser sediments were also observed intermittently along the route where stations were classified as gravelly sand (gS, EUNIS BSH A5.1 sublittoral coarse sediments).

Levels of Arsenic were particularly high at many stations where they exceeded OSPAR Baseline Concentration (BC) at 15 locations and Baseline Assessment concentration (BAC) at eight locations. The levels of most metals, and specifically Zinc, Lead, and Mercury, were higher at the intertidal and inshore stations with many exceeding mean UKOOA (2001) and even 95th % values. Nickel and Copper levels were also high in offshore areas, particularly between Kilometre Point (KP) 83 – 94. Concentrations of Copper and Zinc in offshore areas of the cable route were higher than other North Sea offshore areas but did not exceed Cefas (2003) Action Level 2 (AL2), a proxy for heavy sediment contamination, at any location.

Polycyclic aromatic hydrocarbons (PAH) were only occasionally observed at levels in excess of OSPAR BCs and BACs, Canadian sediment quality guideline Threshold Effects Levels (TELs) and Cefas (2003) Action Level 1 (AL1) guidelines. At no point were Canadian sediment quality guideline Probable Effects Levels (PELs) exceeded. Levels of organotins exceeded Cefas (2003) AL1 only at a single station (UK_ENV_001). Polychlorinated biphenyls (PCBs), and organochlorines did not exceed Cefas (2003) AL1 or Canadian sediment quality guidelines at any of the stations. Concentrations of these compounds were often below the detectable limits at many locations.

1.2. Macrobenthos

The macrobenthic assemblages identified along the NeuConnect cable route were diverse and largely dominated by annelid taxa in terms of number of taxa and overall abundance as expected in this area of the southern North Sea. Molluscs and echinoderms contributed greatest to overall biomass of the macrofaunal communities. The most common faunal group (A), dominated by polychaete worm species, was observed at 39 of the 90 stations. This faunal group was associated with sandy habitats particularly in the offshore areas of the cable route. The other dominant group (Faunal Group B) was characterised by the ross worm *S. spinulosa.* These stations corresponded with areas where notable aggregations of sand tubes constructed by this species were recorded upon review of the seabed imagery and subsequently deemed to be representative of areas of Annex I biogenic reef (as per Gubbay (2007)).

1.3. Key Habitats

The Habitat Assessment (HA) identified several principal EUNIS BSHs and a number of higher level biotopes which enabled the production of a biotope map of the UK section of the cable route combined with mapping of habitats of conservation interest (Table 1).

Table 1. Principal EUNIS biotopes and Habitats of Conservation Interest identified during the NeuConnect cable route survey. *Broad Scale Habitat (EUNIS level 3).

EUNIS Groups	BSH*	EUNIS Biotopes	Habitats of Conservation Interest
Rock	A4.2	A4.21 Echinoderms and crustose communities on circalittoral rock	Annex I Stony Reef
		A4.23 Communities on soft circalittoral rock	
Rock	A4.2	A4.23 Communities on soft circalittoral rock	Section 41 priority habitat - Peat and Clay Exposures
Biogenic Reef	A5.6	A5.611 - [*Sabellaria spinulosa*] on stable circalittoral mixed sediment	Annex I Biogenic Reef

Most seabed habitats along the cable route were characterised as either EUNIS biotope A5.25 'Circalittoral fine sand' or EUNIS biotope A5.44 'Circalittoral mixed sediment' although areas of EUNIS biotope A5.35 'Circalittoral sandy mud' were also recorded. Due to the similarity of the macrobenthos observed in shallower sections (<20 m) of the cable route to those in shallow sandbank habitats some areas of the cable corridor characterised as sublittoral sand biotopes (A5.25) were deemed to be representative of the Annex I habitat 'Sandbanks which are slightly covered by sea water all the time'. The large swaths of Sandy sediments identified along the offshore areas of the cable corridor were not however thought to be presentative of Annex I sandbanks due to the generally greater water depths (>30 m).

Annex I stony reef was identified in areas of the cable route between KP 90 and KP 115. Reefs were assessed to be of low relief only (as per Irving (2009)). Video imagery from these areas was indicative of the EUNIS Biotopes A4.21 – 'Echinoderms and crustose communities on circalittoral rock' and A4.23 – 'Communities on soft circalittoral rock'.

Areas of the Section 41 priority habitat 'Peat and Clay Exposures' were observed along the cable route. This habitat was observed in similar locations to Annex I stony reef at KPs 91, 99, and 116, through interrogation of side scan sonar (SSS) data and Drop-Down Video (DDV) imagery collected during this survey. These areas were indicative of the EUNIS Biotope A4.23 'Communities on soft circalittoral rock' and representative of Annex I bedrock reef habitat.

Representatives of Annex I biogenic reef formed by *S. spinulosa* was identified at multiple points along the cable route. These were classified as either low or medium relief reef and were concentrated around KP 60 – 78, KP 115, and KP 132. Evidence of potential *S. spinulosa* reef from the geophysical surveys and review of the SSS data identified a wider area of low relief reef within a mixed sediment biotope between KP 68 - 78 though the extent of this patch of reef is less certain. This area was indicative of the EUNIS Biotope A5.611 – '[*Sabellaria spinulosa*] on stable circalittoral mixed sediment.

2. INTRODUCTION

2.1. NeuConnect Interconnector

NeuConnect (the 'Project'), is a 1,400 megawatt (MW) interconnector between Great Britain and Germany being developed by an international consortium. The Project will create the first direct electricity link between Great Britain and German energy networks and will allow electricity to be passed in either direction. The Project will be formed by over 700 kilometres (km) of subsea and underground High Voltage Direct Current (HVDC) cables, with on-shore converter stations linking into the existing electricity grids in Great Britain and Germany.

The GB Offshore Scheme will extend from Mean High Water Springs (MHWS) on the northern coast of the Isle of Grain, through the outer Thames Estuary and the southern North Sea before crossing the median line into Dutch waters. The GB Offshore Scheme comprises a project corridor of approximately 270 km length within which subsea Direct Current (DC) cables will be installed.

2.2. Project Background

Ocean Ecology Limited (OEL) was contracted by AECOM to conduct a benthic characterisation survey of the GB Offshore Scheme section of the proposed NeuConnect cable route to include provision of survey vessels, environmental personnel, sampling equipment and sample analysis. Environmental sampling was undertaken during two survey phases from 25th September to 16th October 2018 and from 13th February to 15th February 2019. The data collected during these surveys was intended to characterise the seabed sediments and benthic communities to inform the applications and assessments that are being undertaken by AECOM on behalf of NeuConnect.

2.3. Report Scope

This report presents the results of the macrobenthic and sediment chemistry analysis combined with the results of the analysis of seabed imagery collected as part of the Habitat Assessment (HA) with the aim to characterise the biological and physio-chemical status of the seabed substrates and habitats along the route.

The grab sample data has undergone detailed statistical analysis and habitats have been mapped through interpretation of the geophysical data, which, in combination with analysis of the environmental data have been used to delineate Habitats of Conservation Interest (HOCI) (e.g. Annex I habitats) occurring along the cable corridor.

The survey area lies within the Margate and Long Sands Special Area of Conservation (SAC) and/or the Outer Thames Estuary Special Protection Area (SPA). The HA therefore includes an assessment of the habitats identified within the survey area against the relevant designated features of these protected areas.

3. NATURE CONSERVATION

3.1. Protected Sites

A number of sites that receive designation under various nature conservation legislation overlap with the survey area. Under the European Habitats Directive (92/43/EEC) that came into force in 1992 European Union (EU) Member States are required to ensure "favourable conservation status" of habitats and species listed by the Directive.

Two nature conservation designations fall within the survey area: the Margate and Long Sands SAC and the Outer Thames Estuary SPA.

3.1.1. Margate and Long Sands SAC

The Margate and Long Sands SAC starts to the north of the Thanet coast of Kent and proceeds in a north-easterly direction to the outer reaches of the Thames Estuary. It contains a number of Annex I Sandbanks slightly covered by seawater at all times, the largest of which is Long Sands itself. The sandbanks are composed of well sorted sandy sediments, with muddier and more gravelly sediments in the troughs between banks. The upper crests of some of the larger banks dry out at low tide. The banks are tidally-influenced estuary mouth sandbanks, the southern banks aligned approximately east-west in the direction of tidal currents entering the Thames Estuary from the English Channel, whereas Long Sand is aligned in a north east - south west orientation with influence from the North Sea.

Although the primary feature for designation is the Sandbank Annex I interest feature, there is a significant amount of the reef-forming ross worm (*Sabellaria spinulosa*) at this site, which when formed as a reef qualifies as an Annex I habitat (biogenic reef). However, the available data indicate that the distribution of *S. spinulosa* is patchy, or that the aggregations form crusts rather than reefs. Areas of high *S. spinulosa* density support a diverse attached epifauna of bryozoans, hydroids, sponges and tunicates, and additional fauna including polychaetes, bivalves, amphipods and crustaceans. These diverse communities are usually found on the flanks of the sandbanks and towards the troughs.

3.1.2. Outer Thames Estuary SPA

The Outer Thames Estuary SPA is classified for the protection of the largest aggregation of wintering red-throated diver (*Gavia stellata*) in the UK, an estimated population of 6,466 individuals, which is 38% of the wintering population of Great Britain. It also protects foraging areas for common tern (*Sterna hirundo*) and little tern (*Sternula albifrons*) during the breeding season.

The SPA lies along the east coast of England in the southern North Sea and extends northward from the Thames Estuary to the sea area off Great Yarmouth on the East Norfolk Coast. This SPA crosses the 12 nautical mile boundary and therefore statutory advices is provided jointly with Natural England. The foraging areas protected for little tern and common tern, enhance the protection afforded to their feeding and nesting areas in the adjacent coastal SPAs (Foulness SPA, Breydon Water SPA and Minsmere to Walberswick SPA). The Outer Thames Estuary SPA overlaps with a Special Area of Conservation/Site of Community Importance that has been identified for the protection of Harbour porpoise – the Southern North Sea SAC/SCI.

3.2. Annex I Habitats Present within the Survey Area

A number of important and sensitive habitats occur within the southern North Sea and the survey area, including Annex I habitats such as 'sandbanks slightly covered by seawater all the time', 'stony reef' and 'biogenic *S. spinulosa* reef'.

3.2.1. Sandbanks Slightly Covered by Seawater All the Time

This feature consists of sandy sediments that are permanently covered by shallow sea water, typically at depths of less than 20 m. Distinct banks, formed of elongated, round or irregular "mound" shapes arise from horizontal or sloping plains of sandy sediment. The sediment type of these habitats is the key driver of the diversity and type of associated communities, as well as physical, chemical and hydrographic factors (e.g. exposure, temperature, topography, depth, turbidity and salinity). In UK waters this feature is categorised into four sub-types: gravelly and clean sands, muddy sands, eelgrass *Zostera marina* beds and free-living maerl (Corallinacea) beds.

These habitats are typically colonised by burrowing fauna such as worms, crustaceans, bivalve molluscs and echinoderms. Mobile shrimp, gastropods, crabs and fish also inhabit these areas as well as sandeel (*Ammodytes* sp.), a key bird prey species. Where stable coarse sediments are present species of foliose algae, hydroids, bryozoans and ascidians may be present that comprise key nursery areas for various fish species. Such areas therefore often comprise key feeding grounds for numerous seabirds[1].

3.2.2. Reefs

3.2.2.1. Rocky Reef

Rocky reefs can be very variable in terms of both their structure and the communities that they support. They provide a home to many species such as corals, sponges and sea squirts as well as giving shelter to fish and crustaceans such as lobsters and crabs and can be classified as either bedrock or stony reefs.

Bedrock Reef

Similar to stony reef, Annex I bedrock reef habitat occurs where soft (e.g. clay) or hard bedrock arises from the surrounding seabed, providing a stable habitat for attachment for a diverse range of epibiota. Bedrock reefs and associated biological communities can be highly variable due to the diverse nature of these habitats in terms of topography, structural complexity and exposure to tidal streams. In the photic zone communities associated with bedrock reefs are often dominated by attached algae, and often support various invertebrate species such as corals, sponges and sea squirts. These epibiotic communities further increase structural complexity and represent key prey items that in turn attract more mobile and commercially valuable species such as fish and crustaceans.

Stony Reef

Stony reef habitats occur when stable hard substrata, namely cobbles and boulders > 64 mm in diameter arise from the surrounding habitat, creating a habitat colonised by a variety of species. Numerous SAC sites have been designated in UK waters to protect stony reef habitats and associated communities. Such communities can be highly diverse, supporting assemblages of various coral, sponges, ascidians, fish and crustaceans. These associated communities vary dramatically according to environmental variables and may incorporate species that occupy a range of trophic levels. The complexity of habitat created by stony reefs often supports a higher

[1] http://jncc.defra.gov.uk/ProtectedSites/SACselection/habitat.asp?FeatureIntCode=h1110

abundance of mobile fauna such as echinoderms and various crabs, hermit crabs, and squat lobsters, as well as fish species for which these species represent key prey items.

3.2.2.2. *Sabellaria spinulosa* Reef

Dense subtidal aggregations of tubes created by the Ross worm *S. spinulosa* may form biogenic reefs that can stabilise cobble, pebble and gravel habitats and provide a consolidated habitat for epibenthic species (Pearce et al. 2011). These reefs form solid, raised structures above the surrounding seabed, thus increasing local habitat complexity and creating a biogenic habitat onto which various other species may become established. Those *S. spinulosa* reefs of greatest conservation importance are those which occur on predominantly sediment or mixed sediment areas that allow settlement of fauna that would not otherwise occur in such areas. Biological assemblages in areas of *S. spinulosa* reefs therefore often support a rich diversity of flora and fauna compared to surrounding areas of relatively homogenous sediment habitat.

Such reefs form in areas of favourable environmental conditions, largely areas of muddy sand with coarse material for attachment and high suspended sediment concentrations for tube construction. The species is common around the British Isles, with a relatively widespread distribution throughout the North East Atlantic, the North Sea and the English Channel. Dense aggregations have been recorded in many locations, in particular the Bristol Channel, The Wash and the southern North Sea ((Jenkins et al. 2018). Due to their biological importance, *S. spinulosa* reefs have been identified as a Section 41 priority habitats and also comprise FOCI habitats.[2]

[2] http://jncc.defra.gov.uk/pdf/UKBAP_BAPHabitats-47-SabellariaSpinulosaReefs.pdf

4. SURVEY DESIGN

4.1. Survey Objectives

The overall purpose of the surveys carried out in September and October 2018 and in February 2019 was to acquire environmental data along the GB Offshore Scheme section of the proposed NeuConnect cable route to inform the project EIA being undertaken by AECOM.

The survey had the following objectives:

i. Collect video/stills footage and grab samples from pre-defined site characterisation locations positioned along the entirety of the GB Offshore Scheme section of the cable route to characterise seabed sediments and associated benthic communities.
ii. Collect additional video/stills at proposed ground-truthing stations at targeted locations along the GB Offshore Scheme section of the cable route to allow for high confidence mapping of key HOCI and for a robust assessment of any sensitive habitats identified (e.g. Annex I geogenic and/or biogenic reef habitats).

4.2. Site Characterisation Sampling

A detailed review of existing Side Scan Sonar (SSS) and Multi-Beam Echo Sounder (MBES) data and environmental data previously collected along the GB Offshore Scheme section of the proposed cable route was conducted by OEL to ensure that all strata present within the cable corridor was adequately sampled (see (Ocean Ecology Limited 2018)). This ensured that the interpretation of the SSS and MBES data was sufficiently ground-truthed facilitating subsequent biotope mapping. This resulted in the selection of 83 site characterisation sampling locations to be targeted as Drop-Down Camera (DDC) and grab sampling stations as mapped in Figures 1-3. A full rationale for the selection of each sampling station is provided as Appendix 1a.

Sample station selection was undertaken during two phases. Firstly, sampling stations were positioned at 2 km intervals along the section of the cable route that lies within the Margate and Long Sands SAC and/or the Outer Thames Estuary SPA. This resulted in positioning of 37 DDC and grab sampling stations up to Kilometre Point (KP) 84 the majority of which are predicted to be positioned on sandy sediments thought to be representative of sandbank Annex I habitat features ('Sandbanks which are slight covered by sea water all the time) for which the Margate and Long Sands SAC is designated. The exception to this is between KP 68.9 and KP 78.3 where a substantial area of potential Annex I biogenic reef habitat formed by *S. spinulosa* was thought to occur. To avoid potential damage to this feature, Drop-Down Video (DDV) transects were proposed running along and crossing the proposed cable route (cruciform) every k in place of combined DDC and grab sampling stations.

Sampling positions along sections of the route outside the SAC and/or SPA boundaries (KP 0 to KP 2 and KP 84 to KP 270 (the UK/Netherlands median line)) were positioned either at 5 km intervals or every time that distinct changes in seabed type were predicted (e.g. rippled sand to coarse sediments) resulting in a further 44 site characterisation sampling stations.

Two additional DDC and grab sampling stations were also added at KP 81 and KP 83 to provide greater sampling coverage along the proposed route that lies approximately 1 km north of a pre-existing dredge disposal site (Area 108/3) and within the likely tidal excursion given the NE-SW tidal flow in the area.

Single grab sampling stations were proposed at 40 of the 83 sampling stations for subsequent macrobenthic and Particle Size Distribution (PSD) analysis (see Section 2.4.3) distributed along the cable route. Two grab samples were taken at the remaining 43 stations the first for subsequent macrobenthic and Particle Size Distribution (PSD) analysis and the second for chemical analysis. Additionally, a further seven stations were positioned in the

intertidal area of the cable route (KP 0 – 2). A single grab was taken at all intertidal stations for macrobenthic and PSD analysis and an additional grab was taken for chemical analysis at three of the stations.

4.3. Habitat Assessment Sampling

Following the detailed review of the existing SSS and MBES data a total of 36 DDV transects were proposed to target areas where HOCI (e.g. Annex I biogenic or stony reef) were predicted to occur (Figures 1-3). Transects were positioned to intersect boundaries of key habitats to inform subsequent delineation but where possible, were aligned along or close to the proposed cable route itself to ensure data was collected within the area of potential impact during installation of the cable. Cross lines were also proposed between KP 68.9 and KP 78.3 where Annex I *S. spinulosa* reef habitat was thought to occur to form cruciform sampling at 1 km intervals. A full rationale for the selection of each sampling station is provided as Appendix 1b.

A summary of HA transects sampled in the inshore (KP 000 to KP 084) and offshore (KP 085 to KP 270) areas of the NeuConnect cable route is provided below.

4.3.1. KP000 to KP084

A detailed review of the existing SSS data available between KP 000 and KP 084 was conducted prior to the survey mobilisation. This identified a substantial area of potential Annex I biogenic reef habitat formed by *S. spinulosa* between KP 68.9 and KP 78.3. To avoid potential damage to this feature, DDV transects were proposed running along and crossing the proposed cable route (cruciform) every kilometre in place of combined DDC and grab sampling stations. Transects were positioned to intersect boundaries of key habitats to inform subsequent delineation but where possible, were aligned along or close to the proposed cable route itself to ensure data was collected within the area of potential impact during installation of the cable. Cross lines were also completed between KP 68.9 and KP 78.3 where Annex I *S. spinulosa* reef habitat is thought to occur to form cruciform sampling at 1 km intervals. Overall, a total of 26 transects were completed between KP 000 – KP 084.

4.3.2. KP085 to KP270

Offshore areas were less targeted for HA sampling. However, irregular topography and potential Annex I *S. spinulosa* / stony reef was identified upon review of the acoustic information particularly between KP 224 – 255. Four DDV transects were therefore positioned in this area to enable higher confidence delineation of the Annex I reef habitats along this section of the cable route. A further six transects were positioned between KP085 – 190, where the same rationale was applied. This resulted in a total of 10 HA transects being surveyed between KP 085 and KP 270.

4.4. Conflicts Check

A detailed conflicts check was undertaken to ensure the proposed sampling stations/transects were positioned in safe locations and not in conflict with any seabed features or infrastructure (e.g. cables, pipelines, potential UXO etc.) that were not identified during the proximity check conducted by the Crown Estate prior to issuing the Seabed Survey Licence (SSL) for the survey.

To minimise impacts to sensitive seabed habitats and features, DDC deployments preceded grab sampling at all site characterisation sampling stations. When sensitive habitats were unexpectedly encountered during initial DDC deployments, stations were to be repositioned until an area suitable for grab sampling was identified as close to the original target location as possible. This action was not however required during the survey.

Table 2. Site Characterisation and Habitat Assessment sampling locations along GB Offshore Scheme section of the NeuConnect cable route.

KP	Station	Station Type	Sampling Method	WGS84		SAC	SPA
				Latitude (DD)	Longitude (DD)		
0.0	ENV_UK_INT_001	Site Characterisation	GRB	341666.11	5704628.13	-	Thames Estuary and Marshes
1.0	ENV_UK_INT_002	Site Characterisation	GRB	341797.88	5704754.69	-	Thames Estuary and Marshes
1.0	ENV_UK_INT_003	Site Characterisation	GRB	341895.39	5704886.22	-	Thames Estuary and Marshes
1.0	ENV_UK_INT_004	Site Characterisation	GRB	341980.27	5704995.88	-	Thames Estuary and Marshes
1.0	ENV_UK_INT_005	Site Characterisation	GRB	342064.78	5705112.13	-	Thames Estuary and Marshes
2.0	ENV_UK_INT_006	Site Characterisation	GRB	342144.46	5705222.62	-	Thames Estuary and Marshes
2.0	ENV_UK_INT_007	Site Characterisation	GRB	342228.99	5705339.31	-	Thames Estuary and Marshes
2.2	ENV_UK_HAB_001	Habitat Assessment	DDV	51.47850900	0.73434200	-	-
3.0	ENV_UK_ENV_001	Site Characterisation	DDC & GRB	51.477283	0.729624	-	-
4.0	ENV_UK_ENV_002	Site Characterisation	DDC & GRB	51.479131	0.758240	-	Outer Thames Estuary
6.0	ENV_UK_ENV_003	Site Characterisation	DDC & GRB	51.480057	0.786991	-	Outer Thames Estuary
8.0	ENV_UK_ENV_004	Site Characterisation	DDC & GRB	51.482566	0.815493	-	Outer Thames Estuary
10.0	ENV_UK_ENV_005	Site Characterisation	DDC & GRB	51.484421	0.844134	-	Outer Thames Estuary
11.8	ENV_UK_HAB_002	Habitat Assessment	DDV	51.48369600	0.86893400	-	Outer Thames Estuary
12.0	ENV_UK_ENV_006	Site Characterisation	DDC & GRB	51.484822	0.872886	-	Outer Thames Estuary
12.3	ENV_UK_HAB_003	Habitat Assessment	DDV	51.48523500	0.87486400	-	Outer Thames Estuary
12.8	ENV_UK_HAB_004	Habitat Assessment	DDV	51.48290000	0.88430600	-	Outer Thames Estuary
14.0	ENV_UK_ENV_007	Site Characterisation	DDC & GRB	51.482767	0.901456	-	Outer Thames Estuary
16.0	ENV_UK_ENV_008	Site Characterisation	DDC & GRB	51.479852	0.929847	-	Outer Thames Estuary
18.0	ENV_UK_ENV_009	Site Characterisation	DDC & GRB	51.480217	0.958623	-	Outer Thames Estuary
20.0	ENV_UK_ENV_010	Site Characterisation	DDC & GRB	51.485912	0.985850	-	Outer Thames Estuary
22.0	ENV_UK_ENV_011	Site Characterisation	DDC & GRB	51.492338	1.012745	-	Outer Thames Estuary
22.9	ENV_UK_HAB_005	Habitat Assessment	DDV	51.49794200	1.02078400	-	Outer Thames Estuary
24.0	ENV_UK_ENV_012	Site Characterisation	DDC & GRB	51.501453	1.037573	-	Outer Thames Estuary
26.0	ENV_UK_ENV_013	Site Characterisation	DDC & GRB	51.511262	1.061687	Margate and Longs Sands	Outer Thames Estuary
26.4	ENV_UK_HAB_006	Habitat Assessment	DDV	51.51028200	1.06681100	Margate and Longs Sands	Outer Thames Estuary
28.0	ENV_UK_ENV_014	Site Characterisation	DDC & GRB	51.519328	1.087441	Margate and Longs Sands	Outer Thames Estuary
30.0	ENV_UK_ENV_015	Site Characterisation	DDC & GRB	51.527899	1.112769	Margate and Longs Sands	Outer Thames Estuary
30.9	ENV_UK_HAB_007	Habitat Assessment	DDV	51.53292800	1.12367800	Margate and Longs Sands	Outer Thames Estuary
32.0	ENV_UK_ENV_016	Site Characterisation	DDC & GRB	51.535821	1.138597	Margate and Longs Sands	Outer Thames Estuary
34.0	ENV_UK_ENV_017	Site Characterisation	DDC & GRB	51.545033	1.161322	Margate and Longs Sands	Outer Thames Estuary
35.5	ENV_UK_HAB_008	Habitat Assessment	DDV	51.55423400	1.17833400	Margate and Longs Sands	Outer Thames Estuary
36.0	ENV_UK_ENV_018	Site Characterisation	DDC & GRB	51.557101	1.181418	Margate and Longs Sands	Outer Thames Estuary
38.0	ENV_UK_ENV_019	Site Characterisation	DDC & GRB	51.563275	1.208173	Margate and Longs Sands	Outer Thames Estuary
40.0	ENV_UK_ENV_020	Site Characterisation	DDC & GRB	51.568197	1.235818	Margate and Longs Sands	Outer Thames Estuary
41.4	ENV_UK_HAB_009	Habitat Assessment	DDV	51.57342900	1.25712500	Margate and Longs Sands	Outer Thames Estuary
42.0	ENV_UK_ENV_021	Site Characterisation	DDC & GRB	51.574112	1.262085	Margate and Longs Sands	Outer Thames Estuary
44.0	ENV_UK_ENV_022	Site Characterisation	DDC & GRB	51.585266	1.284720	Margate and Longs Sands	Outer Thames Estuary
46.0	ENV_UK_ENV_023	Site Characterisation	DDC & GRB	51.595822	1.308079	Margate and Longs Sands	Outer Thames Estuary
48.0	ENV_UK_ENV_024	Site Characterisation	DDC & GRB	51.604705	1.332995	Margate and Longs Sands	Outer Thames Estuary

KP	Station	Station Type	Sampling Method	WGS84		SAC	SPA
				Latitude (DD)	Longitude (DD)		
50.0	ENV_UK_ENV_025	Site Characterisation	DDC & GRB	51.615155	1.355819	Margate and Longs Sands	Outer Thames Estuary
52.0	ENV_UK_ENV_026	Site Characterisation	DDC & GRB	51.628045	1.375958	Margate and Longs Sands	Outer Thames Estuary
54.0	ENV_UK_ENV_027	Site Characterisation	DDC & GRB	51.640931	1.396109	Margate and Longs Sands	Outer Thames Estuary
56.0	ENV_UK_ENV_028	Site Characterisation	DDC & GRB	51.653435	1.416874	Margate and Longs Sands	Outer Thames Estuary
58.0	ENV_UK_ENV_029	Site Characterisation	DDC & GRB	51.665865	1.437764	Margate and Longs Sands	Outer Thames Estuary
60.0	ENV_UK_ENV_030	Site Characterisation	DDC & GRB	51.678578	1.458211	Margate and Longs Sands	Outer Thames Estuary
62.0	ENV_UK_ENV_031	Site Characterisation	DDC & GRB	51.691573	1.478089	Margate and Longs Sands	Outer Thames Estuary
64.0	ENV_UK_ENV_032	Site Characterisation	DDC & GRB	51.707537	1.491404	Margate and Longs Sands	Outer Thames Estuary
66.0	ENV_UK_ENV_033	Site Characterisation	DDC & GRB	51.723058	1.505869	Margate and Longs Sands	Outer Thames Estuary
68.0	ENV_UK_ENV_034	Site Characterisation	DDC & GRB	51.737524	1.523066	Margate and Longs Sands	Outer Thames Estuary
69.0	ENV_UK_HAB_010	Habitat Assessment	DDV	51.74421700	1.53102700	Margate and Longs Sands	Outer Thames Estuary
69.0	ENV_UK_HAB_011	Habitat Assessment	DDV	51.74540200	1.53063900	Margate and Longs Sands	Outer Thames Estuary
70.0	ENV_UK_HAB_012	Habitat Assessment	DDV	51.75126500	1.53941400	Margate and Longs Sands	Outer Thames Estuary
70.0	ENV_UK_HAB_013	Habitat Assessment	DDV	51.75253900	1.53913300	Margate and Longs Sands	Outer Thames Estuary
71.0	ENV_UK_HAB_014	Habitat Assessment	DDV	51.75847700	1.54806200	Margate and Longs Sands	Outer Thames Estuary
71.0	ENV_UK_HAB_015	Habitat Assessment	DDV	51.75974200	1.54778200	Margate and Longs Sands	Outer Thames Estuary
72.0	ENV_UK_HAB_016	Habitat Assessment	DDV	51.76566800	1.55675700	Margate and Longs Sands	Outer Thames Estuary
72.0	ENV_UK_HAB_017	Habitat Assessment	DDV	51.76691400	1.55645400	Margate and Longs Sands	Outer Thames Estuary
73.0	ENV_UK_HAB_018	Habitat Assessment	DDV	51.77285900	1.56545500	Margate and Longs Sands	Outer Thames Estuary
73.0	ENV_UK_HAB_019	Habitat Assessment	DDV	51.77409900	1.56514600	Margate and Longs Sands	Outer Thames Estuary
74.0	ENV_UK_HAB_020	Habitat Assessment	DDV	51.78005500	1.57414100	Margate and Longs Sands	Outer Thames Estuary
74.0	ENV_UK_HAB_021	Habitat Assessment	DDV	51.78130800	1.57386900	Margate and Longs Sands	Outer Thames Estuary
75.0	ENV_UK_HAB_022	Habitat Assessment	DDV	51.78611700	1.58476800	Margate and Longs Sands	Outer Thames Estuary
75.0	ENV_UK_HAB_023	Habitat Assessment	DDV	51.78737100	1.58492300	Margate and Longs Sands	Outer Thames Estuary
76.0	ENV_UK_ENV_035	Site Characterisation	DDC & GRB	51.792479	1.596974	Margate and Longs Sands	Outer Thames Estuary
77.5	ENV_UK_HAB_024	Habitat Assessment	DDV	51.80119700	1.61321500	Margate and Longs Sands	Outer Thames Estuary
78.0	ENV_UK_HAB_025	Habitat Assessment	DDV	51.80196400	1.61973600	Margate and Longs Sands	Outer Thames Estuary
78.0	ENV_UK_HAB_026	Habitat Assessment	DDV	51.80314500	1.62049400	Margate and Longs Sands	Outer Thames Estuary
80.0	ENV_UK_ENV_036	Site Characterisation	DDC & GRB	51.806075	1.649020	Margate and Longs Sands	Outer Thames Estuary
82.0	ENV_UK_ENV_037	Site Characterisation	DDC & GRB	51.806705	1.663487	Margate and Longs Sands	-
84.0	ENV_UK_ENV_038	Site Characterisation	DDC & GRB	51.807333	1.677955	Margate and Longs Sands	-
84.2	ENV_UK_ENV_039	Site Characterisation	DDC & GRB	51.805974	1.692194	-	-
89.0	ENV_UK_ENV_040	Site Characterisation	DDC & GRB	51.804082	1.706371	-	-
90.6	ENV_UK_HAB_027	Habitat Assessment	DDV	51.79435000	1.80046600	-	-
91.0	ENV_UK_ENV_041	Site Characterisation	DDC & GRB	51.803773	1.708685	-	-
92.0	ENV_UK_ENV_042	Site Characterisation	DDC & GRB	51.795014	1.777362	-	-
94.0	ENV_UK_ENV_043	Site Characterisation	DDC & GRB	51.792482	1.806070	-	-
99.0	ENV_UK_ENV_044	Site Characterisation	DDC & GRB	51.791214	1.820417	-	-
102.0	ENV_UK_ENV_045	Site Characterisation	DDC & GRB	51.790364	1.849134	-	-
104.0	ENV_UK_ENV_046	Site Characterisation	DDC & GRB	51.825283	1.883711	-	-
107.0	ENV_UK_ENV_047	Site Characterisation	DDC & GRB	51.851543	1.888715	-	-
110.0	ENV_UK_ENV_048	Site Characterisation	DDC & GRB	51.859062	1.914989	-	-

KP	Station	Station Type	Sampling Method	WGS84		SAC	SPA
				Latitude (DD)	Longitude (DD)		
115.0	ENV_UK_ENV_049	Site Characterisation	DDC & GRB	51.870297	1.954594	-	-
116.0	ENV_UK_HAB_028	Habitat Assessment	DDV	51.89839100	2.07456900	-	-
119.4	ENV_UK_HAB_029	Habitat Assessment	DDV	51.91894800	2.10572600	-	-
120.0	ENV_UK_ENV_050	Site Characterisation	DDC & GRB	51.881519	1.994220	-	-
122.2	ENV_UK_ENV_051	Site Characterisation	DDC & GRB	51.896461	2.047085	-	-
125.0	ENV_UK_ENV_052	Site Characterisation	DDC & GRB	51.923932	2.109881	-	-
130.0	ENV_UK_ENV_053	Site Characterisation	DDC & GRB	51.941562	2.124578	-	-
132.6	ENV_UK_HAB_030	Habitat Assessment	DDV	52.01100700	2.21232000	-	-
135.0	ENV_UK_ENV_054	Site Characterisation	DDC & GRB	51.963888	2.143213	-	-
137.4	ENV_UK_HAB_031	Habitat Assessment	DDV	52.02841700	2.27755600	-	-
140.0	ENV_UK_ENV_055	Site Characterisation	DDC & GRB	52.002140	2.179170	-	-
145.0	ENV_UK_ENV_056	Site Characterisation	DDC & GRB	52.020006	2.246018	-	-
150.0	ENV_UK_ENV_057	Site Characterisation	DDC & GRB	52.037834	2.312919	-	-
155.0	ENV_UK_ENV_058	Site Characterisation	DDC & GRB	52.056826	2.378982	-	-
160.0	ENV_UK_ENV_059	Site Characterisation	DDC & GRB	52.076398	2.444645	-	-
165.0	ENV_UK_ENV_060	Site Characterisation	DDC & GRB	52.095934	2.510366	-	-
170.0	ENV_UK_ENV_061	Site Characterisation	DDC & GRB	52.120303	2.564329	-	-
175.0	ENV_UK_ENV_062	Site Characterisation	DDC & GRB	52.165182	2.568515	-	-
180.0	ENV_UK_ENV_063	Site Characterisation	DDC & GRB	52.210061	2.572708	-	-
185.0	ENV_UK_ENV_064	Site Characterisation	DDC & GRB	52.254940	2.576910	-	-
189.0	ENV_UK_HAB_032	Habitat Assessment	DDV	52.36382700	2.63727200	-	-
190.0	ENV_UK_ENV_065	Site Characterisation	DDC & GRB	52.299818	2.581120	-	-
195.0	ENV_UK_ENV_066	Site Characterisation	DDC & GRB	52.343303	2.595046	-	-
200.0	ENV_UK_ENV_067	Site Characterisation	DDC & GRB	52.365400	2.652475	-	-
205.0	ENV_UK_ENV_068	Site Characterisation	DDC & GRB	52.372866	2.724904	-	-
210.0	ENV_UK_ENV_069	Site Characterisation	DDC & GRB	52.406569	2.768830	-	-
215.0	ENV_UK_ENV_070	Site Characterisation	DDC & GRB	52.450111	2.784928	-	-
220.0	ENV_UK_ENV_071	Site Characterisation	DDC & GRB	52.491478	2.812614	-	-
224.3	ENV_UK_HAB_033	Habitat Assessment	DDV	52.60582900	2.91331800	-	-
225.0	ENV_UK_ENV_072	Site Characterisation	DDC & GRB	52.530710	2.848574	-	-
230.0	ENV_UK_ENV_073	Site Characterisation	DDC & GRB	52.570541	2.882724	-	-
235.0	ENV_UK_ENV_074	Site Characterisation	DDC & GRB	52.610628	2.916115	-	-
239.0	ENV_UK_HAB_034	Habitat Assessment	DDV	52.72259300	3.00972200	-	-
240.0	ENV_UK_ENV_075	Site Characterisation	DDC & GRB	52.650706	2.949567	-	-
241.0	ENV_UK_HAB_035	Habitat Assessment	DDV	52.73240700	3.01795600	-	-
245.0	ENV_UK_ENV_076	Site Characterisation	DDC & GRB	52.690773	2.983080	-	-
250.0	ENV_UK_ENV_077	Site Characterisation	DDC & GRB	52.730832	3.016655	-	-
255.0	ENV_UK_ENV_078	Site Characterisation	DDC & GRB	52.770880	3.050291	-	-
255.1	ENV_UK_HAB_036	Habitat Assessment	DDV	52.85311000	3.11534300	-	-
260.0	ENV_UK_ENV_079	Site Characterisation	DDC & GRB	52.810918	3.083989	-	-
265.0	ENV_UK_ENV_080	Site Characterisation	DDC & GRB	52.851727	3.114997	-	-
270.0	ENV_UK_ENV_081	Site Characterisation	DDC & GRB	52.893064	3.144170	-	-

KP	Station	Station Type	Sampling Method	WGS84		SAC	SPA
				Latitude (DD)	Longitude (DD)		
275.0	ENV_UK_ENV_082	Site Characterisation	DDC & GRB	52.921961	3.195839	-	-
280.0	ENV_UK_ENV_083	Site Characterisation	DDC & GRB	52.964058	3.216999	-	-

4.5. Geodetic Parameters

All co-ordinates were based on Word Geodetic System 1984 (WGS84) with projected grid coordinates based on Universal Transverse Mercator zone 31N (UTM Zone 31N) with a Central Meridian of 3°E. A summary of geodetic and projection parameters are provided in Table 3.

Table 3. Geodetic parameters for the NeuConnect cable corridor geophysical, geotechnical and environmental surveys.

Local Geodetic Datum Parameters	
Datum:	WGS84
Spheroid:	International 1924
Project Projection Parameters	
Grid Projection:	Universal Transverse Mercator, Northern Hemisphere
UTM Zone:	31 N
Units:	Metre
Time Datum:	All data logged including survey logbook and video overlay times shall be time stamped with UTC.

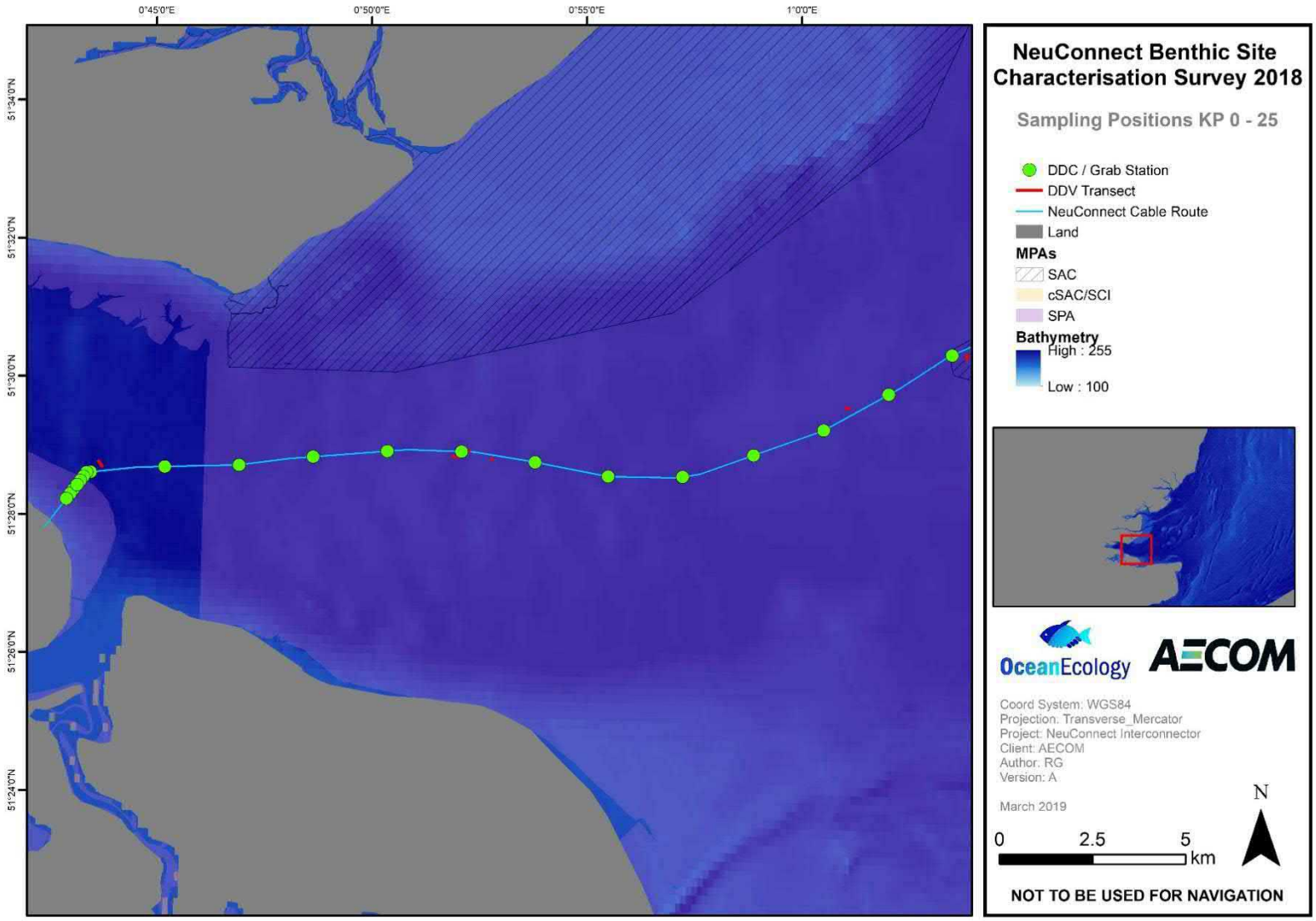

Figure 1 Overview of Site Characterisation and HA transect locations between KP 000 and KP 025 along the NeuConnect cable route[3].

[3] At the time of the writing this report the Southern North Sea Marine Protected Area had not been formally designated and therefore is referred to in all figures as a Candidate SAC (cSAC)".

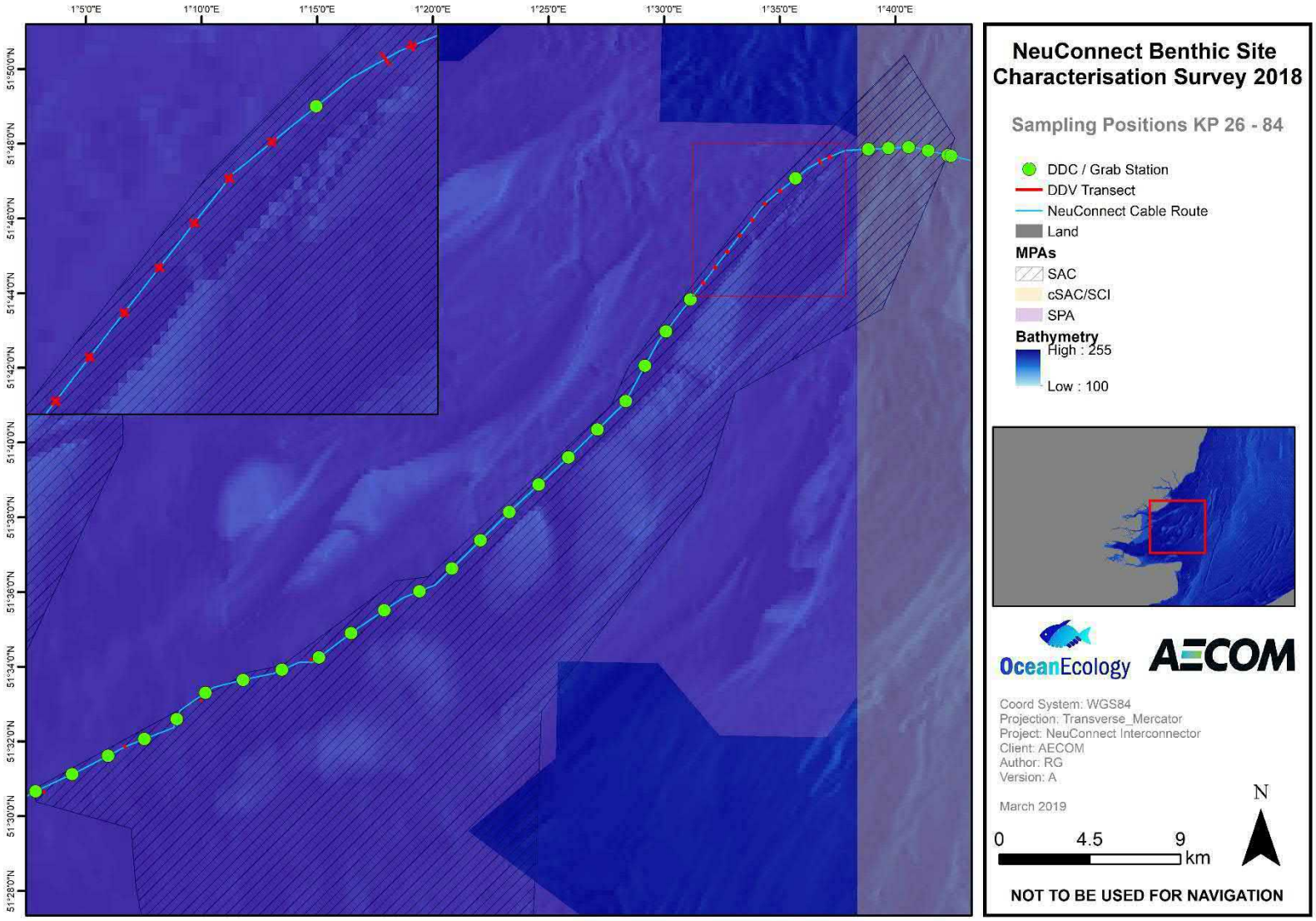

Figure 2 Overview of Site Characterisation and HA transect locations between KP 026 and KP 084 along the NeuConnect cable route and within the Margate and Long Sands Special Area of Conservation.

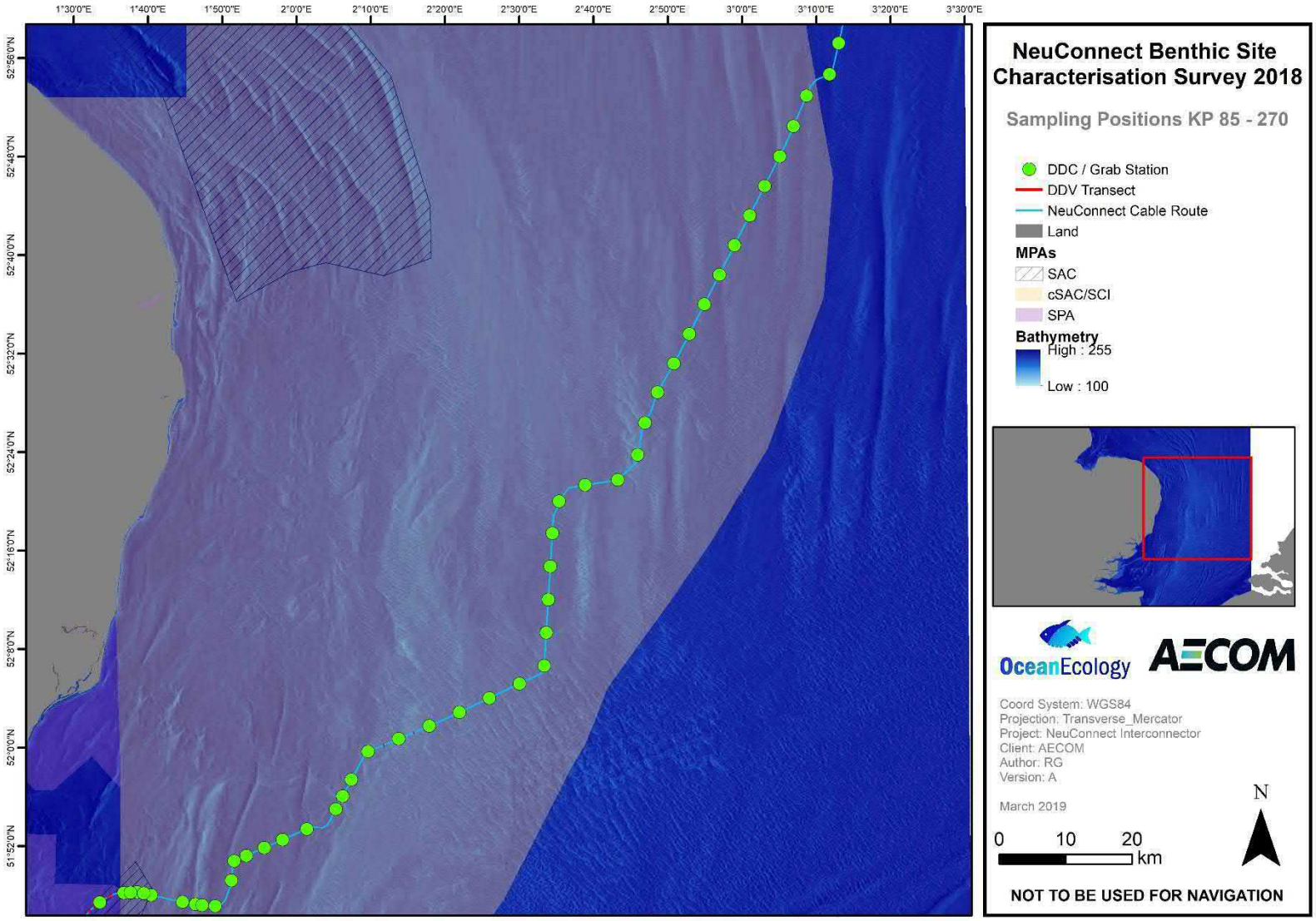

Figure 3 Overview of Site Characterisation and HA transect locations between KP085 and KP270 along the NeuConnect cable route and within the Margate and Long Sands Special Area of Conservation.

5. FIELD METHODS

5.1. Survey Vessel

Offshore survey works were undertaken aboard the vessels the Seiont A (first phase) and Isla B (second phase) operated by Barnes Offshore working out from Whitstable. Nearshore survey works and DDV transects located between KP 68.9 and KP 78.3 were undertaken aboard the survey vessel Seren Las operated by OEL working out from Shotley (Plate 1).

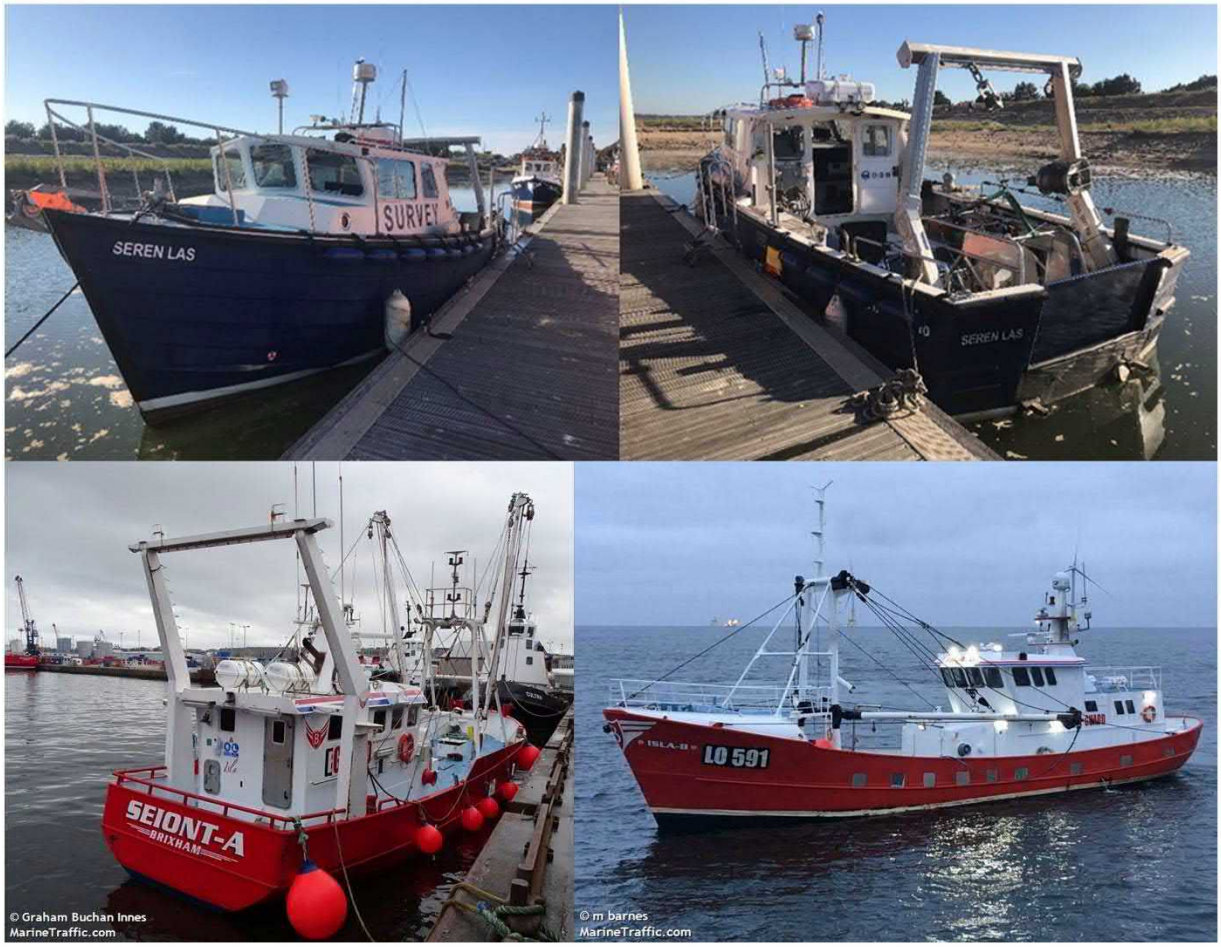

Plate 1. Survey vessels used for the NeuConnect benthic characterisation and habitat assessment survey. Top: *Seren Las*, bottom left: *Seiont-A*, bottom right: *Isla-B*

5.2. Personnel

All environmental works were carried out by a team of experienced OEL Environment Scientists. OEL field personnel all hold offshore safety training certificates and a minimum of a BSc in a Marine Environmental related discipline.

5.3. Sampling Equipment

5.3.1. Positioning

The Seiont A and Isla B were equipped with a Vector VS111™ GNSS compass systems that provided a highly accurate offset position of the sampling equipment when deployed from the stern. This provided a GPS feed to a dedicated survey navigation PC and a Digital Edge DVR system used to project the overlay on the Drop-Down Video (DDV) footage. Seren Las was equipped with a Hemisphere V104s GPS compass system that provided a highly accurate offset position of the sampling equipment when deployed from the stern. This provided a GPS feed to a dedicated survey navigation PC and a Digital Edge DVR system used to project the overlay on the DDV footage.

5.3.2. Seabed Camera System

All seabed imagery collected during the first phase of the survey (Seiont A and Seren Las) was be collected using a 208 Kongsberg camera fitted in a height adjustable freshwater housing camera system providing a variety of options for view, lighting and focal length. The use of this system maximised data quality with respect to prevailing conditions and ensured suitable imagery could be collected regardless of the water clarity at the time of sampling. The frame was also fitted with an LED lighting array.

Video was digitally overlaid using a DVR Edge topside unit giving ROV style overlay options with information including project, date, time and dGPS position (as a minimum) and recorded in a digital format on two hard drives simultaneously. A laser scaling array was also be projected into the field of view to provide a method for determining scale.

All seabed imagery collected during the second phase of the survey (Isla B) was collected using a STR SeaSpyder shallow water ultra-high-resolution camera system, equipped quad parallel lasers for scaling and four adjustable LED lamps.

5.3.3. Grab Samplers

Grab sampling was undertaken using a 0.1 m^2 Day grab. A 0.1 m^2 Hamon grab was also carried on board for sampling of coarse or compact sediments where Day grabbing was unsuccessful. Day grab sampling was prioritised where ever possible as Hamon grab samples are not generally suitable for collection of undisturbed physico-chemical samples due to the mixing of sediments when the grab is triggered.

5.4. Sampling Approach

5.4.1. Drop-Down Video Sampling

Methodologies employed for the collection of seabed imagery were based on guidance in the NMBAQC Operational Guidelines (Hitchin et al. 2015). Along each camera transect, images were taken at 5-10 m intervals and at any other feature of interest or change in habitat. All video was reviewed in situ by the on-board Environmental Scientists. A full description of DDC deployment methods employed during the survey is provided in Appendix II.

5.4.2. Grab Sampling

All grab sample collection and processing was undertaken in line with the methods described in the project Environmental Sampling Plan (ESP) (Ocean Ecology Limited 2018) aligned to relevant best practice guidance (Ware et al. 2011). Grab sampling was only conducted once suitable seabed video and stills of the seabed had been collected from each sampling station and no obstructions to inhibit the collection of grab samples had been identified. Where possible, all grab sampling was undertaken with a 0.1 m^2 Day Grab. This allowed for the collection of an undisturbed sediment surface for physico-chemical sampling (where required). Where sediments were too coarse to obtain an acceptable sample with the Day Grab, a 0.1 m^2 Hamon Grab was used. The grab was deployed to collect two replicate samples at each station. One replicate was sieved over a 1 mm mesh and preserved for macrobenthic analysis. The second replicate was subsampled for physico-chemical analysis (see Appendix II). Appendix III provides details on the sampling stations at which full physico-chemical samples were collected.

Plate 2. Top left: Deployment of freshwater housing camera system aboard *Seren Las.* Bottom left: Sieving of macrobenthic sample. Top right: Day and 0.1m^2 mini-Hamon grabs on deck. Middle right: Camera frame being deployed by Environmental Scientist. Bottom right: Deployment of 0.1m^2 Day grab using ships starboard side crane.

6. LABORATORY & ANALYTICAL METHODS

On arrival to the laboratory, all samples were logged in and entered into the project database created in OEL's web-based data management application ABACUS in line with in-house Standard Operating Procedures (SOPs) and OEL's Quality Management System (QMS).

6.1. Particle Size Distribution Analysis

PSD analysis was undertaken by in-house laboratory technicians at OEL's NE Atlantic Marine Biological Quality Control (NMBAQC) participating laboratory in line with NMBAQC protocols (Mason 2016) as described in Appendix IV.

6.2. Chemical Analysis

All organic matter, hydrocarbon and metals analysis was undertaken by SOCOTEC UK Limited. A full description of the methods used to test for each chemical determinand is provided as Appendix V.

6.3. Macrobenthic Analysis

Macrobenthic analysis was undertaken by in-house marine taxonomists at OEL's NMBAQC participating laboratory. Elutriation, extraction, identification, enumeration and biomassing was carried out in line with the NMBAQC Processing Requirement Protocol (PRP) ((Worsfold & Hall 2010)) as summarised in Appendix VI.

6.4. Seabed Imagery Analysis

6.4.1. Seabed Imagery

Following the methods described in Section 5.3.1, digital photographic stills and video footage were successfully obtained along all HA transects and site characterisation stations and subsequently analysed to aid in the identification and delineation of European Nature Information System (EUNIS) habitats and potential Annex I habitats along the cable corridor. All seabed imagery analysis was undertaken in line with the latest NMBAQC epibiota remote monitoring interpretation guidelines (Turner et al. 2016) and biotopes assigned in line with the most recent JNCC guidance on assigning benthic biotopes (Parry 2015). A full description of the analytical methods employed is provided in Appendix VII.

6.5. Geophysical Data Review

6.5.1. 2018 Geophysical Data

Geophysical data (MBES and SSS) was collected by MMT during an earlier 2018 survey programme. Data collected during the survey was further processed by OEL during interpretation for HA purposes. MBES was processed to produce a shaded relief output and a 0.25 m and 0.50 m contour map. All environmental data was then overlain to assist in the delineation of the principal habitats and biotopes present within the survey corridor.

6.6. Data Pre-Treatment

6.6.1. Macrobenthic Data

As the macrobenthic data may be used for comparison with future studies, it was imperative that the species nomenclature was recorded in a standardised manner. The macrobenthic species lists were therefore checked at the point of data recording via the live link to WoRMS within ABACUS.

Once the species nomenclature had been standardised in accordance with WoRMS accepted names, the taxon lists were examined carefully to truncate the data, excluding incidental recordings that might have skewed the data analysis or combining taxa with differing levels of identification.

In accordance with the OSPAR Commission guidelines (OSPAR 2004) records of colonial, meiofaunal, parasitic, egg and pelagic taxa (e.g. nematode, epitokes and larvae) were recorded, but were excluded when calculating diversity indices or conducting multivariate analysis of community structure. Newly settled juveniles of macrobenthic species may at times dominate the macrobenthos and can be considered an ephemeral component due to heavy post-settlement (OSPAR 2004). OSPAR (2004) states that "Should juveniles appear among the ten most dominant organisms in the data set, the statistical analysis should be conducted both with and without these in order to evaluate their importance". Analysis was conducted on the data set that excluded juveniles, as well as the data set with juveniles included. Comparison between the results of the two analyses revealed similar clustering of stations into groups, suggesting that the two datasets were revealing similar ecological patterns. Consequently, the results presented in this report are based on the data set with juveniles included as they did not dominate the macrobenthic community and enabled fewer faunal groups to be identified.

6.7. Statisical Analysis

6.7.1. Particle Size Distribution Data

Sediment PSD statistics for each sample were calculated from the raw data using Gradistat V8.0 (Blott 2010) and converted into Broad Scale Habitats (BSH) (EUNIS Level 3) using the adapted Folk trigon (Long 2006).

6.7.2. Macrobenthic Data

6.7.2.1. Diversity Indices

In order to condense the full macrobenthic community datasets into a single comparative number, univariate metrics, otherwise known as diversity indices, were calculated from the macrobenthic datasets using the DIVERSE routine in PRIMER v7.

6.7.2.2. Multivariate Analysis

The PRIMER v7 software package (Clarke & Gorley 2015) was utilised to undertake the multivariate statistical analysis on the macrobenthic dataset. In order to fully investigate the multivariate patterns in the data, a suite of analytical routines were employed as described in detail in Appendix VIII. Prior to multivariate analyses, data were displayed as a shade plot with linear grey-scale intensity proportional to macrobenthic abundance to determine the most efficient pre-treatment (transformation) method (Clarke et al. 2014).

6.8. Biotopes

6.8.1. Biotope Determination

Biotopes were identified according to the EUNIS biotope classification system in line with JNCC guidance on assigning benthic biotopes (Parry 2015) in consideration of each of the following datasets/outputs:

- Existing biotope maps (EMODnet);
- Shade plots with linear grey-scale intensity proportional macrobenthic abundance data;
- Macrobenthic faunal groups determined by SIMPROF and/or similarity slice;
- PSD analysis data converted into BSH (EUNIS Level 3) using the adapted Folk trigon (Long 2006); and
- Epibenthic data through analysis of seabed imagery.

6.8.2. Biotope Mapping

All biotope mapping was undertaken in ESRI ArcPro involving overlaying biotopes assigned to each sampling location on the mosaiced SSS and MBES data allowing for delineation of areas representative of similar acoustic signatures aligned to those at each DDC/grab station and along each DDV transect.

7. RESULTS

7.1. Particle Size Distribution Data

The composition of sediment data at each grab sampling station throughout the survey area is mapped in

Figure 4. Grab sampling logs and sample photos are provided in Appendix III and IX respectively and full PSD data has been provided in Appendix X.

7.1.1. Sediment Type

Sediment types at each grab sampling station as classified by the Folk (1954) classification are summarised in Appendix XI. Despite some variation in sediment types between stations, the majority of stations were dominated by sandy sediments with low mud content (sediments < 63 µm). Mud content was highest close to the estuary and between 80 – 100 km along the proposed cable route. Gravel content was variable along the cable route and was highest within the troughs of the Annex I sandbank features at certain locations (e.g. ENV035). The majority of samples were comprised of sand (S), representing EUNIS BSH A5.2 (sublittoral sand), while some stations were classified as muddy sand (mS) or sandy mud (sM), representing EUNIS BSH A5.3 (sublittoral mud). Others exhibited higher gravel content and were classified as gravelly mud (gM) or gravelly muddy sand (gmS), representing sublittoral mixed sediments (EUNIS BSH A5.4). Intertidal stations were classified as either EUNIS BSH A2.2 (Littoral sand and muddy sand) or A2.3 (Littoral mud).

Most of the sediments recorded were classified as poorly to extremely poorly sorted (60 % of stations) as a result of the mixed composition of different size fractions of all three principle sediment types (gravel, sand and mud). However, 20 stations (22 %) were classified as well sorted and comprised almost entirely of sand.

7.1.2. Sediment Composition

The percentage contribution of gravels (> 2 mm), sands (0.63 mm to 2 mm) and fines (< 63 µm) at each station are presented in

Figure 4. Sand was the main sediment fraction present at most stations, comprising the largest percentage contribution across the survey area (**Error! Reference source not found.**Table 3). The mean proportion of sand across all stations was 75.9 % (± 0.03), while the mean mud and gravel content across the survey area was 17.1 % (± 0.02) and 7.0 (± 0.01) respectively. Sand content was greatest at stations ENV023, ENV060, ENV061, ENV081 and ENV082 and lowest at ENV046. The mean grain size at sampling stations ranged from 15.15 µm at station ENV039 (located at the offshore edge of the Margate and Long Sands SAC) to 2455.2 µm at ENV013 (located at the inshore edge of the Margate and Long Sands SAC).

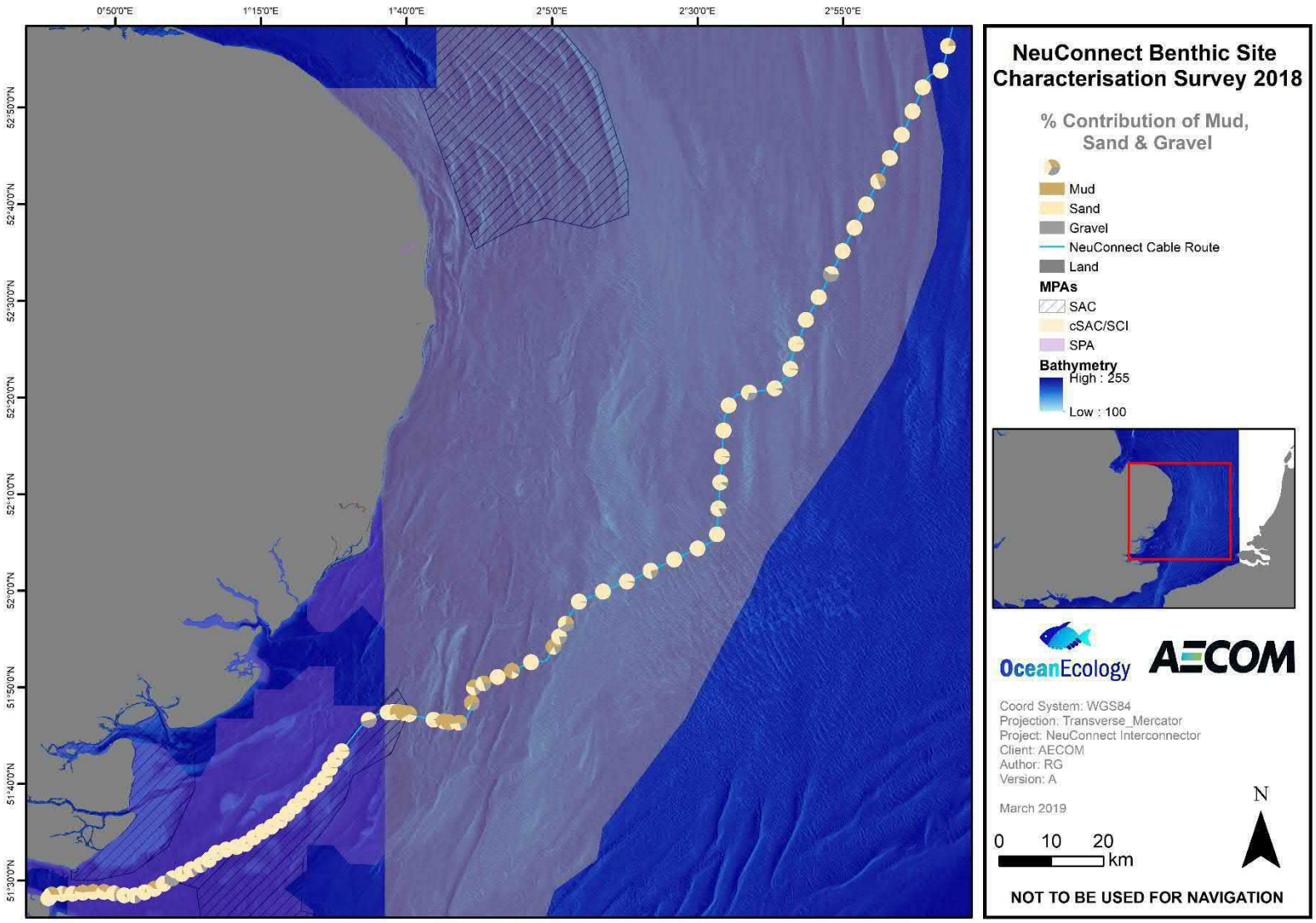

Figure 4. Percentage volume of gravel (G), sand (S) and mud (M) at each sampling station along the GB Offshore Scheme section of the proposed NeuConnect cable route

7.2. Sediment Chemistry

Sediment samples for contaminant analysis were collected from 43 stations sampled along the GB Offshore Scheme section of the proposed NeuConnect cable route. Grab samples taken for contaminant analyses were analysed for heavy and trace metals, Polycyclic Aromatic Hydrocarbon (PAH), Organotins (DBT and TBT), Polychlorinated Biphenyl (PCB), and Organochlorine concentrations.

7.2.1. Heavy and Trace Metals

A series of eight heavy and trace metals – Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), and Zinc (Zn) - were analysed from sediments taken at each of the 41 stations. The results of the sediment metal analyses are summarised in **Table 4** and Table 5, with the raw data sets reported in Appendix XII.

Where available, metal concentrations were compared to the OSPAR BC and BAC, (OSPAR 2014) as well as the UKOOA (2001) background mean and 95th percentile concentrations for the southern North Sea, Cefas (2003) ALs 1 & 2, and Canadian sediment quality guidelines TELs and PELs (See Appendix XII for definitions).

The most abundant metal was As which ranged from 5.3 $mgKg^{-1}$ at INT_002 to 78.6 $mgKg^{-1}$ at ENV_041 and was generally recorded in elevated concentrations across most stations with no obvious spatial distribution. Zn was also recorded in high concentration, ranging from 7.9 $mgKg^{-1}$ at ENV_056 to 61.4 $mgKg^{-1}$ at ENV_011, with lower values often recorded in more offshore areas. Other metals, including Cd, Cu, Ni and Pb were observed in similar concentrations and were often lower at more offshore stations with the exception of Cu. Concentrations of Cd and Cr were below UKOOA (2001) mean concentrations at all stations.

Table 5 summarises comparisons made between the eight heavy and trace metals analysed against OSPAR BC and BAC levels, UKOOA (2001), Cefas (2003) ALs, and Canadian sediment quality guidelines to identify the number of stations sampled that showed elevated concentrations. As exceeded OSPAR BC and BAC levels at the most stations (15 and 8 respectively) as well as Cefas AL1 at 11 stations suggesting high levels of As across the entire route. To a lesser extent, elevated Pb, Hg, and Ni content, in relation to OSPAR levels, were observed at a number of stations. Cu and Zn also showed elevated concentrations, where 30 and 22 stations respectively had concentrations in excess of the UKOOA (2001) mean concentrations. In total 11 sampling stations had concentrations of one or more of Cu, Hg, Ni, Pb, and Zn in excess of the UKOOA (2001) 95th percentile concentrations. This suggests very high levels against background levels for the southern North Sea were only observed at a relatively limited number of stations along the cable route.

Cefas (2003) ALs are used as part of a 'weight of evidence' approach to assessing dredged material and its suitability for disposal to sea (Cefas 2003). Contaminant levels in dredged material which fall below AL1 are of no concern and are unlikely to influence decision-making, while contaminant levels above AL2 are generally considered unsuitable for sea disposal. Contaminant levels between AL1 and AL2 require further assessment. As (11 stations) and Ni (three stations) were the only metals to have been recorded in concentrations that exceeded Cefas (2003) AL 1 with no metals recorded in excess of Cefas (2003) AL2.

Canadian sediment quality guidelines are based on field research programmes that have demonstrated associations between chemicals and biological effects by establishing cause and effect relationships in particular organisms (PLA n.d). At levels above the threshold effect levels (TELs), adverse effects may occasionally occur. At levels above the probable effect levels (PELs), adverse effects may occur frequently. Cd, Cr, Pb, Ni and Zn were all recorded at concentrations falling below the TELs. Cu and Hg were recorded above the TELs at one and two stations respectively. As was recorded above the TELs at 35 stations, and above the PELs at five stations.

A full comparison of metal concentrations with guideline levels and background levels at each sampling station is provided in Appendix XIII.

Table 4. Summary of heavy and trace metal results ($mgKg^{-1}$) against UKOOA (2001) background levels for the southern North Sea

	Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc
ENV_UK_INT_002	5.3	0.09	8.8	7.4	0.06	5.3	8.1	27.4
ENV_UK_INT_004	6.8	0.1	13.3	10.3	0.1	7.8	12.9	36.5
ENV_UK_INT_006	8.6	0.12	17.3	13.1	0.14	9.9	16.8	45.6
ENV_UK_ENV_001	8.6	0.08	19.8	14.4	0.14	11.2	18.9	50.7
ENV_UK_ENV_003	5.9	0.08	10.1	8.4	0.06	5.6	9.5	26.8
ENV_UK_ENV_005	10.8	0.09	10.8	11.2	0.12	7.2	20.8	39.8
ENV_UK_ENV_007	7.5	0.08	6.9	6.9	0.09	5.7	20.5	26.8
ENV_UK_ENV_009	17.1	0.1	21.4	12.9	0.08	15.1	20.7	57.6
ENV_UK_ENV_011	51.5	0.08	11.2	5.4	0.04	7.1	26	61.4
ENV_UK_ENV_013	14.3	0.04	9.9	13.1	0.06	8.4	25.5	22
ENV_UK_ENV_015	21.6	0.09	9.3	6.8	0.02	5.3	10.5	32.5
ENV_UK_ENV_017	38.4	0.05	9.3	6.3	<0.015	5.7	8.7	29.2
ENV_UK_ENV_019	20.6	0.08	8.5	7.1	0.02	5.3	9.5	25
ENV_UK_ENV_021	12.4	0.05	8.6	6.6	<0.015	5.2	5.2	21.2
ENV_UK_ENV_023	50.1	0.07	6.8	5.5	<0.015	5.3	10.8	29
ENV_UK_ENV_025	12.2	0.06	8.7	7.7	0.02	5.7	7	20.2
ENV_UK_ENV_027	12.8	<0.04	7.6	5.9	0.02	4.4	4.6	25.4
ENV_UK_ENV_029	15.6	<0.04	7.7	6.8	<0.015	4.7	5.3	25.8
ENV_UK_ENV_031	11.5	0.05	7.3	5.9	<0.015	4.2	4.3	16.6
ENV_UK_ENV_033	9.1	0.05	7.4	6	<0.015	4.3	4.6	18.6
ENV_UK_ENV_037	10	0.05	7.5	6.7	<0.015	4.4	4.8	18
ENV_UK_ENV_039	24.6	0.25	24.5	24.9	0.06	23.8	13.1	57
ENV_UK_ENV_041	78.6	0.36	21.2	12.1	<0.015	27.5	9.7	42.4
ENV_UK_ENV_042	54.3	0.19	9.2	6.8	0.03	19.2	8.1	29.8
ENV_UK_ENV_045	50.4	0.15	22.1	13.8	<0.015	30.4	7.2	43.3
ENV_UK_ENV_051	30.3	0.12	6.2	4.9	<0.015	5.7	3.8	18
ENV_UK_ENV_056	6.3	<0.04	2.5	3.1	<0.015	2.8	1.8	7.9
ENV_UK_ENV_058	28	0.05	7.8	5.8	<0.015	8.2	3.7	15.9
ENV_UK_ENV_060	9	0.08	5	11.7	0.04	4.5	5.8	24.7
ENV_UK_ENV_062	8.6	<0.04	4.7	9.6	0.02	3.6	2.7	11.9
ENV_UK_ENV_064	8.7	<0.04	5.4	10.9	<0.015	3.9	2	14.6
ENV_UK_ENV_066	12	<0.04	5	9.1	<0.015	3.6	2.1	16.2
ENV_UK_ENV_068	15.7	<0.04	6.4	8.1	<0.015	4.1	2.6	17.1
ENV_UK_ENV_070	10.3	<0.04	5.6	10.6	<0.015	3.9	2.5	25.8
ENV_UK_ENV_072	5.8	<0.04	5.1	7.8	0.12	3.1	1.8	13.5
ENV_UK_ENV_074	11.2	<0.04	5.2	9.5	0.07	3.7	2.4	20
ENV_UK_ENV_076	10.60	<0.04	7.10	8.8	0.03	4.40	3.20	15.30
ENV_UK_ENV_078	11.60	<0.04	6.90	9.7	0.02	4.30	2.80	16.50
ENV_UK_ENV_080	15.50	<0.04	8.70	8.6	<0.015	5.40	4.60	17.80
ENV_UK_ENV_082	7.60	<0.04	7.60	7.2	<0.015	4.50	2.30	12.50
Min	5.30	0.04	2.50	3.10	0.02	2.80	1.80	7.90
Max	78.60	0.36	24.50	24.90	0.14	30.40	26.00	61.40
Mean	**18.75**	**0.10**	**9.61**	**8.94**	**0.06**	**7.61**	**8.43**	**26.91**
SD	16.69	0.07	5.33	3.76	0.04	6.53	6.86	13.44
UKOOA 95th %	-	**0.5**	**48.5**	**11.8**	**0.1**	**18.7**	**21.1**	**43.5**
UKOAA Mean	-	0.5	24.6	6.6	0.03	8	12.7	21.8

Table 5. Number of stations along the GB Offshore Scheme section of the proposed NeuConnect cable route exhibiting elevated heavy and trace metal levels in comparison with OSPAR, UKOOA, Cefas (2003) Action Levels 1 and 2, and Canadian sediment quality guidelines.

	UKOOA		OSPAR		CEFAS Action Level		Canadian sediment quality guidelines	
	Mean	95th %	BC	BAC	AL1	AL2	TEL	PEL
Arsenic	-	-	15	8	11	0	35	5
Cadmium	0	0	2	1	0	0	0	0
Chromium	0	0	-	-	0	0	0	0
Copper	30	7	1	0	0	0	1	0
Mercury	14	4	12	7	0	0	2	0
Nickel	9	4	1	0	3	0	0	0
Lead	9	2	2	0	0	0	0	0
Zinc	22	5	0	0	0	0	0	0

7.2.2. Polycyclic Aromatic Hydrocarbons (PAH)

A full range of PAHs were tested for all 41 samples collected, including those PAHs specified by the Department of Trade and Industry (DTI) regulations (DTI 1993) which include the 16 PAHs recommended as priority pollutants, notably the 2 to 6 ring compounds (Nyberg et al. 2013).

Samples collected for contaminant analysis were analysed for PAH. The results of the PAH analyses undertaken are summarised in Table 6, with full results reported in Appendix XIV. PAH concentrations were then compared to the OSPAR BC and BAC, Canadian sediment quality guideline TELs and PELs, and Cefas (2003) AL1 guidelines.

Table 6 summarises the OSPAR BC and BAC levels, Canadian TELs and PELs and Cefas (2003) AL1 guidelines to show the number of stations sampled that exhibited elevated concentrations. PAHs only occasionally exceeded OSPAR BCs and BACs, Canadian guideline TELs and Cefas (2003) AL1 guidelines. At no point were Canadian PELs exceeded. PAHs were only prevalent at inshore stations, with the exception of ENV_070.

A full comparison of hydrocarbon concentrations with guideline levels and background levels at each sampling station is provided in Appendix XIV.

Table 6. Overview of OSPAR, Canadian and CEFAS guideline PAH level exceedances at stations sampled along the GB Offshore Scheme section of the proposed NeuConnect cable route.

	OSPAR		Canadian sediment quality guidelines		CEFAS
	BC	BAC	TEL	PEL	AL1
Acenaphthene	-	-	3	0	0
Acenaphthylene	-	-	5	0	0
Anthracene	9	6	1	0	0
Benz[a]anthracene	12	7	1	0	1
Benzo[a]pyrene	10	6	3	0	3
Benzo[b]fluoranthene	-	-	-	-	3.0
Benzo[g,h,i]perylene	0	0	-	-	1.0
Benzo[e]pyrene	-	-	-	-	3.0
Benzo[k]fluoranthene	-	-	-	-	1.0
Naphthalene	23	20	8	0	5
Phenanthrene	10	7	2	0	2
Chrysene	12	6	2	0	2
Dibenzo[a,h]anthracene	-	-	6	0	0
Fluoranthene	11	7	4	0	4
Fluorene	-	-	2	0	0
Indeno[123,cd]pyrene	5	2	-	-	3
Perylene	-	-	-	-	1
Pyrene	12	8	0	0	1

7.2.3. Organotins

Samples collected for contaminant analysis were analysed for the organotins: Monobutyltin (MBT), Dibutyltine (DBT), and Tributyltin (TBT). A single station (UK_ENV_001) had levels of MBT greater than Cefas (2003) AL1 (0.1 mg/kg dry weight). Organotins were not detected at any other stations. A detailed summary of organotin concentrations can be found in Appendix XIV.

7.2.4. Polychlorinated Biphenyls (PCB)

Samples collected for contaminant analysis were analysed for PCBs. None of the sampled stations had values greater than Cefas (2003) AL1 or Canadian guideline TELs and PELs. A detailed summary of PCB concentrations can be found in Appendix XIV.

7.2.5. Organochlorines

Samples collected for contaminant analysis were analysed for the organochlorines Dieldrin and Dichlorodiphenyltrichloroethane (DDT). None of the sampled stations had values greater than Cefas (2003) AL1 (0.005 and 0.001 mg/kg dry weight respectively). A detailed summary of organochlorine concentrations can be found in Appendix XIV.

7.3. Macrobenthos

7.3.1. Diversity

The macrobenthic assemblage identified along the GB Offshore Scheme section of the proposed NeuConnect cable route was relatively diverse with a total of 356 taxa recorded with a mean (± SE) of 15.1 ± 2.0 taxa per sample. Mean (± SE) abundance per sample was 62.7 ± 11.6 individuals per sample. These values exclude records of eggs, epitoke, megalopa, juvenile, parasitic and zoea taxa as summarised in Table 7. The full abundance and biomass matrix is provided in Appendix XIV in line with Marine Environmental Data and Information Network (MEDIN) data standards presenting the abundance of each taxon and biomass per major group (Annelida, Crustacea, Mollusca, Echinodermata and Others) in all samples collected across the survey area.

Table 7. Summary of macrobenthic abundance and diversity along the GB Offshore Scheme section of the proposed NeuConnect cable route.

Taxa	Abundance (N)	Number of Taxa (S)
Colonial	-	62
Eggs	1	1
Epitoke	1	1
Juvenile	384	29
Megalopa	2	1
Parasite	1	1
Zoea	6	1
Others	5,033	260
TOTAL	**5,428**	**356**

Figure 5 illustrates the relative contributions to total abundance (N), diversity (S) and biomass (gAFDM) of the major taxonomic groups of the macrobenthic communities sampled within and outside the Margate and Long Sands SAC and combined. Annelid taxa dominated the assemblages in terms of N accounting for 39 % of all individuals recorded (across all areas) with higher % contribution recorded within the SAC (59.7 %). Annelid taxa also dominated S accounting for 36.8 % of the taxa identified across all areas although echinoderms dominated the overall biomass (48.2 %). Molluscs were the second greatest contributors to overall abundance (32.3 %) and biomass (38.3 %), particularly in areas outside of the SAC. The greatest abundance and diversity of macrobenthic taxa were sampled in areas along the cable route characterised as EUNIS biotope A5.611 '*Sabellaria spinulosa* on stable circalittoral mixed sediment' and A5.44 circalittoral mixed sediment

Figure 7 and

Figure 8.

The mollusc, *Peringia ulvae*, contributed most to total abundance, had the highest maximum abundance in a single sample, and the highest mean density per sample (Figure 6). The Ross worm, *S. spinulosa*, was also abundant across the survey area. *S. spinulosa* accounted for 6.5 % of all individuals recorded and was recorded in 21.1 % of samples (Figure 6). *Nephtys cirrosa* and *Nephtys* juveniles were the most frequently observed taxa and were recorded in 44.4 % and 37.8 % of samples respectively (Figure 6B).

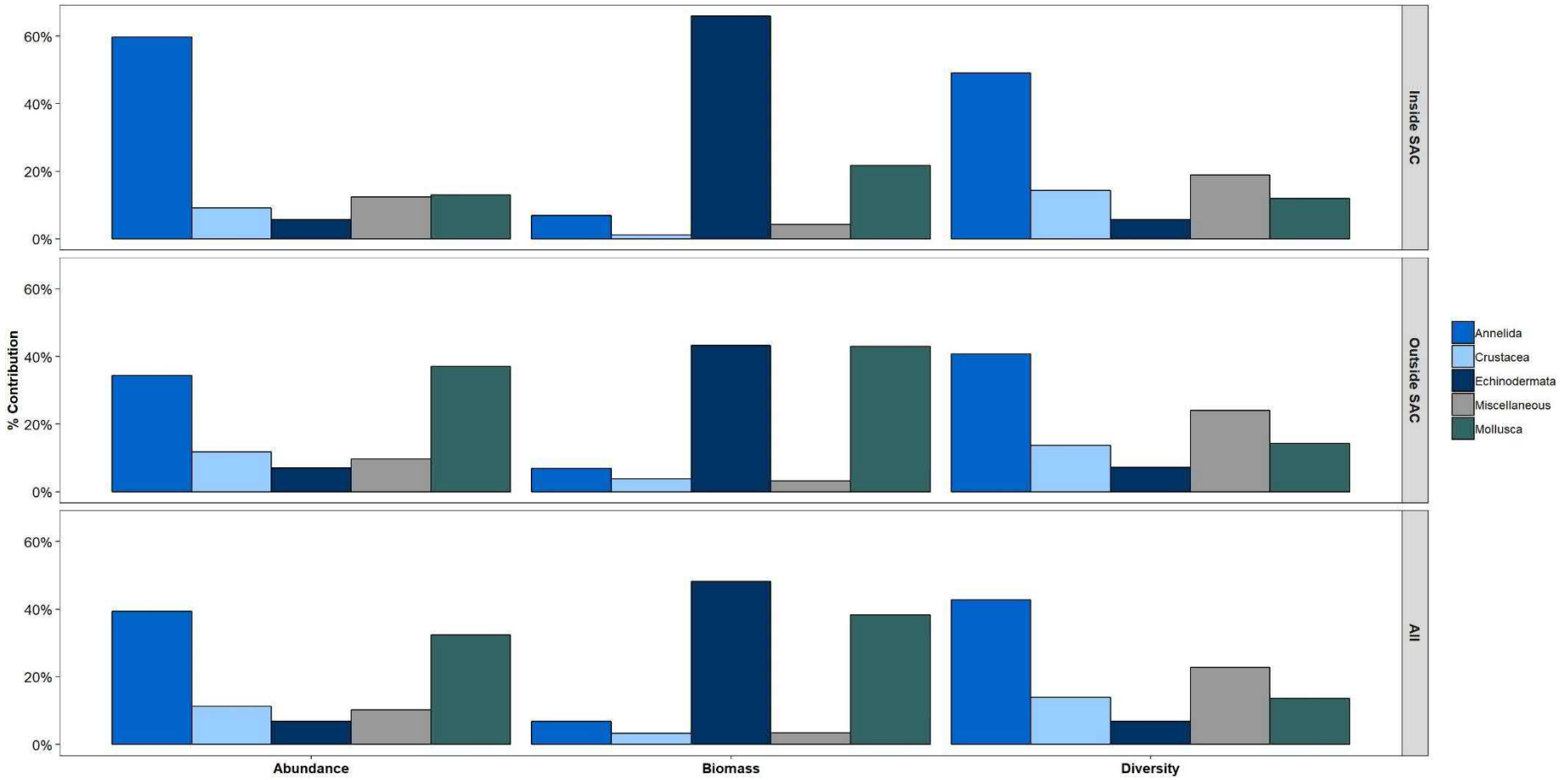

Figure 5. Relative contribution of the major taxonomic groups to the total abundance (N), biomass (gAFDW), and diversity (S), of the macrobenthic communities sampled along the GB Offshore Scheme section of the proposed NeuConnect cable route. Data reported for both inside and outside the Margate and Long Sands Special Area of Conservation (SAC) as well as for both areas combined.

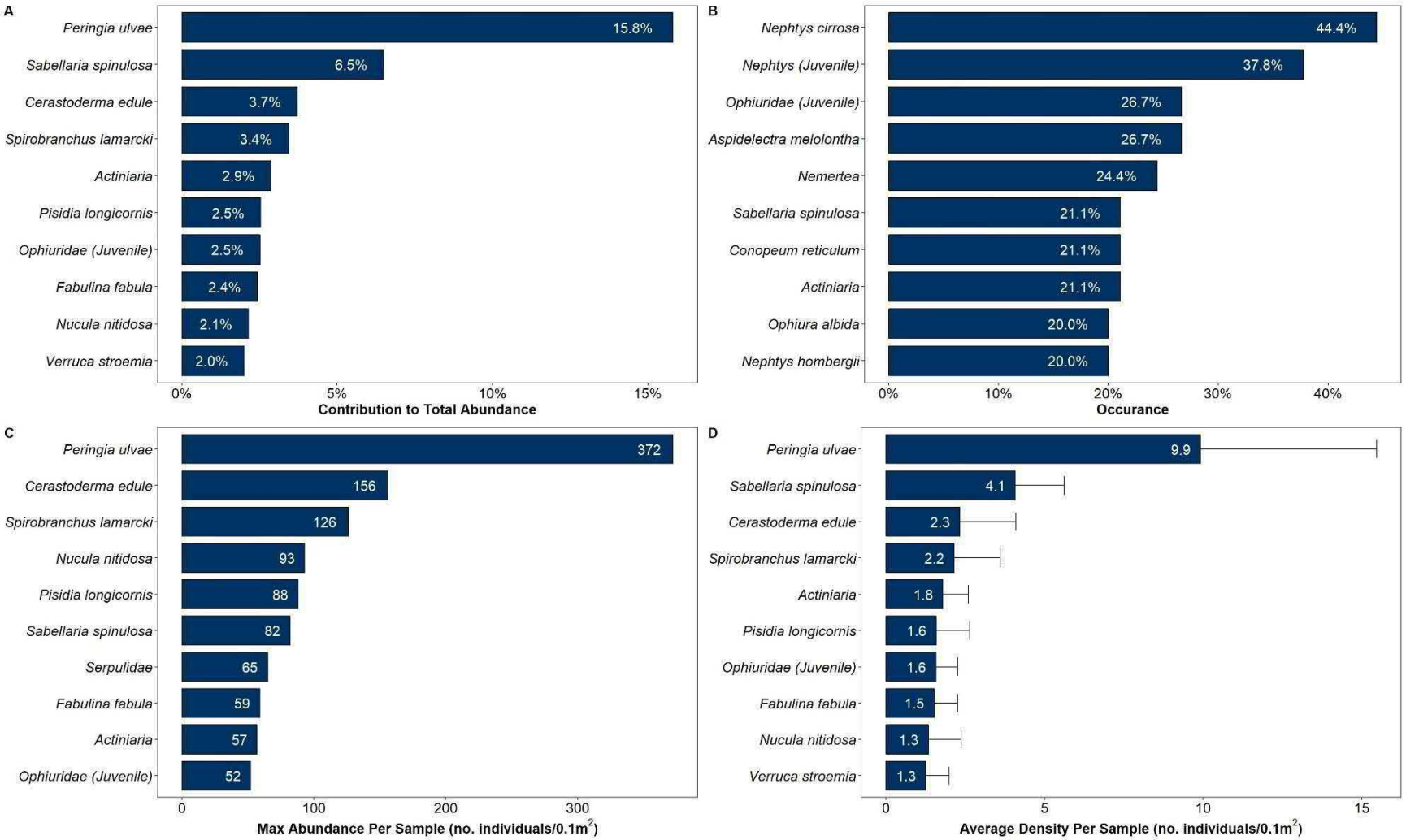

Figure 6. Percentage contributions of the top 10 taxa to total abundance (A) and occurrence (B) from samples collected during the NeuConnect cable survey. Also shown are the maximum densities of the top 10 taxa per sample (C) and average densities of the top 10 taxa per sample (D).

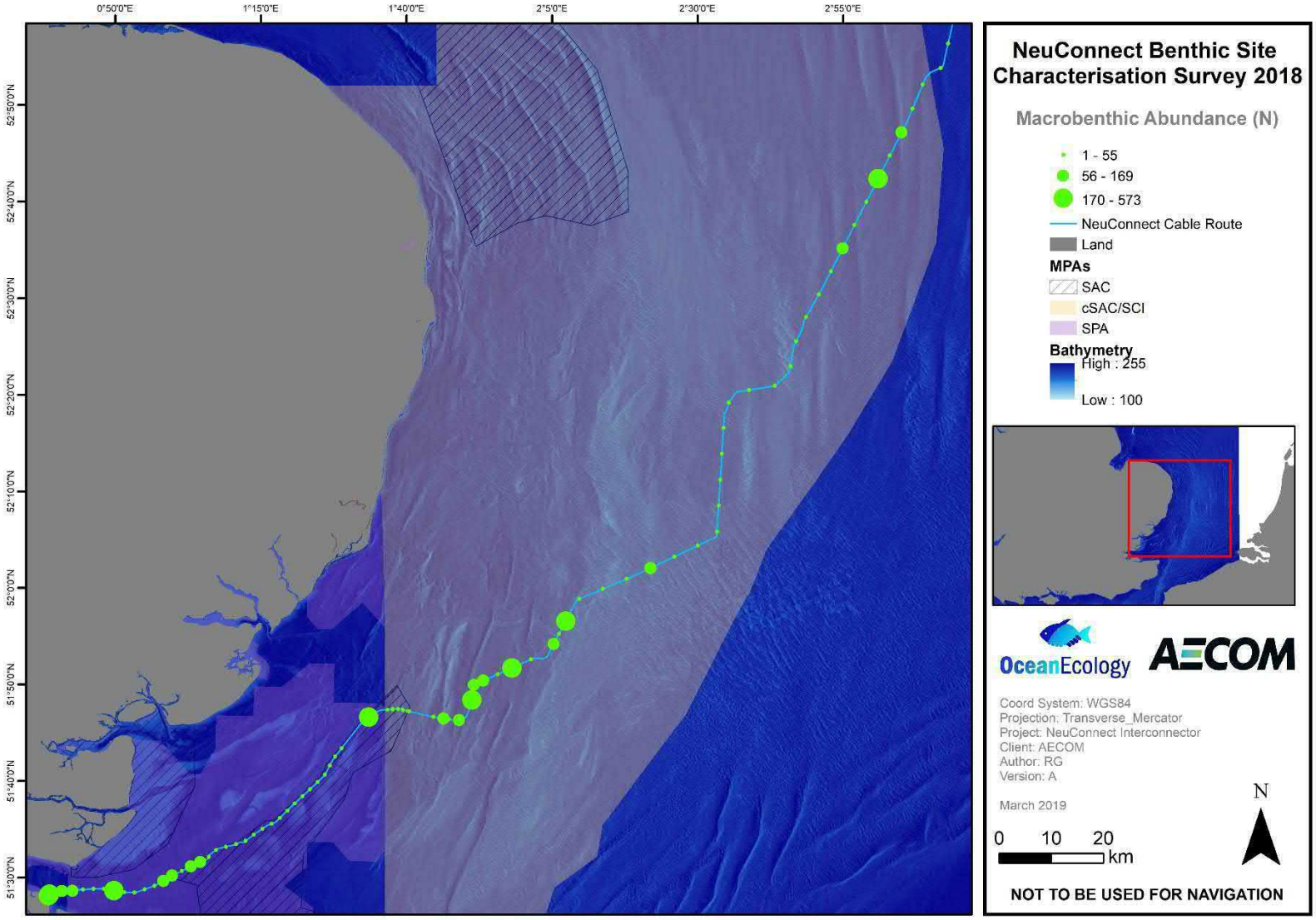

Figure 7 Map to show mean macrobenthic abundance along the GB Offshore Scheme section of the proposed NeuConnect cable route overlain on EUNIS biotope mapping determined as part of the HA for the project.

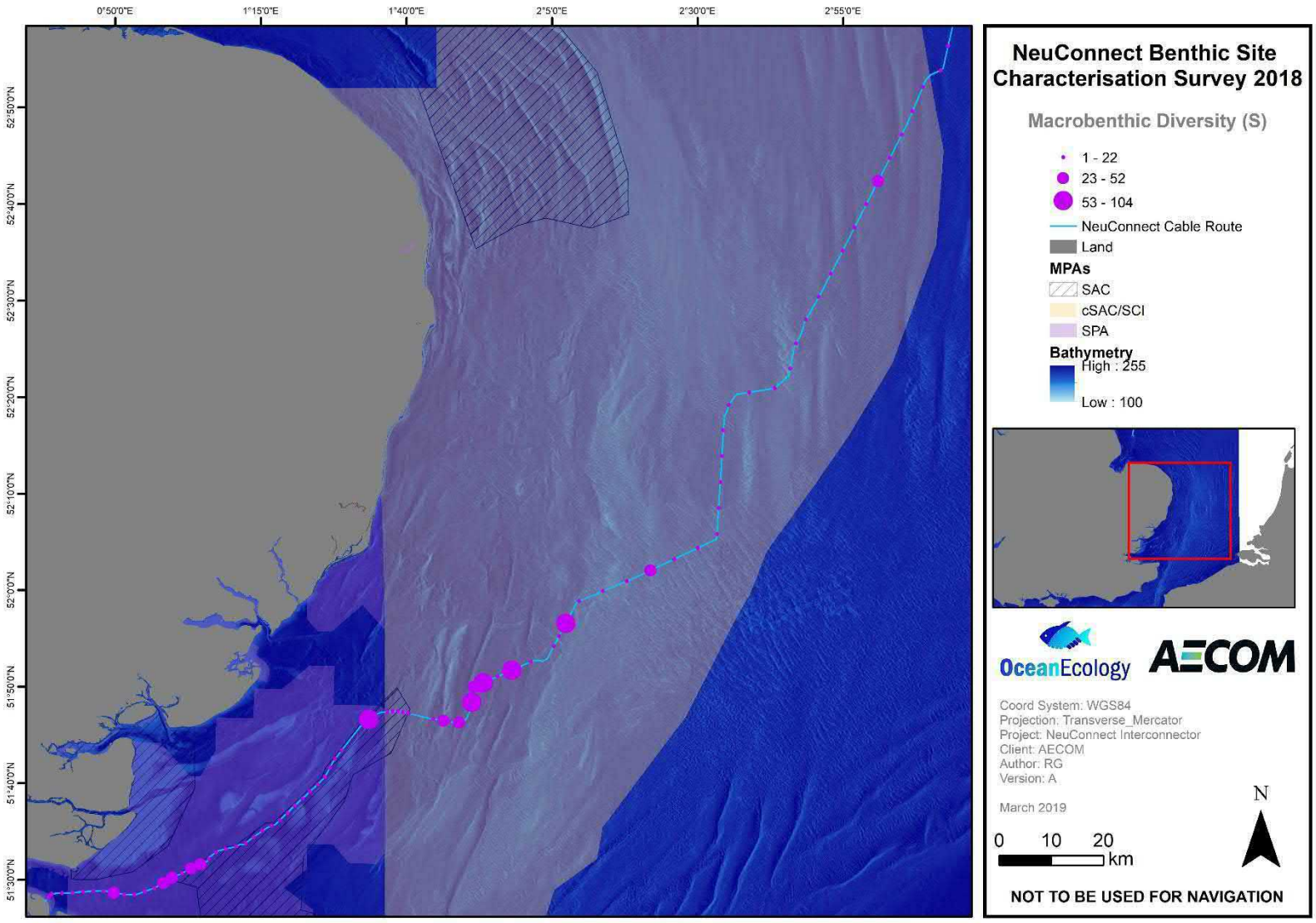

Figure 8 Map to show mean macrobenthic diversity along the GB Offshore Scheme section of the proposed NeuConnect cable route overlain on EUNIS biotope mapping determined as part of the HA for the project.

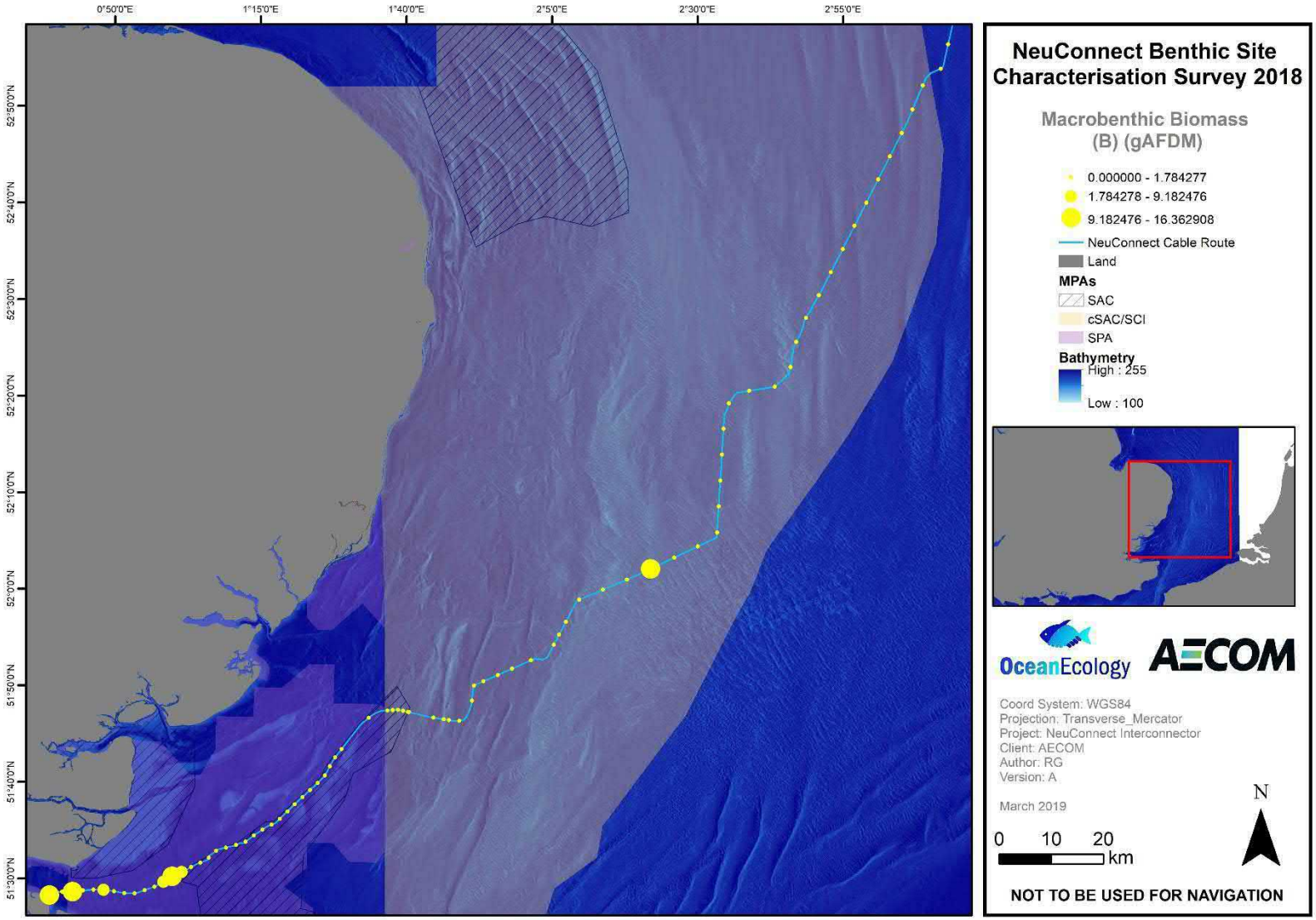

Figure 9 Map to show mean macrobenthic biomass (gAFDM) along the GB Offshore Scheme section of the proposed NeuConnect cable route overlain on EUNIS biotope mapping determined as part of the HA for the project.

Plate 3. Example micrographs of the key macrobenthic taxa sampled along the GB Offshore Scheme section of the proposed NeuConnect cable route.

7.4. Macrobenthic Faunal Groupings

Two techniques were used to elucidate similarities and differences in the macrobenthic data; cluster analysis, which outputs a dendrogram displaying the relationship between data based on the Bray Curtis similarity measure, and non-metric multi-dimensional scaling (nMDS) in which station data are ordinated in a 2-dimensional plot. All data underwent a square-root transformation as a means of reducing the influence of highly abundant taxa which would otherwise have a disproportionate influence on the dataset, whilst allowing the underlying community structure to be assessed. Details of the multivariate statistical analyses routines undertaken are presented in Appendix VIII.

7.4.1. Determination of Macrobenthic Faunal Groups

The dendrogram and SIMPROF test identified 17 statistically significant faunal groups and six outliers derived based on the similarity of the community composition. Similarity between stations was relatively low, however, SIMPROF groups were condensed (to 15 % similarity) to form a more manageable number of groups. Given the size of the area sampled, which covered a wide variety of habitats from the intertidal to offshore, low similarity

between stations is to be expected. Lack of replicates can also lead to increased variability in the dataset as well as low numbers and diversity of taxa in samples.

The similarity slice (15 %) was overlain on the dendrogram to identify fewer faunal groupings and therefore demonstrate broader scale changes in community composition. The slice grouped the stations into 11 significant groups (A-C) and two outliers. Faunal group A contained the greatest number of stations within the survey area (39 out of 90). The corresponding nMDS ordination plot

Figure 10, displayed in two-dimensions, graphically displays the similarity of the communities based on the distance between the sample points. The degree of clustering of intra-group sample points demonstrates the level of within group similarity (i.e. points within Faunal Groups A and B show distinct clustering), whilst the degree of overlap of inter-group sample points is indicative of the level of similarity of the different faunal groups. One outlier, station ENV_030, is not shown in Figure 10 as it was highly dissimilar from all other samples.

The stress value of the nMDS ordination (0.18) indicates that the two-dimensional plot provides a relatively poor representation of the similarity between the samples given the variability between them as to be expected when considering single replicates across an expansive survey area. The characteristic taxa within each of the faunal groups were determined by the results of the SIMPER routine which provide a level of percentage contribution (%Contrib) to the group similarity which is discussed for each faunal group below. Results of the SIMPER routine are provided in Appendix XV. The distribution of the faunal groups along the pipeline route are shown in Figure 11.

7.4.2. Composition of Macrobenthic Faunal Groups

Faunal Group A occurred at 39 of the 90 sampling stations and was dominated by a number of polychaete worm species including *Nephtys cirrosa, Nephtys* sp. (Juveniles), and *Magelona johnstoni* which contributed 57.0 %, 9.1 % and 6.4 % of the within-group similarity respectively. Stations belonging to this faunal group were located within areas of high sand content characterised as EUNIS biotope A5.25 'Circalittoral fine sand' and was observed within the SAC and in offshore areas (Figure 11).

Faunal Group B occurred at 15 sampling stations and was characterised by the ross worm *S. spinulosa, Actinaria* sp.*, Lumrineris cingulata, and Notomastus* sp. which all contributed between 6.9 and 6.3 % to within-group similarity. Stations belonging to this faunal group were located within areas with high mud and gravel content thought to be generally representative of the EUNIS biotopes A5.511 '*Sabellaria spinulosa* on stable circalittoral mixed sediment' and A5.44 'Circalittoral mixed sediment' (Figure 11).

Faunal Group C occurred at nine sampling stations and was dominated by the polychaete *Nephtys hombergii* (57.0 % similarity) and also contained the bivalves *Nucula nitidosa* and *N. nucleus* which contributed to 11.0 %, and 8.4 % of the within-group similarity respectively. Stations belonging to this faunal group were located within areas of high sand content characterised as EUNIS biotope A5.25 'Circalittoral fine sand' and was mainly observed in inshore areas (Figure 11). This group contained the two outermost intertidal stations (INT_006 and INT_007).

Faunal Group D was representative of six sampling stations and was characterised by *Peringia ulvae, Cerastoderma edule,* and *Nephyts* sp. (Juveniles) which contributed to 38.6 %, 21.1 %, and 13.9 % of the within-group similarity respectively. This faunal group was characteristic of the sandy intertidal communities. This included five of the seven intertidal stations: INT_001 – INT_005.

Faunal Group E occurred at five sampling stations and was characterised by *Spiophanes bombyx, Conopeum reticulum,* and *Mytilidae* sp. (Juveniles) which contributed to 16.4 %, 13.1 %, and 8.5 % of the within-group similarity respectively. Stations belonging to this faunal group were located within patches of coarse and mixed sediments characterised as EUNIS biotope A5.14 'Circalittoral coarse sediment' and A5.44 'Circalittoral mixed sediment' (Figure 11).

Faunal Group F was representative of four sampling stations and was dominated by the bryozoans *Aspidelectra melolontha* and *Electra monostachys* which contributed to 57.0 % and 22.8 % of the within-group similarity respectively. This faunal group was observed in sandy/coarse sediments.

Faunal Group G occurred at two sampling stations and had very low within group similarity (17.9 %) which was characterised by the presence of *Ophiuridae* sp. (100 %) in each sample.

Faunal Group H occurred at two sampling stations and was characterised by *Actiniaria* spp. and *Nemertea* spp. which both contributed to 36.9 % within-group similarity.

Faunal Group I occurred at two sampling stations and had very low within group similarity (16.6 %) which was characterised by the presence of *Urothoe brevicornis* (100 %) in each sample.

Faunal Group J occurred at two sampling stations and had low within group similarity (25.0 %) which was characterised by the presence of *Ophiura albida* (100 %) in each sample.

Faunal Group K occurred at two sampling stations and while it higher within group similarity (36.9 %) than other groups it was characterised by the presence of *Gastrosaccus spinifer* (100 %) in each sample.

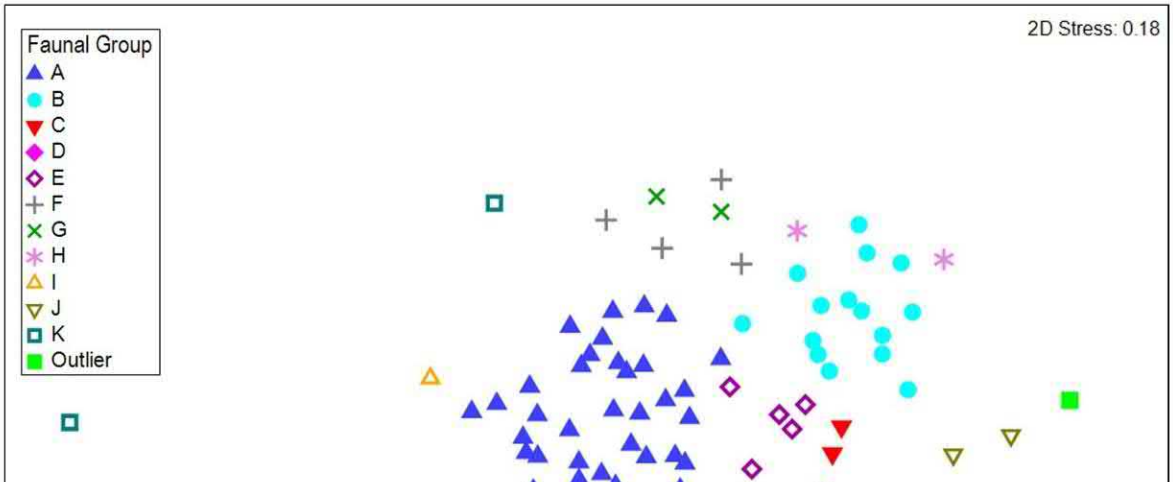

Figure 10. nMDS ordination plot of square-root transformed Bray-Curtis similarity macrobenthic abundance data. Faunal groups were grouped based upon 15 % similarity.

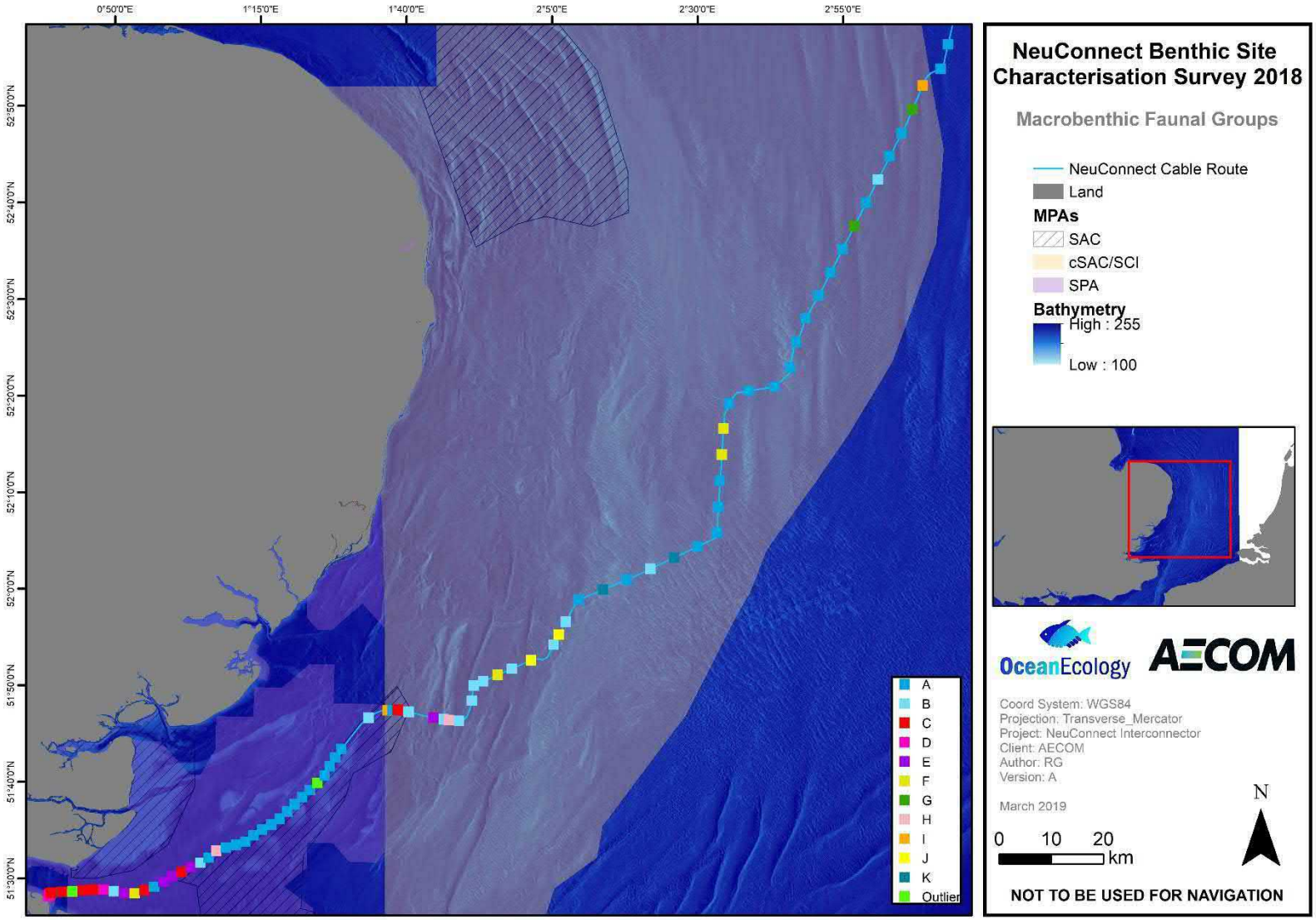

Figure 11 Distribution of macrobenthic faunal groups along the GB Offshore Scheme section of the proposed NeuConnect cable route.

7.5. Seabed Imagery

Generally, seabed imagery correlated well with SSS however the ability to delineate between coarser sediments in the central area of the route and those sandier sediments furthest offshore using SSS was limited therefore DDV transects and PSD data were fundamental in determining the sediment / substrate type. The main assessment was conducted using the still images captured during the DDC deployments / DDV transects due to high turbidity levels, which reduces the resolution of analysis from the video imagery. The main habitats identified based on the seabed imagery are presented in Plate 4.

Example imagery from each DDC station is presented in Appendix XVII, along with a description of the substratum type, species present and the EUNIS habitat description. The dive logs for all seabed imagery collected during HA and site characterisation transects are presented in Appendix XVIII and XX respectively. Example imagery from site characterisation transects can be found in Appendix XIX.

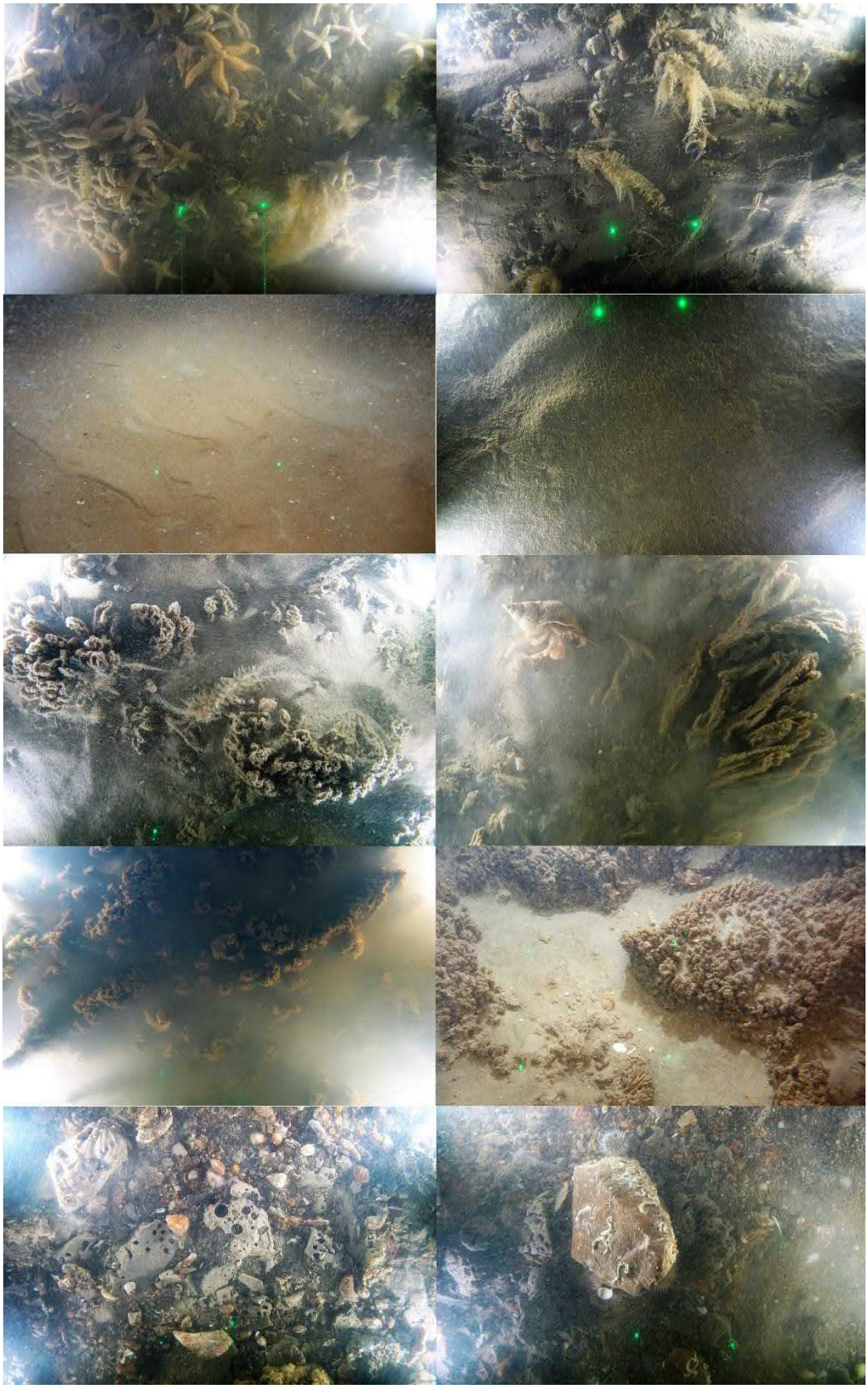

Plate 4. Example seabed imagery collected along the GB Offshore Scheme section of the proposed NeuConnect cable route. Top row: EUNIS biotope A5.44 Circalittoral mixed sediments. Second row (left): EUNIS biotope A5.25 Circalittoral fine sand. Second row (right): EUNIS biotope A5.35 Circalittoral sandy mud. Third and fourth rows: Annex I *Sabellaria spinulosa* reef. Bottom row (left): Section 41 priority habitat Peat and Clay Exposures. Bottom row (right): EUNIS biotope A4.21 Echinoderms and crustose communities on circalittoral rock.

7.6. Biotope Mapping

To map the principal biotopes along the extent of the NeuConnect cable route, a full interrogation of available geophysical data in combination with review of DDV imagery collected at dedicated HA transect locations and site characterisation DDV locations was undertaken. PSD data was also used to support this data and better understand the sediment type within the wider habitat types. The main habitats identified along the route at which seabed imagery or grab samples were obtained comprised primarily of rippled or megarippled sand characterised as EUNIS biotope A5.25 'Circalittoral fine sand' in offshore areas, A5.44 'Circalittoral mixed sediment' in central areas. The inshore areas where comprised of a mixture of sediment types in the inshore areas ranging from A5.14 'Circalittoral coarse sediment' to A5.35 'Circalittoral sandy mud'.

Annex I stony reef formations were present in inshore/central areas which also corresponded with the presence of the Section 41 priority habitat 'Peat and Clay Exposures'. Areas of mixed sediment with *S. spinulosa* tube aggregations, sometimes present as low-medium reef (Annex I) formations, were observed intermittently along the route. The distribution and extent of the habitats identified across the survey area based on all the available data have been mapped in

Figure 12 to

Figure 14. Descriptions of each of these habitat types, for which shapefiles have been created for biotope mapping purposes, are presented in

Table 8, along with the corresponding EUNIS biotopes associated with each habitat.

Three main biotopes were identified in the intertidal areas. The inner-most sites, INT_001 – INT_004, were best characterised by the EUNIS biotope A2.242 '*Cerastoderma edule* and polychaetes in littoral muddy sand', though high numbers of *Peringia ulvae* were also present. Station INT_005 had a greater proportion of sand with a limited macrofaunal community and represented EUNIS biotope A2.231 'Polychaetes in littoral fine sand'. The outer intertidal stations INT_006 and INT_007 were best represented by the EUNIS biotope A2.321 '*Nephtys hombergii* and *Streblospio shrubsolii* in littoral mud'.

Table 8. Summary of EUNIS Biotopes, Broad Scale Habitats (BSHs) and Habitat Sensitivities to inform biotope mapping shown in

Figure 12 to

Figure 14.

	Description	Habitat Sensitivity	EUNIS Groups	BSH	EUNIS Biotope

Annex I Habitats					
Stony Reef	Stable cobbles and boulders with a dense faunal turf and epifaunal community.	Annex I Stony Reef	Rock	A4.2	A4.21 Echinoderms and crustose communities on circalittoral rock
					A4.23 Communities on soft circalittoral rock
Sabellaria Reef	Agglomerations of *Sabellaria spinulosa* on circalittoral gravelly muddy sands.	Annex I Biogenic Reef	Mixed sediment	A5.6	A5.611 - [Sabellaria spinulosa] on stable circalittoral mixed sediment
				A5.4	A5.44 - Circalittoral mixed sediment
Peat and Clay Exposures	Mosaic of coarse gravels, pebble and cobble with clay exposures and sparse epifauna.	Section 41 priority habitat	Rock	A4.2	A4.23 Communities on soft circalittoral rock
Seabed Habitats					
Coarse Sediment	Very coarse pebble and cobble with diverse epifaunal community.	n/a	Coarse Sediment	A5.1	A5.14 - Circalittoral coarse sediment
Sand (Rippled)	Rippled fine sand.	Annex I Sandbanks*	Sand and Muddy Sand	A5.2	A5.25 - Circalittoral fine sand
Sand (Megarippled)	Fine sand with megaripples.	Annex I Sandbanks*	Sand and Muddy Sand	A5.2	A5.25 - Circalittoral fine sand
Sandy Mud	High proportion of finer (muddy) sediments with sand.	n/a	Mud and Sandy Mud	A5.3	A5.35 - Circalittoral sandy mud
Mixed Sediment	Mosaic of sand, gravel, mud, pebbles, and occasional boulders with occasional epifauna.	n/a	Mixed Sediment	A5.4	A5.44 - Circalittoral mixed sediment
Intertidal Habitats					
Littoral Sand and Muddy Sand	Mixture of mud and sand particles with polychaetes.	n/a	Littoral Sand and Muddy Sand	A2.2	A2.231 - Polychaetes in littoral fine sand
					A2.242 - *Cerastoderma edule* and polychaetes in littoral muddy sand
Littoral Mud	High proportion of finer (muddy) sediments with polychaetes	n/a	Littoral Mud	A2.3	A2.321 - *Nephtys hombergii* and *Streblospio shrubsolii* in littoral mud

* Sandbanks which are slightly covered by sea water all the time' in areas where water depth <20 m.

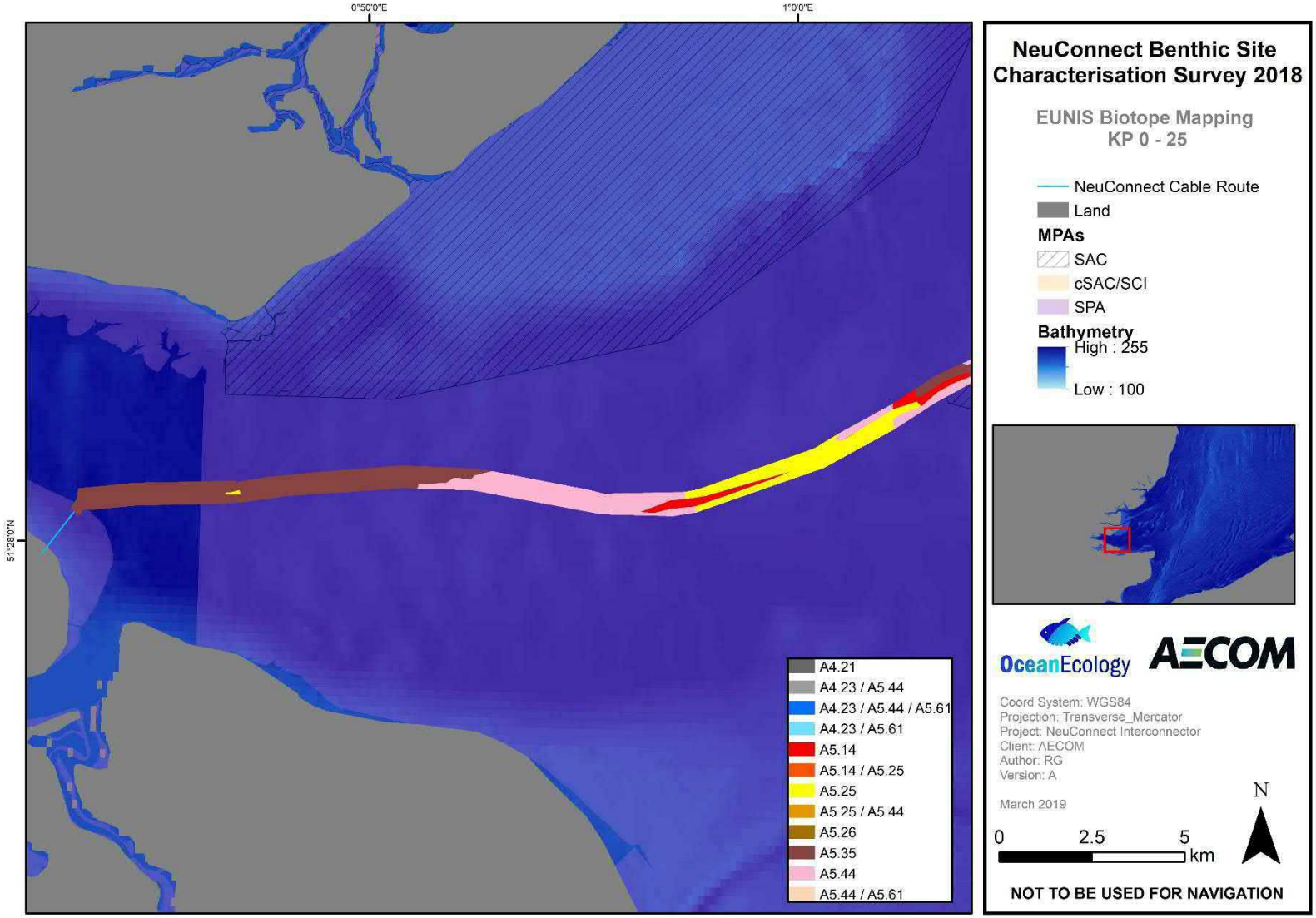

Figure 12 Map to show EUNIS biotopes between between KP 000 and KP 25 of the GB Offshore Scheme section of the proposed NeuConnect cable route.

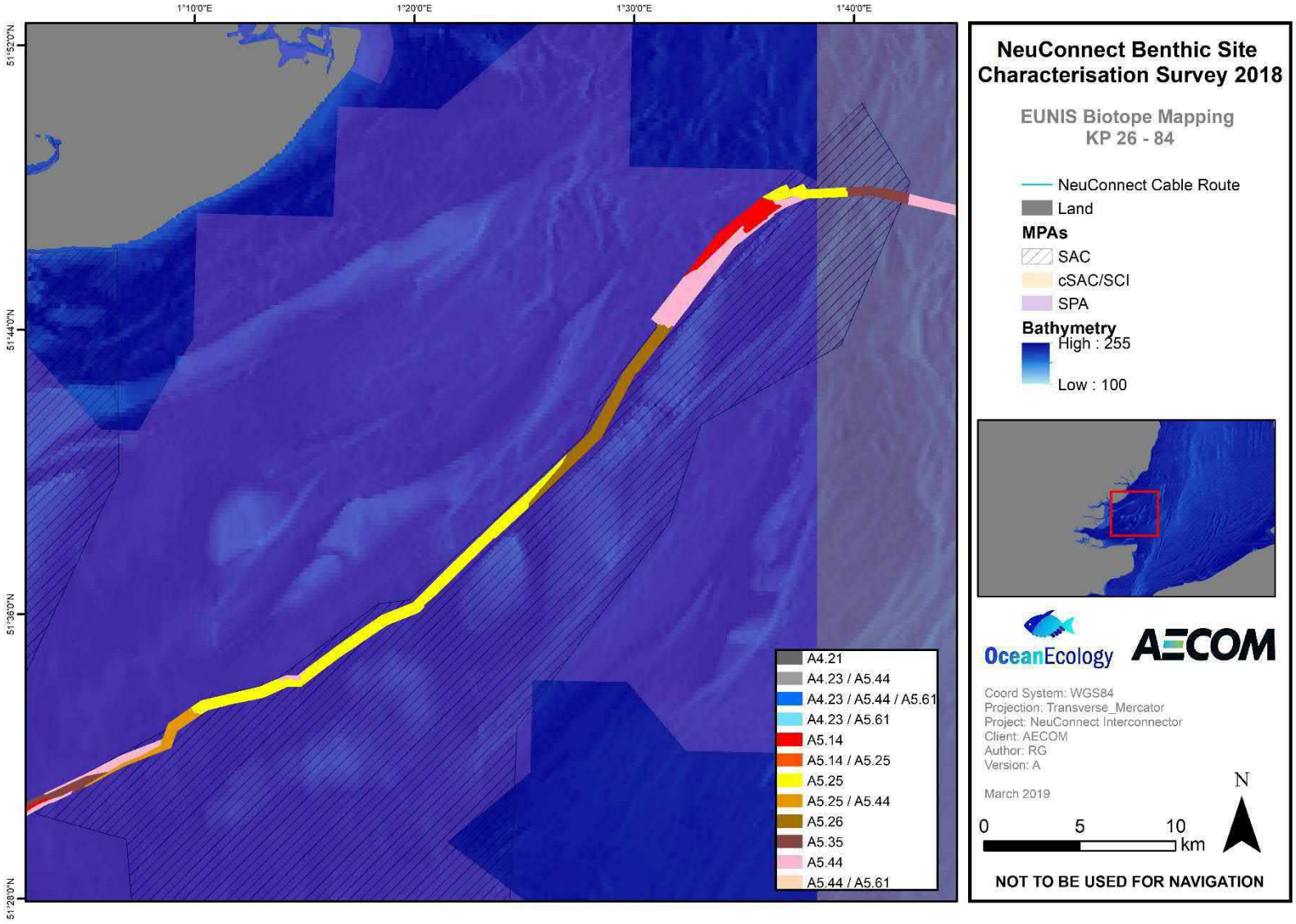

Figure 13 Map to show EUNIS biotopes between KP 26 and KP 84 of the GB Offshore Scheme section of the proposed NeuConnect cable route.

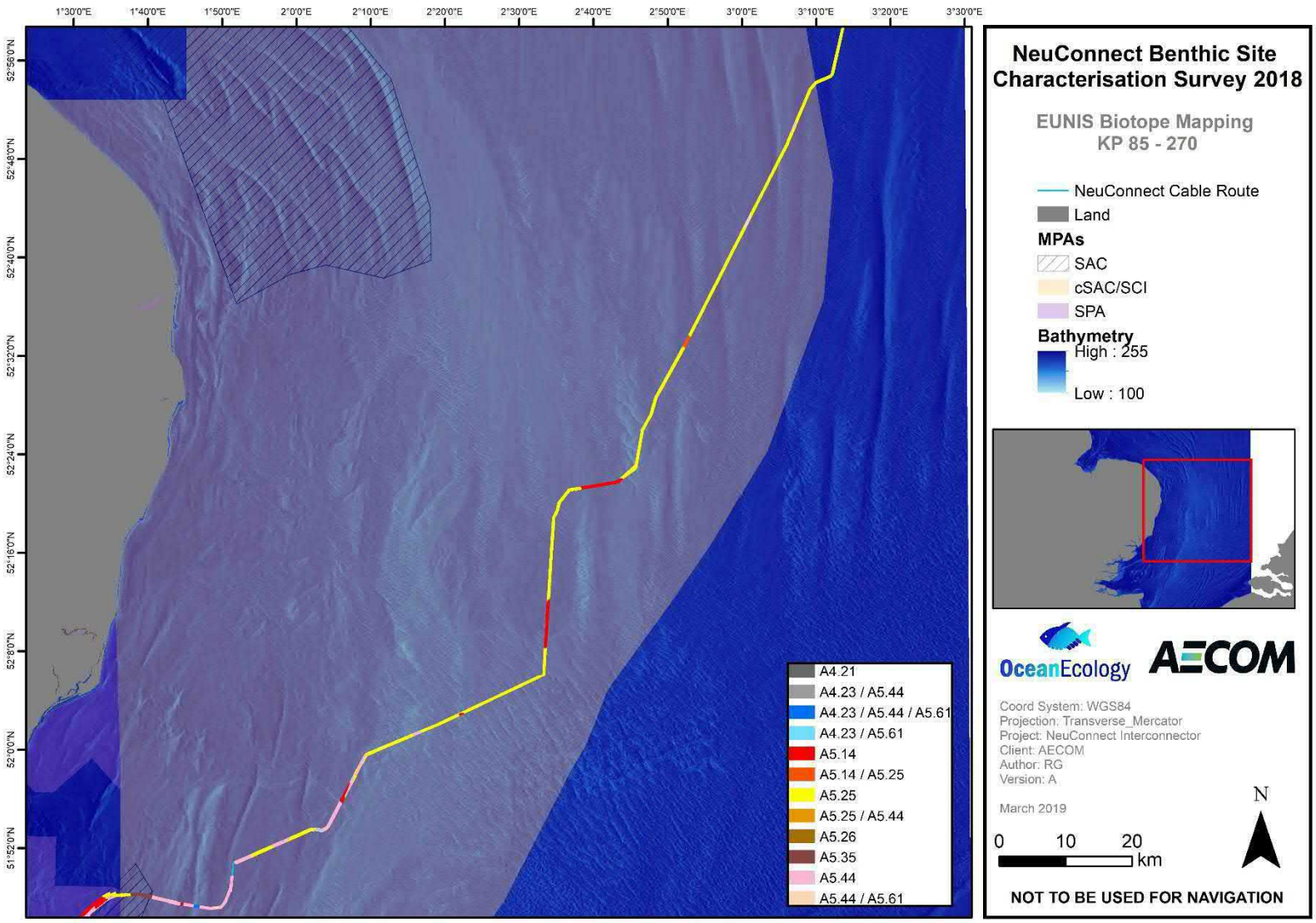

Figure 14 Map to show EUNIS biotopes between KP 85 to KP 270 of the GB Offshore Scheme section of the proposed NeuConnect cable route

7.7. Habitats of Conservation Value

7.7.1. Annex I Stony Reef

Small areas of Annex I stony reef were present along the NeuConnect cable survey corridor however these areas were restricted to between KP 91 and KP 116 (Figure 15). In total, four video transects showed evidence of low resemblance stony reef (Table 9). Coverage of this habitat type was most extensive at HAB_028, ENV_048, ENV_046, and ENV_50, however, reefs were only classified as low resemblance. In order to qualify as reef, the composition must be 10 - 40 % cobbles and with elevation greater than "flat" but less than 64 mm. According to Irving (2009) the minimum size of a cobble reef is considered to be >25 m^2, which must consist of >10 % cobbles or boulders. From this assessment there were several areas identified as stony reef. Example imagery, including classification procedures based on the Irving (2009) criteria is presented in Plate 5 and Appendix XIX.

Table 9. Summary of Annex I stony reef quality assessments to show predominant reef quality classification per transect.

Station	Annex I Stony Reef (Image Classification)	
	Not a Reef	Low
ENV_UK_ENV_011	2	0
ENV_UK_ENV_043	0	6
ENV_UK_ENV_046	0	8
ENV_UK_ENV_047	0	8
ENV_UK_ENV_048	3	3
ENV_UK_ENV_050	5	0
ENV_UK_HAB_028	4	9

Plate 5. Example imagery of stony reef habitat quality assessments based on percentage cover and elevation.

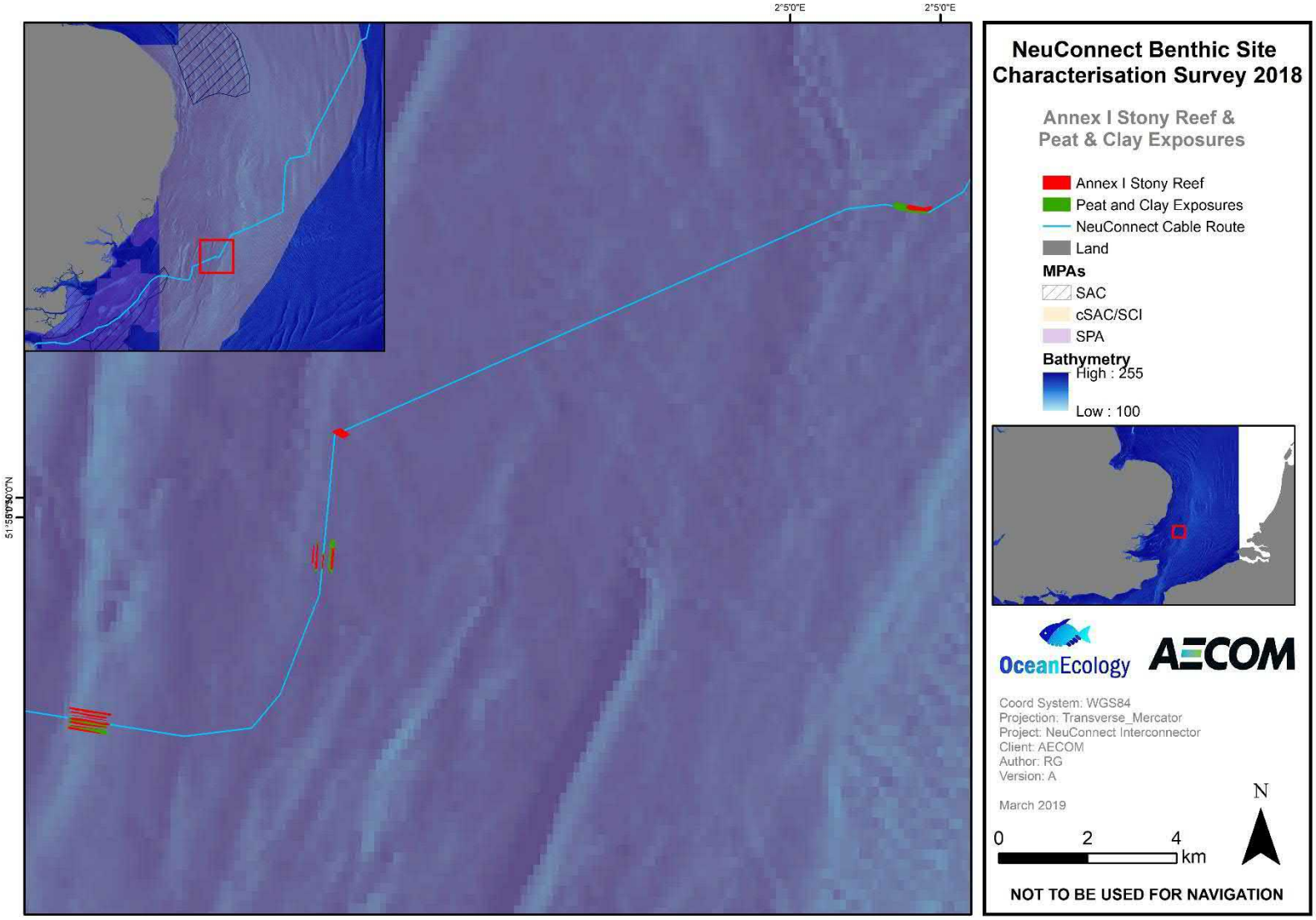

Figure 15. Map to show distribution of Annex I stony reef and Section 41 priority habitat 'Peat and Clay Exposures' between KP 91 and KP 116 of the GB Offshore Scheme section of the proposed NeuConnect cable route.

7.7.2. Peat and Clay Exposures

The Section 41 priority habitat 'Peat and Clay Exposures'[4] was recorded at the stations HAB_028, ENV_043 and ENV_046 within the NeuConnect cable survey area. These stations coincided with areas that stony reef was observed between KP91 and KP116 in offshore areas of the cable route. Exposures were surrounded by a matrix of cobbles and coarse sediments with incidental patches of mixed sediments ranging from mud to coarse gravels and pebble and occasional patches of low relief Annex I stony reef.

Associated epifauna was often sparse restricted to *Flustra foliacea, Alcyonium digitatum,* and *Tubularia* sp. on stable substrate and occasional starfish, *Asterias rubens,* present at the interface between hard substrate and coarse sediments. Evidence of boring piddocks (Pholadidae) was also noted in the majority of still images where exposed clay was observed. This habitat was indicative of the EUNIS biotope A4.23 – 'Communities on soft circalittoral rock' which was also representative of Annex I reef. Example imagery is presented below in Plate 6 and the extent of this habitat is mapped in

Figure 15.

Plate 6. Example imagery showing exposed clay as part of the Section 41 priority habitat – Peat and Clay Exposures.

[4] It should be noted that as soft rock substrates, clay exposures qualify as Annex I bedrock.

7.7.3. Annex I *Sabellaria spinulosa* Reef

Generally, the presence of *S. spinulosa* was restricted to small clusters of tube aggregations amongst mixed sediments. Denser aggregations or condensed reef formations were observed in the mid-offshore stations HAB_030, HAB_033, and HAB_035 (KP 132, KP 224, and KP 241).

Plate 7 presents example imagery of *S. spinulosa* reef quality assessments based on percentage cover and reef elevation criteria as outlined in Gubbay (2007). In general, where *S. spinulosa* was present, it was predominately patchy agglomerations of tubes with low elevation <5 cm and with very little to no concretion of sediment. Where there were clumps of taller tubes (>5 cm in height), they often did not cover an area large enough to be consistently classified as reefs. In order to qualify as low quality reef as per Gubbay (2007), elevation must be over 2 cm height with more than 10 % substratum coverage of an area of at least 5 x 5 m (25 m^2). Therefore, a high number of images analysed from the transects were classified as "not a reef" or "low". There were only 17 images classified as medium reef under the Gubbay (2007) assessment criteria. This classification is however based on the assumption that still images collected at 5 m intervals were representative of the surrounding 25 m^2 area[5].

The review of digital imagery did not identify Annex I *S. spinulosa* reef between KP 68 – 78, however, following review of the SSS data as well as analysis of data from geophysical surveys (completed by MMT) an area of low relief reef was identified in this area. A lower confidence score has been assigned to this specific area due to low sampling coverage and lack of *S. spinulosa* in corresponding imagery.

Table 10. Summary of Annex I *S. spinulosa* reef quality assessments from DDV still imagery per transect.

Station	Annex I *S. spinulosa* Reef (Image Classification)			
	No. *S.spinulosa* present in grab sample	Not a Reef	Low	Medium
ENV_UK_ENV_006	1	-	-	-
ENV_UK_ENV_007	82	-	-	-
ENV_UK_ENV_012	1	-	-	-
ENV_UK_ENV_013	1	-	-	-
ENV_UK_ENV_014	17	-	-	-
ENV_UK_ENV_016	3	-	-	-
ENV_UK_ENV_039	1	-	-	-
ENV_UK_ENV_040	3	-	-	-
ENV_UK_ENV_041	1	-	-	-
ENV_UK_ENV_043	0	1	-	-
ENV_UK_ENV_045	3	5	-	-
ENV_UK_ENV_046	57	-	-	-
ENV_UK_ENV_047	15	-	-	-
ENV_UK_ENV_050	69	-	-	-
ENV_UK_ENV_054	8	-	-	-
ENV_UK_ENV_058	4	-	-	-
ENV_UK_ENV_063	0	1	-	-
ENV_UK_ENV_068	1	-	-	-
ENV_UK_ENV_069	1	-	-	-
ENV_UK_ENV_074	58	-	-	-
ENV_UK_ENV_077	41	-	-	-
ENV_UK_HAB_028	N/A	-	1	1
ENV_UK_HAB_030	N/A	3	-	7
ENV_UK_HAB_033	N/A	6	-	4
ENV_UK_HAB_034	N/A	8	2	
ENV_UK_HAB_035	N/A	3	6	5

[5] The distinction between *S. spinulosa* aggregations and surrounding substrates is usually evident in SSS data however in this instance the low-lying nature of the tubes aggregations meant it was not possible to confidently make this distinction.

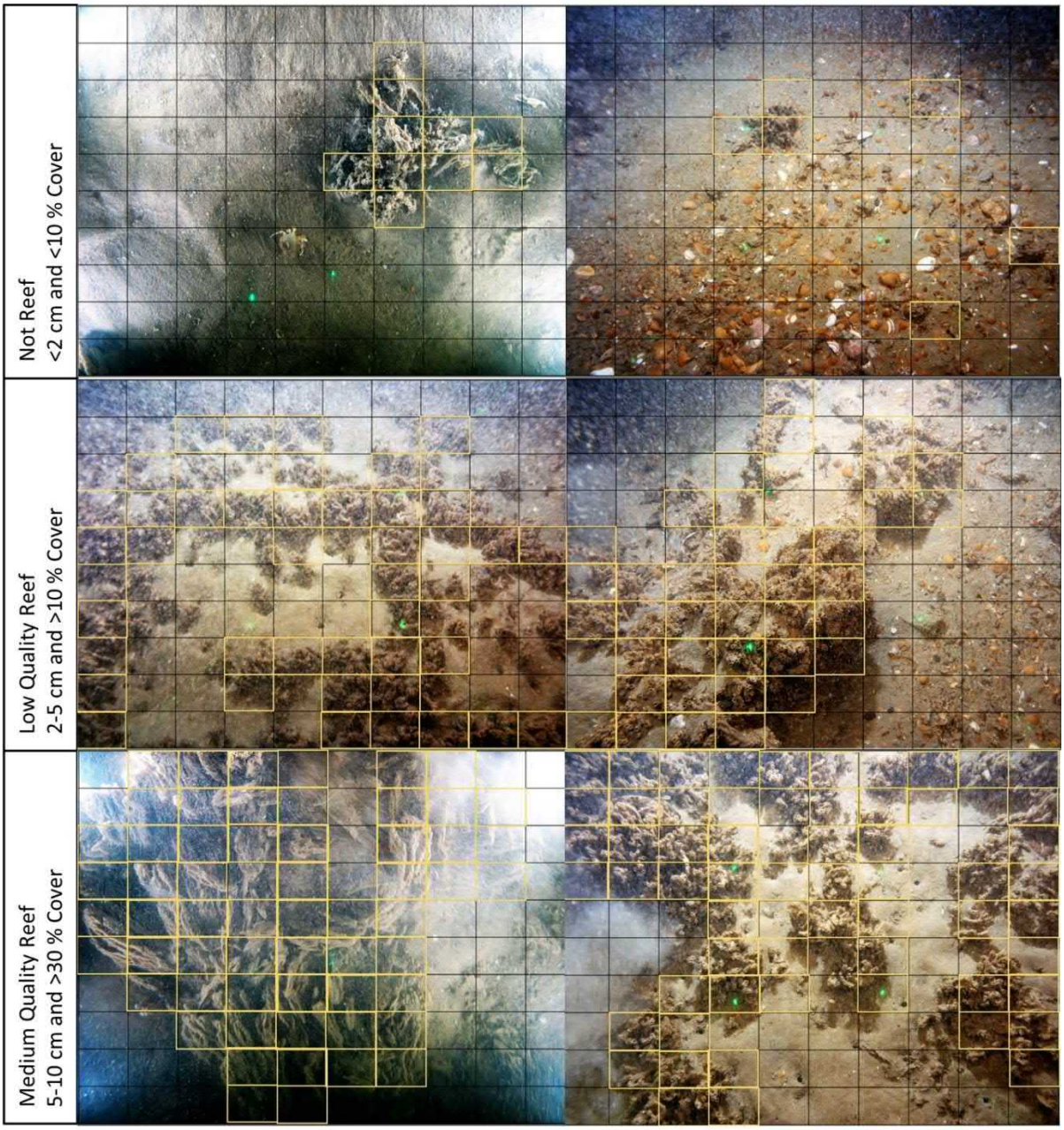

Plate 7. Example imagery of *S. spinulosa* habitat quality assessments based on percentage cover and elevation, including habitat not classified as reef, low quality and medium quality reef.

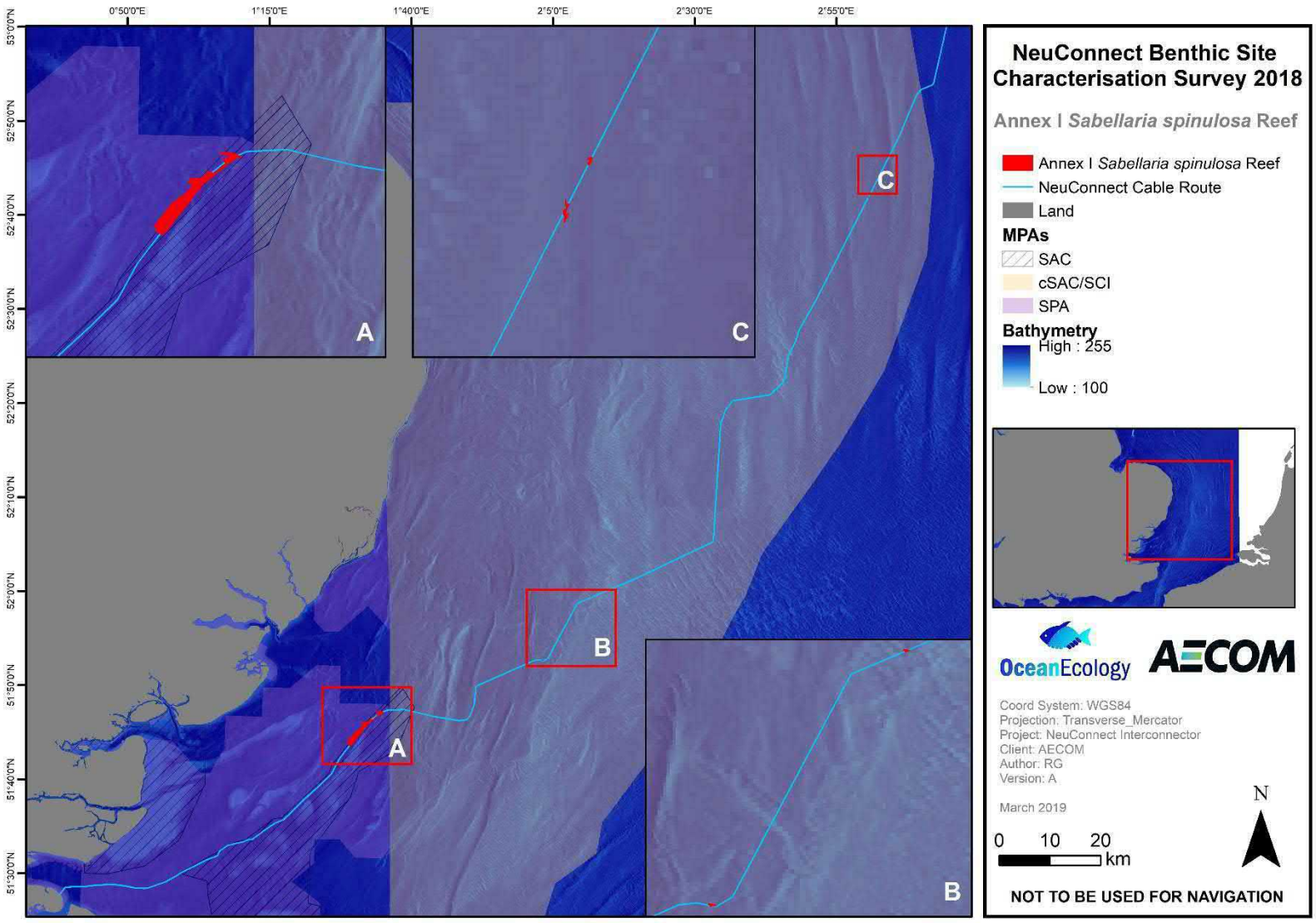

Figure 16 Map to show observed areas of Annex I *S. spinulosa* reef within a wider EUNIS biotope of A5.611 – '[*Sabellaria spinulosa*] on stable circalittoral mixed sediment' along the GB Offshore Scheme section of the proposed NeuConnect cable route.

7.7.4. Other Habitats

Most seabed habitats along the GB Offshore Scheme section of the proposed NeuConnect cable route were characterised as either EUNIS biotope A5.25 'Circalittoral fine sand' or EUNIS biotope A5.44 'Circalittoral mixed sediment' although areas of EUNIS biotope A5.35 'Circalittoral sandy mud' were also recorded.

7.7.5. A5.25 Circalittoral sand

Areas of the cable route were characterised by this biotope at both inshore and offshore sections of the survey area. Areas of sand were often characterised by the presence of either ripples or megaripples, with megaripples more common in offshore areas. Both the macrobenthos and epifauna were relatively impoverished in these sandy habitats. Where present in less than 20 m water depth in the inshore parts of the cable corridor these areas were deemed to be representative of Annex I 'Sandbanks which are slightly covered by sea water all the time' due to the relatively shallow water depths in these areas. Areas characterised by this biotope are mapped in Figure 12 to Figure 14 and example imagery is presented in Appendices XVII and XIX.

7.7.6. A5.44 Circalittoral mixed sediment

Seabed habitats in the central portion of the cable route were best characterised as EUNIS biotope A5.44 'Circalittoral mixed sediment'. These areas exhibited greater mud content, along with sands, gravels, and some coarser sediments, including stable pebbles, cobbles and occasional boulders. Areas characterised by these habitats supported relatively diverse epifaunal communities including dense hydroid/bryozoan turf including *Flustra foliacea* and *Hydrallmania falcata*, Ophiuridae and more diverse and abundant infaunal communities.

7.7.7. A5.35 Circalittoral sandy mud

Inshore sediments were primarily characterised as EUNIS biotope A5.35 'Circalittoral sandy mud'. These areas exhibited elevated levels of mud content and finer particles in comparison to the rest of the cable route. Areas characterised by these habitats supported relatively sparse macrobenthic communities, with low numbers of individuals and diversity recorded.

7.7.8. Species of Conservation Importance and Non-natives

Two individuals of the non-native species *Austrominius modestus* were found at a single intertidal station (INT_003). *A. modestus* occurs naturally in Australasia and was first reported in Britain in 1946, by which time it was already widespread in the southeast of England. By 1972 it was common in parts of the west coast of Scotland and in 1978 it was reported in Shetland (Hiscock et al. 1978). *A. modestus* not only competes with endemic British species, particularly *Balanus balanoides*, but has colonized some sheltered and estuarine habitats not previously inhabited by them (Bassindale 1964).

Thia scutellate was observed at four stations (ENV_058, 064, 068, and 071). This species is listed under the Great Britain Rare and Scarce Species list, classified as occurring in nine to 55 grid squares within the three mile territorial limit.

8. DISCUSSION

8.1. Sediments

A wide variety of sediment types were observed along the cable route. A trend towards increased mud content was apparent at inshore stations while the offshore stations were almost entirely composed of sand, forming either ripples or megaripples. Most samples comprised of sand (S), representing EUNIS BSH A5.2 (sublittoral sand), while a number of stations were classified as mud and sandy mud (mS) or gravelly mud (gM) and gravelly muddy sand (gmS) which represent a mixture of EUNIS BSH A5.2 (sublittoral sand), A5.3 (sublittoral mud), and A5.4 (sublittoral mixed sediments). Coarser sediments were also observed intermittently along the route where stations were classified as gravelly sand (gS, EUNIS BSH A5.1 Sublittoral coarse sediments).

Arsenic was observed in the highest concentrations along the cable route. Levels of Arsenic were particularly high at a number of stations where they exceeded OSPAR BC and BAC values at 15 and eight stations respectively, and Canadian sediment quality guideline TELs and PELs at 35 and five stations respectively. Additionally, Cefas (2003) AL1 was exceeded at 11 stations, which suggests contamination. Although background levels were exceeded along the route, at this level of investigation, there were no macrobenthic anomalies identified at this location to suggest any adverse effects were present. Elevated metal sediment concentrations do not necessarily imply toxicity to benthic communities (Rees et al. 2007) as the bioavailability of these metals is more important than simply concentration levels.

The levels of most metals, and specifically Zinc, Lead, and Mercury, were higher at the intertidal and inshore stations with many exceeding mean UKOOA (2001) and even 95th % values. Nickel and Copper levels were also high in offshore areas, particularly between KP 83 – 94. Levels of some metals (including Lead and Copper) are known to be higher in the southern North Sea compared to the northern North Sea UKOOA (2001) and in particular higher than usual concentrations of pollutants in the sediments around the Dogger Bank, in proximity to the survey area (Portman 1987). Conversely, Aluminium, was recorded in very low concentrations and Mercury was recorded at or below detection limits at all stations.

Comparison of five commonly reported metals (Ni, Cu, Zn, Cd and Hg) showed that the concentrations of these metals along the cable route were generally lower than concentrations recorded in the wider North Sea (northern and central areas) and in proximity to oil & gas installations

Table 11. Concentrations of Copper and Zinc in offshore areas of the cable route were higher than other North Sea offshore areas but did not exceed Cefas (2003) AL2, a proxy for heavy sediment contamination, at any location.

Table 11. Comparison of mean concentrations ($mgKg^{-1}$) of five key metals sampled along the NeuConnect cable route with previous records.

Area	Nickel	Copper	Zinc	Cadmium	Mercury
Oil & Gas Installations in the North Sea[1]	17.79	17.45	129.74	0.85	0.36
Offshore areas of the North Sea[1]	9.5	3.96	20.87	0.43	0.16
Central and Northern North Sea[2]	23	14	155	-	-
Neuconnect Cable Route (Offshore >12nm)	7.50	8.61	22.14	0.12	0.04
Neuconnect Cable Route (Coastal <12nm)	7.86	9.68	38.03	0.08	0.08
Guidelines Values (OSPAR ERL - ERM)[3]	20.9 - 51.6	34 - 270	150 - 410	1.2 - 9.6	0.15 - 0.71

1 Cefas (2001). Contaminant Status of the North Sea. Technical report produced for SEA2. TR_004. Pp. 101.
2 Breuer et al., (1999) A review of contaminant leaching from drill cuttings piles.
3 Long, E.R., MacDonald, D.D., Smith, S.L. and Calder, F.D., (1995). Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environmental Management, 19:81-97.

PAHs only occasionally exceeded OSPAR BCs and BACs, Canadian guideline TELs and Cefas (2003) AL1 guidelines. At no point were Canadian PELs exceeded. It is considered that concentrations that are above OSPAR BCs, Canadian guideline TELs and Cefas (2003) AL1 rarely cause adverse effects in marine organisms; however, concentrations above OSPAR BACs and Canadian guideline PELs can often cause adverse effects in some marine species (OSPAR 2009, PLA n.d).

Levels of organotins exceeded Cefas (2003) AL1 at a single station (UK_ENV_001). Organotins were not detected at any other stations. Levels of polychlorinated biphenyls (PCBs) and organochlorines did not exceed Cefas (2003) AL1 at any of the stations. Concentrations of these compounds were often below the detectable limits at many locations and so are not likely to cause concern.

8.2. Macrobenthos

The macrobenthic assemblages identified along the NeuConnect cable route were diverse and largely dominated by annelid taxa in terms of number of taxa and overall abundance as expected in this area of the southern North Sea. Molluscs were highly abundant at stations that were outside of the Margate and Long Sands SAC. Furthermore, molluscs, as well as echinoderms, contributed greatest to overall macrobenthic biomass.

Sediment habitats can be highly heterogenous as they are heavily influenced by ambient environmental conditions such as sediment composition (Cooper et al. 2011), hydrodynamic forces and physical disturbance (Hall 1994), depth (Ellingsen, 2002) and salinity (Thorson 1966). Sediment composition is a key factor in determining macrobenthic community structure (Hall 1994, Cooper et al. 2011), itself defined by ambient conditions. This is clearly a strong driver of variability within the macrobenthic communities along the cable route. There was a high degree of variability in the macrobenthic communities, as demonstrated by the numbers of statistically significant faunal groupings. This may be due to a number of reasons. Firstly, the cable route covers a large distance and intersects a variety of sediment habitats and environmental gradients (from the intertidal to offshore). Secondly, the lack of replicates at each station is likely to have led to increased variability within the dataset. Grabs sample a small area and so a single replicate is less likely to be entirely representative of the broader area (Downing & Downing), only a portion of the macrobenthic community is likely to be present in a single sample which can lead to statistically significant faunal groups. Finally, relatively few numbers of individuals and taxa in a number of samples can lead to increased numbers of statistically significant groups as indicated by the relatively loose clustering of the faunal groups (Warwick 1988). The most common faunal group (A), dominated by polychaete worm species, was observed at 39 of the 90 stations. This faunal group was

associated with sandy habitats particularly in the offshore areas of the cable route. The other dominant group (Faunal Group B) was characterised by the presence of the ross worm *S. spinulosa.* These stations corresponded with areas where notable aggregations of sand tubes constructed by this species were recorded upon review of the seabed imagery and subsequently deemed to be representative of areas of Annex I biogenic reef (as per Gubbay (2007).

8.3. Key Habitats

Most seabed habitats along the cable route were characterised as either EUNIS biotope A5.25 'Circalittoral fine sand' or EUNIS biotope A5.44 'Circalittoral mixed sediment' although areas of EUNIS biotope A5.35 'Circalittoral sandy mud' were also recorded. Due to the similarity of the macrobenthos observed in shallower sections (<20 m) of the cable route to those in shallow sandbank habitats some areas of the cable corridor characterised as sublittoral sand biotopes (A5.25) were deemed to be representative of the Annex I habitat 'Sandbanks which are slightly covered by sea water all the time'. The large swaths of Sandy sediments identified along the offshore areas of the cable corridor were not however thought to be presentative of Annex I sandbanks due to the generally greater water depths (>30 m).

Annex I stony reef was identified in areas of the cable route, focused between KP 90 and KP 115. Reefs were assessed to be of low resemblance only (as per Irving (2009)). Video imagery was indicative of the EUNIS biotopes A4.21 – 'Echinoderms and crustose communities on circalittoral rock' and A4.23 – 'Communities on soft circalittoral rock'. These areas often coincided with the presence of the Section 41 priority habitat 'Peat and Clay Exposures'. This habitat was observed between at KP 91, 99, and 116, through interrogation of SSS data and DDV imagery collected during this survey. These areas were indicative of the EUNIS Biotope A4.23 'Communities on soft circalittoral rock' and representative of Annex I bedrock reef habitat.

Sabellaria spinulosa Annex I biogenic reef was identified at multiple points along the cable route. These were classified as either low or medium reef 'status' (as per Gubbay (2007)) and was concentrated around KP 60 – 78, KP 115, and KP 224. Evidence of potential *S. spinulosa* reef from the geophysical surveys and review of the SSS data identified a wider area of low 'status' reef within a wider mixed sediment biotope between KP 68 - 78 though the extent of this patch of reef is less certain. Lower confidence in the extent of the reef in this area is due to a lack of sampling coverage over this area (grabs or imagery) and the lack of *S. spinulosa* in corresponding video stations. As *S. spinulosa* can be ephemeral it may not always be present across the entire area. This area was indicative of the EUNIS Biotope A5.611 – '[*Sabellaria spinulosa*] on stable circalittoral mixed sediment.

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Appendix 7.A – Noise Baseline Survey

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement
Appendix 7A – Baseline Noise Survey

NeuConnect Britain Ltd

September 2019

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Table of Contents

Figures

No table of figures entries found.

Tables

Glossary & Abbreviations

Glossary

Term	Meaning
$L_{Aeq,T}$	The A-weighted equivalent continuous sound pressure level *over period T* ($L_{Aeq,T}$). This is effectively the average sound pressure level over a given period. As the decibel is a logarithmic quantity the L_{eq} is not a simple arithmetic mean value.
$L_{A90,T}$	Background noise level, The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T, measured using the fast time weighting, F, and quoted to the nearest whole number

Abbreviations

Abbreviation	Definition
W	west
dB	Decibel

1. Baseline Monitoring

Sound Monitoring Equipment

1.1 The sound monitoring equipment used in the survey is presented in Table Error**! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.1.

1.2 The calibration of the survey equipment was checked before and after all measurements, and no drift greater than ±0.3 dB was experienced during the monitoring periods.

Table Error! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.1 Monitoring Equipment**

Monitoring Location	Grid Reference	Sound Level Meter	Calibration Date	Field Calibrator (start)	Field Calibrator (end)
LT1	51°27'34.3"N 0°42'18.5"E	Rion NL-52 Serial No. 743082	03/10/2018	Rion NC-74 Serial No. 50541127	Rion NC-74 Serial No. 50541127
LT2	51°27'39.3"N 0°41'33.8"E	Rion NL-52 Serial No. 743081	28/08/2018	Rion NC-74 Serial No. 50541127	Rion NC-74 Serial No. 50541127
LT3	51°27'39.3"N 0°41'33.8"E	Rion NL-52 Serial No. 420763	04/07/2018	Rion NC-74 Serial No. 50541127	Rion NC-74 Serial No. 50541127

Meteorological Conditions

1.3 The weather during the survey period was noted at the beginning and the end of the survey, as well as checked using online weather stations. A summary of meteorological conditions can be seen in Table Error**! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.2.

Table Error! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.2 Meteorological Conditions During Baseline Measurements**

Date	Compass Wind Direction	Wind Speed (ms^{-1})	Temperature (°C)	Rainfall (mm)
27/03/2019	W	1	9	0
28/03/2019	W	1	10	0
29/03/2019	W	1	9	0
30/03/2019	W	1	11	0
31/03/2019	W	5	9	0
01/04/2019	W	3	9	0
02/04/2019	W	2	7	0
03/04/2019	W	1	5	0

Baseline Noise Results

1.4 The results of baseline unattended measurements at LT1 to LT3 are presented below.

1.5 For analysis of long-term unattended noise data, the $L_{Aeq,T}$ noise metrics are calculated using the logarithmic average of 15-minute measurements made during each day and night period. The subsequent day and night $L_{Aeq,T}$ noise levels are averaged arithmetically to provide the typical levels presented. The $L_{A90,T}$ is presented as both the statistical mode of all measurements and the 10th percentile of all measurements made during day and night period.

Table Error! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.3 Measurement Results Location LT1**

Date	Daytime			Night-time		
	$L_{Aeq,16h}$ dB	$L_{A90,15min}$ dB Mode	$L_{A90,15min}$ dB 10th Percentile	$L_{Aeq,8h}$ dB	$L_{A90,15min}$ dB Mode	$L_{A90,15min}$ dB 10th Percentile
Wed 27/03/19	54	29	26	51	29	28
Thu 28/03/19	55	37	29	53	39	34
Fri 29/03/19	56	37	34	50	35	34
Sat 30/03/19	54	38	33	49	31	29
Sun 31/03/19	54	43	42	52	35	35
Mon 01/04/19	54	37	31	53	38	34
Tue 02/04/19	55	37	32	51	30	29
Wed 03/04/19	55	33	30	-	-	-
Overall Average	**55**	**36**	**32**	**51**	**34**	**32**

Table Error! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.4 Measurement Results Location LT2**

Date	Daytime			Night-time		
	$L_{Aeq,16h}$ dB	$L_{A90,15min}$ dB Mode	$L_{A90,15min}$ dB 10th Percentile	$L_{Aeq,8h}$ dB	$L_{A90,15min}$ dB Mode	$L_{A90,15min}$ dB 10th Percentile
Wed 27/03/19	49	28	26	41	29	27
Thu 28/03/19	52	36	28	46	38	36
Fri 29/03/19	53	38	34	43	36	34
Sat 30/03/19	53	36	33	48	33	30
Sun 31/03/19	56	47	45	51	39	39
Mon 01/04/19	48	42	32	51	38	37
Tue 02/04/19	51	36	32	45	34	29
Wed 03/04/19	47	30	29	-	-	-
Overall Average	**51**	**37**	**32**	**46**	**35**	**33**

Table Error! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.5 Measurement Results Location LT3**

Date	Daytime			Night-time		
	$L_{Aeq,16h}$ dB	$L_{A90,15min}$ dB Mode	$L_{A90,15min}$ dB 10th Percentile	$L_{Aeq,8h}$ dB	$L_{A90,15min}$ dB Mode	$L_{A90,15min}$ dB 10th Percentile
Wed 27/03/19	55	36	33	50	33	31
Thu 28/03/19	55	39	34	53	40	37
Fri 29/03/19	56	40	38	50	37	35
Sat 30/03/19	55	40	35	49	33	33
Sun 31/03/19	56	44	42	54	38	37
Mon 01/04/19	55	38	36	52	36	36
Tue 02/04/19	55	41	36	53	34	34
Wed 03/04/19	56	34	34	-	-	-
Overall Average	**55**	**39**	**36**	**52**	**36**	**35**

Appendix 7.B – Noise Monitoring Information

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement

Appendix 7B – Noise Modelling Information

NeuConnect Britain Ltd

September 2019

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Table of Contents

Figures

No table of figures entries found.

Tables

Glossary & Abbreviations

Glossary

Term	Meaning
*L*i	Internal reverbant sound pressure levels
*R*w	The weighted sound reduction index

Abbreviations

Abbreviation	Definition
OS	Ordanance Survey
Hz	Hertz
SWL	Sound Power Level
SRI	Sound Reduction Index
dB	Decibel

1. Modelling Information

Acoustic Modelling Details

1.1 Modelling of sound levels from the development have been undertaken using SoundPLAN (version 8.0) acoustic modelling software. This software implements the sound propagation calculation methodology set out in ISO 9613-2.

Acoustic modelling input data

1.2 Data sources used for this modelling are shown in Table Error**! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.1.

Table Error! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.1 Data sources**

Data	Source file	Received from
OS mapping	OS OpenMap Local (ESRI Shape File) TQ	AECOM
Existing topography	Contour_1m_clip.shp	AECOM
Proposed GB Onshore Scheme layout	Draft UK Onshore Site Layout Drawing Reference NC_190411_P64_v2 – Figure 2.2 of Volume II of the Environmental Statement (ES) Draft UK NGET Converter Station Layout Drawing Reference NC_190514_P76_v1 – Figure 2.3 of Volume II of the ES	AECOM
Proposed building heights	ES Volume II, Chapter 2: Proposed GB Onshore Scheme	AECOM

1.3 The octave-band sound power levels for external plant sound sources (each modelled as a point source) included in the acoustic model are set out in Table Error**! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.2 below.

Table Error! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.2 Sound power levels of external plant sound sources**

Plant	Number	Sound Power Levels (dB) at Octave Band Centre Frequency (Hz)								Total A-weighted (dB)	Data Source
		63	125	250	500	1k	2k	4k	8k		
Transformer	6	83	85	80	80	74	69	64	57	80	A-weighted SWL from NSN Link ES Chapter, frequency spectrum from published data for this source type[1]
Transformer cooler	6	56	93	85	62	56	56	56	56	80	A-weighted SWL from NSN Link ES Chapter, frequency spectrum from published data for this source type[2]
Outdoor cooling fans	66	86	83	80	77	74	71	68	65	80	A-weighted SWL from NSN Link ES Chapter, frequency spectrum from

[1] Engineering Noise Control, Theory and Practice (D A Bies and C H Hansen, 1996)
[2] National Grid Viking Limited (2017). UK Onshore Scheme Environmental Statement. Available at http://viking-link.com/media/1395/es_c_ch26_noise-and-vibration-cs-_revfinal.pdf

Plant	Number	Sound Power Levels (dB) at Octave Band Centre Frequency (Hz)								Total A-weighted (dB)	Data Source
		63	125	250	500	1k	2k	4k	8k		
											published data for this source type[2]

The internal reverberant sound pressure levels (L_i) inside the Reactor Hall and AC Filter Hall are shown in Table Error! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.3. The sound reduction index (SRI) data used for the building walls and roof are set out in**

1.4 Table **Error! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.4. External sound power levels of building walls and roof have been calculated from these parameters using standard acoustic equations implemented by the modelling software.

Table Error! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.3 Internal Reverberant Sound Pressure Levels in Buildings**

Building	Internal Reverberant Sound Pressure Levels (dB) at Octave Band Centre Frequency (Hz)								Total A-weighted (dB)	Data Source
	63	125	250	500	1k	2k	4k	8k		
Reactor Hall	77	83	85	80	74	69	64	57	80	A-weighted SWL from NSN Link ES Chapter, frequency spectrum from published data for this source type[3]
AC Filter Hall	66	73	75	70	64	59	54	47	70	A-weighted SWL from NSN Link ES Chapter, frequency spectrum from published data for this source type[4]

Table Error! Use the Home tab to apply Level 1 Heading to the text that you want to appear here.**.4 Building Sound Transmission Data**

Material	Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)								Overall R_w (dB)	Data Source
	63	125	250	500	1k	2k	4k	8k		
Composite panel	11	14	19	23	23	23	39	50	24	SoundPlan[5] noise modelling software internal library

1.5 External doors to the Reactor Hall and AC Filter Hall are assumed to be closed while the facility is operational. The doors, junction details and large openings for ventilation are assumed to achieve the equivalent acoustic performance as the main wall panels.

Acoustic model settings

1.6 Acoustic modelling has been undertaken using the following model settings:

- Maximum search radius of 5000 m (this is to the maximum source to receiver distance which is considered in the calculations).
- Maximum number of reflections: 3.

[3] Engineering Noise Control, Theory and Practice (D A Bies and C H Hansen, 1996)
[4] National Grid Viking Limited (2017). UK Onshore Scheme Environmental Statement. Available at http://viking-link.com/media/1395/es_c_ch26_noise-and-vibration-cs-_revfinal.pdf
[5] SoundPlan. (2018). Backnang, Germany: SoundPLAN GmbH

- Noise predictions carried out at a height of 1.5 m and 4 m to represent ground and first floor levels.
- Side diffraction enabled (this setting includes calculation of sound travel not only over an obstacle but also around the sides of it).
- Heights of buildings not included in the GB Onshore Scheme assumed to be 6 m.

1.7 Ground absorption has been set as below:

- Acoustically hard ground (G=0) for converter station and substation footprints plus proposed laydown area.
- Remaining areas set to G=0.8 representing a mix of 80% soft and 20% hard ground.

Appendix 8.A – Desk-Based Assessment

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Appendix 8.A - Cultural Heritage Desk Based Assessment

NeuConnect Britain Ltd

September 2019

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Table of Contents

Figures

Tables

1. Introduction

Instructions

1.1 AECOM has been appointed by NeuConnect Great Britain Ltd. (the Applicant) to prepare a Cultural Heritage Desk-Based Assessment (DBA) to accompany its planning application for the development of a converter station and onshore sections of a Direct Current (DC) cable route connecting Great Britain to Germany. The GB Onshore Scheme (the Site) is located on the Isle of Grain, Kent.

1.2 The requirement of this assessment is to identify, map, and assess the significance of all designated and non-designated heritage assets that are present within the Site and to determine the potential for the presence of as yet unknown archaeological remains. The assessment also identifies heritage assets beyond the Site and assesses the potential for their settings to change as a result of the scheme. The baseline conditions presented in this document provide the evidence base for the Environmental Impact Assessment (EIA) and therefore provide the evidence base to inform decisions in relation to avoiding, minimising and/or mitigating the impact to both the known and potential cultural heritage assets identified. This DBA will form a technical appendix to the Cultural Heritage Chapter of the Environmental Statement (ES).

Site Location and Description

1.3 The proposed development Site is located to the west of the village of Grain, within the boundary of Medway Council, and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south (Figure 1). The proposed converter complex is centred on National Grid Reference (NGR) TQ 87599 76431, while the proposed DC cable route would run from TQ 87759 76415 to mean high water springs (MHWS) at TQ 88544 77350.

1.4 Land use on the peninsula comprises a mix of industrial development to the south, the small settlement of Grain to the southeast and undeveloped land, much of which is designated for ecological interests, to the north (along the coastline) and to the west. There are also some small areas of brownfield or derelict land and some small areas of agricultural land (some of these coincide with brownfield land). The existing 400 kilovolt (kV) overhead line (OHL) which is broadly routed east to west generally marks the boundary between the extent of industrial or brownfield land and settlement or undeveloped coastal land. The only road access to the peninsula is from the B2001/ Grain Road.

1.5 The majority of the proposed development Site is situated within fields currently under cultivation or lying fallow. This includes all above ground structures, the access road, and the southern half of the proposed DC cable route. The northern half of the proposed DC cable route crosses West Lane and runs north along an existing access road that runs towards the cost towards the former White Hall Farm and reaches MHWS. This last section lies in an existing ditch and scrubland to east of the access road.

The Scheme

1.6 The proposed development is composed of four components:

- a converter station, including AC cables and an access road;
- a substation, including sealing end compound;
- the DC cable route; and
- a National Grid Electricity Transmission (NGET) tower, including connections.

1.7 The footprint of the proposed converter station at Grain is expected to be up to approximately 250m by 250m (to the perimeter security fence). This area would comprise specialist electrical

equipment, most of which would be located indoors in one or two building units in order to provide protection from the increased levels of salinity of the air. The building units would have maximum height of up to 26m. There would be a 2m exclusion zone around the perimeter fencing.

1.8 The footprint of the proposed substation would be expected to be approximately 80m by 80m (to the perimeter security fence). The substation would comprise specialist electrical equipment which would be located within a single building unit, with a maximum height of approximately 14m. The area would be surrounded by palisade security fencing.

1.9 Two DC cables and up to six AC cables would be installed as part of the proposed development. The cables would be approximately 20cm in diameter. From the converter station to MHWS, the DC cables would be approximately 1.6km long, after which the scheme would continue as the GB Offshore Scheme. The proposed AC cables may either be underground or above ground. If above ground these would be gas-insulated transmission lines (GIL) tubes. The proposed AC cable will be installed within the footprint of the proposed converter station and substation platforms. At the landfall location, where the subsea cable transitions to the onshore underground cable, a Transition Joint Pit (TJP) would be installed, which would consist of a buried concrete pad where the subsea and underground cables would be connected. The TJP would have an indicative footprint of up to 75m2 as a worst case (dimensions approximately 15m by 5m). The proposed DC cable would be installed in lengths of 800m to 1km. In between each length a joint bay would be required to join the lengths together. The joint bays would be similar in scale to the TJP, approximately 15m by 5m, and consist of a concrete slab for jointing to be undertaken.

1.10 Access to the proposed converter station would be via the B2001 Grain Road from the development of a new access point and internal road. This would be the primary point of access during construction and operation of the GB Onshore Scheme. Temporary access for construction of the proposed DC cable route would also be taken from Grain Road from the Perry's Farm access track, as well as from West Lane further to the north, which provides access to Rose Court Farm and Peat Way, which may also be used for temporary and/ or permanent access.

1.11 An additional working area, beyond the required area to accommodate the permanent footprint of the GB Onshore Scheme, of approximately 1.5ha would be required for the construction compound, laydown and storage areas, and 0.35ha would be required for sub laydown areas. These construction compounds would accommodate temporary construction facilities and include provision for offices, welfare, storage, and parking, waste management, as well as rock crushing and concrete batching facilities. These areas are likely to be topsoil stripped, levelled, and padded early in the construction works and would be entirely reclaimed upon completion.

Scope and Structure

1.12 This report has been prepared to determine the cultural heritage baseline to inform the ES chapter for the proposed development, and conforms to the requirements of the National Planning Policy Framework (NPPF) 2019. It describes the site, including the heritage assets within the site and within the study area.

1.13 This report is structured in six sections as follows, with illustrations and appendices at the end.

- The legislative and planning policy framework is provided in Section 2 (Legislation and Planning Policy) which also includes an overview of Historic England policy and guidance.
- The methodology for assessment and determination of the study area is set out in Section 3 (Assessment Methodology).
- A description of the Site's historical and archaeological background is set out in Section 4 (Baseline Assessment).
- Section 5 provides an assessment of known and potential heritage assets within the Site which have the potential to be impacted by the proposed development.
- Finally, Section 6 summarises the results of the assessment.

2. Legislation and Planning Policy

Legislation

The Ancient Monuments and Archaeological Areas Act (1979)

2.1 This Act is the central piece of legislation that protects the archaeological resource. The first section of the Act requires the Secretary of State for National Heritage to maintain a schedule of nationally important sites. For the purposes of the Act, a monument is defined as:

2.2 "a) any building, structure or work, whether above or below the surface of the land, and any cave or excavation; b) any site comprising the remains of any such building, structure or work or of any cave or excavation; and c) any site comprising, or comprising the remains of, any vehicle, vessel, aircraft or other moveable structure or part thereof which neither constitutes nor forms part of any work which is a monument as defined within paragraph a) above; d) and any machinery attached to a monument shall be regarded as part of the monument if it could not be detached without being dismantled' (Section 61 (7))."

2.3 The Act further defines an ancient monument as:

2.4 "any Scheduled Monument; and any other monument which in the opinion of the Secretary of State is of public interest by reason of the historic, architectural, traditional, artistic or archaeological interest attaching to it' (Section 61 (12))."

2.5 A set of criteria, defined as survival/condition, period, rarity, fragility/vulnerability, diversity, documentation, group value and potential, assist in the decision making process as to whether an asset is deemed of national importance and best managed by scheduling.

The Planning (Listed Buildings and Conservation Areas) Act 1990

2.6 The Act sets out the principal statutory provisions which must be considered in the determination of any application affecting either listed buildings or conservation areas.

2.7 Section 66 of the Act states that in considering whether to grant planning permission for development which affects a listed building or its setting, the local planning authority or, as the case may be, the Secretary of State shall have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses. By virtue of Section 1(5) of the Act a listed building includes any object or structure within its curtilage.

National Planning Policy

National Planning Policy Framework (NPPF; MHCLG 2019)

2.8 The NPPF sets out the Government's planning policies for England and how these should be applied to contribute to the achievement of sustainable development. The NPPF requires plans, both strategic and non-strategic, to make provision for the conservation and enhancement of the historic environment (paragraphs 20d and 28). Section 16 of the NPPF sets out a series of policies that are a material consideration to be taken into account in development management decisions in relation to the heritage consent regimes established in the Ancient Monuments and Archaeological Areas Act 1979 and the Planning (Listed Buildings and Conservation Areas) Act 1990.

2.9 The NPPF sets out the importance of being able to assess the significance of heritage assets that may be affected by a development proposal. Significance is defined in Annex 2 as 'the value of an asset because of its heritage interest. This interest may be archaeological, architectural, artistic or historic and can extend to its setting'. The setting of a heritage asset is defined in Annex 2 as 'the surroundings in which a heritage asset is experienced'. In determining applications, local planning authorities should require an applicant to describe the significance of any heritage

assets affected, including any contribution made by their setting. The level of detail should be proportionate to the asset's importance and no more than is sufficient to understand the potential impact of the proposal on their significance (paragraph 189). Similarly, there is a requirement on local planning authorities to identify and assess the particular significance of any heritage asset that may be affected by a proposal; and that they should take this assessment into account when considering the impact of a proposal on a heritage asset (paragraph 190).

2.10 In determining planning applications, local planning authorities should take account of the following three points:

- the desirability of sustaining and enhancing the significance of heritage assets and putting them to viable uses consistent with their conservation;
- the positive contribution that conservation of heritage assets can make to sustainable communities including their economic vitality; and
- the desirability of new development making a positive contribution to local character and distinctiveness (paragraph 192).

2.11 Paragraphs 193 to 196 of the NPPF introduce the concept that heritage assets can be harmed or lost through alteration or destruction or development within their setting. This harm ranges from less than substantial through to substantial. With regard to designated assets, paragraph 193 states that great weight should be given to an asset's conservation and the more important the asset, the greater the weight should be. This is irrespective of the level of harm to its significance as a result of any proposals. Distinction is drawn between those assets of exceptional interest (e.g. grade I and grade II* listed buildings), and those of special interest (e.g. grade II listed buildings). Any harm or loss of heritage significance requires clear and convincing justification, and substantial harm or loss should be wholly exceptional with regard to those assets of greatest interest (paragraph 194).

2.12 In instances where development would cause substantial harm to or total loss of significance of a designated asset, consent should be refused unless that harm or loss is 'necessary to achieve substantial public benefits that outweigh that harm or loss' (paragraph 195). In instances where development would cause less than substantial harm to the significance of a designated asset, the harm should be weighed against the public benefits of the proposal including its optimum viable use (paragraph 196). In relation to non-designated assets a balanced judgment is required taking into account the scale of harm or loss and the significance of the asset (paragraph 197). Distinction is made between those non-designated assets of archaeological interest which are demonstrably of equivalent significance to scheduled monuments; the latter should be considered against polices for designated heritage assets (footnote 63).

Planning Practice Guidance (MHCLG 2018)

2.13 The Planning Practice Guidance (PPG; MHCLG 2018) is a government produced interactive on-line document that provides further advice and guidance that expands the policy outlined in the NPPF. It expands on terms such as 'significance' and its importance in decision making. The PPG clarifies that being able to properly assess the nature, extent and the importance of the significance of the heritage asset and the contribution of its setting, is very important to understanding the potential impact and acceptability of development proposals (paragraph 009).

2.14 The PPG states that in relation to setting a thorough assessment of the impact on setting needs to take in to account, and be proportionate to, the significance of the heritage asset under consideration and the degree to which proposed changes enhance or detract from that significance and the ability to appreciate it (paragraph 013).

2.15 The PPG discusses how to assess if there is substantial harm. It states that what matters in assessing if a proposal causes substantial harm is the impact on the significance of the asset. It is the degree of harm to the asset's significance rather than the scale of the development that is to be assessed (paragraph 017). Generally, harm to heritage assets can be avoided or minimised if proposals are based on a clear understanding of the heritage asset and its setting (paragraph 019).

2.16 The NPPF indicates that the degree of harm should be considered alongside any public benefits that can be delivered by development. The PPG states that these benefits should flow from the proposed development and should be of a nature and scale to be of benefit to the public and not just a private benefit and would include securing the optimum viable use of an asset in support of its long term conservation (paragraph 020).

Local Planning Policy

Medway Local Plan

2.17 Local policy is defined by the Medway Local Plan adopted by Medway Council on 14th May 2003. Medway Council is currently working on a new Local Plan, Future Medway, which will cover the period up to 2035.

2.18 The Medway Local Plan makes several provisions for the protection and enhancement of the heritage environment. Relevant to this study are the following policies:

2.19 Policy BNE18: Setting of Listed Buildings. 'Development which would adversely affect the setting of a listed building will not be permitted.'

2.20 Policy BNE21: Development affecting potentially important archaeological sites will not be permitted, unless:

- the developer, after consultation with the archaeological officer, has arranged for an archaeological field evaluation to be carried out by an approved archaeological body before any decision on the planning application is made; and
- it would not lead to the damage or destruction of important archaeological remains. There will be a preference for the preservation of important archaeological remains in situ.
- where development would be damaging to archaeological remains, sufficient time and resources are made available for an appropriate archaeological investigation undertaken by an approved archaeological body. Such investigations should be in advance of development and in accordance with a specification and programme of work approved by the council. Resources should also be made available for the publication of the results of the investigation.

Policy Guidance

2.21 Historic England has published a number of relevant guidance documents that should be taken into account when assessing the historic environment.

Historic England Conservation Principles Guidance (EH 2008)

2.22 The primary aim of the Conservation Principles, Policies and Guidance is to support the quality of decision-making, and create a clear, transparent and sustainable management regime for all aspects of the historic environment.

2.23 This document sets out six guiding principles governing the approach to decision making. The principles describe:

How the public values and participates in the historic environment;

- The development process and assessment of harm;
- Articulate an approach to assessing significance of heritage assets based on their evidential, historical, aesthetic and communal values, and balances these with the contribution made by setting;
- The document also sets out how to manage impacts on significance; and,
- How decisions are guided by public policy and the balance to be struck between heritage significance and the impact of change on that significance.

2.24 These principles are intended to be used as a tool to aid analysis rather than be taken as policy.

Historic England Good Practice Advice Notes

2.25 Historic England has published a series of Good Practice Advice (GPA) of which those of most relevance to this appraisal are *GPA2 Managing Significance in Decision-taking* (March 2015) and *GPA3 The Setting of Heritage Assets* (Second Edition, 2017).

2.26 GPA2 emphasises the importance of having a knowledge and understanding of the significance of heritage assets likely to be affected by the development and that the 'first step for all applicants is to understand the significance of any affected heritage asset and, if relevant the contribution of its setting to its significance' (para 4). Early knowledge of this information is also useful to a local planning authority in pre-application engagement with an applicant and ultimately in decision making (paragraph 7).

2.27 GPA3 (Second Edition) provides detail on the setting of heritage assets provides general advice on understanding setting, and how it may contribute to the significance of heritage assets and allow that significance to be appreciated. The document also provides advice on how views contribute to setting.

2.28 Paragraph 8 of the advice note confirms that the extent of the setting, as defined in the NPPF, is not fixed and may change as the asset and its surroundings evolve.

2.29 Paragraph 9 states that although the setting is not itself a heritage asset, nor a heritage designation, land comprising a setting may itself be designated. The concept of a 'core', 'wider' and 'extended' setting is introduced in the same paragraph (under the section on Designated Views); however, it is acknowledged that there is no formal meaning for these terms and they will only apply in certain cases.

3. Methodology of Assessment

Standards and Guidance

3.1 The assessment of baseline conditions was carried out following the guidelines of the Chartered Institute for Archaeologists (CIfA), the Standard and Guidance for Historic Environment Desk-Based Assessment (CIfA 2017) and the Code of Conduct (CIfA 2014).

Study Area

3.2 The study area for the collation of information on archaeological assets was defined as a 3km buffer from the Site boundary, but only ends at the MHWS on the Isle of Grain. This distance has been agreed with Kent County Council as appropriate to provide the context of, and potential for, surviving archaeological remains on the Site given the nature of the proposed development and its location. The enlarged study area is specifically targeted to include key Palaeolithic sites on the peninsula, a number of archaeological interventions that have been carried in the south-east of the Isle of Grain, and the high ground on which the village of Grain is located (defined as the Head and River Terrace Gravels geological deposits and margins). Known archaeological assets located on the foreshore or offshore, which consist largely of ship and airplane wrecks, jetties, salting, and post-medieval or modern defensive features, were considered to have little bearing on the potential for archaeological remains onshore. These assets are, however, considered by the offshore aspect of the scheme submitted separately from this document (Wessex Archaeology, XXX). Impact to offshore heritage assets between MHWS and MLWS have been identified in the offshore aspect of the proposed development's cultural heritage desk-based assessment (Wessex Archaeology XXX). Assets identified within the intertidal zone will not be discussed in this desk-based assessment but will be incorporated within the onshore scheme's cultural heritage ES chapter.

3.3 The study area for the collation of information on built heritage assets was defined as 1km from the Site boundary. Given the low lying location of the Site the study area was extended to the west to take in the villages of Allhallows and Lower Stoke which are located on higher ground to the west.

3.4 Within these study areas, information was collated in relation to all designated and non-designated heritage assets. Heritage assets were identified using the data sources listed below (section 3.3).

Data Sources

3.5 The preparation of the baseline was informed by information gathered and collated from various sources, including:

- Kent Historic Environment Record (KHER);
- National Heritage List for England;
- Historic England Archive ;
- Kent Archives at the Kent History & Library Centre;
- Open Lidar data obtained from the Environment Agency accessed through Lidar Finder (https://www.lidarfinder.com/) ;
- British Geological Survey (BGS) online (http://www.bgs.ac.uk/geoindex/);
- Historic Ordnance Survey maps;
- Research frameworks for South East England;
- Geotechnical borehole data; and
- Other online sources.

Site Visit and Walkover Summary

3.6 A Site visit and visual assessment of heritage assets within the study area and Site was undertaken on 7th May 2019. General photographs of the walkover survey are included in Appendix D. The aims of the survey were:

- To identify known archaeological sites and find spots;
- To identify historic buildings and related assets including listed and locally listed buildings;
- To identify areas with the potential to contain any previously unidentified archaeological or historical remains;
- To identify and assess the setting of heritage assets; and
- To identify the location, extent and severity of modern ground disturbance and previous construction or agricultural impacts.

Analysis Tools

3.7 The data gathered through both the Site visit and desk-based review have been collated and the results mapped in ArcView GIS using Ordnance Survey base mapping.

3.8 An assessment of the historic development of the Site and its surrounds including a map regression exercise has been undertaken (Figures 6 to 15). This was designed both to provide a context for known assets and to help identify the potential for other archaeological remains to be present.

3.9 An assessment of the setting of assets and its contribution to their significance was determined with reference to Historic England guidance on setting (EH 2015c) and the PPG (MHCLG 2018). Statements in relation to the heritage significance of assets are made with reference to their Artistic, Architectural, Archaeological and Historic qualities as stated in the NPPF (MHCLG 2019).

Historic Landscape Characterisation

3.10 The sources used to characterise the historic landscape within the Site included:

- Natural England's National Character Areas;
- Kent Historic Landscape Characterisation (HLC);
- Published documentation, in particular those of the Hoo Peninsula Historic Landscape Project (see below for list of references); and
- Walkover and visual inspection of the Site.

3.11 For the purpose of this study the GIS data for the Kent Historic Landscape Characterisation (HLC) Study were obtained from Kent County Council (KCC) and have been incorporated into the project under license from KCC. The dataset was in the form of HLC type polygons and is presented in Figure 4 of Appendix C.

Assessment Criteria

Heritage Asset Significance

3.12 An assessment of the significance of assets and their setting has been undertaken in consideration of guidance and good practice issued by Historic England. A methodology for the assessment of significance of heritage assets is outlined in *Conservation Principles, Policies and Guidance* (English Heritage, 2008) whilst Historic England GPA3 (2017) provides the basis of a methodology for the assessment of setting.

3.13 Annex 2 of the NPPF states that the significance of heritage asset is its value "to this and future generations because of its heritage interest. This interest may be archaeological, architectural,

artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting" (MCHLG 2019, 71).

3.14 Significance is often established by statutory designations such as listed buildings, scheduled monuments and conservation areas. More particular advice as to what makes up significance is set out in Conservation Principles, which establish a method for thinking consistently about the heritage values that can be ascribed to a place. When making an assessment of significance numerous aspects are considered including: architectural interest, historic interest, group value, social value, former uses and local distinctiveness. These aspects are grouped into four values: Evidential, Historic, Aesthetic and Communal.

3.15 The terminology used in this desk-based assessment relates to the terminology used by both the NPPF and Conservation Principles, referring to significance in terms of heritage interest and not heritage values. Whilst heritage interest and heritage values are not completely interchangeable they are broadly similar.

3.16 In the related ES chapter, this value, interest, or significance of a heritage asset will be referred to as its sensitivity; ensuring that these documents' terminology accord with that used under Environmental Impact Assessment methodologies.

Magnitude of Previous Ground Disturbance

3.17 The magnitude of impact to buried archaeological remains caused by historic development has been assessed based on available data listed above, with particular attention paid to historic boreholes and available data obtained from previous archaeological evaluations and excavations in the study area.

Archaeological Potential

3.18 The potential for an area to contain archaeological remains is rated 'high', 'moderate, 'low', 'negligible', or 'unknown'. This rating is based on an understanding of the archaeological resource as a whole and its national, regional and local context. This includes the number, proximity and significance of known and predicted archaeological/historical sites or find spots within the Site and its surrounding study area.

Consultation

3.19 Direct consultation with statutory bodies of Kent County Council and Historic England was carried out by AECOM in lieu of an Environmental Impact Assessment Scoping Report.

3.20 Kent County Council's Archaeological Officer's response (Appendix E; dated 12/02/2019) highlighted the potential for Palaeolithic, Iron Age, and Roman remains within the proposed project Site. It was requested that the study area encompass the area of higher gravel terrace grounds and take into account archaeological investigations carried out along the south and south-east coast line of the Isle of Grain. The officer also asked that the report incorporate the findings of Historic England's Hoo Peninsula Project. Lastly, it was requested that preliminary geotechnical investigations borehole logs be made available and subsequent ground investigation works be archaeologically monitored.

3.21 Historic England's response (Appendix E; dated 01/03/2019) was largely in agreement with Kent Council's Archaeological Officer, also highlighting the potential for Iron Age, Roman, as well as for Second World War heavy anti-aircraft batteries. Historic England also requested that the intertidal and terrestrial aspects of the projects be well integrated and cross-referenced in order to avoid omitting potential remains.

4. Baseline

Physical Site Conditions

Site Topography

4.1 The Site is located on the Isle of Grain, the eastern tip of the Hoo Peninsula. Once separated from the mainland by the Yantlet Creek, a navigable tidal channel between the Thames and Medway estuaries, this channel was infilled sometime in the medieval period, effectively transforming the Isle of Grain from an Island to a peninsula. Nevertheless, the former infilled channels of the Yantlet Creek and its related natural fleets remained low-lying and marshy until the 18th century following extensive reclamation efforts.

4.2 The Isle of Grain appears to have been extensively eroded for the last several centuries if not millennia. Historical accounts tell of wide-scale inundation across much of the island in throughout the 15th and 16th centuries until the erection of strong sea wall defences in the 17th century (Carpenter *et al*. 2013, 15). Despite this, the erosion of the northern portion of the Isle of Grain remains rapid even today. This is clearly evident from aerial photographs which show the loss of over 50m of coastline north of the village of Grain since the 1940s, despite the construction of groynes all along that coast. It is likely that historically the Isle of Grain extended as far as the current extent of the mudflats and mean low water mark.

4.3 The Site itself is located on the western side of the area of high ground on which the village of Grain is centred. The main proposed complex is located on the south-west edge of this high ground, approximately 8m Ordnance Datum (OD). The cable route running north-east of the complex will follow the western contour of the hill, rising up to approximately 12m OD near West Lane before reaching MHWS to north.

4.4 To the west of the proposed electrical converter and substation, the land drops down towards low-lying reclaimed marshes and former Yantlet Creek. On the opposite side of the low-lying area, the land rises again to form the easternmost point of the 'Hundred of Hoo Hills', a central ridge of high land that traverses the Hoo Peninsula north-east to south-west. The open low-lying land that separates these two areas of high ground results in wide views and perspectives linking the two high points. The site of the proposed development and settlements located on the ridge to the west (Lower Stokes and Allhallows) are clearly inter-visible across this span.

4.5 The landscape also drops to the south and south-east of the main complex. However, in those directions the Isle of Grain has been heavily industrialised since the post-medieval period and is now dominated by power generation plants, liquid natural gas storage, and the accompanying infrastructure.

4.6 Immediately east and north of the main complex, where the proposed DC cables lie, the land is relatively flat and currently either under cultivation as part of Perry's Farm, or lying fallow following extensive sand and gravel extraction.

4.7 The proposed DC cable route north of West Lane is situated within an area of former mineral extraction. The area has only been partially reinstated and is now low-lying scrubland.

4.8 As the proposed DC cable route approaches the coast, the land drops sharply down to a pebble beach giving onto wide mudflats beneath the MHWS mark.

Site Geology

4.9 Although much of the Isle of Grain is formed of London Clay bedrock deposits overlain by alluvium (BGS), the proposed development Site is located on higher ground composed of terrace gravels and related colluvium. Detailed investigation of the Hoo Peninsula has shown that the gravel deposits on the Isle of Grain differ significantly from those to the west of Yantlet Creek (Bridgeland 2003, 42). The similarity of the Grain Gravels to deposits in Southend, on the opposite side of the Thames today, suggests that they belong to the same Thames-Medway

subgroup (*ibid*.). More specifically, the Grain Gravels originate from the Corbets Tey Gravel of the Lower Thames and the Stoke Gravel of the Medway (Bridgland *et al.*, 1993).

4.10 The composition of the Grain Gravel is closely comparable to the Low-level East Essex Gravel of the Southend area, of Thames-Medway origin. It had been suggested that the Grain Gravels are a downstream continuation of the Corbets Tey Gravel of the Lower Thames and the Stoke Gravel of the Medway, dating to Marine Isotope Stage (MIS) 8 through 10 (Bridgland *et al*., 1993). However, more recent direct dating of gravel deposits on the Isle of Grain through Optically-Stimulated Luminescence (OSL) has provided direct dates that place the gravels in MIS 6, roughly 224±25ka (thousands of years ago) (Wessex 2013) and 196±14ka (Wenban-Smith *et al*. 2007).

4.11 These Grain Gravel deposits have been extracted at several locations across the study area, but given the origin of their formation, areas of undisturbed gravels retain the potential to contain Lower Palaeolithic material. The deposits themselves are also considered to be of research interest in that they may inform on the Pleistocene landscape and the formation processes of the Thames and Medway estuaries.

4.12 Ground investigations were carried out in advance of the proposed development within the location of the proposed converter station and its access road. This study included nine boreholes, two trial pits, and four piezocone penetration tests, the results of which are included in Appendix F. The investigations show the presence of made ground deposits below topsoil in six of the boreholes to the west and south of Perry's Farm. In all instances, the logs show that beneath topsoil, or beneath made ground where present, superficial deposits of mixed sand, clay, and gravel are present. These superficial deposits are likely a combination of Grain Gravel with the underlying London Clay bedrock, but may also include a component of alluvial deposits formed by tidal flooding. These deposits appear to be highly variable and may have been redeposited through colluvial processes.

Heritage Assets

4.13 There are no World Heritage Sites, scheduled monuments, registered parks and gardens, or registered battlefields within the Site. A single grade II listed building, consisting of Second World War dragon's teeth anti-tank defences, is situated within the Site boundary.

4.14 Four non-designated assets have been identified within the Site boundary, all of which are archaeological in nature and date from the medieval period to the modern period. In addition to these assets, the proposed development extends over two Areas of Archaeological Potential (AAP), centred on KHER assets considered by Kent County Council to be of archaeological interest and which have the potential for further remains to have survived in their vicinities. The first is a large AAP overlying the Grain Gravel terrace which is considered to be a geological formation with potential to hold Palaeolithic remains. The second AAP is centred on an Iron Age settlement and late Roman cemetery north of Rose Court Farm.

4.15 Five designated assets have been identified within the 1km study area. These consist of two scheduled monuments, one grade I listed and two grade II listed buildings. A further four listed buildings, one grade I and three grade II, are located within the villages of Allhallows and Lower Stoke approximately 4km to the west of the Site.

4.16 A total of 143 further non-designated assets lie within the study area, consisting of 11 extant built heritage assets and 132 archaeological assets. The built heritage resource dates from the post-medieval to the modern period, while the archaeological assets date from the Lower Palaeolithic period to the modern period. Twenty-one AAPs are situated within the study area, centred on KHER assets considered to be of particular interest.

4.17 Assets identified within the Site and study area have been given unique reference numbers. These are pre-fixed with [**A**] for archaeological assets, [**E**] for archaeological investigations, and [**BH**] for built heritage assets. Each asset will be cross-referenced to the gazetteer in Appendices A and B. The location of archaeological assets is shown in Figure 2, while archaeological events are shown in Figure 3, historical landscape character is shown in Figure 4, and built heritage assets are shown in Figure 5, all of which can be found in Appendix C.

Previous Studies

4.18 The location of the Hoo Peninsula and the Isle of Grain, situated as they are between the ancient estuaries of the Thames and Medway, marks them as being of particular archaeological and palaeoenvironmental research interest. This has resulted in a relatively large number of archaeological, geoarchaeological, and landscape investigations over the last two decades.

4.19 Several academic research projects have been aimed at cataloguing and characterising the historic landscape in order to produce research frameworks to guide future development and research on the peninsula. The largest and most inclusive of these is the wide-ranging Hoo Peninsula Landscape project (Carpenter *et al*. 2013), which produced a report on the historic landscape of the entire peninsula (Sarah *et al*. 2015), a historic area assessment for the Isle of Grain (Smith 2014), a desk based assessment of the Grain Island Firing Point (Edgeworth 2013), an assessment of Second World War bombing decoys (Small 2014), and a paleoenvironmental study of the Hoo Peninsula (Hazell 2011). Together, these studies provide excellent overviews of relevant geological and historic landscape of the Isle of Grain.

4.20 A further research project of direct relevance to this proposed development is the Medway Valley Palaeolithic Project (Wenban-Smith *et al*. 2007), which was aimed at identifying and characterising geological deposits of archaeological and palaeoenvironmental potential. The Grain Gravels that cover much of the proposed development were investigated as part of this project, and a field survey of mineral extraction at Clubb's Pitt uncovered a lower Palaeolithic handaxe near the proposed DC cable route.

4.21 Determining the Palaeolithic and later prehistoric archaeological potential of the Isle of Grain has been the subject of a number of developer-led investigations over the last three decades. Most of these were focused on identifying and dating deeply buried deposits through programmes of geoarchaeological investigations. These have confirmed the expected geological deposit model reported by BGS and studies previously mentioned, consisting of Holocene alluvial deposits covering much of the Isle of Grain and gravel terrace deposits dating to the Wolstonian Stage of the Middle Pleistocene restricted to the higher ground in the north-east quadrant of the Isle. While few boreholes were tested for environmental remains, a number of samples taken from the Isle of Grain Power Station revealed palaeo-environmental remains dating to the Late Bronze Age.

4.22 In an effort to enhance the Kent Sites and Monuments Record and thereby facilitate strategic coastal planning, management initiatives, and improve services to individual development or works proposals, Kent County Council commissioned a Rapid Coastal Zone Assessment Survey (Wessex 2000; 2002; 2004; 2004a; 2005; 2006). This was carried out over several years and focused on recording, through desk-based research and non-intrusive surveys, the historic environment resource along the Kent coastline. The Isle of Grain features prominently in these reports due to its location along a coastline famous for its treacherous waters and for its military history. Although much of the findings of these studies relate best to the offshore element of this scheme, the monuments recorded by the initiative have recorded a number of onshore and potential resources that are relevant to the Site.

4.23 A significant Iron Age to Roman settlement site was investigated within the Clubb gravel extraction pit in the 1970s near Rose Court Farm [**E3**], which may fall within the footprint of the proposed development's northern onshore cable section. Unfortunately, the excavation reports have since been lost and the details of the excavations are limited to two short summaries that suggest the presence of an existing settlement and cemetery[1].

4.24 Iron Age to Roman settlement remains have also been recorded by geophysical surveys [**E12**], watching briefs, and trial trenching for a gas pipeline running from Grain to Shorne (Site A). This site is not located on the Isle of Grain itself, but near Lower Stoke 4.2km west (Meaton 2008; Dawkes 2009). Along with the extensive remains reported at Rose Court, these two sites suggest that the area was populated and settled from at least the Iron Age onwards.

[1] Repeated contact was made with former staff of Kent Archaeological Research Unit to try to source information relating to the 1970s excavations. Unfortunately, information about the site or site archive has not been provided.

4.25 Due to the extent of early 20th century industrial developments on the Isle of Grain, which are likely to have removed much of the archaeological resource, and the focus of more recent developments on these brownfield areas, few developer-led investigations have focused on late prehistoric to medieval archaeology. As such, only six watching briefs [**E1**, **E2**, **E7**, **E9**, **E10**, and **E11**] have been carried out on the Isle of Grain, none of which revealed any archaeological features of interest. A single study [**E2**], however, noted the presence of organic deposits which had the potential to relate to archaeology at the Isle of Grain Power Station, 1km south of the Site. It should be noted that all of these investigations have been concentrated in the southern half of the Isle of Grain, and therefore are not entirely indicative of the potential for archaeology on the higher gravel terraces on which the proposed development is located.

4.26 Nevertheless, a series of geoarchaeological investigations [**E4**, **E5**, **E6**, **E8**, **E13**, **E14**, and **E15**] on the Isle have clearly detailed the geological landscape of the study area.

Archaeological and Historical Overview

4.27 An assessment of the historic development of the Site through the study of a map regression exercise has been undertaken to provide a context for known assets and to help identify the potential for previously unknown assets to be present within the Site.

Palaeolithic (to *c.* 10,000 BC)

4.28 Evidence of the Palaeolithic period is usually limited to individual finds of lithic material, due to the lack of permanent settlement evidence and lack of preservation of organic remains.

4.29 The Site is located on a peninsula overlooking the Thames Estuary to the north and the Medway Estuary to the south, both of which have produced gravel deposits in which Palaeolithic finds have been recorded. The Grain gravels on which the Site is located were formed as part of the Thames system (Bridgeland *et al*. 1993; Bridgeland 2003) and which has been dated to MIS 6, roughly 200,000 years ago (Wessex 2013; Wenbau-Smith *et al*. 2007). This period is of particular interest as it corresponds to known Neanderthal occupation in Britain and as such has the potential to contain such remains.

4.30 A single flint artefact [**A1**] of Lower Palaeolithic date was found during a field survey of the J. Clubb mineral extraction pit 150m east of the proposed electrical complex. This confirms the presence of Palaeolithic remains within the Grain Gravels.

4.31 Environmental remains comprising ostracods, molluscs, and foraminifera dating to the Lower Palaeolithic [**A2**] have been reported 2km west of the Site, below Allhallows Marsh.

Mesolithic (*c.* 10,000-4,000BC)

4.32 The Mesolithic of the British Isles is characterised by small nomadic groups of hunter gatherers who moved periodically around the landscape to take advantage of wild and readily available sources of food. This movement is typically seasonal, and is thought to have followed the migratory route of game animals.

4.33 It is immediately prior to the Mesolithic that the Rivers Thames and Medway entered their current courses. The Hoo Peninsula's situation between these two major estuaries and the abundance of available resources would have been highly attractive to nomadic hunter gatherers. Geoarchaeological studies of the low-lying areas of the Isle of Grain show that the environment was predictably wetter and marshier than it is today. However, the higher gravel terrace on which the Site is located was likely drier then much as it is today and may have been occupied during this period.

4.34 Although no Mesolithic remains have been recorded in the study area, two areas of prehistoric peat have been recorded in the mud flats off the south and east coast of the Isle of Grain that may date to the Mesolithic. Furthermore, alluvium deposits recorded by various boreholes have also been dated to the Holocene that may therefore contain archaeological or environmental deposits dating to the Mesolithic.

Late Prehistoric (c. 4,000 BC–AD 43)

4.35 The late prehistoric period covers the Neolithic, Bronze Age and Iron Age, which account for the adoption of farming and more sedentary communities. From *c*. 4000 BC, the landscape became more representative of sedentary communities, with further ordering of field systems during the Bronze Age and Iron Age.

4.36 While the Hoo Peninsula is rich in late prehistoric remains, comparatively little archaeology from this period has been recorded on the Isle of Grain. This may be largely the result of the focus of developer-led archaeology to the southern half of the Isle where the prehistoric landscape was altogether too marshy and low-lying to be suitable for occupation. Few investigations have been carried out on the areas of higher ground that may have a higher potential for prehistoric archaeology, which may account for the scarcity of such remains recorded within the study area.

4.37 The two areas of prehistoric peat off the coast of the Isle of Grain and alluvium encountered in several locations already discussed have the potential to contain prehistoric archaeological and/or environmental remains from any period of the late prehistoric. Such peat deposits are expected to be present throughout the low-lying former marshland and coast but are unlikely to extend to the gravel terrace on which the Site is located.

4.38 Several undated enclosures and ring ditches, visible as cropmarks, have been recorded within the study area. These may date to any period from the late prehistoric onwards.

4.39 The only Neolithic find within the study area consists of a single Neolithic axe [**A3**], of insecure provenance described vaguely as having been recovered from the junction of the Thames and Medway.

4.40 No Bronze Age remains have been identified within the study area. The nearest evidence of Bronze Age activity consists of just over one hundred sherds of pottery recovered from Site A along the Grain to Shorne gas pipeline (Meaton 2008; Dawkes 2009) approximately 4.2 km west of the Site. These sherds are described as being poorly understood local Late Bronze Age types that likely, although not certainly, predate the Iron Age settlement uncovered at this location.

4.41 While no evidence of salt production has been recorded within the study area, the industry is well attested in the marshes of the Hoo Peninsula, albeit further west. Late Bronze Age salt production is reported at Hoo St. Werburgh (Moore 2002), 10km south-west of the Site, and at Allhallows (Greatorex, 2005), 3.5km west of the Site. Iron Age production is also attested at Hoo St. Werburgh and Stoke (Miles 1975), 3-10km south-west of the Site. Given the presence of a similar saltmarsh environment on the Isle of Grain to the areas of known prehistoric salt production, it is likely that the salt industry extended east onto the island, although such activities are unlikely to have taken place within the Site itself given that it is situated on higher ground and therefore above the tidal regime needed for salt production.

4.42 Although the results of several phases of excavations near Rose Court Farm remain unpublished, the works uncovered a major Iron Age complex [**A6**] that forms the earliest evidence of permanent occupation on the Isle of Grain. The Iron Age phase included a complex of ditched enclosures and post-hole structures extending over an area of well over 10ha dating to the first centuries BC and AD. Situated on the higher grounds of the Grain gravel terrace, it controlled the approach to both the Medway and Thames estuaries (Philp and Garrod 1980; Philp 1982). Despite the exact location of the site being unknown, it is recorded as located in the Grain gravel pit which covers the area surrounding Rose Court Farm north of West Lane and which is crossed by the proposed development's cable route. The remains are likely to have been entirely removed by mineral extraction associated with the Grain gravel pit, although there may be some residual material within the access road that may not have been subjected to mineral extraction.

4.43 Evidence of burnt Iron Age to Roman material [**A7**] was recorded at Wallend Petroleum Tank Farm, approximately 700m southeast of the Site, which may relate to Roman pottery kilns uncovered in the same area.

4.44 Lastly, two Iron Age gold coins [**A4** and **A5**] have been recorded by the Portable Antiquities Scheme in the area of Grain, although their exact provenance is not known.

Roman (AD 43-410)

4.45 Despite the Romans landing in AD 43 on the east coast of Kent some 50km southeast of the Site, the Hoo Peninsula appears to have remained largely undisturbed by the conquest itself. This was likely in part due to the inhospitality of the marshy landscape and the area's remoteness. However, the Romans began exploiting the rich resources of the Peninsula soon after the conquest, slowly transforming it into a rural agricultural landscape dotted by salt and pottery production centres.

4.46 The Roman period on the Isle of Grain itself is poorly understood. The most significant remains consist of an enclosure, field ditches, and a Roman cemetery containing at least two cremation and 47 inhumation burials uncovered during salvage excavations in 1978-81 [**A11**]. Although grave goods have been tentatively dated to AD 250-350, the results of the excavations have not been properly assessed or published, and as such these results are based on preliminary summary reports only. The cemetery was recorded during salvage excavations ahead of mineral extraction at the Isle of Grain gravel pit, and while the exact location of the cemetery is not currently known, it may have extended across the area of the proposed cable route north of West Lane. It is, however, unlikely that any remains have survived the extensive mineral extraction in the mid-20th century.

4.47 Even less is known about a Roman pottery kiln and scatter of kiln bricks and pottery [**A10**] purportedly uncovered at 1m OD by workmen digging a trench in 1939. The exact location of this trench is unknown, but is reported by the KHER 1.2km south of the Site. It may or may not relate to Iron Age to Roman burnt material reported at Wallend Farm already mentioned [**A7**].

4.48 Roman salt production, the remains of which tend to be located at the junction between the low-lying marshy ground and higher ground (Carpenter *et al*. 2013, 43), have been reported at Hoo St. Werburgh 10km west of the Site (Miles 1975). Possible evidence of salt production has also been reported closer to the Site, in the form of pottery and 'briquetage' recovered from the marshes east of Allhallows, just beyond the study area and approximately 3.1km from the Site.

4.49 Two cordoned flasks findspots [**A8** and **A9**] are also reported within the study area, both of which date to the 1st to 2nd centuries AD. It is highly likely that these two finds are in fact the same given that they are both described as recovered during works at an oil refinery carried out in 1951. The first of these finds is reported as located at Wallend, approximately 200m south of the Site, while the latter is reported at imprecise coordinates 1.3km south of the Site.

Early Medieval (410-1066)

4.50 The name Grain is believed to have originated from the Anglo-Saxon word *greon*, meaning gravel and interpreted as referred to a gravelly or sandy shore (MacDougall 1980, 20), long since eroded away (Evans 1954). This does not however necessarily imply the presence of an Anglo-Saxon settlement on the Isle of Grain. The Isle and its parish are not mentioned in the Domesday Book of 1086, suggesting that it was not a significant holding at the time of the Conquest.

4.51 Archaeological remains dating to the early medieval period identified within the study area are limited to four isolated findspots. These consist of two copper alloy fittings [**A12** and **A13**] and two Anglo-Saxon silver pennies (sceats) [**A14** and **A15**].

Medieval (AD 1066-1540)

4.52 Following its apparent abandonment in the early medieval period, the Isle of Grain was re-occupied sometime in the 12th century when the settlements of Wallend and St James Grain (now known simply as Grain) were founded (Smith 2014, 7). The parish belonged, at the time, to the Hundred of Gillingham, rather than the Hundred of Hoo to which it was later granted. The extant parish church of St. James [**BH2**] retains some features dating to its 12th century founding, when it is said to have been located in the centre of the medieval settlement. The manor of Grain was held by the Archbishop of Canterbury until it was conveyed to Henry VIII in the early 16th century. A further manor, Rose Court Farm, was reportedly present on the Isle of Grain in the 14th century onwards (ibid.). The location of the medieval manors of Grain, Wallend, and Rose Court is not known, their later incarnations being post-medieval in date.

4.53 The Isle of Grain is known to have been subjected to devastating and periodic inundations throughout the medieval period. Historical records from the 15th and 16th centuries in particular point to the loss of reclaimed land to extended periods of salt water inundation (Carpenter *et al*. 2013, 15). It is highly probable that the gravel terrace on which the village of Grain is situated today was, at several points during the medieval period, the only part of the Isle of Grain above sea level. This would in effect have confined and concentrated medieval activities to the higher ground on which the proposed development is located.

4.54 Archaeologically, the period is evidenced within the study area by remains at just three locations. The first consists of a 13th century midden [**A16**] found near Wallend in 1950 approximately 750m south-east of the Site. This midden measured approximately 2m by 2m, contained hundreds of shells of oysters, whelk and cockle, together with bones of ox and sheep and sherds of pottery dated to the 13th century. It may relate to the medieval manor of Wallend. The second medieval archaeological asset consists of medieval pottery uncovered in the vicinity of the Roman kiln [**A10**] 1.2km south of the Site. The third asset is a large area of ridge and furrow [**A70**] identified in aerial photographs by the National Mapping Project. This area of ridge and furrow lies entirely within the footprint of the planned electrical converter station.

Post-Medieval (1540-1901)

4.55 The earliest map to show the Isle of Grain in any detail is Saxton's of 1575 which shows the Yantlet Creek cutting the island off from the rest of the Hoo peninsula. In common with the rest of the Hoo peninsula, the Isle of Grain was predominantly used for marshland grazing and arable farming with some salt panning by the Yantlet Creek and the River Medway on the south-west of the island until the late 18th century.

4.56 Reclamation of the salt marshes on the Isle of Grain was an ongoing process, possibly dating back to Roman times. From 1530 responsibility for the sea walls rested with the North and East Kent Sewer Commissions. Flooding and loss of land were a regular occurrence from the 16th to 18th centuries but protection was improved in the 17th to 19th centuries forming an island of approximately 3100 acres by the end of the post-medieval period.

4.57 In the late medieval period the manor of Grain was owned by the Brooke family but was forfeit in 1603 when George Brooke, 11th Baron Cobham was executed after being implicated in a plot against King James I. The location of Grain manor house is not known and it was later absorbed into the manor of Gillingham. The other manors on the island, Rose Court and Wallend, are thought to have continued to be in use throughout the post-medieval era, although they are known to have been moved or rebuilt given that they have been recorded as 19th century structures discussed below.

4.58 The island was taken by the Dutch in 1667 during the Anglo-Dutch wars, the Dutch fleet proceeding up the Medway to fire several vessels of the English fleet.

4.59 In addition to Grain, an untitled chart dating to 1688 shows a place called 'Blackstakes' [**A62**] on the southern coast of the Isle of Grain approximately 2.3km south of the Site. This name appears again on the southern coastline near Horseshoe Point on the First Edition Ordnance Survey map of 1870 and subsequent maps. It is likely to refer to a feature on the foreshore which has long since been submerged.

4.60 Parker's map of 1719 shows the Church of St James [**BH2**] and a windmill to the south-east of it. On the south coast of the island a building is labelled Red House, although this has now been entirely submerged by erosional forces and will therefore not be further discussed. This farmstead should not be confused with the Red House Farm [**A36**] shown on later maps. The map also shows a bridge crossing Yantlet Creek, which is probably an earlier form of Grain Bridge [**A67**] carrying Grain Road shown on later Ordnance Survey maps.

4.61 Andrews and Dury's map of 1769 and Hasted's of 1778 have more detail showing two sets of salt pans with their windmills and shallow ponds to the west [**A17**] and south [**A18**] of Grain; the parish Church of St James [**BH2**] and its parsonage; the Cock Inn (later Hogarth Inn) [**BH3**]; and farms and cottages in and around the village including Wallend [**A40** to **A43**], Perry's and Wilford's farms [**A48** and **BH11**], West Bear [**A49**], White House Farm [**A51** and **BH4**], St James'

Farm [**A52**], a farm located on the later Lee's Cottages [**A56**]; and Red House. A farm labelled Brick House could be White Hall Farm [**A47**] shown on later maps in an area to be later used for extraction. The 1801 map produced by Mudge and the 1816-19 Ordnance Survey Old Series map of Essex and Suffolk have slightly less detail but both show the village, the surrounding farmsteads, and the salt pans to the south along with the addition of Baytree Farm [**A58**] and Bethel Chapel [**A61**] to the south-east of Grain.

4.62 In addition to the two large areas of salt extraction marked on Andrew and Dury's map, cartographic and aerial photographs suggest there may be further remains of post-medieval salt production in the marshes on the western periphery of the Isle of Grain [**A19**, **A20**] and within the Allhallows marshes west of the Yantlet and beyond the study area.

4.63 In 1841 the population of the Isle of Grain was approximately 250. Grain village consisted of a number of farms and farm workers cottages, the church, Bethel Chapel (built *c.* 1826), the poorhouse, and the Cock Inn. The National School was built in the 1860s. The First Edition Ordnance Survey 25in map of 1870 shows that by that point the town of Grain had grown to include a number of features shown for the first time. A Royal Engineer Office can be seen on this map adjacent to St James' Farm, a detached house is shown to the north of St James's Farm. This is possibly the current house on the site, Rissington which appears to have been much amended and is not treated as a built heritage asset in this assessment due to its lack of architectural or historic value. On the same map Redhouse Farm [**A36**] is shown in the marshes west of Wallend. Although by this point the town of Grain had begun clustering closer to the Church of St James, it remained largely defined by its dispersed character throughout the 19th century. West Bear is shown and labelled on the 1870 map but all that remains from that time is a dilapidated outhouse which is not recognised as a built heritage asset in this assessment. The map also provides the first detailed layout of White Hall Farm within the proposed development's cable route, including a large enclosure to the north that has since been eroded away and would now lie beyond MHWS.

4.64 The second edition of the Ordnance Survey 25in map of 1898 also marks several additions to the Isle of Grain landscape. Rosecourt Farm [**A44**, **A45**, and **BH10**] is shown for the first time with two cottages facing south-west and two farm buildings behind. The new Bethel Chapel of 1895, later Grain United Reformed Church [**BH7**] is shown on the opposite side of Chapel Road from its predecessor. The National School [**A59**] and Rectory [**A60** and **BH6**] are labelled to the south and south-west of the parish church respectively, and Parsonage Barn [**A53**] and a large row plan farm [**A54**] are also shown to the south-east of the church. A large outfall sewer [**A68**] is also shown for the first time east of Grain. While Lees Cottages are shown on the 1870 map they are in a different configuration than the building standing today, 1, 3 and 5. West Lane. This row first appears on the 1898 map but the cottages have undergone so much change that they are not treated here as a heritage asset.

4.65 In addition to the farmsteads and buildings discussed in and around Grain, the KHER lists a further 8 farmsteads or related buildings in the study area [**A35**, **A37**, **A38**, **A39**, **A46**, **A50**, **A55**, and **57**]. These are all located at least 1km from the Site and will therefore not be discussed in relation to the Site.

4.66 From the mid-19th century military fortifications were built on the Hoo peninsula. The first was Grain Tower (1855), one of the last examples of a British Gun Tower. This was followed by fortifications to the south and east of Grain village including Dummy Battery (1867-69); Wing Battery (1895) and Grain Battery (1900-1), all of which form part of the scheduled Coastal Artillery Defences on the Isle of Grain, Immediately East and South East of Grain Village [**BH5**]. In 1882 the Hundred of Hoo railway [**A63**] was extended to the ferry port of Port Victoria [**A64**] on the island's southern marshes with a halt [**A65**] at Grain Crossing [**A66**]. Grain Crossing signal box (outside the study area) is a grade II listed building. It was planned to develop Port Victoria as a rail and ferry port for continental and trans-Atlantic travel but despite the Queen using the pier for the Royal yacht the site was never fully developed.

4.67 The post-medieval maritime heritage of the Isle of Grain is well attested archaeologically both onshore and offshore. While offshore remains are discussed in a separate desk-based assessment, the onshore remains located on the Isle of Grain are discussed here. They comprise

a wide range of features, including buried features such as jetties and sea wall defences along former channels in the marshes [**A23** to **A27**], former wharves [**A28** and **A29**], a coastguard station [**A30**], and the sites of former signal beacons [**A31** to **A34**]. Given the Site's location, these maritime remains have little bearing on the potential for archaeological remains within the Site other than the short stretch of shoreline above MHW.

4.68 Features of lesser importance are also recorded in the KHER throughout the study area. These include two post-medieval enclosures of unknown purpose [**A69** and **A70**] near the Yantlet Creek, a burial mound or ground [**A71**] marked on 19th century Ordnance Survey maps 2km south-east of the Site, a circular embanked feature [**A72**] 2.3km south of the Site, flint foundations and scatters of red brick 1km north-west of the Site [**A73**], and water management features or pounds [**A74**] 1.4km south of the Site. Isolated finds dating to the post-medieval period include a rudder [**A75**] likely forming part of a wrecked vessel in the Yantlet and a post-medieval silver coin [**A76**] registered by the portable antiquities scheme.

Modern (1901 to present)

4.69 The Isle of Grain underwent drastic changes in the 20th century, in part due to the strategic importance of the area to the defence of the Thames and Medway estuaries during the First and Second World Wars, and in part due to the shift from a coal powered to an oil powered navy. These government-led military and industrial developments largely dictated the evolution of the Isle of Grain until the end of the Second World War, after which the military complex quickly declined while the petroleum industry and port facilities established on the southern half of the peninsula during the Second World War continued to thrive, developing into a power station complex and culminating in the landscape present there today.

4.70 The military areas are not shown in detail on early Ordnance Survey maps, but a long narrow building to the north-east of St James's Farm first shown on the Second Edition Ordnance Survey map of 1898 may have served a military purpose. The 1908 map is the first to show the Coastguard Station [**BH9**] which was built in 1900 for the Admiralty and comprises a row of terraced cottages and watch room to the north-east of Whitehouse Farm. A chart from 1910 shows several oil tanks near Hooks Fleet [**A94**], marking the beginnings of the use of the Isle as an oil depot.

4.71 An area of marsh to the south of Grain village was commissioned as a naval seaplane base in 1912 and a Marine Experimental Aircraft Depot at Port Victoria in 1918, the two being known collectively as RNAS Grain [**A96**]. The 800 personnel were housed in a temporary settlement to the south of Grain village known as Bungalow Town. During the First World War the batteries at Grain were re-used to mount guns. Two searchlight batteries were added to the Grain batteries.

4.72 In 1920 plans were drawn by the Admiralty for firing point buildings and structures on the Grain Range Line (also known as Yantlet Battery) on Yantlet Creek [**A86** and **BH12**]. The site was used as a firing point for the velocity testing of artillery from the 1920s to the 1950s. The remains consist of a number of structures [**A87**] including concrete bases and platforms; a Workshop complex; Powerhouse; Mess building; Guardhouse and Cottages. Artillery was brought on and off-site through via a wharf [**A88**] and slipway [**A89**] from Yantlet Creek and a purpose built railway [**A90**]. In 1928 an oil depot was developed at Port Victoria, although neither the depot nor the port facilities are shown on Ordnance Survey maps, presumably due to the military nature of the assets.

4.73 The revised Ordnance Survey map of 1933 shows the expansion of Grain village with the semi-detached Trenchard Cottages on Chapel Road built in the 1920s by Hoo Rural District Council. A new outfarm [**A131**], south of White Hall Farm and within the footprint of the proposed cable route, is shown on this map for the first time. The map also shows the coastal defences in some detail and Bungalow Town south of Chapel Road on Baytree Farm land. Yantlet Battery is also shown on the former salt pans.

4.74 From May 1940 the vulnerable beaches at Grain were protected by obstructions and defences including barbed wire, minefields, anti-tank blocks, dragon's teeth [**BH1**] and road blocks. Inland, pillboxes and gun emplacements were used. A camp to house the army personnel [**A91**] needed to man the gun emplacements was built around Whitehouse Farm. These facilities were

defended by batteries themselves [**A97**]. In 1941 oil bombing decoys [**BH13**] were built east of Yantlet Creek by the Petroleum Board to deflect the enemy from bombing the oil depot at Port Victoria. The oil depot was an important asset during the Second World War and by 1942 22 oil storage tanks buried under soil [**A92** and **A93**] had been built on the southern coast of the Isle. Pillboxes [**A95**] were placed near these to defend it. The tanks were connected to a pipeline known as PLUTO which connected the facility with the continent and supplied the Allies after D-Day.

4.75 Further Second World War military remains within the study area include two clusters of radio masts [**A98** and **A99**] and a military installation of unknown purpose 700m south of the Site. All of these have since been demolished. Three Second World War German airplane crash sites [**A101**, **A102**, and **103**] are also recorded within the study area.

4.76 Following the end of hostilities, British Petroleum expanded the facilities by building the Kent Oil Refinery in 1950, which was built by 1,000 construction workers housed in a specially built camp on the island. In 1957 Segas set up a facility next to the oil refinery to produce gas from petroleum products and in 1960 a petrochemicals plant was built. British Gas plc's Grain Power Station (oil fired) was constructed between 1971 and 1982 and included a chimney 244m tall and 20m across. The first British North Sea Oil was piped to the Kent Oil Refinery in 1975 and the facility was closed in 1981 and its site demolished. In the late 1980s London Thamesport, a container terminal was built on part of the refinery site. The 1988 Ordnance Survey map shows the extent of the oil refinery which covered the entire south of the island.

4.77 In 1961 demolition began of the Grain Fort and Batteries which became a recreation area, St James Park. The 1961 Ordnance Survey map shows further expansion of the village to house workers in the petroleum industry with a number of new road and building plots having been laid out.

4.78 Although not shown on historical maps of that century, it is clear from the presence of Gravel Pit House on the 1851 census that gravel extraction was occurring in Grain in the 19th century. Mineral extraction activities increased in the early 20th century with extraction of the Grain Gravel terrace west of the village of Grain visible on the 1908 Ordnance Survey map. That map shows that a tramway [**A104**] was constructed from the centre of the pit to a jetty to the north, presumably to facilitate shipping. Mineral extraction continued throughout the 20th century. The tramway and jetty were removed by 1933, as inferred from the Ordnance Survey map of that year. White Hall Farm remained in operation as a farm until it was taken over by the gravel pit in the late 20th century, at which point several buildings were demolished. By the 1990s roughly 46 hectares had been removed around White Hall Farm and Rose Court Farm and a small complex of farm buildings south of White Hall Farm had been demolished. While Rose Court Farm was left intact following the land reinstatement, the remaining buildings of White Hall Farm were ultimately demolished between 2007 and 2010. A mound [**A105**] to the east of the village of grain may relate to small-scale extraction activities.

4.79 The extent of 20th century development on the Isle of Grain is reflected in the large number of modern assets reported in the KHER. Although maritime remains were not included in the study area, 11 archaeological assets have been recorded along the shore above the MHW, consisting of wharves, beacons, groynes, and hards [**A77** to **A87**].

4.80 The remaining KHER archaeological asset within the study dating to the modern period consists of a former sewage outfall [**A106**] south-east of Grain marked on 20th century OS maps.

Unknown

4.81 Assets of unknown date include former flood defences [**A107**], borrow pits [**A108**], possible salt works [**A109**], buildings of unknown purpose identified in aerial photographs [**A110**], alignments of stakes on the foreshore near Yantlet Creek [**A111** and **A112**], and an unknown feature identified in aerial photographs [**A113**]. Given their nature and the evidence that led to their identification, these features are unlikely to pre-date the post-medieval period.

4.82 Archaeological assets that may be of older origins include enclosures [**A114**, **A115**, and **A116**], mounds [**A117** and **A118**], a pond cut in the saltmarshes [**A119**], various ring ditches and field systems visible as cropmarks [**A120** to **A131**].

Historic Landscape

4.83 Several documents have been produced which describe the historic landscape character of Kent. These are broad brush in their approach but provide a context from which to assess the historic landscape character of the Site.

Natural England National Character Area 81 Greater Thames Estuary

4.84 The Site lies within National Character Area 81 covering the Greater Thames Estuary, described as:

4.85 'predominantly a remote and tranquil landscape of shallow creeks, drowned estuaries, lowlying islands, mudflats and broad tracts of tidal salt marsh and reclaimed grazing marsh that lies between the North Sea and the rising ground inland. It forms the eastern edge of the London Basin and encompasses the coastlines of South Essex and North Kent, along with a narrow strip of land following the path of the Thames into East London.

4.86 Despite its close proximity to London, the NCA contains some of the least settled areas of the English coast, with few major settlements and medieval patterns of small villages and hamlets on higher ground and the marsh edges. This provides a stark contrast to the busy urban and industrial areas towards London where population density is high and development pressures are increasing. Sea defences protect large areas of reclaimed grazing marsh and its associated ancient fleet and ditch systems, and productive arable farmland. Historic military landmarks are characteristic features of the coastal landscape.'

Kent Historic Landscape Character

4.87 The Kent Historic Landscape Characterisation (HLC) forms part of the regional project covering all of Kent County. The Kent HCL is formed of an assessment of historic and current mapping that separated blocks of landscape into Types based on either morphology or land use. A total of seven HLC broad types and fifteen subtypes are present within the study area and listed in Table 1.

4.88 The GIS data for the HCL date within the Site was obtained from the Kent County Council and is presented in Figure 4. HLC types presented in Figure 4 have been used in this study to establish the existing time depth of the historic landscape of the Site and to examine how the surviving historic landscape of the Site relates to that of the surrounding areas, and to the rest of Kent; this enables an assessment of the sensitivity of the historic landscape to change. The HLC types can also be used to examine the evolution of the Site in the post-medieval and modern periods.

Table 1 Kent Historic Landscape Character

Broad Type	Subtype
KHLC 1 - Field Patterns	• KHLC 1.10 - Medium regular fields with straight boundaries KHLC 1.13 - Prairie Fields
KHLC 5 - Reclaimed Marsh	• KHLC 5.1 - Small irregular enclosures • KHLC 5.2 - Irregular enclosures KHLC 5.2 - Small rectilinear enclosures
KHLC 8 - Coastal	• KHLC 8.2 - Salt marsh and estuarine resources • KHLC 8.7 - Mud Flats • KHLC 8.9 - Dunes KHLC 8.10 - Creeks and Fleets
KHLC 9 - Settlements	KHLC 9.6 - Post 1801 settlement (general)

Broad Type	Subtype
KHLC 10 - Parkland and designed Landscape	KHLC 10.2 - 19th century and later parkland
KHLC 12 - Extractive and other industry	• KHLC 12.2 - Active and disused Gravel & Clay • KHLC 12.4 - Modern large scale industry KHLC 12.6 - Dockyards
KHLC 14 - Military and Defence	KHLC 14.4 - 19th century (1830-1914)

4.89 Within the Site itself, there are only two broad HLC types, each containing a single subtype.

4.90 North of West Lane, the proposed cable route lies entirely within the HLC subtype 'active and disused gravel and clay workings' (KHLC 122). These are described by the KHLC as often regular in shape, but with wavy edges landscapes, which, when disused, are often used as refuse tips or form artificial lakes. The combination of reclaimed filled sites, waste disposal, active workings and lakes often combine to form a distinctive landscape character of gravel workings. In this instance, this landscape related to gravel extraction at Clubb pit which was carried out throughout the 20th century. It should be noted that despite the KHLC only placing this landscape north of West Lane, large sections of the fields east of Perry's Farm have also been subjected to gravel extraction and only partial reinstatement. This landscape therefore extends further south than is shown on Figure 4 and covers much of the proposed DC cable route despite the preservation of the agricultural field boundaries.

4.91 South of West Lane, the proposed development lies within HLC subtype 'medium regular fields with straight boundaries', which is defined as field typically created by 19th and 20th century by the enclosure of low lying areas or as enclosures whose boundaries have been straightened. In this case, the fields likely belong to Wilford's and/or Perry's farm, which is known to have been in existence since at least the 18th century according to cartographic evidence. As such, it is likely that the enclosures predate the 19th century but were straightened by the mid-19th century as evidenced by the Grain Parish tithe map of 1841. These types of fields are common throughout the country and general form regular grid-like field patterns.

Hoo Peninsula Project

4.92 The historic landscape of the Hoo Peninsula has recently been the subject of a large research project led by Historic England. In addition to a comprehensive study of the landscape of the Hoo Peninsula as a whole (Carpenter *et al*. 2013), the project also produced a historic area assessment for the Isle of Grain (Smith 2014) and individual reports on the Second World War Grain Island Firing Point (Edgeworth 2013) and the scheduled remains of Second World War Bombing decoys (Small 2014).

4.93 Together, these documents define the historic landscape of the study area in depth. They highlight the conventional and historic view of the Isle of Grain's remoteness, isolation, and bleakness. The post-medieval landscape of the Isle of Grain is described in these documents as composed of a scattered parish village with surrounded dispersed farmsteads supported by maritime activities and exploitation of the saltmarshes prior to late 19th century developments. In the second half of the 19th century, the strategic value of the Isle led to its militarisation and to dramatic changes in the late 19th and early 20th century. The publications of the Hoo Landscape project focus most of their attention on the effects of the First and Second World War and the subsequent industrialisation of the landscape due to the development of the petrochemical and power generation industries on the character of the Isle of Grain.

Historic Landscape Character Summary

4.94 An appraisal of the Kent HLC data, a review of the Hoo Historic Landscape project publications, and the results of the walkover survey show that the Site can be broadly categorised as formed of two landscape types within a patchwork of industrial, military, urban, and agricultural landscapes. The northern and eastern portions of the Site are largely composed of disused gravel workings and reinstated farmland in use by Rose Court Farm and Perry's Farm. South of West

Lane, the landscape is defined as one dominated by fields created in the 19th century in addition to the disused gravel workings.

4.95 The surrounding landscape is dominated by large-scale 20th century industry to the south, urban and military landscapes dating to the 19th and 20th century to the east, and enclosures on reclaimed marshland dating to the medieval to modern periods to the west.

5. Assessment

5.1 This desk-based assessment has established the archaeological, built heritage, and historic landscape baseline conditions for the application Site and surrounding study areas. Of these, only a single designated asset [**BH1**] and four non-designated archaeological assets [**A47**, **A70**, **A91**, and **A132**] lie within the Site.

Designated Assets

Scheduled Monuments

Coastal artillery Defences on the Isle of Grain, Immediately East and South East of Grain Village – BH5 (Scheduled Monument, NHLE 1019955)

5.2 The scheduled coastal defences commence to the south-east of the Church of St James and continue south, with a break for the road to Grain Tower for approximately 1.25km in six separate areas of protection. The monument includes a gun tower (Grain Tower, outside the study area), a fort and three batteries together with later, 20th century additions including two searchlight emplacements. Grain Tower was built in response to the perceived threat from French invasion in the mid-19th century and was supported from the 1860s by Grain Fort which was built on the recommendation of the 1859 Royal Commission into the Defences of the United Kingdom Fortifications. The fort was formed of a semi-circular keep with a central parade and accommodation for 250 men, the whole being surrounded by inner and outer ditches and defended by bastions and caponiers. The fort's armaments were upgraded up until the Second World War and the fort was decommissioned in 1956 and the keep and caponiers were demolished and the ditch partially filled in in the 1960s. Visible remains today comprise earth banks and platforms but the subterranean passages that linked the keep, caponiers and magazines remain.

5.3 A series of open batteries were built to the south of the fort. The first, Grain Battery (renamed Dummy Battery in 1901) was built approximately 1km south of the fort in the 1860s and was linked to it by a communications road on an earthen bank. In 1895 Wing Battery was built immediately to the south of Grain Fort and in 1900 Grain Battery was built to the west of Wing Battery. The upstanding parts of these fortifications were similarly demolished in the 1960s. Finally, during World War II, two searchlight emplacements were built on the esplanade to the east of Grain Fort.

5.4 The asset has historic interest as part of Britain's coastal defences for almost 100 years after the middle of the 19th century and archaeological interest in its surface and subterranean features which have the ability to provide information on construction, use and adaptation of the defences. The asset's setting is the estuary of the River Thames and River Medway and the coastal strip behind. Anti-tank cubes to the north-west of asset also contribute to its setting as they form part of the chain of World War II defences along the coastline. Despite the development of the petro-chemical plant to the east of the southern end of the asset the setting has not changed substantially and contributes to the asset's significance.

Second World War QF P-Series Oil Bombing Decoy – BH13 (Scheduled Monument, NHLE 1425319)

5.5 The asset is located in two areas of protection approximately 1.78km west, north-west of the Site boundary at its nearest point in a wide bend of Yantlet Creek. The asset is one of eleven QF (diversionary fire) P (petroleum division) oil bombing decoy sites developed in Britain in the early years of the Second World War. This example was designed to draw enemy bombing away from the oil storage depot to the south. Aerial photographs and archaeological surveys have found that the asset retails all its above and below ground features. The decoy was designed to burn fuel oil in brick or clay-lined pools to simulate burning oil storage tanks, ignition being controlled from a control building and associated generator building approximately 200m to the west of the pools.

5.6 The asset has considerable historic interest as one of only 11 such sites to be built and only two remaining. It has archaeological interest in the complete survival of its original above and below ground features.

5.7 The asset's setting is the flat floodplain of Yantlet Creek situated between the higher ground on which Allhallows is located to the west and Grain us located to the east. This extends to the site of the oil depots the asset was designed to protect on the south coast of the island. The post-war development of the petro-chemical site approximately 1km south-east of the asset is within the asset's setting and can be seen as an expansion of the earlier oil depot. The asset's setting therefore continues to contribute to its significance.

Listed Buildings

World War II Anti-Tank Obstacles on the Foreshore – BH1 (Grade II, NHLE 1393145)

5.8 The asset comprises a line of concrete anti-tank obstacles erected *c*. 1940 and running for approximately 570m from north-west to south-east along the north coast of the Isle of Grain. The main type of obstacle is formed by truncated square pyramids known as dragons teeth attached to a concrete grid. The teeth are arranged in rows four deep but every other row is offset so in effect the rows are eight deep. At the north-west end of the line is s double row of anti-tank concrete cubes while at the south-eastern end of the line is a pile of concrete caltrops, designed like medieval caltrops with four arms so that however they are placed one arm will always point upwards.

5.9 The asset has historic interest as part of Britain's coastal defences during the Second World War and archaeological interest for their strategic positioning.

5.10 Historic aerial photographs show that the obstacles were originally deployed inland some 50 metres from the beach but coastal erosion means that the dragon's teeth are now on the beach and are being undermined by the tides, uncovering the concrete grids below. The asset's setting is now the coastline rather than the coastal strip but the setting still contributes to the significance of the asset by demonstrating its purpose of defending the land from seaborne attack. The Coastal Artillery Defences on the Isle of Grain, Immediately East and South East of Grain Village [**BH5**] are of 19th century origin but were modified in the First and Second World Wars and contribute both to the asset's setting and its significance.

Church of St James – BH2 (Grade I, NHLE 1085755)

5.11 The church has its origins in the 12th century with additions in the 13th and 15th centuries and a south-west tower added in 1903-05. Construction is ragstone rubble and the plan is simple with a nave, chancel, south-west tower, north-east sacristy and south porch. The chancel retains 13th century windows in the Early English style. The aisles have been removed but the remains of the arcade can still be seen with the early 20th century replacement windows inside the blocked up spaces. Brick buttresses were added after the aisles were taken away.

5.12 The asset's setting is the village of Grain but is not extensive, being restricted to the less developed part of the village to the north that once formed the village's historic core. Due to the flatness of the topography and the asset's short, squat tower the asset cannot be seen from a wide area. The asset retains a relationship with the school to the south-west (although its 19th century buildings have been removed) and with the old rectory to the west of the school. The presence of the modern school buildings does nothing to enhance the church's setting and the chimney of the power station is a presence as it is in most parts of the village and the island. Apart from these incursions modernity has not encroached unduly and the open nature of the setting around the church contributes to its significance.

The Hogarth Inn – BH3 (Grade II, NHLE 1336496)

5.13 The Hogarth Inn is a rendered, timber-framed public house dating to the late 16th century. The asset was built as a house and was later the Cock Inn and then the Post Office and stores before being reinstated as a public house in 1975. The Hogarth name is a reference to William Hogarth who visited the Cock Inn in 1732 during a visit to the Hoo peninsula. The brick outbuilding to the north-west of the asset is shown on the First Edition Ordnance Survey map of 1870 while a further building between the two shown on subsequent Ordnance Survey maps and labelled PO is no longer in place.

5.14 The asset has historic interest as the oldest domestic building on the island and historical interest and community value as the village's pub, Post Office and store since at least the early 18th century. The asset's setting is the centre of the village of Grain but has changed considerably in

the last century. In the early 20th century the pub was the first building encountered on entering the village from the west. Over time the asset has become surrounded by modern development and now stands roughly in the centre of the developed part of High Street. The provision of a large area of hard standing immediately to the north-west of the asset has also been detrimental to the asset. This combination of changes to the asset's setting means that it no longer contributes to its significance.

White House Farmhouse – BH4 (Grade II, NHLE 1204482)

5.15 White House Farmhouse is a two-storey, three-bay 18th century weatherboarded farmhouse with timber sash windows with glazing bars and a panelled front door with a fanlight above. The hipped roof is tiled, with brick stacks to the rear elevation. There is a triple-pile back addition to the rear of the main range.

5.16 The asset has historic interest as the last remaining example of what was a number of farmhouses present on the Isle of Grain in the 18th century. Although a small outbuilding shown on the 1898 Ordnance Survey map is extant, all the farms other buildings have been removed and the surrounding land has been developed on all sides. Although much of the asset's former land remains in agricultural use to the south and west these considerable changes to the assets setting mean it contributes only slightly to significance.

Church of All Saints – BH14 (Grade I, NHLE 1085758)

5.17 The Church of All Saints is the parish church of Allhallows and dates from the 12th to 15th centuries with restoration in the late 19th century. Construction is of uncoursed rubble and stale roof. The plan is of aisled nave with cupola, chancel and south porch. The asset has historic and architectural interest as Allhallows' parish church. The asset is located in a raised churchyard surrounded by a brick wall. It retains a village setting but, with the exception of the former Rose & Crown public house to the west with which the asset forms a group the majority of the historic buildings that one stood around the church yard, including two farms, are no longer extant. The predominantly modern buildings within the setting have weakened the sense of place and the setting only contributes moderately to significance.

Rose and Crown Public House – BH15 (Grade II, NHLE 1086504)

5.18 The asset is an 18th century house, formerly the Rose and Crown public house and now a dwelling house again. The two storey building is in painted brick with a hipped, tiled roof with two dormers to the front elevation. Both the roof and timber framed windows are said (list description) to have been replaced in the 20th century. The asset retains a village setting but one that has been largely changed, with only the Church of All Saints remaining from the 19th century and earlier. While the asset retains its important relationship with the church the setting only contributes moderately to its significance.

Non-designated Assets

The Old Vicarage, High Street, Grain Village – BH6

5.19 The Old Vicarage is a 19th century detached house in yellow stock brick with red brick detailing and a concrete tiled roof. The main range faces the High Street with a double-pile addition to the rear. The asset has historic interest as the former parish rectory. While the asset has retained that part of its grounds to the rear of the house the grounds towards the High Street the grounds on the High Street side have been developed, severing the asset's relationship with the church. The wire fencing surrounding the school to the south has a negative influence on setting which does not contribute to the asset's significance.

Grain United Reformed Church – BH7

5.20 The asset is a single storey gable ended structure in yellow stock brick with red brick details and a slate roof. The gabled porch at the south-west end bear a date stone reading 1895 while the name of the chapel, BETHEL CONGREGATIONAL CHAPEL is inscribed above. The door and three windows in the south-west end have pointed arches and replacement fenestration. The asset was a replacement for an earlier chapel on the same street dating to 1827 so it has a considerable amount of historic interest. The asset also serves as Grain's library and has community value for its religious and secular roles. The asset's setting is the village of Grain and

although most of its contemporary buildings have been replaced by modern development the setting continues to contribute to the asset's significance.

Grain Village Hall – BH8

5.21 Grain village hall is a single storey structure constructed of pebble-dashed concrete panels, Crittal style metal windows and a curved roof. The structure dates to the 1950s and has served as the village's hall since. The asset has some architectural interest for its unusual design. The asset's village setting contributes to its significance.

Former Coastguard Station (Medtha House and Coastguard Cottages) – BH9

5.22 The former coastguard station was built by the Admiralty in 1900 facing the River Medway. The building comprised a row of 12 cottages for the coastguards and their families with a larger house at the eastern end for the Chief Officer. A single storey watch room was attached to the house. Construction is in buff brick with red brick detail to the ground floor. The first floor walls are divided into square panels with concrete detaining and the panels are pebble dashed. The roofs are slate with brick stacks to the front and rear and former windows to the front elevation.

5.23 The asset has historic interest as a former coastguard station, architectural interest for its design and potential archaeological interest in its orientation and internal plan form. Whereas once the asset had an open setting with views out to the River Medway it is now surrounded by later development on all sides including houses in the front gardens of the cottages themselves. The watch room is obscured from view eroding the ability to understand the asset's former role. The setting has therefore ceased to contribute to the significance of the asset.

Rosecourt Farm – BH10

5.24 Rosecourt Farm dates to the 1870s and is first shown on the 1898 Second Edition Ordnance Survey map. The map shows a pair of semi-detached cottages with two masonry outbuildings on either side of a courtyard to the north-east. The cottages are in buff brick with a concrete tiled roof while the more northerly of the two out buildings is in buff brick with a corrugated roof. The more southerly of the two outbuildings is not as tall and was obscured from view by modern buildings to the east but appears to be original to the development. The courtyard walls connecting the two outbuildings also appear to be in place. The asset has historic interest as a late 19th century farmstead with all of its original features intact. The asset's setting is the farmland and saltmarshes of the northern part of the Isle of Grain. Modern farm buildings have been added to the complex but do not prevent understanding of the asset. Although much of this landscape has been subject to gravel extraction most of the land has returned to grassland meaning the setting has not changed greatly and contributes to significance.

Perry's Farm and Wilford's Farm – BH11

5.25 The two farms are located within the Site. Both farms are shown on the 1870 Ordnance Survey map as comprising a number of buildings around courtyards. The 1898 Ordnance Survey map shows just two buildings at Perry's Farm with an additional pair of semi-detached cottages and three buildings at Wilford's. At the time of the Site walkover only the rendered brick cottages survive at Perry's and one of the outbuildings in buff brick at Wilford's. Although most of the buildings have gone the remains have some historic interest as the remains of two late 19th century farms. The asset's setting is the surrounding farmland and saltmarshes of the northern part of the Isle of Grain. This has been changed by the presence of the petro-chemical plant less than 1km to the south-west of the asset although the part of the plant closer to the asset to the south has been removed. The land surrounding the asset has been subject to gravel extraction but the majority of the land has returned to grassland and the setting continues to contribute to significance.

Grain Range Line on Yantlet Creek – BH12

5.26 In 1920 the War Office drew up plans for buildings and structures for a firing point on the Isle of Grain to the east of Yantlet Creek. The location was chosen for its remoteness coupled with the fact that it was accessible by rail or water. The firing point's main function was to measure the velocity of heavy artillery shells from the gun emplacement. Thus was achieved by firing the shell through two wire screens a fixed distance apart. From the 1950s the facility was increasingly used as a demolition range for controlled explosions and continues in that role today. While a number of the facilities original buildings and structures such as the wharf and dock, gantry path and velocity screen bases have been demolished other structures still stand including a workshop

complex, powerhouse, mess building, guardhouse and cottages. The site is not open to the public and was not covered in the Site walkover. The complex has historical significance as an example of a rare type of facility and archaeological interest for its potential to yield information about inter-war and Second World War firing points. The asset's setting is saltmarshes of the northern part of the Isle of Grain which, although the petro-chemical plant is less than 1km to the south, remain remote and inaccessible. The asset's firing zone to the north-east remains unchanged.

Area of Ridge and Furrow – A70

5.27 The significance of features of ridge and furrow is derived from their archaeological and historical interest, which has the ability to inform on, at most, local research aims relating to the rural and agricultural development of the Isle of Grain.

Site of White Hall Farm – A47

5.28 The remains of the post-medieval farmstead of White Hall Farm are of archaeological and historical significance due to the information they may hold on the post-medieval rural landscape and the dispersed farms and the evolution of agricultural practices, following the research aims of the South-East Research Framework (Barber 2013).

Site of 20th Century Outfarm South of White Hall Farm – A132

5.29 The remains of the 20th century outfarm south of White Hall are considered to be of no or, at most, local archaeological and historical interest, based on their ability to inform local research aims. These remains are likely to have been entirely removed by 20th century gravel extraction activities, although it is possible that some features have survived within the former gravel pit's access road.

Site of Second World War Camp west of White Hall Farm – A91

5.30 The significance of the Second World War military barracks is derived from its historical and archaeological interest in the potential for the remains to inform on the research aims of both the Greater Thames Estuary (Heppell 2010, 74-75) and the South-East (Smith 2013, 29) Research Frameworks. A small section of this site is likely to have survived within the former gravel pit's roads.

Potential Archaeological Remains and their Significance

Potential Ground Disturbance

5.31 The main converter station, substation, and access road, NGET tower, working compounds, and lay down areas are situated in a ploughed field on the south-west slope of the Grain Gravel deposit. This area does not appear to have been subjected to post-medieval or modern developments and ground disturbance is likely limited to ploughing and natural erosion of the gravel terrace by tidal action and flooding. It is likely that archaeological remains situated in these sections of the proposed development will have survived below the topsoil.

5.32 With the exception of a 60m stretch immediately east of the converter station, a 50m section north-west of West Bear, and the northernmost 30m which lies on the beach-head, the proposed route of the cable is entirely located within areas of extensive historical mineral extraction. The fields north of West Lane were extracted in the 1970s and 1980s, while those lying to the south and east of Perry's Farm were extracted in the 1990s and 2000s. Where the cable route turns towards the north, it would lie within the footprint of the gravel haulage road. After crossing West Lane, it continues north immediately east of the access road to the former White Hall Farm. It remains unclear whether the area beneath the access road itself was subject to quarrying since it remained in active use as an access road throughout the period of 20th century mineral extraction. The 30m easement to the west of the proposed cable route overlies this access road.

5.33 Where the cable route and easement are located in areas where no mineral extraction has occurred, there is potential for survival of archaeological remains. Where the route crosses areas of mineral extraction, it is unlikely that archaeological features will have survived. Any gravel that has not been extracted beneath the quarried zone retains the potential to contain Lower Palaeolithic remains. However, since the quarried land has been partially reinstated, the pipeline trench is unlikely to reach these deeply buried gravel deposits.

Archaeological Potential

5.34 This section assesses the potential for further unrecorded buried archaeological remains to be present within the Site. The assessment of archaeological potential is based on the data available at the time of writing and takes into consideration the known archaeological assets within the Site and study area, as well as historical and cartographic evidence presented in the baseline.

5.35 **Palaeoenvironmental**: Despite the presence of alluvium deposits, and in some locations peat deposits, across much of the Isle of Grain, these are confined to the low-lying areas and are not expected to extend to the gravel terrace on which the Site is located. The beach front at the northernmost point of the DC cable route is actively eroding away, exposing deposits which have not been actively formed since the Pleistocene and earlier, and which therefore is unlikely to overly environmental remains The potential palaeoenvironmental remains to be encountered within the Site is therefore considered to be **low**.

5.36 The Grain Gravel deposits on which the proposed development is located are, however, of archaeological interest. They are expected to have survived well in areas outside of the quarrying zones.

5.37 **Palaeolithic**: Palaeolithic remains are rare nationally and often consist of residual finds recovered from alluvial deposits, terrace gravels and sediment sequences created by ancient rivers. The proposed development lies on the Grain Gravel deposits of the Thames River dating to the MIS 6 of the Pleistocene. The potential for these deposits to contain Lower Palaeolithic material has been confirmed by a recent targeted survey of disused former gravel extraction workings, which uncovered a single flint artefact. While gravel extraction activities are likely to have removed much of this deposit, the proposed development retains a **moderate** potential for Palaeolithic material where Grain Gravel deposits remain present. Any such material is likely to consist of isolated lithic artefacts in secondary deposition.

5.38 **Mesolithic**: The Mesolithic is poorly represented on the Hoo Peninsula and no remains dating to this period have been uncovered within the Isle of Grain or the wider study area. Despite the presence of alluvium and peat deposits that are known to date to the Holocene period, these are located in the low-lying areas and have not thus far revealed any archaeological material dating to the Mesolithic. The potential for Mesolithic remains within the proposed development Site is therefore considered **low**.

5.39 **Late Prehistoric**: While only a single Neolithic artefact of insecure provenance and no Bronze Age remains have been recorded within the study area, an extensive Iron Age settlement has been uncovered within the gravel extraction area north of West Lane. Although the exact location and extent of these features is not currently known, it is possible that these remains will have extended across the proposed cable route. The presence of a nearby settlement, however, does suggest that there is a potential for related remains in its vicinity. Furthermore, further evidence of Iron Age activities suggests the possible presence of a kiln in the marshes south of the Site. The potential for late prehistoric remains to be situated within areas where no gravel extraction has taken place within the Site is therefore considered to be **high**, particularly for settlement and agricultural remains dating to the Iron Age.

5.40 **Roman**: The Roman period is attested within the study area by the recovery of one or two isolated cordoned flasks and burnt material at Wallend Farm south of the Site, a possible Roman kiln south of Wallend Farm, and an extensive late Roman cemetery in the gravel quarry north of West Lane that may have extended across the proposed cable route. Together, these finds suggest a substantial Roman presence on the Isle of Grain. The potential for Roman period archaeological remains to be present within the proposed development Site is therefore considered to be **high** where no gravel extraction has taken place. Such remains may comprise further funerary remains, a settlement area near the cemetery, and remains of pottery and salt production within and on the boundary of the salt marshes.

5.41 **Early Medieval**: Despite the Isle of Grain's name being derived from Anglo Saxon origins, there is little evidence to suggest substantial early medieval occupation of the island. Only four isolated artefacts dating to this period have been identified within the study area. As such, the potential

for early medieval remains to be situated within the proposed development Site is considered **low**.

5.42 **Medieval**: The medieval period is poorly attested within the study area. The parish church the village of Grain is known to have been erected in the 12th century, suggesting that a settlement did exist during this time period. However, the only feature of medieval date recorded within the study area consists of 13th century midden and a scatter of medieval pottery uncovered near Wallend Farm south of the Site. Given that historical accounts recount continual flooding and salinization of the surrounding marshland, it is likely that the area was seen as unsuitable for long term occupation beyond the higher ground of the gravel terrace. Ridge and furrow agricultural features have been recorded in the south-west corner of the proposed development, suggesting that least some cultivation was taking place on the gravel landform during the medieval period. Given the presence of ridge and furrow features within the proposed development, but the distance of the Site from the parish church that likely formed the core of the medieval settlement of Grain, the potential for archaeological remains of the medieval period to be located within the proposed development Site is considered to be **moderate**. Any such remains are likely to be of an agricultural nature and consist of ridge and furrow features, field boundaries, or drainage ditches, present only in areas where no mineral extraction has taken place.

5.43 **Post-Medieval**: The post-medieval saw a number of significant developments across the Isle of Grain. Following centuries of flooding, efforts to construct and strengthen the flood defences resulted in the silting up of the Yantlet, connecting the Isle of Grain to the mainland of the Hoo Peninsula. Several new farms were erected across the landscape and the dispersed settlement of Grain began to agglomerate and grow during this period. In addition, the strategic position of the Isle of Grain, overlooking both the Thames and Medway estuaries led to the militarisation of the landscape starting in the 19th century. The proposed development is located within the fields of the post-medieval farmsteads of Perry's Farm, Wilford's Farm, and White Hall Farm. Given the agricultural, military, and industrial character of the Isle of Grain and the rapid pace of changes affecting this landscape in the late post-medieval period, there is a **high** potential for archaeological remains dating to this period to be located within the Site. Such remains are likely to be of an agricultural nature and consist of field systems and drainage ditches, but may also include previously unknown military or industrial remains associated with the Grain defences or industrial background.

5.44 **Modern**: The landscape of the Isle of Grain underwent extensive developments in the modern era, largely relating to military defences erected during the First and Second World War in the first half of the 20th century, followed by the development of the oil and gas and energy production industries in second half of the century. The Site itself was subject to large scale gravel extraction activities throughout the whole of the 20th century, beginning east of White Hall Farm in the 1900s, expanding to encompass most of the land around both White Hall and Rose Court farms by the 1980s, before reaching the area north-east and east of Perry's Farm in the 1990s and 2000s. The fields west, south, and north of Perry's farm continued to be under cultivation throughout the 20th century. The proposed cable route and easement north of West Lane is in close proximity to, and may overly, the remains of White Hall Farm, an outfarm south of White Hall Farm, and the eastern edge of Second World War military barracks immediately west of White Hall Farm. In addition, the cable route traverses the listed dragon's teeth Second World War coastal defences, an area that may contain further such defensive works. Given the scale of mineral extraction within the Site and cartographic data showing several modern buildings and military structures within the proposed cable route easement, the potential for archaeological remains dating to the modern period within the Site is considered **high**. These remains are likely to consist of the remains agricultural features such as field boundaries and ditches, and military remains relating to the barracks west of White Hall Farm and coastal defences.

5.45 This desk-based assessment has identified the known archaeological resource within the study area and has predicted the archaeological potential of the Site. There is, however, still a risk that unexpected archaeological remains of all periods may be discovered within the Site.

Significance of Potential Archaeological Remains

5.46 The NPPF stresses the importance of identifying and assessing the significance of any heritage asset and its setting that may be affected by a proposed development. Once significance has been established, the impact of any proposal can be appropriately assessed.

5.47 The significance of potential heritage assets is based on regional research resource assessments and research frameworks, particular those for South East England (Barber 2013; Bates and Corcoran 2018; Smith 2013), the Greater Thames Estuary (Williams and Brown 1999; Heppell 2010), and Historic England guidelines (e.g. EH, 2011, 2012). In addition, reference is made to research aims of thematic and period-specific reviews such as for the prehistoric period (EH, 2010), the Palaeolithic and Mesolithic periods (Pettitt, Gamble & Last (eds), 2008; Prehistoric Society, 1999), the Iron Age (Haselgrove, *et al*., 2001), the Roman period (James and Millett (eds), 2001; EH, 2012; Van der Veen, *et al*., 2007), extractive heritage (NAMHO, 2016), and industrial environments (EH, 2010).

5.48 This desk-based assessment determined that the Site holds a low potential for palaeoenvironmental, Mesolithic, and early medieval remains, a moderate potential for Palaeolithic and medieval remains, and a high potential for late prehistoric, Roman, post-medieval and modern remains. The potential for Palaeolithic, Iron Age, and Roman period remains is highlighted by the presence of two AAPs, defined by KCC as overlying sections of the Site.

5.49 The Grain Gravel terrace deposits on which the Site is located are of archaeological interest in their ability to inform on the Pleistocene landscape and possibly inform on understanding of Palaeolithic activities. In particular, these deposits may inform the regional research aims of the South-East Research Framework (Bates and Corcoran 2018) and the Greater Thames Estuary Framework's objectives 1A and 1B (Heppell 2010,18-19) aimed at understanding the physical evolution of the Thames estuary during the Pleistocene in order to assess the movement of peoples across the evolving landscape. Such remains would build on the results of a previous regional research project on the Palaeolithic of the Medway (Wenban-Smith *et al*. 2017). Particularly well preserved, well stratified, or abundant remains may be of national significance.

5.50 Medieval remains, for which there is a moderate potential within the Site, are likely to be related to rural and agricultural activities. Such remains are of archaeological and historical interest, but given that such remains are common and that they are well recorded through the appearance of cropmarks, they would be considered of local significance at most.

5.51 There is a high potential for Late prehistoric and Roman period remains within the Site, which would likely consist of features and artefacts relating to agricultural, settlement, and possibly industrial activities. Such remains would be of archaeological and possibly historical interest in their ability to inform on local and/or regional frameworks (Martyn *et al*. 2018; Champion 2019; Heppell 2010, 30-31 and 54-55). Isolated findspots or poorly preserved remains would be considered of local significance, while *in situ* or well preserved settlement remains would be considered of regional significance.

5.52 This report has also identified a high potential post-medieval and modern remains within the proposed development. These are likely to relate to agricultural activities of dispersed farmsteads, and later to gravel extraction activities. Any such remains would be of negligible significance given that they are already well understood and recorded in cartographic and historical archives. There is, however, also the potential for unknown military or sea wall defences dating to either period to be situated within the proposed development, which may be considered to be of local and possibly regional significance based on their historical and archaeological interest. Depending on their preservation, any such remains have the potential to inform on local or regional research frameworks (Smith 2013; Barber 2013; Heppell 2010, 74-75 and 84-85).

Historical Landscape

Historical Landscape Character

5.53 The Site is characterised by a combination of agricultural field systems as well as disused and reinstated gravel extraction quarries dating to the 19th and 20th centuries. To the west of the proposed development Site are the low-lying saltmarshes reclaimed and enclosed throughout the post-medieval period. To the east, the historic landscape is defined by the 18th and 19th century village of grain, coastal defences and other military remains.

5.54 This patchwork landscape is the result of the recent history of the Isle of Grain, resulting in its transformation from a rural and sparsely populated dispersed village surrounded by saltmarshes to one dominated by military and industrial activities. These changes have mostly occurred in the last hundred years and have drastically altered the character of the Isle of Grain when compared to what it was pre-18th century.

5.55 Although medium regular field with straight boundaries are considered common across the country, the Isle of Grain has only a limited amount of such fields. This is largely due to the scarcity of suitable land on the Isle for such field systems to exist (Smith 2014). In practical terms, the higher and well-drained ground of the gravel terrace overlying the north-east quadrant of the Isle affords the only possible location for such fields.

5.56 The lack of farmable land may have played a significant role in keeping population densities on the Isle of Grain relatively low throughout the prehistoric and historic periods. The pre-18th century rural landscape of the Isle of Grain, defined by a number of dispersed farmsteads on the gravel terrace and salt production in the low-lying marshes supporting a small parish village, was therefore likely, at least in part, a consequence of the restricted amount of suitable farmland on the Isle.

5.57 The 19th century agricultural landscape is still somewhat legible within the areas of disused gravel quarries, but is at risk of disappearing entirely by urban encroachment from the village of Grain and industrial encroachment from the industrial area to the south.

HLC Sensitivity to Change

5.58 The importance and significance of historic landscape character is assessed in terms of sensitivity to change. Those with a high sensitivity to change should be accommodated and preserved where possible within new developments, or should be subject to well managed changes. Historic landscapes with a lower sensitivity to change can be potentially enhanced by new developments and can absorb most types and scales of essential, well-managed change.

5.59 There are no historic landscapes within the Site with a very high or high sensitivity to change. Historic landscapes fall within the moderate or negligible categories, as described below.

5.60 The disused gravel extraction workings are common throughout the country and considered of no historical or aesthetic interest. This type of landscape, located north of West Lane and in sections south-east and east of Perry's Farm, is considered to be of **negligible** sensitivity to change.

5.61 Despite the abundance of 19th century field systems in England as a whole, the fieldscape surrounding the village of Grain is currently at risk of disappearing entirely. This landscape has lost much of its 19th century and earlier relationship to the rural village of Grain and the saltmarshes to the south due to 20th century urban and industrial developments. Nevertheless, this landscape is rapidly disappearing and as such our ability to understand the historical landscape of the Isle of Grain is at risk. The common occurrence of this type of landscape nationally has been weighed against its local significance, and on measure it has been assessed as being of **low** sensitivity to change.

6. Conclusions

6.1 AECOM was commissioned by NeuConnect Great Britain Ltd. to prepare a heritage desk-based assessment in support of an Environmental Statement with the aim of obtaining planning permission to construct a new international electrical transmission line and associated electrical converter and substation. This DBA first set out the heritage baseline for the Site in order to identify all known designated and non-designated archaeological assets within the Site, to determine the potential for as yet unknown buried archaeological remains to be present within the Site, and to identify heritage assets within the study area that may have their settings impacted by the proposed scheme. This report includes an assessment of the significance, using NPPF terminology, of the known and potential heritage resources that may be impacted by scheme. Finally, this assessment has assessed the historic landscape within the Site and surrounding study area and determined its sensitivity to change.

6.2 There is a single designated asset within the Site boundary and five such assets within the 1km built heritage study area. The asset within the Site is a grade II listed building, while those in the study area comprise two scheduled monuments, one grade I listed and two grade II listed buildings. A further two listed buildings; one grade I and one grade II are located within the village of Allhallows approximately 4km to the west of the Site. Finally, there are eleven non-designated built heritage assets located within the 1km built heritage study area.

6.3 This report has identified four non-designated archaeological assets within the proposed development Site boundary and a further 132 such assets within the archaeological study area. It has also determined that there is a low potential for palaeoenvironmental, Mesolithic, and early medieval remains, a moderate potential for Palaeolithic and medieval remains, and a high potential for late prehistoric, Roman, post-medieval and modern remains to be present within the Site. The potential for Palaeolithic, Iron Age, and Roman remains is captured by KCC in two Areas of Archaeological Potential that overly sections of the Site.

6.4 Two historic landscapes have been identified within the Site comprising disused 20th century gravel extraction, considered of negligible sensitivity to change, and 19th century medium regular field systems with straight boundaries considered of low sensitivity to change.

The impact of the proposed development on these heritage assets will be discussed within the Cultural Heritage Chapter of the Environmental Statement (Chapter 08), for which this desk-based assessment has been completed.

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Appendix A Archaeological Gazetteer

Table 2 Archaeological Gazetteer Assets

Asset ID	Reference	NGR	Name	Description	Period
A1	MWX20881	TQ 88030 76160	Palaeolithic flint artefact, Clubb's Pit, Isle of Grain	One Palaeolithic flint artefact was found during fieldwork associated with the Medway Valley Palaeolithic Project in 2005.	Palaeolithic
A2	MWX20766	TQ 8548 7745	Pleistocene palaeo-environmental remains from Allhallows	Pleistocene palaeoenvironmental remains from deposits below Allhallows Marsh, especially ostracods, molluscs, and foraminifera.	Lower Palaeolithic
A3	MKE3651	TQ 90 75	Neolithic axe find	Neolithic axe find.	Neolithic
A4	MKE71909	TQ 87000 75000	Iron Age gold coin	Portable Antiquities Scheme find - Iron Age gold coin.	Iron Age
A5	MKE71910	TQ 87000 75000	Iron Age gold coin	Portable Antiquities Scheme find - Iron Age gold coin.	Iron Age
A6	MKE3185	TQ 884 772	Iron Age settlement, Gravel pit near Rose Court Farm, Isle of Grain	An Iron Age settlement with enclosure, discovered during rescue excavations at the Isle of Grain Gravel pit near Rose Court Farm. The excavations revealed circular ditched enclosures containing possible hut structures. The ditches contained pottery dating from the first centuries BC and AD. A Romano-British Inhumation cemetery was found overlying the southern part of this complex.	Iron Age
A7	MWX17261	TQ 878 755	Burnt Roman and iron age material, Wallend Petroleum Tank Farm, Isle of Grain	Burnt Iron Age to Roman material was previously found at Wallend Petroleum Tank Farm.	Iron Age to Roman
A8	MKE3173	TQ 8748 7602	1st/2nd century Upchurch flask, near Wallend Farm, Isle of Grain	A 1st or early 2nd century cordoned flask vessel of Upchurch ware.	Roman
A9	MWX17253	TQ 87 75	Roman Flask, Found on the Isle of Grain	A 1st to 2nd century Cordoned Flask was unearthed by workmen during construction works on the Isle of Grain in 1951.	Roman
A10	MKE3216	TQ 8745 7495	Kiln bricks, Medieval and Roman pottery, Isle of Grain	The remains of a suspected pottery kiln were discovered during excavations by workmen in 1939. The finds included thin kiln bricks and a mixture of Roman and medieval sherds, as well as the handle of a large jug.	Roman

Asset ID	Reference	NGR	Name	Description	Period
A11	MWX19315	TQ 883 772	Late Roman cemetery, Gravel Pit near Rose Court Farm, Isle of Grain	Superimposed across an area of Iron Age occupation examined in advance of gravel working (see TQ 87 NE 14) lay part of a late Roman cemetery with at least forty seven inhumations. Grave goods suggest a tentative date-range of 250-300.	Roman
A12	MKE71351	TQ 87954 76408	Early Medieval copper alloy strap fitting	Portable Antiquities Scheme find - Early Medieval copper alloy strap fitting.	Early medieval
A13	MKE71855	TQ 86800 76100	Early Medieval copper alloy buckle	Portable Antiquities Scheme find - Early Medieval copper alloy buckle.	Early medieval
A14	MKE76591	TQ 8700 7600	Anglo-Saxon silver early penny ('sceat'), Isle of Grain	Anglo-Saxon silver early penny ('sceat'), Isle of Grain.	Early medieval
A15	MKE76592	TQ 8700 7600	Anglo-Saxon silver early penny ('sceat'), Isle of Grain	Anglo-Saxon silver early penny ('sceat'), Isle of Grain.	Early medieval
A16	MKE3175	TQ 8790 7548	Site of a 13th cent midden, near Wallend, Isle of Grain	A 13th century midden found near Wallend in 1950, measuring *c.*2m by 2m, contained hundreds of shells of oysters, whelk and cockle, together with bones of ox and sheep and sherds of pottery dated to the 13th century.	Medieval
A17	MKE3172	TQ 8673 7650	Site of salt-pans, windpump and buildings, near Newlands, Isle of Grain	A group of about 10 salt-pans, with a wind-pump and three buildings is shown on Hasted's map of 1782.	Post-medieval
A18	MKE3217	TQ 877 742	Site of salt pans, Isle of Grain	Site of salt pans, marked as 'Old Salt Works' on the Ordnance Survey historic maps (*c.*1858-1940).	Post-medieval
A19	MWX17942	TQ 86439 78191	Possible salt works, North Levels, Isle of Grain	The remains of a possible salt making site may be suggested by grid pattern in cropmarks and drainage on North Levels.	Post-medieval
A20	MWX19124	TQ 87793 73960	Site of Saltpan House, Saltpan Reach, Isle of Grain	Saltpan House is marked on the 1st edition Ordnance Survey map (*c.*1858-1873). On the later edition maps this building appears to have become the Port Victoria Hotel.	Post-medieval
A21	MKE78421	TQ 8745 7698	Old Sea Wall, Isle of Grain	Old Sea Wall, Isle of Grain (Old Counter Wall?).	Post-medieval to modern
A22	MWX0005	TQ 87608 73979	Squared timber feature, Saltpan Reach, Isle of Grain	Four squared timber piles forming a regularly shaped feature. Unknown function.	Post-medieval

Asset ID	Reference	NGR	Name	Description	Period
A23	MWX0376	TQ 85755 77727	Wooden stakes on foreshore by Yantlet Creek, Allhallows	Wooden stakes on foreshore by Yantlet Creek, probably all modern.	Post-medieval
A24	MWX0377	TQ 85815 77665	Landing stage on foreshore by Yantlet Creek, Allhallows	Three eroded wooden piles visible on the foreshore with stones between the piles by Yantlet Creek. Possible remains of a landing stage.	Post-medieval
A25	MWX0378	TQ 86045 77562	Seawall reinforcement on foreshore by Yantlet Creek, Allhallows	Seawall reinforcement comprising a triple row of wooden stakes on foreshore at the base of the sea wall by Yantlet Creek.	Post-medieval
A26	MWX0386	TQ 85573 75214	Wooden stakes on foreshore north of Colemouth Creek, Stoke	Row of eight wooden stakes crossing a branch of Colemouth Creek.	Post-medieval
A27	MWX0387	TQ 85520 75147	Wooden stakes on foreshore north of Colemouth Creek, Stoke	A row of four small wooden squared stakes on the foreshore north of Colemouth Creek.	Post-medieval
A28	MWX18897	TQ 89146 76216	Independent Wharf, Isle of Grain	Independent Wharf marked on the 1st edition Ordnance survey map (*c.*1858-1873). No further information.	Post-medieval
A29	MWX0006	TQ 87849 73942	Remains of wharf, Saltpan Reach, Isle of Grain	Substantial remains of former wharf, Saltpan Reach.	Post-medieval
A30	MWX18898	TQ 88749 74330	Site of Cockleshell Hard Coastguard Station, Isle of Grain	Cockleshell Hard Coastguard Station is marked on the 1st edition Ordnance Survey map (1858-1873) but is not visible on any of the later editions. No further information.	Post-medieval
A31	MWX18597	TQ 8903 7539	Site of White Beacon, Smithfield Marshes, Isle of Grain	White Beacon, marked on a chart of 1836 and also on the 1st, 2nd and 3rd edition Ordnance Survey maps (*c.*1858-1922). No longer visible above ground at the site.	Post-medieval to modern
A32	MWX18650	TQ 8669 7407	Site of a Beacon, Isle of Grain	Beacon marked on a map of the River Medway from 1910. Also marked on the 2nd and 3rd edition Ordnance Survey maps (*c.*1891-1922). The site has now been developed.	Post-medieval to modern
A33	MWX18660	TQ 8877 7433	Pilot Beacon near Cockleshell Hard, Isle of Grain	Beacon, marking the eastern edge of merchant vessel anchorage shown on a chart from 1910. Also marked on the 1st, 2nd and 3rd edition Ordnance Survey maps (1858-1922).	Post-medieval to modern

Asset ID	Reference	NGR	Name	Description	Period
A34	MKE3177	TQ 87 75	Site of 16th cent Beacon, Isle of Grain	William Lambarde's 'Carde' of *c.*1570 shows a beacon at 'Grene'. This 'carde' indicates there was a total of 52 beacons in Kent. The Beacon System dropped out of use after 1640 and no further record of this monument is known.	Post-medieval
A35	MKE83387	TQ 8548 7555	Farmstead east south east of Gold Nugget Wharf	A dispersed plan farmstead, demolished.	Post-medieval
A36	MKE83388	TQ 8643 7542	Redhouse Farm, Isle of Grain	A loose courtyard plan farmstead with buildings to two sides of the yard, demolished.	Post-medieval
A37	MKE83389	TQ 8652 7427	Wick	Outfarm with a loose courtyard plan with a building to one side of the yard, demolished.	Post-medieval
A38	MWX18298	TQ 88217 74450	Site of a Wick (pen)/Sheepwash, near Horseshoe Point, Isle Grain	Wick marked on the Ordnance Survey mapping (1858-1940) firstly as 'Wick' and subsequently as a Sheepwash. Also identified from aerial photographs.	Post-medieval to modern
A39	MKE83390	TQ 8711 7412	Red Wick	A regular L-plan farmstead, demolished.	Post-medieval
A40	MKE83391	TQ 8751 7569	Farmstead in Wallend	A regular U-plan courtyard farmstead, demolished.	Post-medieval
A41	MKE83392	TQ 8740 7557	Farmstead in Wallend	A regular multiyard farmstead, demolished.	Post-medieval
A42	MKE83393	TQ 8751 7576	Outfarm in Wallend	A field barn with no associated yard, demolished.	Post-medieval
A43	MKE83394	TQ 8761 7578	Home Farm, Wallend, Isle of Grain	A loose courtyard plan farmstead with buildings to two sides of the yard, demolished.	Post-medieval
A44	MKE83395	TQ 8694 7792	Rosecourt Barn	An outfarm with a regular U-plan, demolished.	Post-medieval
A45	MKE83397	TQ 8805 7696	Rose Court Farm (Rosecourt Farm), Isle of Grain	A loose courtyard plan farmstead with buildings to two sides of the yard. The best example on the Isle of Grain of a historic farmstead still in agricultural use and the only one retaining the majority of its historic structures.	Post-medieval
A46	MKE83396	TQ 8743 7805	Sheepfold on Lees Marshes	A field barn with no associated yard, demolished.	Post-medieval
A47	MKE83398	TQ 8848 7719	White Hall Farm, Isle of Grain	A full regular courtyard plan farmstead, demolished.	Post-medieval
A48	MKE83399	TQ 8786 7653	Perry's Farm, Isle of Grain	A loose courtyard plan farmstead with buildings to two sides of the yard. Still some extant features.	Post-medieval
A49	MKE83401	TQ 8824 7630	West Bear	A loose courtyard plan farmstead with buildings to three sides of the yard. Extant features present.	Post-medieval

Asset ID	Reference	NGR	Name	Description	Period
A50	MKE83402	TQ 8822 7445	Sheepfold north east of Port Victoria	Outfarm with a loose courtyard plan with a building to one side of the yard, demolished.	Post-medieval
A51	MKE83403	TQ 8884 7617	Whitehouse Farm, Isle of Grain	A regular courtyard farmstead with buildings to three sides of the yard incorporating a L-plan element. Farmhouse remains extant, the rest is demolished.	Post-medieval
A52	MKE83404	TQ 8881 7654	St James's Farm, Isle of Grain	A linear plan farmstead, demolished.	Post-medieval
A53	MKE83405	TQ 8881 7670	Parsonage Barn	A field barn with no associated yard, demolished.	Post-medieval
A54	MKE83406	TQ 8891 7666	Outfarm south east of Parsonage Barn	Outfarm consisting of a row plan element, demolished.	Post-medieval
A55	MKE83439	TQ 8750 7436	Outfarm on Stan Marsh	A field barn with no associated yard, demolished.	Post-medieval
A56	MKE83440	TQ 8833 7648	Outfarm adjacent to Lee's Cottages	Outfarm or field barn group consisting of two detached buildings, demolished.	Post-medieval
A57	MKE88529	TQ 8580 7747	Sheepfold on Allhallows Marshes	Outfarm with a loose courtyard plan with a building to one side of the yard, demolished.	Post-medieval
A58	MKE98846	TQ 8879 7633	Baytree Farm, Isle of Grain	A linear plan farmstead, completely demolished.	Post-medieval
A59	MKE98870	TQ 8886 7675	Old School House, Grain, Isle of Grain	Mid-to-late 19th century structure built next to the National School (*c.* 1860), on a site now housing a 'post-war replacement' school	Post-medieval
A60	MKE98871	TQ 8883 7674	Site of former National School, Grain, Isle of Grain	Site of a National School, built in 1864, enlarged in 1890 and now demolished. Replaced 'post war' with a new school.	Post-medieval
A61	MKE98872	TQ 8867 7639	Site of a former Bethel Chapel and Sunday School, Grain, Isle of Grain	Site of a congregational chapel opened in 1826, which was converted to use as a Sunday School in 1895, when a new congrational chapel was built nearby	Post-medieval
A62	MWX17550	TQ 872 739	Blackstakes	Name on chart of 1688 AD.	Post-medieval
A63	MKE44047	TQ 7893 7466	HOO JUNCTION AND PORT VICTORIA RAILWAY	Single track railway from Hoo Junction on the North Kent Line to Port Victoria on the Isle of Grain.	Post-medieval
A64	MWX18654	TQ 8795 7393	Port Victoria Railway Landing Pier, Isle of Grain	Built in 1882 as the terminal point for the Hundred of Hoo Railway, Port Victoria Railway Landing Pier was extensively damaged by an explosion on board a naval minelayer in May 1915. It was partially replaced by the Port Victoria Seaplane Slipway.	Post-medieval to modern

Asset ID	Reference	NGR	Name	Description	Period
A65	MKE8342	TQ 8635 7527	Site of Grain railway halt, Isle of Grain	A railway station/halt on the Hoo Hundred Railway line, built 1892, on the Isle of Grain marked.	Post-medieval to modern
A66	MKE8365	TQ 863 752	Site of Grain crossing, Isle of Grain	Grain level crossing, Isle of Grain, visible on 1891 OS map.	Post-medieval to modern
A67	MWX18896	TQ 8581 7549	Grain Bridge, Grain Road, Isle of Grain	Grain Bridge, was first marked on the 1st edition Ordnance Survey map (1858-1873). It is visible on all the subsequent OS maps.	Post-medieval to modern
A68	MWX19114	TQ 89277 76160	Outfall Sewer/sluice at Grain, Isle of Grain	Outfall sewer, visible on the 2nd edition Ordnance Survey map (1891-1898) and marked on all subsequent editions.	Post-medieval to modern
A69	MWX18147	TQ 86681 76650	Enclosure near Old Salt Works, near Yantlet Creek, Isle of Grain	A rectangular enclosure is marked on the Ordnance Survey historic maps (*c.*1858-1940) near the site of an 'Old Salt Works'. It was also identified from aerial photographs taken shortly after the end of the second World War.	Post-medieval
A70	NMP	TQ 87576 76420	Ridge and Furrow	Area of ridge and furrow as identified from aerial photographs.	medieval
A71	MWX18162	TQ 88668 74263	Burial ground, near Cockleshell Hard, Isle of Grain	A burial ground marked on the 1st edition Ordnance Survey map (1858-1873). Also marked on the subsequent Ordnance Survey maps as 'Old Burial Ground'.	Post-medieval to modern
A72	MWX19126	TQ 86171 74536	Site of a Circular embanked feature, near Isle of Grain Oil Distribution Terminal	Circular embanked feature visible on the 2nd and 3rd edition Ordnance Survey maps on the South Level, now the site of an Oil Distribution Terminal. Date and Function unknown.	Post-medieval to modern
A73	MKE3187	TQ 8790 7795	Flint foundations and red brick scatter, Lees Marshes, Isle of Grain	Flint foundations and scatter of red brick identified in fields by a local farmer. May possibly be the site of Rosecourt Manor, believed to have existed near this location in the 16th and 17th centuries.	Post-medieval
A74	MWX17975	TQ 87828 74844	Site of Eldertree Pounds, Isle of Grain	Remains of Eldertree Pounds marked on the Ordnance survey historic maps (*c.*1858-1940).	Post-medieval
A75	MWX19821	TQ 85960 76701	Isolated rudder	Isolated rudder, probably from one of the vessels close by. The rudder is wooden and just over 2m tall and just under 2m wide with metal fastenings and comprises planks joined together.	Post-medieval to modern
A76	MKE71755	TQ 88400 76800	Post Medieval silver coin	Portable Antiquities Scheme find - Post Medieval silver coin.	Post-medieval
A77	MWX18148	TQ 86789 77198	Wharf/landing stage, Yantlet Creek, Isle of Grain	A possible Wharf/landing stage, on Yantlet Creek. Nothing is marked on the Ordnance Survey maps; during a survey in 2002 a dilapidated wharf frontage, comprising three large vertical timbers and evidence of iron bolts was identified.	Modern

Asset ID	Reference	NGR	Name	Description	Period
A78	MWX18655	TQ 8855 7418	Site of a Beacon at Horseshoe Point, Isle of Grain	One of a set of three beacons forming two consecutive measured half miles shown on a chart from 1910.	Modern
A79	MWX19108	TQ 85762 78219	Hard, North Levels, Isle of Grain	A hard identified on the 3rd edition Ordnance Survey map and during a 2002 survey. The structure comprises paired, vertical squared timbers joined with large iron bolts.	Modern
A80	MWX19110	TQ 85696 77925	Site of a Groyne, Yantlet Creek, Isle of Grain	Groyne at Yantlet Creek marked on the 3rd edition Ordnance Survey map (*c*.1905-1922).	Modern
A81	MWX19111	TQ 85911 77587	Wharf, Yantlet Creek, Allhallows Marshes	A Wharf at Yantlet Creek is marked on the Ordnance Survey 3rd edition map (1905-1922). The remains of a timber structure, consisting of wooden planks and iron screws, were identified.	Modern
A82	MWX19113	TQ 89232 76080	Site of a Groyne, near Grain, Isle of Grain	A groyne marked on the 3rd edition Ordnance Survey map (*c*.1905-1922). No further information.	Modern
A83	MWX19115	TQ 89279 76057	Wharf, near Grain, Isle of Grain	Wharf marked on the 3rd and 4th edition Ordnance survey maps (1905-1940) near Grain. No further information.	Modern
A84	MWX19118	TQ 89286 75746	Site of a Beacon, Smithfield Marshes, Isle of Grain	A beacon is marked on the 3rd edition at Smithfield Marshes. It is in close proximity to a number of other beacons. There is no further trace of the monument on the 4th edition map (*c*.1931-1940).	Modern
A85	MWX19808	TQ 85971 74621	Former wharf	Former wharf	Modern
A86	MKE92760	TQ 8685 7746	Grain Island Firing Point, Yantlet Creek, Isle of Grain	The principal function of the firing point was to measure the velocity of shells fired from the gun emplacement.	Modern
A87	MKE16291	TQ 8690 7720	Site of Yantlet firing range, Isle of Grain	Site of Yantlet range firing point and associated structures. A firing range for testing heavy artillery. In use between 1917 and 1950, uncertain if still in use today.	Modern
A88	MKE16289	TQ 8678 7740	Wharf at Yantlet firing range, Isle of Grain	The wharf at Yantlet firing range was constructed in 1917.	Modern
A89	MWX19804	TQ 86744 77335	Slipway, Grain Island Firing Point	Slipway.	Modern
A90	MKE16290	TQ 8690 7720	Embankment of disused military railway, Yantlet Creek, Isle	An embankment on the Right bank of Yantlet Creek was part of the former military railway serving Yantlet Range.	Modern

Asset ID	Reference	NGR	Name	Description	Period
A91	MKE16297	TQ 8845 7725	Site of barracks for an anti-aircraft battery, near White Hall Farm	Remains of Barracks for an Anti-aircraft defensive battery near White Hall Farm. The concrete bases for these huts are no longer present.	Modern
A92	MWX17958	TQ 87183 74190	World War II oil tank farm, Power Station, Isle of Grain	World War II oil tank farm identified from aerial photographs taken shortly after the end of the conflict.	Modern
A93	MWX18166	TQ 86196 74662	World War II oil tank farm, Isle of Grain	World War II oil tank farm, identified from aerial photographs taken shortly after the end of the Second World War. Presumably now part of the oil distribution terminal.	Modern
A94	MWX18652	TQ 8711 7400	Site of Oil Tanks, Hooks Fleet, Isle of Grain	Oil Tanks near Hooks Fleet shown on a chart from 1910. The area has since been developed, now forming part of the Medway Power Station and container terminal.	Modern
A95	MWX18159	TQ 87533 73972	Pillbox, near Grain Power Station, Isle of Grain	A World War Pillbox on the coast, identified from aerial photographs taken after the end of World War II. Located near Grain Power Station, present condition unknown.	Modern
A96	MKE20480	TQ 8861 7441	Site of Grain Air Station, Port Victoria, Isle of Grain	The Royal Naval Air Service established two bases on the Isle of Grain, one at Cockleshell Hard and one at Port Victoria (at neighbouring points on the coast). Known as Grain Air Station, they were used between 1912 and 1924. Few extant remains survive.	Modern
A97	MKE42226	TQ 8885 7699	White Hall Farm battery, Isle of Grain	World War I coastal artillery battery, no structures above ground level. Only concrete aprons visible.	Modern
A98	MKE16293	TQ 8757 7820	Military observation tower, near Cockleshell Beach, Lees Marshes, Isle of Grain	A 20th century Military observation tower near Cockleshell Beach.	Modern
A99	MWX17943	TQ 86844 77446	Site of probable World War II Radio masts, Grain Marsh, Isle of Grain	Four large radio masts were identified from aerial photographs taken shortly after World War II.	Modern
A100	MWX18161	TQ 87545 75282	Military Installation, Isle of Grain	A Military Installation identified from aerial photographs taken after the end of World War II. Located near Grain Power Station, present condition unknown.	Modern
A101	MKE89755	TQ 8800 7600	Crash site of Dornier Do17Z-3	Crash site of Dornier Do17Z-3	Modern
A102	MKE89756	TQ 8900 7600	Crash site of Messerschmitt Bf109E-4	Crash site of Messerschmitt Bf109E-4	Modern

Asset ID	Reference	NGR	Name	Description	Period
A103	MKE89757	TQ 8700 7600	Crash site of Heinkel He 111H-2	Crash site of Heinkel He 111H-2	Modern
A104	MWX19112	TQ 88828 77116	Site of a gravel pit tramway, Isle of Grain	A gravel Pit tramway is marked on the 3rd edition Ordnance Survey map. Not visible on any of the later edition maps and no further trace is known.	Modern
A105	MKE20488	TQ 8896 7683	Mound and hollow features, Isle of Grain	A small oval mound and a large oval hollow perhaps connected with the small scale extraction of sand or gravel. These features may be associated with the Grain Fortifications to the south.	Modern
A106	MWX19116	TQ 89288 75870	Site of an Outfall Sewer, Smithfield Marshes, Isle of Grain	Outfall marked on the 3rd and 4th edition Ordnance Survey maps (*c*.1905-1940) at Smithfield Marshes. Not thought to remain today.	Modern
A107	MWX18855	TQ 86367 77294	Old counter sea defence wall, Yantlet Creek, Allhallows	The modern sea defence wall of Yantlet Creek is thought to have been built on the site of the old counter sea defence, possibly incorporating elements of this old wall.	Unknown
A108	MWX17939	TQ 86033 77895	Borrow pits to seaward of the sea wall, North Level, Isle of Grain	Borrow pits to seaward of the sea wall identified from aerial photographs.	Unknown
A109	MWX17941	TQ 85546 77483	Site of possible Salt Works, Allhallows Marshes	Grid pattern in cropmarks and drainage, possibly the remains of a salt making site.	Unknown
A110	MWX18837	TQ 88779 74796	Possible site of former buildings, near Grain Power Station, Isle of Grain	Regular features in a field, identified from aerial photographs. Possibly indicative of former buildings.	Unknown
A111	MWX19802	TQ 86067 78410	Small alignment stakes	Small alignment of stakes.	Unknown
A112	MWX19803	TQ 85960 78305	Double alignment of wooden stakes	Double alignment of wooden stakes.	Unknown
A113	MWX18481	TQ 87665 75384	Unidentified feature, near Wallend, Isle of Grain	Unidentified feature noted from aerial photographs. No further information.	Unknown
A114	MWX18149	TQ 86413 76923	Site of a possible enclosure, near Hooks Fleet, Allhallows	The drainage pattern in a field indicates this was once the site of an enclosure. The boundary is similar on the Ordnance Survey historic maps (*c*.1858-1940), and a sheepfold is marked within the enclosure on the 3rd edition map (*c*.1905-1922).	Unknown
A115	MWX18151	TQ 88436 76576	Site of two circular enclosures, Grain	Two circular enclosures were identified near Grain from aerial photographs taken after the end of the Second World War.	Unknown

Asset ID	Reference	NGR	Name	Description	Period
A116	MWX18165	TQ 86929 74498	Site of a Circular enclosure, Isle of Grain	A circular enclosure, identified from aerial photographs taken shortly after the end of the Second World War. The site has since been developed and is now part of the Medway Power Station.	Unknown
A117	MWX18836	TQ 88475 74641	Mound, near Grain Power Station, Isle of Grain	A mound of uncertain date or function, identified from aerial photographs. No further information.	Unknown
A118	MWX18150	TQ 87251 77044	Possible barrow, near Yantlet Farm, Isle of Grain	A circular mound feature, identified as a barrow. Marked on the Ordnance Survey maps from the 1st edition to the present (*c.*1858-2007). Also visible from aerial photographs.	Unknown
A119	MWX18167	TQ 85900 74656	Rectangular pond cut into saltmarsh, Near Colemouth	A rectangular pond cut into saltmarsh was identified from aerial photographs near the foreshore on what is now the site of the Oil Distribution Terminal.	Unknown
A120	MWX18720	TQ 87603 77998	Ring ditches, Lees Marshes, Isle of Grain	Ring ditch features identified from aerial photographs. Interpreted as a possible settlement site of unknown date.	Unknown
A121	MKE77257	TQ 8879 7666	Cropmark of a ring ditch, to the north of Grain	A ring ditch visible as a cropmark in aerial photos of 1990 to the north of Grain. Possible second ring ditch to the south west of this.	Unknown
A122	MKE77258	TQ 8872 7663	Cropmark of a possible ring ditch, to the north of Grain	A possible ring ditch visible as a cropmark in aerial photos 1990 to the north of Grain.	Unknown
A123	MKE77259	TQ 8889 7668	Cropmarks of a field system, to the north of Grain	A field system visible as cropmarks in aerial photos of 1990 to the north of Grain. It is 132m across from east to west and 118m across from north to south and consists of several ditches.	Unknown
A124	MKE77261	TQ 8806 7669	Cropmark of a ring ditch, to the north west of Grain	A ring ditch visible as cropmarks in aerial photos of 1990 to the north west of Grain. It is 22m across and consists of a singular circular ditch with no interruption.	Unknown
A125	MKE77262	TQ 8820 7663	Cropmarks of ring ditch, to the west of Grain	A ring ditch visible of as a cropmark in aerial photos from 1990 to the west of Grain. It is 17m wide and consists of a singular circular ditch. In 1990 a pipe line was built partial truncating the north east.	Unknown
A126	MKE77263	TQ 8807 7663	Cropmarks of a field system, to the north west of Grain	A field system visible as cropmarks in aerial photos from 1990 to the north west of Grain. It is 288m east to west and 182m north to south. It consists of several ditches.	Unknown
A127	MKE77362	TQ 8777 7594	Cropmark of a ring ditch to the west of Grain	A ring ditch visible as a cropmark in aerial photos of 1990 to the east of Grain. It is 22m by 20m and consists of a singular ring with no interruption.	Unknown
A128	MKE91138	TQ 8767 7591	Cropmark of a ring ditch to the west of Grain Road	A ring ditch is visible as cropmark in a Google Earth image of 2013. It is 19m by 19m across and consists of a single circular ditch with one interruption by the road.	Unknown

Asset ID	Reference	NGR	Name	Description	Period
A129	MKE91139	TQ 8753 7599	Cropmark of a ring ditch, to the west of Grain Road	A ring ditch is visible as a cropmark in a Google Earth image of 2013. It is 11m by 12m across and consists of a single circular ditch.	Unknown
A130	MKE91140	TQ 8843 7592	Cropmark of a ring ditch, to the south west of Whitehouse	A ring ditch is visible as a cropmark in a Google Earth image of 2013. It is 14m by 15m and consists of a single circular ditch.	Unknown
A131	MKE97632	TQ 8880 7682	Stone head found in Clubb's Pit, opposite Grain Church	A stone head of slightly less than life size was found at Clubb's Pit, Grain, possibly c. 1983. It is now in the Guildhall Museum, Rochester	Unknown
A132	Aerial Photograph	TQ 88360 77025	Site of 20th Century Outfarm South of White Hall Farm	Outfarm built in the 20th century as identified from historical maps and aerial photographs. Destroyed in the 1970-80s by gravel extraction.	Post-medieval

Event ID	Reference	Name	Description
E1	EKE9724	Watching brief at Additional LNG Storage Tanks - Grain LNG, Isle of Grain	A watching brief undertaken prior to the sites further development. Nothing of archaeological interest was discovered.
E2	EKE9729	Watching brief at the B2001 Culvert, Isle of Grain	The watching brief was undertaken during the construction of a new pipeline. The pipeline ran through the culvert of the B2001. No archaeological features were discovered, although the site was contaminated with hydro-carbons, and the gravel layers appeared to be intact, giving the possibility that prehistoric remains may exist.
E3	EKE4028	Settlement Site, Rose Court Farm	Iron Age settlement and Late Roman cemetery excavated in advance of mineral extraction north of Rose Court Farm. The excavations took place over a period of 10 years in the 1970s and 1980s but the results have never been fully published and information is sparse.
E4	EKE10128	Grain LNG Second Cryogenic Pipeline - Appendix 10.3: Atkins 2007 investigation extracts	Boreholes and test pits dug along the route of a pipeline.
E5	EKE8105	The AES Medway Site (Alternative Site) Isle Of Grain - Archaeological Assessment Report	Assessment of palaeoenvironmental stratigraphy and archaeological potential using borehole and other observations at the site, and including data from previous evaluations in the area.
E6	EKE12719	Geoarchaeological boreholes, Grain pipeline route	Eight boreholes were dug for geoarchaeological investigation of the route. Pleistocene and Holocene deposits were encountered.

Event ID	Reference	Name	Description
E7	EKE10722	Watching brief along the route of the BritNed Interconnector	A watching brief was organised for the route of a new cable. It largely relied upon non-archaeological contractors identifying potential deposits and calling in archaeologists. No such deposits were reported. A small section of the cable route, where it crossed a Scheduled Monument, was fully monitored. Nothing was observed.
E8	EKE16408	LNG JETTY No 8 Isle of Grain A geoarchaeological borehole monitoring report	A geoarchaeological report on the monitoring of boreholes drilled in Jetty No8. Report was commissioned by National Grid Grain LTD. Samples were taken and sent to MoLAS via the Fugro Consett laboratories for analysis. It was decided further radiocarbon dating would be undertaken.
E9	EKE10138	Watching Brief at Grain Water Treatment Works, Isle of Grain	A negative watching brief.
E10	EKE12631	Negative watching brief at Isle of Grain Power Station, Isle of Grain	Monitoring of groundworks associated with drilling and the removal of contaminated soil. No archaeological finds or features were observed.
E11	EKE16407	Grain Road Isle of Grain an archaeological watching brief	Watching brief by MoLAS was conducted at the Grain Road site which consisted of a number of geotechnical test pits. There were deposits of limited local significance and no archaeology. 13 test pits were dug all 1m square and 0.90 m deep.
E12	EKE17318	Magnetometry survey along route of Grain to Gravesend gas pipeline	Magnetic geophysical survey was undertaken by Stratascan on behalf of Canterbury Archaeological Trust, and overall the results of the survey produced little evidence for archaeological activity. Fourteen scattered responses were detected, although none of these seem to form any coherent pattern, and it was believed that most related to geological or pedological anomalies.
E13	EKE15641	A Geoarchaeological Assessment ahead of a proposed Isle of Grain Windfarm	A geoarchaeological assessment of the site ahead of construction of a proposed wind farm at the Isle of Grain, Kent. The report modelled a sequence of Pleistocene and Holocene deposits with the potential to contain archaeological remains of value despite all investigative boreholes being negative for such material.
E14	EKE14336	Geoarchaeological Evaluation: Land at Grain Power Station, Isle of Grain, Kent	Geoarchaeological Evaluation on land with planning permission to construct a new gatehouse, and visitors centre, security lodge, workshop and car park at Grain Power Station. The fieldwork consisted of machine excavation, recording and sampling of three Geoarchaeological test pits, along with drilling and core sample recovery from three bore holes. Excellent pollen preservation, coupled with radiocarbon dating of the sequence and a paucity of comparable work in the local area for the late Bronze Age, highlights the importance of the pollen assemblage in determining the vegetative composition of the Isle of Grain during the Late Bronze Age. It is recommended that a full pollen analysis is undertaken. Two radiocarbon dates on marine shells taken from a single borehole revealed dates of 1040-730 cal. BC and 1100-770 cal. BC - implying late Bronze age date for the sediment deposition. Optically Stimulated Luminescence (OSL) dates indicated a date of

Event ID	Reference	Name	Description
			224 +/- 25 ka (thousand years) for the River Terrace Gravel- an interesting date archaeologically as it corresponds to known Neanderthal occupation in Britain. However no archaeological material was recovered during the Geoarchaeological evaluation.
E15	EKE10137	Evaluation at Grain Power Station, Isle of Grain	14 auger samples comprising two transects across the site in order to target the projected route of the House Fleet (derived from historic mapping).

Appendix B Built Heritage Gazetteer

Table 3 Built Heritage Gazetteer Assets

Asset ID.	List Entry Number	NGR	Name	Type	Description	Period	Designation
BH1	1393145	588497, 177380 to 588832, 177147	World War II Anti-Tank Obstacles on the Foreshore	Anti-tank obstacles	A line of concrete anti-tank obstacles erected *c*. 1940 and running for approximately 570m from north-west to south-east along the north coast of the Isle of Grain. The main type of obstacle is formed by truncated square pyramids known as dragons teeth attached to a concrete grid. The teeth are arranged in rows four deep but every other row is offset so in effect the rows are eight deep. At the north-west end of the line is s double row of anti-tank concrete cubes while at the south-eastern end of the line is a pile of concrete caltrops, designed like medieval caltrops with four arms so that however they are placed one arm will always point upwards.	Modern	Grade II
BH2	1085755	588874, 176789	Church of St James	Parish church	12th century with additions in the 13th and 15th centuries and a south-west tower added in 1903-05. Construction is ragstone rubble and the plan is simple with a nave, chancel, south-west tower, north-east sacristy and south porch. The chancel retains 13th century windows in the Early English style. The aisles have been removed but the remains of the arcade can still be seen with the early 20th century replacement windows inside the blocked up spaces. Brick buttresses were added after the aisles were taken away.	Medieval and post-mediaeval	Grade I
BH3	1336496	588612, 176588	The Hogarth Inn	Public House	A rendered, timber-framed public house dating to the late 16th century. The two-storey building has a hipped, tiled roof and sliding sash windows to the first floor. The canted bay windows on the ground floor are a 20th century addition. The asset was built as a house and was later the Cock Inn and then the Post Office and stores before being reinstated as a public house in 1975. The Hogarth name is a reference to William Hogarth who visited the Cock Inn in 1732 during a visit to the Hoo peninsula. The brick outbuilding to the north-west of the asset is shown on the First Edition Ordnance Survey map of 1870 while a further building between the two shown on subsequent Ordnance Survey maps and labelled PO is no longer in place.	Post medieval	Grade II
BH4	1204482	588850, 176146	White House Farmhouse	House	A two-storey, three-bay 18th century weatherboarded farmhouse with timber sash windows with glazing bars and a panelled front door with a fanlight	Post medieval	Grade II

Asset ID.	List Entry Number	NGR	Name	Type	Description	Period	Designation
					above. The hipped roof is tiled, with brick stacks to the rear elevation. There is a triple-pile back addition to the rear of the main range.		
BH5	1019955	588972, 176405; 589077, 176559; 589193, 176555; 589231, 175655; 589261, 176119; 589642, 176043.	Coastal artillery Defences on the Isle of Grain, Immediately East and South East of Grain Village	Coastal defences	The scheduled coastal defences commence to the south-east of the Church of St James and continue south, with a break for the road to Grain Tower for approximately 1.25km in six separate areas of protection. The monument includes a gun tower (Grain Tower, outside the study area), a fort and three batteries together with later, 20th century additions including two searchlight emplacements. Grain Tower was built in response to the perceived threat from French invasion in the mid-19th century and was supported from the 1860s by Grain Fort which was built on the recommendation of the 1859 Royal Commission into the Defences of the United Kingdom Fortifications. The fort was formed of a semi-circular keep with a central parade and accommodation for 250 men, the whole being surrounded by inner and outer ditches and defended by bastions and caponiers. The fort's armaments were upgraded up until the Second World War and the fort was decommissioned in 1956 and the keep and caponiers were demolished and the ditch partially filled in in the 1960s. Visible remains today comprise earth banks and platforms but the subterranean passages that linked the keep, caponiers and magazines remain. A series of open batteries were built to the south of the fort. The first, Grain Battery (renamed Dummy Battery in 1901) was built approximately 1km south of the fort in the 1860s and was linked to it by a communications road on an earthen bank. In 1895 Wing Battery was built immediately to the south of Grain Fort and in 1900 Grain Battery was built to the west of Wing Battery. The upstanding parts of these fortifications were similarly demolished in the 1960s. Finally, two searchlight emplacements were built on the esplanade to the east of Grain Fort.	Post medieval and modern	Scheduled
BH6	N/a	588723, 176727	The Old Vicarage	House	A 19th century detached house in yellow stock brick with red brick detailing and a concrete tiled roof. The main range faces the High Street with a double-pile addition to the rear.	Post medieval	Non-designated
BH7	N/a	588628, 176458	Grain United Reformed Church	Chapel	A single storey gable ended structure in yellow stock brick with red brick details and a slate roof. The gabled porch at the south-west end bear a date stone reading 1895 while the name of the chapel, BETHEL CONGREGATIONAL CHAPEL is inscribed above. The door and three	Post-medieval	Non-designated

Asset ID.	List Entry Number	NGR	Name	Type	Description	Period	Designation
					windows in the south-west end have pointed arches and replacement fenestration.		
BH8	N/a	588775, 176277	Grain Village Hall	Village Hall	A single storey structure constructed of pebble-dashed concrete panels, Crittal style metal windows and a curved roof. The structure dates to the 1950s and has served as the village's hall since.	Modern	Non-designated
BH9	N/a	588895, 176218	Former Coastguard Station	House, former coastguard station	Built by the Admiralty in 1900 facing the River Medway. The building comprised a row of 12 cottages for the coastguards and their families with a larger house at the eastern end for the Chief Officer. A single storey watch room was attached to the house. Construction is in buff brick with red brick detail to the ground floor. The first floor walls are divided into square panels with concrete detaining and the panels are pebble dashed. The roofs are slate with brick stacks to the front and rear and former windows to the front elevation.	Post-medieval	Non-designated
BH10	N/a	588056, 176951	Rosecourt Farm	Farm complex	Rosecourt Farm dates to the 1870s and us first shown on the 1898 Second Edition Ordnance Survey map. The map shows a pair of semi-detached cottages with two masonry outbuildings on either side of a courtyard to the north-east. The assets were not accessible during the site walkover but were observed from a distance. The cottages are in buff brick with a concrete tiled roof while the more northerly of the two out buildings is in buff brick with a corrugated roof. The more southerly of the two outbuildings is not as tall and was obscured from view by modern buildings to the east but appears to be original to the development. The courtyard walls connecting the two outbuildings also appear to be in place.	Post-medieval	Non-designated
BH11	N/a	587828, 176485	Perry's Farm and Wilford's Farm	Farm complexes	The two farms are located within the Site. Both farms are shown on the 1870 Ordnance Survey map as comprising a number of buildings around courtyards. The 1898 Ordnance Survey map shows just two buildings at Perry's Farm with an additional pair of semi-detached cottages and three buildings at Wilford's. Only the rendered brick cottages survive at Perry's and one of the outbuildings in buff brick at Wilford's.	Post-medieval	Non-designated
BH12	N/a	587077, 177097	Grain Island Firing Point	Artillery testing station	In 1920 the War Office drew up plans for buildings and structures for a firing point on the Isle of Grain to the east of Yantlet Creek. The location was chosen for its remoteness coupled with the fact that it was accessible by rail or water. The firing point's main function was to measure the velocity of heavy artillery shells from the gun emplacement. Thus was achieved by firing	Post-medieval	Non-designated

Asset ID.	List Entry Number	NGR	Name	Type	Description	Period	Designation
					the shell through two wire screens a fixed distance apart. From the 1950s the facility was increasingly used as a demolition range for controlled explosions and continues in that role today. While a number of the facilities original buildings and structures such as the wharf and dock, gantry path and velocity screen bases have been demolished other structures still stand including a workshop complex, powerhouse, mess building, guardhouse and cottages.		
BH13	1425319	585766, 177330	Second World War QF P-Series Oil Bombing Decoy	Oil Bombing Decoy	The asset is located in two areas of protection approximately 1.78km west, north-west of the Site boundary at its nearest point in a wide bend of Yantlet Creek. The asset is one of eleven QF (diversionary fire) P (petroleum division) oil bombing decoy sites developed in Britain in the early years of the Second World War. This example was designed to draw enemy bombing away from the oil storage depot to the south. Aerial photographs and archaeological surveys have found that the asset retails all its above and below ground features. The decoy was designed to burn fuel oil in brick or clay-lined pools to simulate burning oil storage tanks, ignition being controlled from a control building and associated generator building approximately 200m to the west of the pools.	Modern	Scheduled
BH14	1085758	584178, 178880	Church of All Saints	Parish church	Dates from the 12th to 15th centuries with restoration in the late 19th century. Construction is of uncoursed rubble and stale roof. The plan is of aisled nave with cupola, chancel and south porch. The asset has historic and architectural interest as Allhallows' parish church. The asset is located in a raised churchyard surrounded by a brick wall.	Medieval and post-medieval	Grade I
BH15	1086504	583566, 177539	Rose and Crown Public House	House, formed public house	18th century house, formerly the Rose and Crown public house and now a dwelling house again. The two storey building is in painted brick with a hipped, tiled roof with two dormers to the front elevation. Both the roof and timber framed windows are said (list description) to have been replaced in the 20th century.	Post-medieval	Grade II

Appendix C Figures

Figure 1 Site location plan.

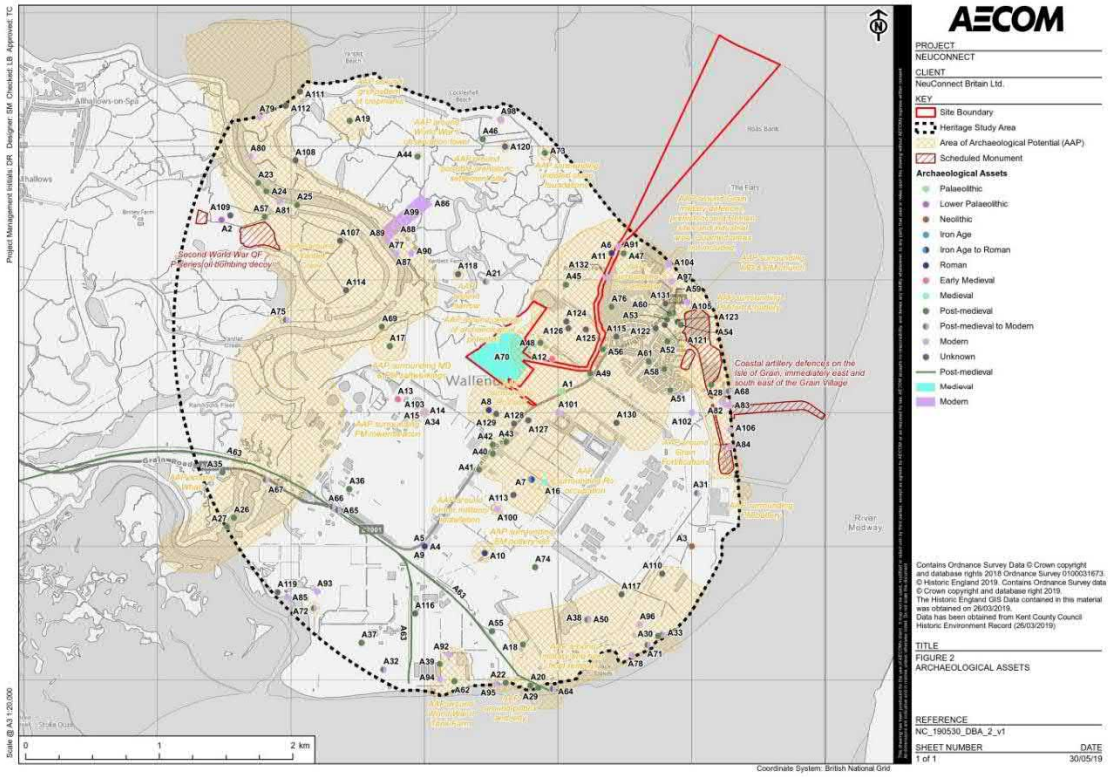

Figure 2 Archaeological Assets

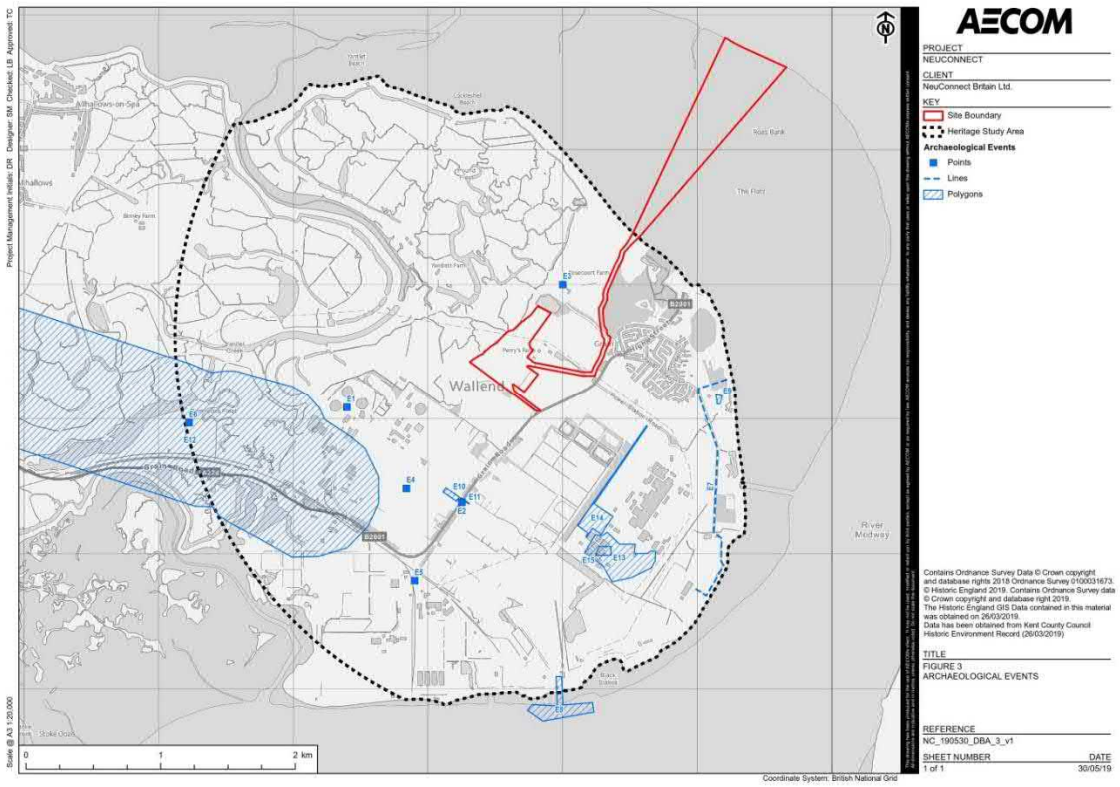

Figure 3 Archaeological Events

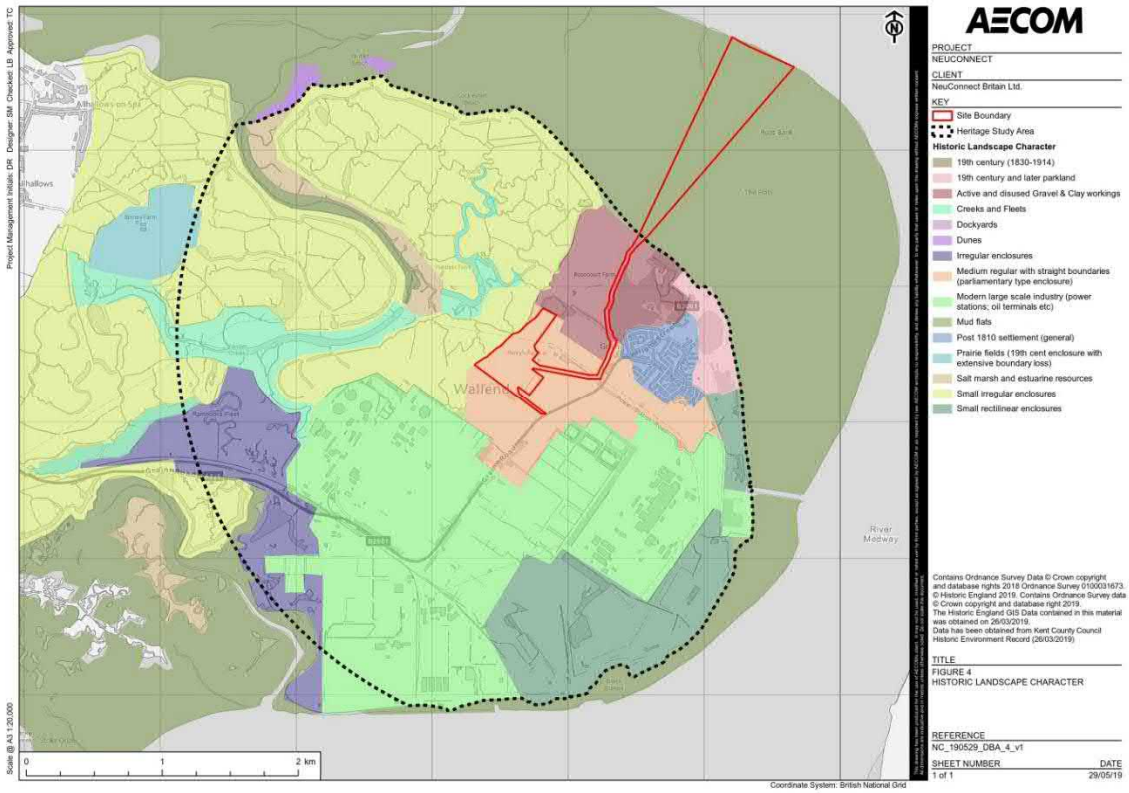

Figure 4 Historic Landscape Character

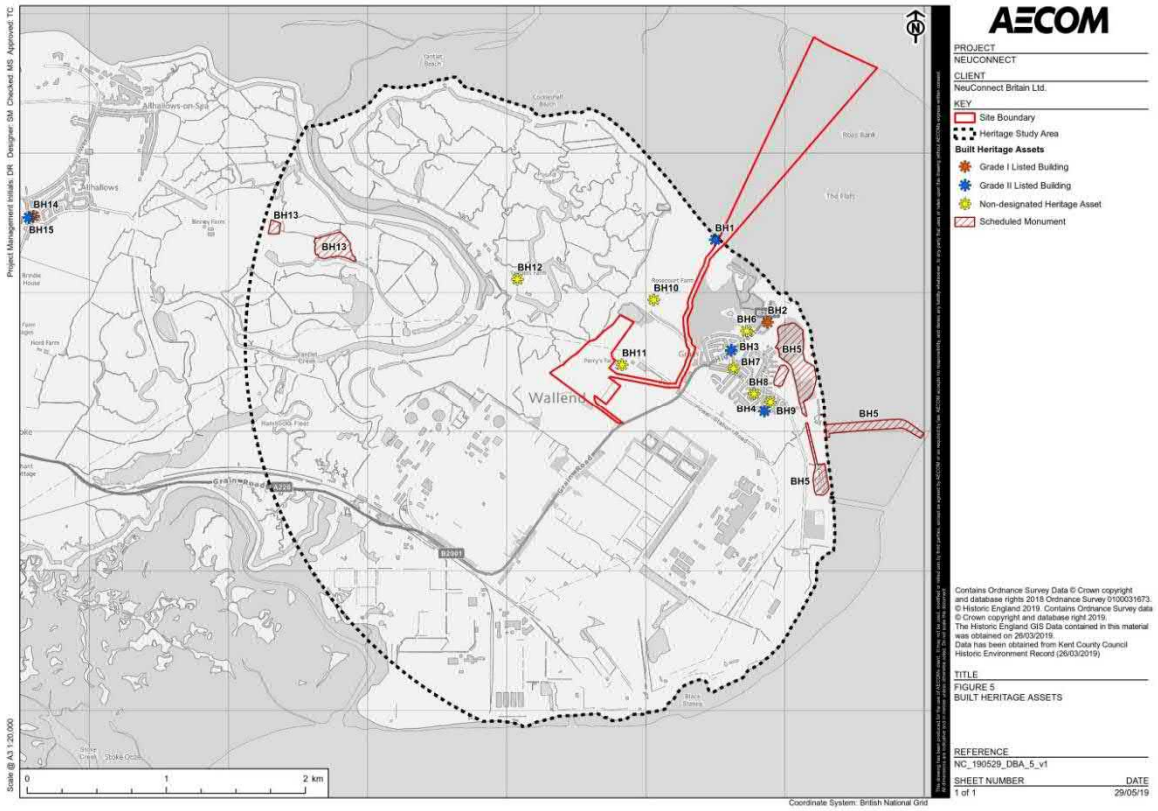

Figure 5 Built Heritage Assets

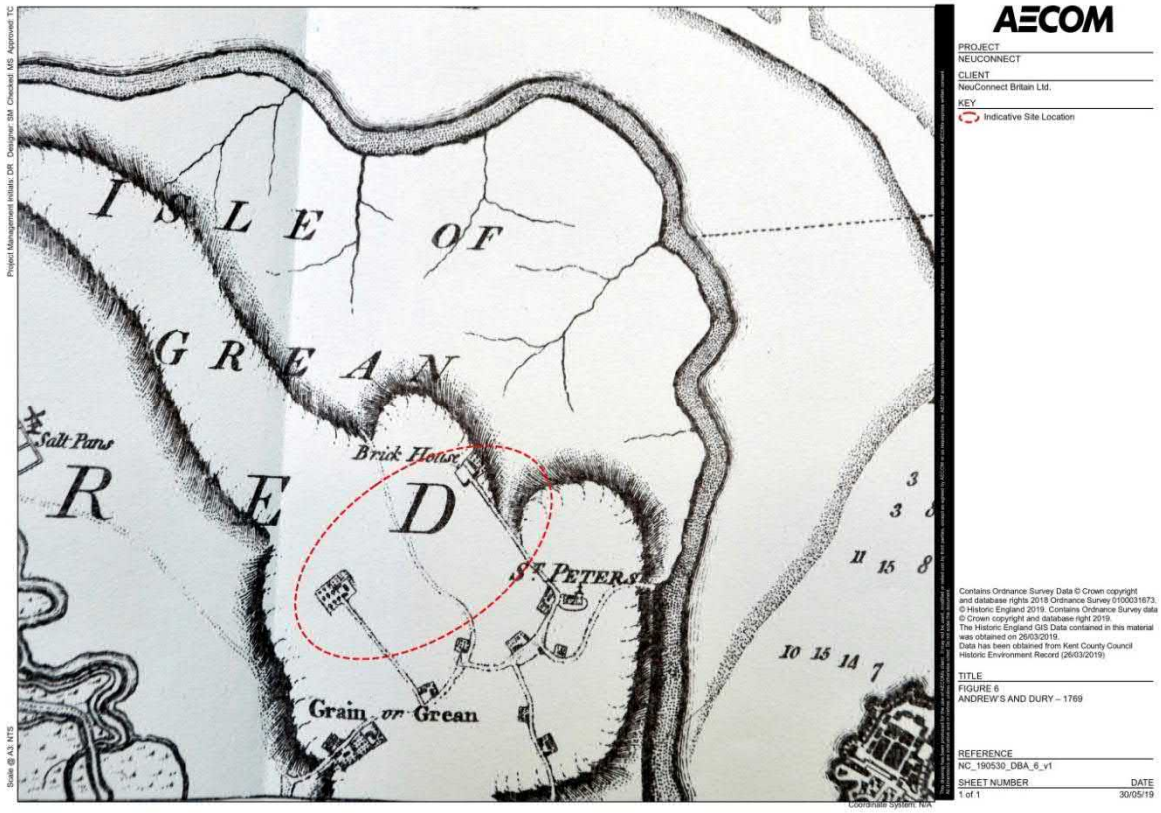

Figure 6 Andrew and Dury's map of 1769

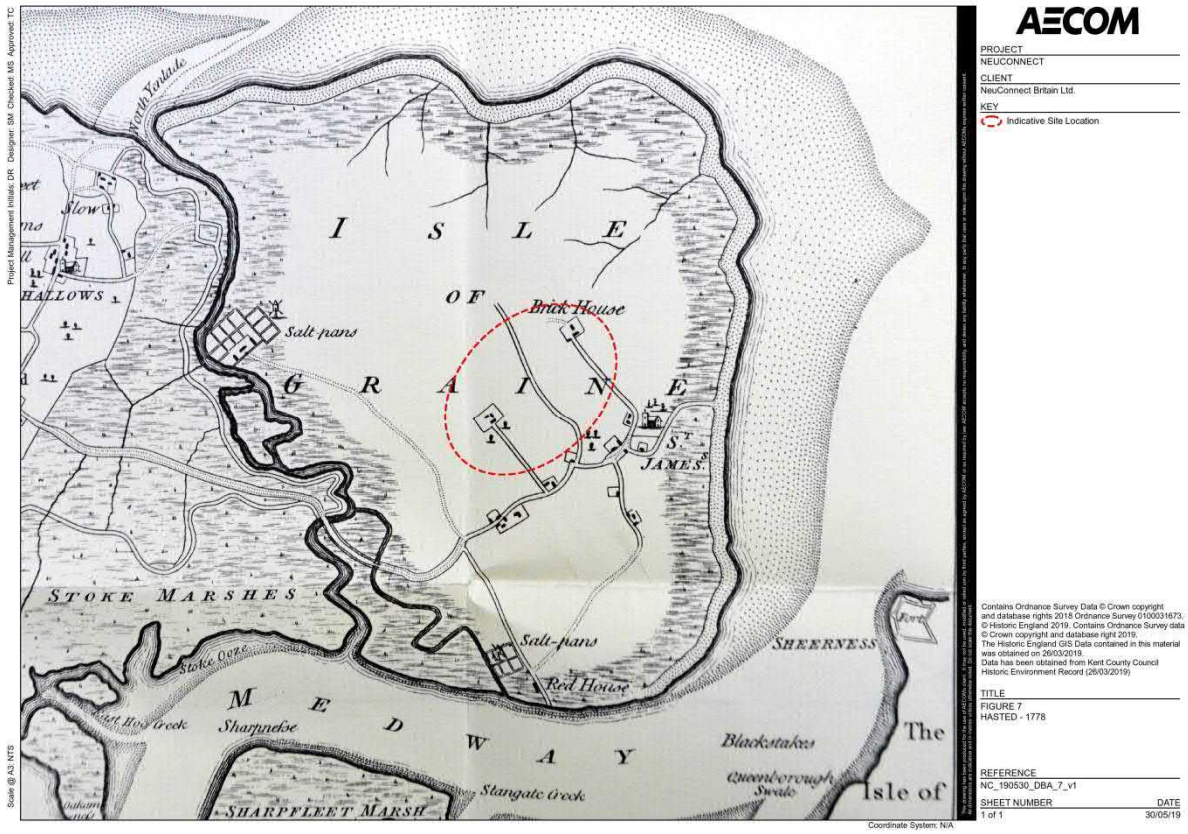

Figure 7 Hasted's map of 1778

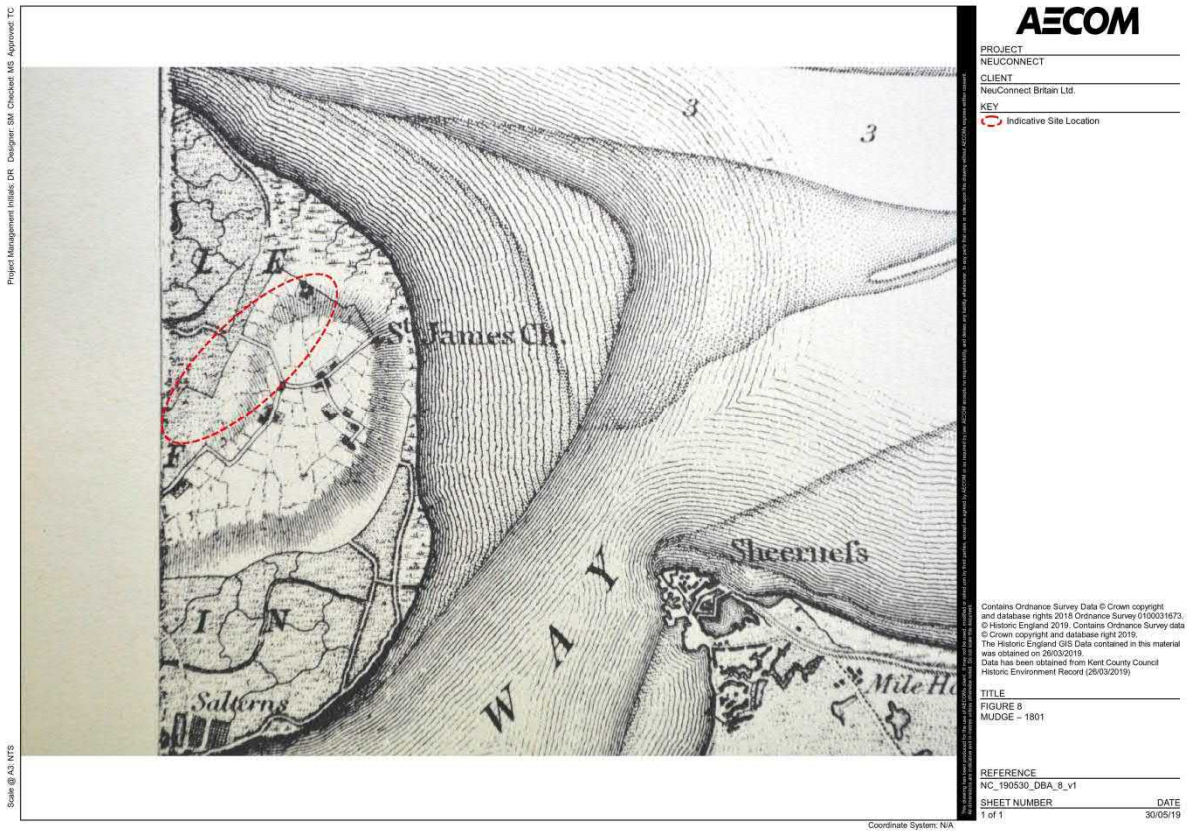

Figure 8 Mudge's map of 1801

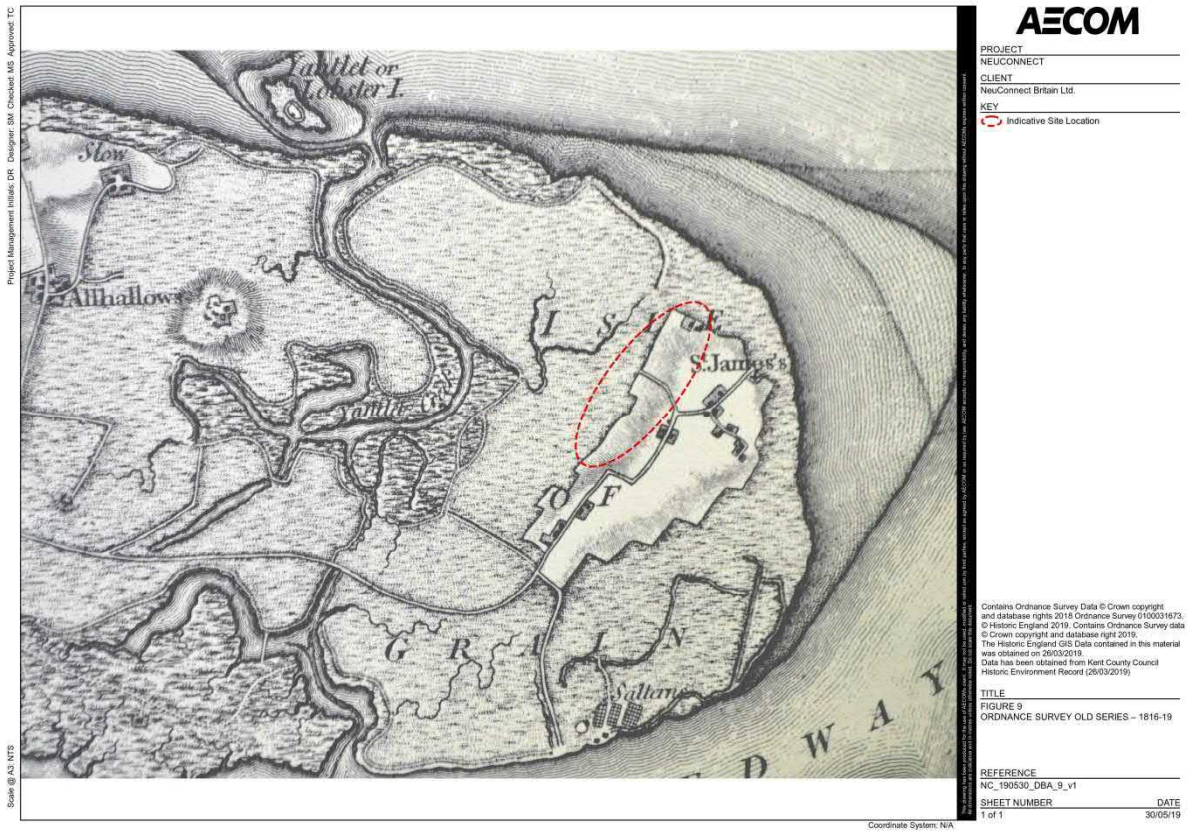

Figure 9 Ordnance Survey Old series map of 1816-9

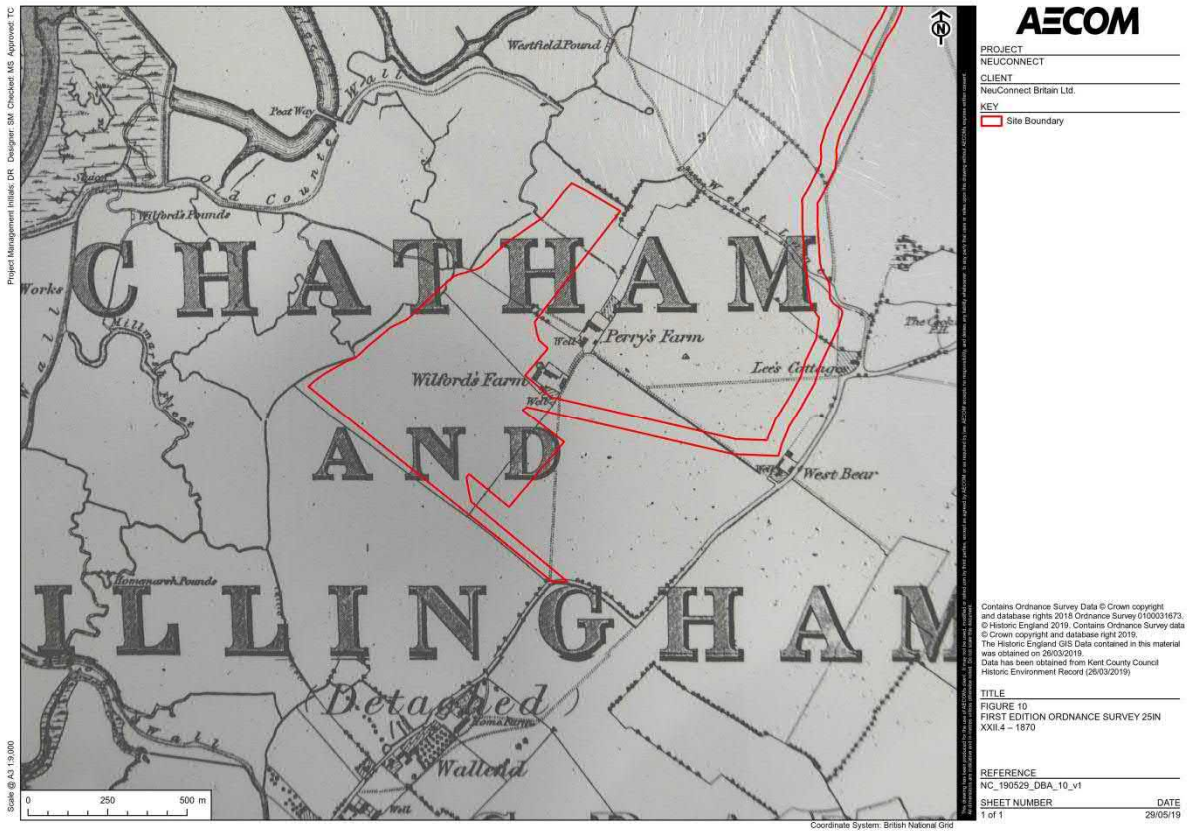

Figure 10 First Edition Ordnance Survey map 25inXXII.4 of 1870

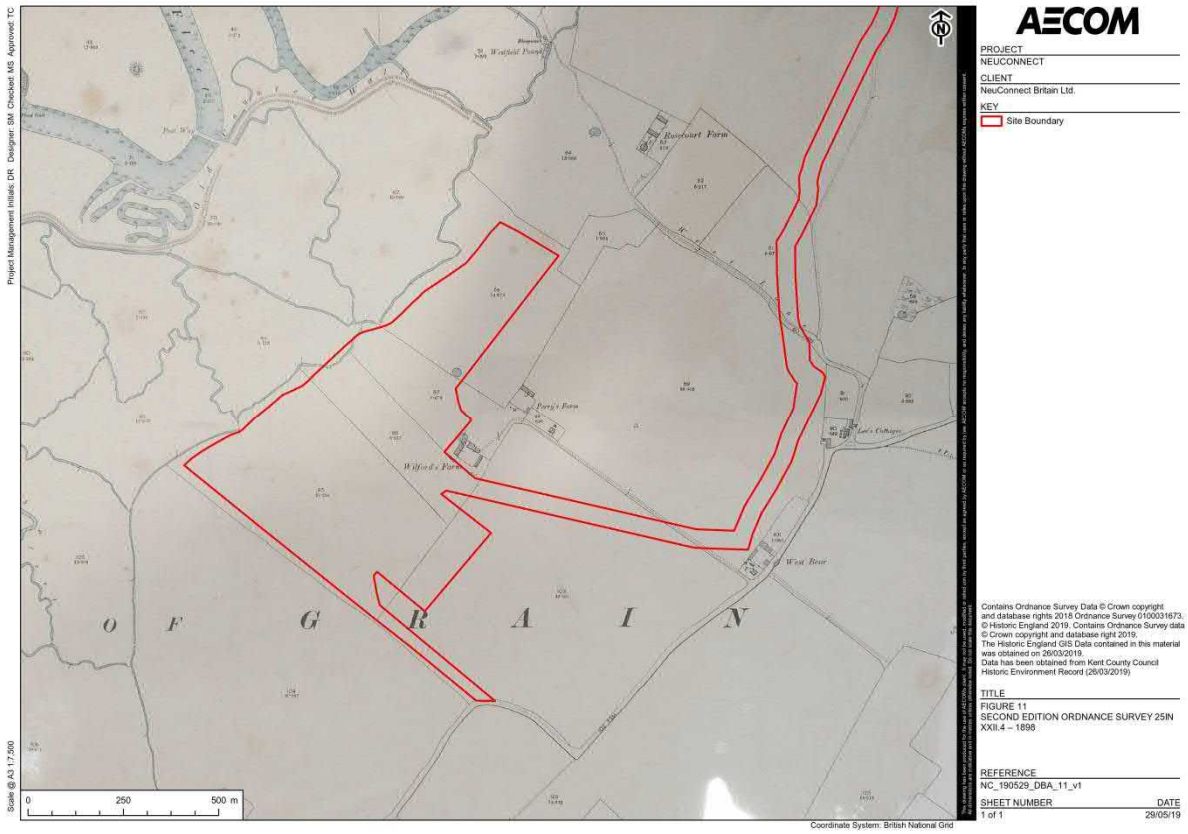

Figure 11 Second Edition Ordnnce Survey 25in XXII.4 map of 1898

Figure 12 Third Edition Ordnance Survey XXII.4 map of 1908

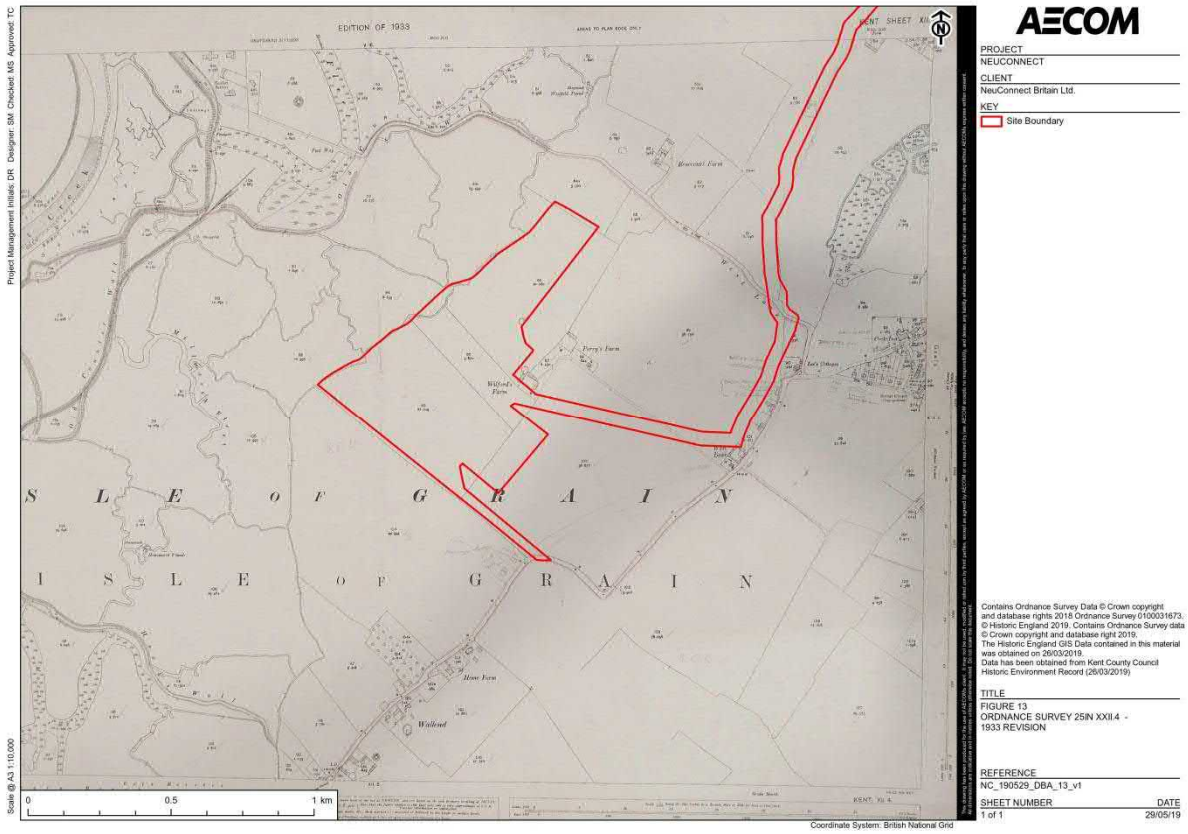

Figure 13 Ordnance Survey 25in XXII.4 1933 revision map

Figure 14 Ordnance Survey aerial photomosaic dated 1947

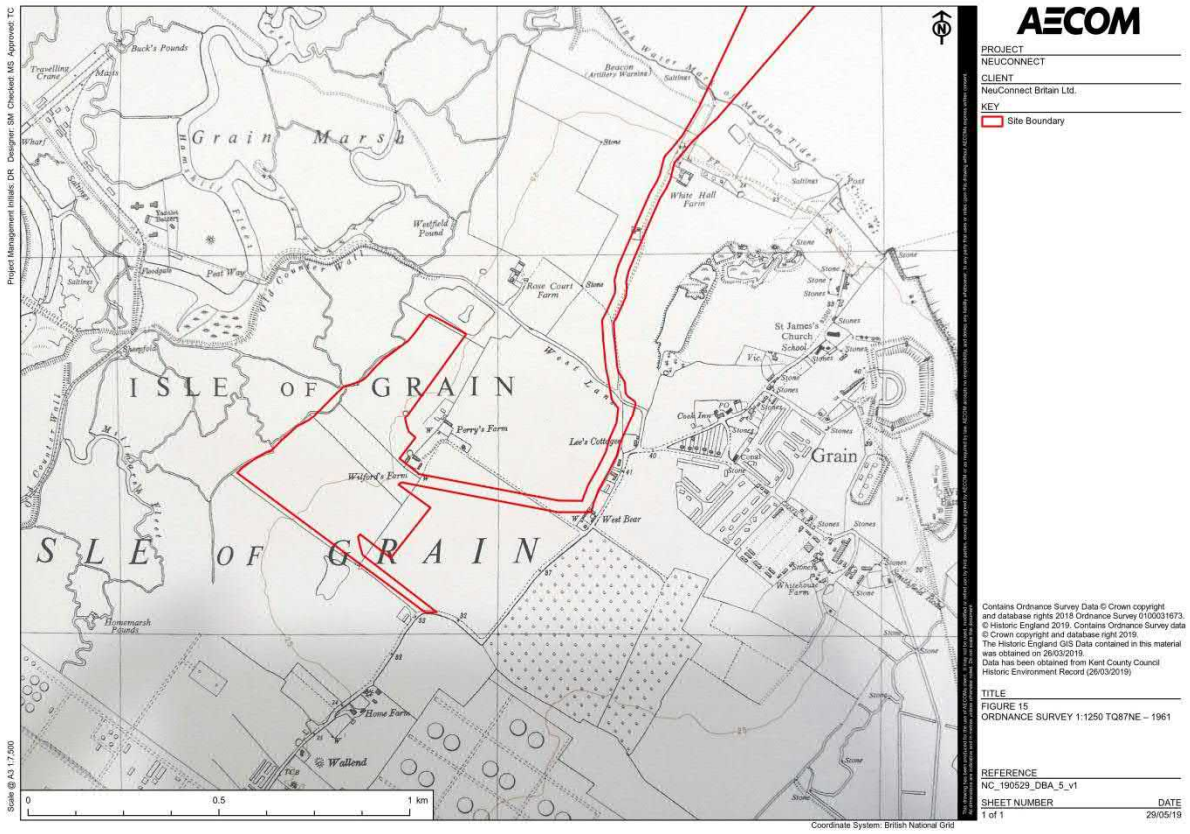

Figure 15 Ordnance Survey 1:1250 TQ87NE map of 1961

Appendix D Plates

Plate 1 View towards the south-east of the attenuation pond area of the proposed development

Plate 2 South-facing view of the proposed location of the converter station

Plate 3 East-facing view of potential military remains within the footprint of the proposed DC cable route

Plate 4 World War II Anti-Tank Obstacles on the Foreshore [BH1] looking northwest

Plate 5 View to Site from Grain Fort [BH5] with Church of St James [BH3] to right side of shot and Old Vicarage [BH6] to left of centre.

Plate 6 View to Rosecourt Farm [BH10] from site

Plate 7 Wilford's Farm [BH11] with Site in background

Appendix E Consultation

Boscher, Loic

From: heritage@kent.gov.uk
Sent: 26 March 2019 10:07
To: Boscher, Loic
Subject: RE: KHER search NeuConnect (Isle of Grain)

Dear Loïc,

I have had a look, and discussed this with Ben and with Lis Dyson. Ben has provided me with a detailed description of sites and reports that should be included in the search. I think the simplest way of achieving this is to apply a 3km buffer from the site boundary: your search area will then include the key Palaeolithic sites that Ben and Lis have mentioned, as well as details of all the archaeological interventions on the south-east coast of Grain near Thamesport and the power station sites, and all of the 'higher ground' of the Isle of Grain (the area of Head and River Terrace Gravels and margins). The charge will be £260 in this case due to the size and complexity of the search area. We do not charge VAT.

Kind regards,

Rose

Dr Rose Broadley | Historic Environment Record Officer | Environment, Planning and Enforcement | Heritage Conservation Group
Kent County Council | Maidstone, ME14 1XX | Tel: **03000 419190 | www.kent.gov.uk/HER**

From: Boscher, Loic [mailto:Loic.Boscher@aecom.com]
Sent: 25 March 2019 13:53
To: Heritage Conservation - GT
Subject: RE: KHER search NeuConnect (Isle of Grain)

Sorry about that, please find the files attached this time!

Kind regards,
Loic

From: heritage@kent.gov.uk [mailto:heritage@kent.gov.uk]
Sent: 25 March 2019 10:43
To: Boscher, Loic
Subject: RE: KHER search NeuConnect (Isle of Grain)

Dear Loïc,

Thank you for your email. I think the attachments are missing though – could you send those over? Then I will consider the processes involves and the sizes of the search areas and come back to you with a quote.

Best wishes,

Rose

Dr Rose Broadley | Historic Environment Record Officer | Environment, Planning and Enforcement | Heritage Conservation Group
Kent County Council | Maidstone, ME14 1XX | Tel: **03000 419190 | www.kent.gov.uk/HER**

From: Boscher, Loic [mailto:Loic.Boscher@aecom.com]
Sent: 22 March 2019 16:02
To: Heritage Conservation - GT
Subject: KHER search NeuConnect (Isle of Grain)

Good afternoon Rose,

Please could you provide me with a quotation for a KHER search comprising a 1km buffer surrounding the attached redline boundary for designated assets and a roughly 500m boundary for non-designated assets. Following advice from Ben Found, we'd like to also include all gravel and head deposits in the area into the 'non-designated boundary' where it extends beyond the 500m buffer. I've attached a jpg of the British Geological Society website showing the extent of these deposits (the orange and pink layers). Let me know if this is something you can do with the pdf and jpg attached or if you need me to provide a shape file. The RLB boundary is defined in this case as both the red line and the dashed purple line extending northeast to the Mean High Water mark (MHW) on the attached pdf.

The site is centred roughly on NGR point TQ 88151 76564.

I will require both SHAPE files for entry into GIS software and the KHER output (preferably as pdf) for the following records:

- full entries for Historic Environment Records;
- full entries for monuments (monuments points, polygons and lines);
- full entries for Previous Archaeological Investigations (events points, polygons and lines);
- full entries for Archaeological Priority Areas/Zones;
- full entries for Ancient/Historic Burial grounds;
- Kent HLC

Following receipt of the quotation I'll confirm whether we wish to proceed with the search and place an order.

I know this is a bit non-standard so please don't hesitate to contact me on my direct dial below if you have any questions.

Kind regards,
Loic

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Boscher, Loic

From:	Calder, Annie
Sent:	04 March 2019 09:22
To:	a.bicket@wessexarch.co.uk
Cc:	Cramond, Tom; Boscher, Loic
Subject:	FW: NeuConnect cable and associated works.
Attachments:	RE: Proposed development of a converter station, substation and underground DC electricity cables on land at Grain, Isle of Grain.

Hi Andrew

AECOM will be producing the cultural heritage chapter for terrestrial impacts. In lieu of a formal scoping report, I've emailed KCC's archaeology officer and HE for their comments to our proposed methodology, and for your reference I've included their responses below, and attached.
We haven't yet commenced with our baseline study, plan to do so in the next few weeks, but if you're more advanced with your baseline, could you forward your constraints mapping for the intertidal zone to MHW mark? We are likely to refer to the same assets in our baseline reports, but I want to make sure, for the impact assessment, that we x-ref to your chapter where relevant and avoid duplicating impacts.

Drop me a line if you have any queries, or if you think we may be able to help with baseline data.

Best regards
Annie

Annie Calder
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aecom.com

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From: Roberts, Paul [mailto:Paul.Roberts@HistoricEngland.org.uk]
Sent: 01 March 2019 17:24
To: Calder, Annie
Cc: ben.found@kent.gov.uk
Subject: RE: NeuConnect cable and associated works.

Dear Annie,

Thanks for consulting Historic England about this Screening Application. We have been formally consulted by the Marine Management Organisation about the offshore and intertidal works, but not by Medway Council regarding the terrestrial component of the project. However, I've seen Ben Founds Screening advice to the Council and I concur with his advice to them.

I note that you mention your liaison with Wessex Archaeology regarding the seabed and intertidal part of the project. During the course of this would you ensure that the potential for the remains of the Second World War heavy anti-aircraft batteries, Roman cemetery and Iron Age settlement north of Rosecourt farm are not overlooked, please? I'm sure that you wouldn't overlook them; it's just that some of them might be beyond your study zone but above Mean High Water, which is presumably the edge of Wessex Archaeology's Project Area.

For information, with respect to the intertidal zone we advised the MMO that:

- Provision should be made to liaise, share information and integrate the works of the intertidal and terrestrial project,
- KCC Heritage Team should also be consulted about the intertidal work and
- The details of the proposed direct drilling, including the details of the route, depth, trajectory, launch pits and breakout points should be carefully considered and amended where necessary in order to avoid harm to archaeological remains.

I hope this is of some assistance

Regards,
Paul

Paul D Roberts MCIfA
Inspector of Ancient Monuments for Kent and Sussex

Development Management Team | Planning Group
Historic England | Eastgate Court, 195-205 High Street, Guildford, GU1 3EH
Direct dial: 07711 095202

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From: Roberts, Paul
Sent: 19 February 2019 12:27
To: 'annie.calder@aecom.com'
Cc: ben.found@kent.gov.uk
Subject: NeuConnect cable and associated works.

Dear Annie,

Thanks for consulting Historic England about this proposal. We would be pleased to provide some initial pre-application advice about the scope of your EIA, although I expect it will be a few weeks before we can respond. We offer a free initial stage of pre-application advice in the first instance; following that, if further advice is required, we can offer our Extended Pre-application service, which is charged on a cost-recovery basis. Charging will only commence after a free cycle of advice and if the service is formally commissioned from us. Further information on

our Extended Pre-application service can be found on our website at the following address: www.HistoricEngland.org.uk/EAS. While we offer our pre-application advice confidentially to you, we advise that it is usually best to work in partnership with District and County Council conservation staff. I note that you've been in contact with Ben Found at KCC so I'll copy him in to this, for information.

Thank you for sending the Screening Report. We have already commented on a similar report for the intertidal and seabed element of the proposed scheme via the Marine Management Organisation. One of our recommendations is very likely to be that assessment should cover the overlap between the terrestrial and intertidal elements of the scheme.

Regards,

Paul D Roberts MCIfA
Inspector of Ancient Monuments for Kent and Sussex

Development Management Team | Planning Group
Historic England | Eastgate Court, 195-205 High Street, Guildford, GU1 3EH
Direct dial: 07711 095202

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Boscher, Loic

From:	Ben.Found@kent.gov.uk
Sent:	11 February 2019 16:01
To:	Calder, Annie
Subject:	RE: Proposed development of a converter station, substation and underground DC electricity cables on land at Grain, Isle of Grain.
Attachments:	KCC Spec Manual B_Generic standard DBA+Pal (DRAFT)_Revised by KCC 12.10.18.docx

Hi Annie

I am sorry that I have not been able to get back to you before now, but have set out some initial thoughts below. I think the outline scope set out in your email below seems reasonable. I have attached a copy of our generic standards for archaeological desk-based assessments (including for areas with Palaeolithic potential) and I would suggest your assessment is prepared in-line with these.

I note you are proposing a 500m study area, I think this is reasonable, provided that this is a true 500m buffer from the red-line boundary, not 500m from a central point. You might however want to consider using a custom search area, such that you take in more of the 'higher ground' of the Isle of Grain (the area of Head and River Terrace Gravels and margins) as this might help you better understand the archaeological character of the area. Our HER team are able to accommodate irregular search areas, including search areas based on custom GIS shapefile. Recent archaeological investigations on the Isle of Grain have mostly been focussed on the southern/south-eastern side of Grain (along the Medway) around the Power Stations, Thamesport, BritNed and the LNG site. You should look at the various reports arising from these works, which although outside your proposed study area will be informative to your study.

There is a significant gap in our HER data around the Isle of Grain as we are aware that major excavations were undertaken by the Kent Archaeological Rescue Unit from the late 1970s over a period of some 16+years around Rose Court Farm (J. Clubb Ltd site). As far as I am aware, these works have never been published (other than in a short 2002 note in Brian Philp's *Archaeology in the Front Line* and mentions in Kent Archaeological Review). We do not have comprehensive plans showing areas investigated or what was exposed. As such the HER entry for this major programme of archaeological investigation is very limited.

Hopefully you will be aware of Historic England's study of the Hoo Peninsula and its landscapes – here is a link to the project summary web-page
https://historicengland.org.uk/research/current/discover-and-understand/rural-heritage/hoo-peninsula/

I note the proposed geotechnical works. If you are not proposing to monitor the boreholes directly, then it is essential that the resulting logs are made available to you. If SI test-pits are proposed as a follow-up stage of work, then these would warrant archaeological monitoring (potentially including input from a Palaeolithic/Pleistocene specialist).

I trust that the above comments are helpful and would be pleased to discuss further as required.

Kind regards
Ben

Ben Found | Senior Archaeological Officer | Heritage Conservation | Kent County Council | Invicta House, County Hall, Maidstone ME14 1XX |

Telephone: 03000 413375 | Mobile: 07876 577275 | www.kent.gov.uk |

From: Calder, Annie <annie.calder@aecom.com>
Sent: 11 February 2019 09:48
To: Found, Ben - GT EPE <Ben.Found@kent.gov.uk>
Subject: RE: Proposed development of a converter station, substation and underground DC electricity cables on land at Grain, Isle of Grain.

Hi Ben

I haven't heard from you so I'm assuming you're fine with our proposed scope of work. I'll be asking the team to commence with the baseline in the next week.

Kind regards
Annie

From: Calder, Annie
Sent: 06 February 2019 10:12
To: ben.found@kent.gov.uk
Subject: RE: Proposed development of a converter station, substation and underground DC electricity cables on land at Grain, Isle of Grain.

Hi Ben

Just to follow up on my earlier email. I have been informed that the GI team plan to carry out preliminary GI on the SE section of the Site, which is the site of the proposed converter station. The works will comprise six boreholes and three cone penetration test areas.
We do not plan to monitor the boreholes on site, as we wouldn't see anything. We may monitor test pitting in the area, but this is scheduled for later in the year. I'll keep you informed.

Annie

From: Calder, Annie
Sent: 04 February 2019 16:52
To: 'ben.found@kent.gov.uk'
Subject: Proposed development of a converter station, substation and underground DC electricity cables on land at Grain, Isle of Grain.

Our ref: MC/18/3363
Your ref: MC 18 3363 LE01

Hi Ben

I'm going to be managing the cultural heritage for a proposed development at the Isle of Grain, and have been forwarded your response to the screening request.

A scoping report is not being prepared, so I've set out a brief scope that we can discuss if you'd like to.

Firstly, just to keep you in the loop, the marine archaeology assessment is being carried out by Wessex Archaeology. We have worked with Wessex a lot on various EIA schemes in the past, including Dogger Bank Offshore wind farm.

Wessex's assessment will stop at MHW, which is where our assessment will begin. I will be responsible for liaising with Wessex and x-ref to their assessment as necessary to ensure that potential impacts aren't double-counted.

There is still a certain amount of flexibility in the design, particularly in terms of where the HDD will start from, so I will be working with the design team to make sure that the GII anti-tank cubes and dragon's teeth are avoided entirely via HDD. In order to help inform the design, we are going to produce a cultural heritage DBA (archaeology/built heritage/historic landscape). The study area for non-designated assets will be 500 from the redline boundary in the screening report, which is, as you may be aware, a lot larger than site area that will be required and be taken forward to planning. A 500m study corridor will also be adopted for the cable system to MHW.
Provisionally, a study area of 1km from the redline boundary will be adopted for the assessment of change to the setting of designated assets. However, this study area will be further informed by a site visit, and assets beyond 1km may be included in the baseline assessment where it is assessed that their setting extends into the Site.
The results of previous investigations, archaeological and geotechnical, will be reviewed and incorporated into the baseline. This preliminary information will be used to understand the depositional sequence from MHW to the Site, and to help ID deposits with archaeological potential.
Once all available information has been collated, we can review the results and gauge whether there are any gaps in knowledge that may compromise the impact assessment process.

Let me know if you'd like to talk this through and I'll give you a call whenever you're free. I should be in the office all this week.

Best regards
Annie

Annie Calder
Associate Director – Heritage
Environment & Ground Engineering, UK
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Appendix F Borehole Logs

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	CR	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	2.74 mOD
Logged	LF	13/05/2019	Dando 3000 Hand dug pit then cable percussion drilling to 20m.	0.00	20.00	150	2.80	**Coordinates (m)**	E 587579.97
Checked		**End**						**National Grid**	N 176569.45
Approved		14/05/2019							

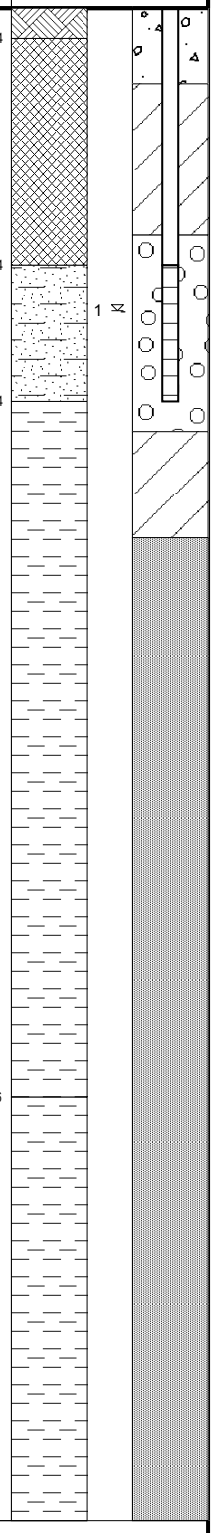
Samples and Tests

Depth	Type & No.	Records	Date / Casing	Time / Water
			13/05/19	0900
			0.00	Dry
0.30	ES 1	PID=2.1 ppmv		
0.30 - 0.40				
1.00	ES 2	PID=1.7 ppmv		
1.00	D 3			
1.00	HV		0.00	Dry
1.20	UT 4	p 67kPa, r 29kPa		
1.20 - 1.65		35 blows 100% rec		
1.70 - 2.15	SPTS	N=12 (1,1/2,2,4,4)	0.00	Dry
1.70	D 5			
1.70 - 2.15	D 6			
1.70 - 2.00	B 7			
2.00	ES 8	PID=1.5 ppmv		
2.00	SPTS		0.00	Wet
2.20 - 2.65	D 9	N=8 (1,1/1,2,2,3)		
2.20 - 2.65				
3.00	ES 10	PID=1.0 ppmv		
3.00				
3.20 - 3.65	UT 11	35 blows 100% rec	2.80	Dry
3.70 - 4.15	SPTS	N=13 (1,2/3,2,4,4)	2.80	Dry
3.70	D 12		13/05/19	1700
3.70 - 4.15	D 13		2.80	Dry
4.00	ES 14	PID=1.0 ppmv		
4.00			14/05/19	0800
4.20 - 4.65	UT 15	45 blows 100% rec	2.80	Dry
			2.80	Dry
4.70 - 5.15	SPTS	N=12 (1,2/2,3,3,4)	2.80	Dry
4.70	D 16			
4.70 - 5.15	D 17			
5.00	ES 18	PID=<1.0 ppmv		
5.00				
5.20 - 5.65	UT 19	50 blows 89% rec	2.80	Dry
5.70 - 6.15	SPTS	N=14 (2,2/3,3,3,5)	2.80	Dry
5.70	D 20			
5.70 - 6.15	D 21			
6.50	ES 22	PID=<1.0 ppmv		
6.50				
6.70 - 7.15	UT 23	50 blows 100% rec	2.80	Dry
7.20 - 7.65	SPTS	N=15 (2,2/3,4,4,4)	2.80	Dry
7.20	D 24			
7.20 - 7.65	D 25			
8.00	ES 26	PID=<1.0 ppmv		
8.00				
8.20 - 8.65	UT 27	55 blows 100% rec	2.80	Dry
8.70 - 9.15	SPTS	N=15 (2,2/3,4,3,5)	2.80	Dry
8.70	D 28			
8.70 - 9.15	D 29			
9.50	ES 30	PID=<1.0 ppmv		
9.50				
9.70 - 10.15	UT 31	60 blows 100% rec	2.80	Dry

Strata Description

Main	Detail	Depth, Level (Thickness)
Dark brown slightly sandy slightly gravelly CLAY. Gravel is angular fine chalk subroundedfineto medium chert and rare angular fine brick. (TOPSOIL)		(0.20) 0.20 +2.54
Soft brown mottled dark reddish brown slightly gravelly CLAY. Gravel is subrounded fine to coarse chert and rare angular fine brick and chalk to 1.20m. Becoming slightly sandy from 1.60m. (MADE GROUND?)		(1.50)
Brown clayey fine to medium SAND. (SUPERFICIAL DEPOSITS)		1.70 +1.04 (0.90)
Firm to stiff brown with grey mottled CLAY with rare pockets of orangish brown fine sand. (LONDON CLAY)		2.60 +0.14
	6.50 selenite/ gypsum	
Stiff dark grey very closely fissured CLAY. (LONDON CLAY)		7.20 -4.46 (4.60)
	9.50-11.00 nodule of pyrite and rare shell fragments 9.50-20.00 pyrite stringers	

Legend / Backfill



Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
1	2.00	Driller recorded no flow	

Depth Related Remarks

Depths (m)	Remarks
0.00 - 2.60	50mm diameter standpipe installed.

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:55

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH108

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	CR	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	2.74 mOD
Logged	LF	13/05/2019	Dando 3000 Hand dug pit then cable percussion drilling to 20m.	0.00	20.00	150	2.80	**Coordinates (m)**	E 587579.97
Checked		**End**						**National Grid**	N 176569.45
Approved		14/05/2019							

Samples and Tests

Strata Description

Depth	Type & No.	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
10.20 - 10.65 10.20 10.20 - 10.65	SPTS D 32 D 33	N=18 (2,2/3,4,5,6)	2.80	Dry	Stiff dark grey very closely fissured CLAY. (LONDON CLAY)				
11.00 11.00 11.20 - 11.65	ES 34 UT 35	PID=<1.0 ppmv 65 blows 89% rec	2.80	Dry					
11.70 - 12.15 11.70 11.70 - 12.15	SPTS D 36 D 37	N=21 (2,3/4,5,6,6)	2.80	Dry					
12.50 12.50 12.70 - 13.15	ES 38 UT 39	PID=<1.0 ppmv 80 blows 100% rec	2.80	Dry					
13.20 - 13.65 13.20 13.20 - 13.65	SPTS D 40 D 41	N=21 (3,3/4,5,5,7)	2.80	Dry			(12.80)		
14.00 14.00 14.20 - 14.65	ES 42 UT 43	PID=<1.0 ppmv 90 blows 89% rec	2.80	Dry		14.00 siltstone gravel			
14.70 - 15.15 14.70 14.70 - 15.15	SPTS D 44 D 45	N=23 (3,4/5,5,6,7)	2.80	Dry					
15.50 15.50 15.70 - 16.15	ES 46 UT 47	PID=<1.0 ppmv 65 blows 100% rec	2.80	Dry					
16.20 - 16.65 16.20 16.20 - 16.65	SPTS D 48 D 49	N=24 (3,4/5,5,6,8)	2.80	Dry					
17.00 17.00 17.20 - 17.65	ES 50 UT 51	PID=<1.0 ppmv 65 blows 89% rec	2.80	Dry					
17.70 - 18.15 17.70 17.70 - 18.15	SPTS D 52 D 53	N=25 (3,4/5,6,7,7)	2.80	Dry					
18.50 18.50 18.70 - 19.15	ES 54 UT 55	PID=<1.0 ppmv 80 blows 100% rec	2.80	Dry					
19.20 - 19.65 19.20 19.20 - 19.65	SPTS D 56 D 57	N=23 (3,4/5,5,6,7)	2.80	Dry					
			14/05/19 2.80	1300 Dry					
~~20.00~~ 20.00	~~ES 58~~	~~PID=<1.0 ppmv~~			END OF EXPLORATORY HOLE		~~20.00~~ ~~-17.26~~		

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:55

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH108

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	CR	Start	Equipment, Methods and Remarks	Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level	7.19 mOD
Logged	LF	14/05/2019	Dando 3000 Hand dug pit then cable percussion drilling to 20m.	0.00	20.00	150	3.00	Coordinates (m)	E 587731.78
Checked		End						National Grid	N 176475.30
Approved		15/05/2019							

Samples and Tests

Depth	Type & No.	Records	Date / Casing	Time / Water
			14/05/19 0.00	1400 Dry
0.30 0.30 - 0.40	ES 1	PID=1.9 ppmv		
1.00 1.00 1.00 1.00 1.20 - 1.65	HV ES 2 D 3 UT 4	PID=1.0 ppmv p 66kPa, r 22kPa 35 blows 88% rec	0.00	Dry
1.70 - 2.15 1.70 1.70 - 2.15 2.00 2.00 2.20 - 2.65	SPTS D 5 D 6 ES 7 UT 8	N=8 (1,1/2,2,2,2) PID=<1.0 ppmv 30 blows 100% rec	0.00 0.00	Dry Dry
2.70 - 3.15 2.70 2.70 - 3.15 3.00 3.00 3.20	SPTS D 9 D 10 ES 11 UT 12	N=7 (1,1/1,2,2,2) PID=<1.0 ppmv 25 blows 89% rec	0.00 2.80	Dry Dry
3.70 - 4.15 3.70 3.70 - 4.15 4.00 4.00 4.20 - 4.65	SPTS D 13 D 14 ES 15 UT 16	N=9 (1,2/2,2,2,3) PID=<1.0 ppmv 30 blows 100% rec	2.80 3.00	Dry Dry
4.70 - 5.15 4.70 4.70 - 5.15 5.00 5.00 5.20 - 5.65	SPTS D 17 D 18 ES 19 UT 20	N=13 (2,2/3,3,3,4) PID=<1.0 ppmv 35 blows 100% rec	3.00 3.00	Dry Dry
5.70 - 6.15 5.70 5.70 - 6.15	SPTS D 21 D 22	N=12 (1,2/3,3,3,3)	3.00	Dry
6.50 6.50 6.70 - 7.15	ES 23 UT 24	PID=<1.0 ppmv 35 blows 100% rec	 3.00	 Dry
7.20 - 7.65 7.20 7.20 - 7.65	SPTS D 25 D 26	N=12 (1,3/2,3,3,4)	3.00	Dry
8.00 8.00 8.20 - 8.65	ES 27 UT 28	PID=<1.0 ppmv 50 blows 100% rec	 3.00	 Dry
8.70 - 9.15 8.70 8.70 - 9.15	SPTS D 29 D 30	N=14 (1,3/3,3,4,4)	3.00	Dry
9.50 9.50 9.70 - 10.15	ES 31 UT 32	PID=<1.0 ppmv 50 blows 100% rec	 3.00	 Dry
			14/05/19 3.00	1700 Dry

Strata Description

Main	Detail	Depth, Level (Thickness)
Soft brown slightly sandy CLAY. (TOPSOIL)		0.15 (0.15) +7.04
Soft brown slightly sandy slightly gravelly CLAY. Sand is medium to coarse. Gravel is subrounded medium to coarse chert. Rare fine brick gravel. (MADE GROUND)		0.40 (0.25) +6.79
Soft light brown slightly sandy slightly gravelly CLAY. Becoming sandy from 2.00m. Sand is fine to medium. Gravel is subrounded fine to medium chert. (SUPERFICIAL DEPOSITS)		2.70 (2.30) +4.49
Soft brown mottled light grey slightly silty CLAY with occasional very closely spaced fissuring from 3.70m and rare relic rootlets in the grey silt. (LONDON CLAY)	5.00 pockets of fine orangish brown and black sand	5.70 (3.00) +1.49
Firm to stiff dark grey slightly silty CLAY with occasional pockets of fine black silty sand and occasional pyrite stringers. (LONDON CLAY)		

Legend | Backfill

Water strike marker: 1 (at 5.00 m)

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
1	5.00	Seepage	

Depth Related Remarks

Depths (m) | Remarks

Hard Boring

Depths (m) | Duration (mins) | Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

AGS

Scale 1:50 24/05/2019 11:52:56

Project	NeuConnect Isle of Grain
Project No.	G9017-19
Carried out for	AECOM

Borehole **BH109**

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	CR	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	7.19 mOD
Logged	LF	14/05/2019	Dando 3000 Hand dug pit then cable percussion drilling to 20m.	0.00	20.00	150	3.00	**Coordinates (m)**	E 587731.78
Checked		**End**						**National Grid**	N 176475.30
Approved		15/05/2019							

Samples and Tests

Strata Description

Depth	Type & No.	Records	Date / Time Casing / Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
10.20 - 10.65 10.20 10.20 - 10.65	SPTS D 33 D 34	N=17 (1,2/3,4,5,5)	~~3.00~~ ~~Dry~~ 15/05/19 0900 3.00 Dry	Firm to stiff dark grey slightly silty CLAY with occasional pockets of fine black silty sand and occasional pyrite stringers. (LONDON CLAY)				
10.70 10.70 - 11.15	D 35 D 36							
11.00 11.00 11.20 - 11.65	ES 37 UT 38	PID=<1.0 ppmv 50 blows 100% rec	 3.00 Dry					
11.70 - 12.15 11.70 11.70 - 12.15	SPTS D 39 D 40	N=16 (2,2/3,3,4,6)	3.00 Dry					
12.50 12.50 12.70 - 13.15	ES 41 UT 42	PID=<1.0 ppmv 60 blows 100% rec	 3.00 Dry			(14.30)		
13.20 - 13.65 13.20 13.20 - 13.65	SPTS D 43 D 44	N=19 (2,3/4,4,5,6)	3.00 Dry					
14.00 14.00 14.20 - 14.65	ES 45 UT 46	PID=<1.0 ppmv 70 blows 100% rec	 3.00 Dry					
14.70 - 15.15 14.70 14.70 - 15.15	SPTS D 47 D 48	N=23 (3,3/4,5,7,7)	3.00 Dry					
15.50 15.50 15.70 - 16.05	ES 49 UT 50	PID=<1.0 ppmv 100 blows 67% rec	 3.00 Dry		15.70 claystone in top of UT			
16.10 - 16.55 16.10 16.10 - 16.55	SPTS D 51 D 52	N=27 (3,4/5,6,8,8)	3.00 Dry					
17.00 17.00 17.20 - 17.65	ES 53 UT 54	PID=<1.0 ppmv 80 blows 89% rec	 3.00 Dry					
17.70 - 18.15 17.70 - 18.15	SPTS D 55	N=25 (8,5/5,6,6,8)	3.00 Dry		17.70-19.20 subangular coarse claystone recovered as gravel			
18.50 18.50 18.70 - 19.15	ES 56 UT 57	PID=<1.0 ppmv 100 blows 100% rec	 3.00 Dry		18.50 shell fragments			
19.20 - 19.65 19.20 19.20 - 19.65	SPTS D 58 D 59	N=25 (2,4/5,6,6,8)	3.00 Dry					
			15/05/19 1700 3.00 Dry					
~~20.00~~ 20.00	~~ES 60~~	~~PID=<1.0 ppmv~~		END OF EXPLORATORY HOLE		~~20.00~~ ~~-12.81~~		

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

AGS

Scale 1:50

24/05/2019 11:52:56

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH109

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	TL	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	6.74 mOD
Logged	SW	13/05/2019	Dando 3000 Hand dug pit then cable percussion drilling to 20m.	0.00	20.00	150	1.60	**Coordinates (m)**	E 587583.85
Checked		**End**						**National Grid**	N 176420.36
Approved		14/05/2019							

Samples and Tests

Depth	Type & No.	Records	Date Casing	Time Water
			13/05/19	1223
0.20	HV	p 107kPa, r 26kPa	0.00	Dry
0.20	D 1			
0.30	ES 2	PID=<1.0 ppmv		
0.30	B 3			
0.30 - 0.60	ES 4			
0.60	B 5	PID=<1.0 ppmv		
0.60				
0.60 - 1.00				
1.00	D 6			
1.20 - 1.65	SPTS	N=9 (1,1/2,2,2,3)	0.00	1.10
1.20 - 1.65	D 7			
1.20 - 1.65	B 8			
1.30	ES 9	PID=<1.0 ppmv		
1.30	D 10			
1.30				
2.20 - 2.65	UT 11	25 blows 100% rec	1.60	Damp
2.30	ES 15	PID=<1.0 ppmv		
2.30	D 16			
2.30				
2.65	D 12		1.60	Damp
2.70 - 3.15	SPTS	N=10 (1,2/2,2,3,3)		
2.70 - 3.15	D 13			
2.70 - 3.15	B 14			
3.20 - 3.65	UT 17	40 blows 100% rec	1.60	Damp
3.30	ES 20	PID=<1.0 ppmv		
3.30	D 21			
3.30				
3.65	D 18		1.60	Damp
3.70 - 4.15	SPTS	N=11 (1,2/2,2,3,4)		
3.70 - 4.15	D 19			
3.70 - 4.15	B 22			
4.20 - 4.65	UT 23	45 blows 100% rec	1.60	Damp
4.30	ES 26	PID=<1.0 ppmv		
4.30	D 27			
4.30				
4.65	D 24		1.60	Damp
4.70 - 5.15	SPTS	N=16 (2,3/3,4,4,5)		
4.70 - 5.15	D 25			
4.70 - 5.15	B 28			
5.20 - 5.65	UT 29	45 blows 100% rec	1.60	Damp
5.30	ES 32	PID=<1.0 ppmv		
5.30	D 33			
5.30				
5.65	D 30		1.60	Damp
5.70 - 6.15	SPTS	N=16 (2,3/3,4,4,5)		
5.70 - 6.15	D 31			
6.30	D 34			
6.70 - 7.15	UT 35	40 blows 100% rec	1.60	Damp
6.80	ES 38	PID=<1.0 ppmv		
6.80				
7.15	D 36		1.60	Damp
7.20 - 7.65	SPTS	N=19 (2,3/4,4,5,6)		
7.20 - 7.65	D 37			
7.30	D 39			
8.20 - 8.65	UT 40	50 blows 89% rec	1.60	Damp
8.30	ES 43	PID=<1.0 ppmv		
8.30	D 44			
8.30				
8.65	D 41		1.60	Damp
8.70 - 9.15	SPTS	N=26 (15,8/8,6,6,6)		
8.70 - 9.15	D 42			
8.70 - 9.10	B 45		13/05/19	1800
			1.60	Damp
9.20	W 46			
9.30	D 47		14/05/19	0800
			1.60	8.60
9.70 - 10.15	UT 48	60 blows 56% rec	1.60	Damp
9.80	ES 51	PID=<1.0 ppmv		
9.80				

Strata Description

Main	Detail	Depth, Level (Thickness)	Legend	Backfill
Brown slightly clayey slightly gravelly SAND. SaAnd is fine to coarse. Gravel is angular to subangular, fine to coarse flint. (POSSIBLE MADE GROUND)		(0.60)		
Orangish brown slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is angular to subangular fine to coarse flint.		0.60 +6.14 (0.70)		
Soft becoming firm brown mottled bluish grey slightly sandy CLAY. Sand is fine to coarse.		1.30 +5.44 (4.35)		
Firm/stiff brownish grey slightly silty CLAY.		5.65 +1.09 (3.65)		
Stiff becoming very stiff grey slightly silty CLAY.	8.60-8.90 becoming slightly gravelly. Gravel is rounded to subangular fine to coarse claystone (mudstone) 9.30-10.10 recovered as very soft to firm	9.30 -2.56		

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
1	1.20	Rose to 1.10 m after 20 minutes. Seepage	1.50
2	8.60	Rose to 8.55 m after 20 minutes. Seepage	

Depth Related Remarks

Depths (m)	Remarks
0.00 - 19.00	50mm diameter standpipe installed.

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:56

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH110

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	TL	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	6.74 mOD
Logged	SW	13/05/2019	Dando 3000 Hand dug pit then cable percussion drilling to 20m.	0.00	20.00	150	1.60	**Coordinates (m)**	E 587583.85
Checked		**End**						**National Grid**	N 176420.36
Approved		14/05/2019							

Samples and Tests

Depth	Type & No.	Records	Date Casing	Time Water
10.15	D 49			
10.20 - 10.65	SPTS	N=19 (2,3/3,4,6,6)	1.60	Damp
10.20 - 10.65	D 50			
10.30	D 52			
11.20 - 11.65	UT 53	65 blows 100% rec	1.60	Damp
11.30	ES 56	PID=<1.0 ppmv		
11.30	D 57			
11.30				
11.65	D 54			
11.70 - 12.15	SPTS	N=22 (3,3/4,5,6,7)	1.60	Damp
11.70 - 12.15	D 55			
12.30	D 58			
12.70 - 13.15	UT 59	60 blows 100% rec	1.60	Dry
12.80	ES 62	PID=<1.0 ppmv		
12.80				
13.15	D 60			
13.20 - 13.65	SPTS	N=26 (5,5/6,6,7,7)	1.60	Dry
13.20 - 13.65	D 61			
13.30	D 63			
14.20 - 14.65	UT 64	65 blows 100% rec	1.60	Dry
14.30	ES 67	PID=<1.0 ppmv		
14.30	D 68			
14.30				
14.65	D 65			
14.70 - 15.15	SPTS	N=24 (4,4/6,6,6,6)	1.60	Dry
14.70 - 15.15	D 66			
15.30	D 69			
15.70 - 16.15	UT 70	65 blows 100% rec	1.60	Dry
15.80	ES 73	PID=<1.0 ppmv		
15.80				
16.15	D 71			
16.20 - 16.65	SPTS	N=29 (5,5/6,7,8,8)	1.60	Dry
16.20 - 16.65	D 72			
16.30	D 74			
17.20 - 17.65	UT 75	65 blows 100% rec	1.60	Dry
17.30	ES 78	PID=<1.0 ppmv		
17.30	D 79			
17.30				
17.65	D 76			
17.70 - 18.15	SPTS	N=29 (4,5/7,7,7,8)	1.60	Dry
17.70 - 18.15	D 77			
18.30	D 80			
18.70 - 19.15	UT 81	65 blows 100% rec	1.60	Dry
18.80	ES 84	PID=<1.0 ppmv		
18.80				
19.15	D 82			
19.20 - 19.65	SPTS	N=34 (5,6/7,7,9,11)	1.60	Dry
19.20 - 19.65	D 83			
19.30	D 85			
			14/05/19	1749
			1.60	Dry

Strata Description

Main	Detail	Depth, Level (Thickness)
Stiff becoming very stiff grey slightly silty CLAY.		(10.70)
END OF EXPLORATORY HOLE		20.00 -13.26

Legend

Backfill

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:56

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH110

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	CR	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	4.44 mOD
Logged	LF	10/05/2019	Dando 3000 Hand dug inspection pit then cable percussion drilling to 20m.	0.00	20.00	150	2.50	**Coordinates (m)**	E 587400.22
Checked		**End**						**National Grid**	N 176412.42
Approved		13/05/2019							

Samples and Tests

Strata Description

Depth	Type & No.	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
			10/05/19	1300	Topsoil.		(0.40)		
			0.00	Dry					
0.40	ES 1	PID=4.3 ppmv			Soft orangish brown mottled light grey sandy slightly gravelly CLAY. Sand is medium to coarse. Gravel is subangular to subrounded fine to coarse chert. (SUPERFICIAL DEPOSITS)		0.40 +4.04		
0.40							(0.60)		
1.00	ES 2	PID=1.2 ppmv					1.00 +3.44		
1.00	D 3				Orangish brown slightly gravelly clayey SAND. Sand is medium to coarse. Gravel is subrounded fine to coarse chert. (SUPERFICIAL DEPOSITS)				
1.00	SPTC		0.00	Dry					
1.20 - 1.65	B 4	N=18 (1,3/6,4,4,4)					(1.00)		
1.20 - 1.65									
2.00	ES 5	PID=1.6 ppmv					2.00 +2.44		
2.00	B 6				Soft brown slightly gravelly sandy CLAY. Sand is medium to coarse. Gravel is subrounded fine to coarse chert. (SUPERFICIAL DEPOSITS)				
2.00 - 2.65	SPTC		1.50	Dry			(0.40)		
2.20 - 2.65		N=11 (1,1/2,2,3,4)					2.40 +2.04		
					Stiff brown with occasional grey mottles CLAY. With localised pockets of orangish brown fine sand and rare rounded fine to medium chert gravel from 2.40-3.00m. (LONDON CLAY?)				
3.00	ES 7	PID=2.6 ppmv							
3.00									
3.20 - 3.65	UT 8	35 blows 100% rec	2.50	Dry			(1.60)		
3.70 - 4.15	SPTS	N=9 (1,2/2,2,2,3)	2.50	Dry					
3.70	D 9		10/05/19	1430					
3.70 - 4.15	D 10		2.50	Dry					
4.00	ES 11	PID=2.0 ppmv					4.00 +0.44		
4.00			13/05/19	1000	Stiff very closely fissured brown CLAY with frequent disseminated mica and occasional pockets of orangish brown fine sand. Possible selenite at 6.50m. (LONDON CLAY)				
4.20 - 4.65	UT 12	50 blows 100% rec	2.50	Dry					
			2.50	Dry					
4.70 - 5.15	SPTS	N=17 (2,2/4,3,5,5)	2.50	Dry					
4.70	D 13								
4.70 - 5.15	D 14								
5.00	ES 15	PID=<1.0 ppmv							
5.00									
5.20 - 5.65	UT 16	55 blows 100% rec	2.50	Dry					
5.70 - 6.15	SPTS	N=17 (2,3/3,4,5,5)	2.50	Dry					
5.70	D 17								
5.70 - 6.15	D 18								
							(4.70)		
6.50	ES 19	PID=<1.0 ppmv							
6.50									
6.70 - 7.15	UT 20	50 blows 100% rec	2.50	Dry					
7.20 - 7.65	SPTS	N=19 (2,3/4,4,5,6)	2.50	Dry					
7.20	D 21								
7.20 - 7.45	D 22								
8.00	ES 23	PID=<1.0 ppmv							
8.00									
8.20 - 8.65	UT 24	60 blows 100% rec	2.50	Dry					
8.70 - 9.15	SPTS	N=17 (2,4/4,4,4,5)	2.50	Dry			8.70 -4.26		
8.70	D 25				Stiff to very stiff very closely fissured grey CLAY with occasional small pockets of light grey silt. Possible selenite at 11.0m. (LONDON CLAY)				
8.70 - 9.15	D 26								
9.50	ES 27	PID=<1.0 ppmv							
9.50									
9.70 - 10.15	UT 28	70 blows 89% rec	2.50	Dry					

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
1	1.10	Seepage	

Depth Related Remarks

Depths (m)	Remarks
0.00 - 2.00	50mm diameter standpipe installed.

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:57

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH111

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	CR	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	4.44 mOD
Logged	LF	10/05/2019	Dando 3000 Hand dug inspection pit then cable percussion drilling to 20m.	0.00	20.00	150	2.50	**Coordinates (m)**	E 587400.22
Checked		**End**						**National Grid**	N 176412.42
Approved		13/05/2019							

Samples and Tests

Strata Description

Depth	Type & No.	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
10.20 - 10.65 10.20 10.20 - 10.65	SPTS D 29 D 30	N=21 (2,3/4,5,5,7)	2.50	Dry	Stiff to very stiff very closely fissured grey CLAY with occasional small pockets of light grey silt. Possible selenite at 11.0m. (LONDON CLAY)				
11.00 11.00 11.20 - 11.65	ES 31 UT 32	PID=<1.0 ppmv 70 blows 89% rec	 2.50	 Dry					
11.70 - 12.15 11.70 11.70 - 12.15	SPTS D 33 D 34	N=22 (2,4/4,5,6,7)	2.50	Dry					
12.50 12.50 12.70 - 13.15	ES 35 UT 36	PID=<1.0 ppmv 60 blows 100% rec	 2.50	 Dry					
13.20 - 13.65 13.20 13.20 - 13.65	SPTS D 37 D 38	N=22 (3,3/4,5,6,7)	2.50	Dry					
14.00 14.00 14.20 - 14.65	ES 39 UT 40	PID=<1.0 ppmv 70 blows 100% rec	 2.50	 Dry		14.00 pyrite	(11.30)		
14.70 - 15.15 14.70 14.70 - 15.15	SPTS D 41 D 42	N=23 (2,3/5,5,6,7)	2.50	Dry					
15.50 15.50 15.70 - 16.15	ES 43 UT 44	PID=<1.0 ppmv 70 blows 100% rec	 2.50	 Dry					
16.20 - 16.65 16.20 16.20 - 16.65	SPTS D 45 D 46	N=25 (3,3/5,6,6,8)	2.50	Dry		16.00 angular medium gravel of possible gypsum/ siltstone?			
17.00 17.00 17.20 - 17.65	ES 47 UT 8	PID=<1.0 ppmv 85 blows 88% rec	 2.50	 Dry					
17.70 - 18.15 17.70 17.70 - 18.15	SPTS D 49 D 50	N=28 (3,4/5,7,8,8)	2.50	Dry					
18.50 18.50 18.70 - 19.15	ES 51 UT 52	PID=<1.0 ppmv 85 blows 100% rec	 2.50	 Dry		18.50 small siltstone gravels			
19.20 - 19.65 19.20 19.20 - 19.65	SPTS D 53 D 56	N=25 (3,4/5,6,6,8)	2.50	Dry					
			13/05/19 2.50	1700 Dry					
~~20.00~~ 20.00	~~ES 55~~	~~PID=<1.0 ppmv~~			END OF EXPLORATORY HOLE		~~20.00~~ ~~-15.56~~		

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

AGS

Scale 1:50

24/05/2019 11:52:57

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH111

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	CR	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	8.87 mOD
Logged	LF	09/05/2019	Dando 3000	0.00	20.00	150	2.50	**Coordinates (m)**	E 587587.18
Checked		**End**	Hand dug inspection pit then cable percussion drilling to 20m.					**National Grid**	N 176293.54
Approved		10/05/2019	Checked for water flow at 20m started dry and remained dry after 20 minutes.						

Samples and Tests

Depth	Type & No.	Records	Date Casing	Time Water
			09/05/19	0915
			0.00	Dry
0.30	ES 1	PID=3.3 ppmv		
0.30				
1.00	ES 2	PID=1.1 ppmv		
1.00	D 3			
1.00	SPTC		0.00	1.05
1.20 - 1.65	D 4	N=17 (1,3/4,5,4,4)		
1.20 - 1.60				
1.60	D 5			
2.00	ES 6	PID=2.4 ppmv		
2.00				
2.20 - 2.65	UT 7	30 blows 100% rec	2.10	Wet
2.70 - 3.15	SPTS	N=11 (1,2/2,2,3,4)	2.10	Wet
2.70	D 8			
2.70 - 3.15	D 9			
3.00	ES 10	PID=1.7 ppmv		
3.00				
3.20 - 3.65	UT 11	40 blows 100% rec	2.50	Dry
3.70 - 4.15	SPTS	N=15 (1,2/3,3,4,5)	2.50	Dry
3.70	D 12			
3.70 - 4.15	D 13			
4.00	ES 14	PID=<1.0 ppmv		
4.00				
4.20 - 4.65	UT 15	40 blows 100% rec	2.50	Dry
4.70 - 5.15	SPTS	N=15 (2,2/3,3,4,5)	2.50	Dry
4.70	D 16			
4.70 - 5.15	D 17			
5.00	ES 18	PID=1.1 ppmv		
5.00				
5.20 - 5.65	UT 19	50 blows 100% rec	2.50	Dry
5.70 - 6.15	SPTS	N=17 (2,2/4,4,4,5)	2.50	Dry
5.70	D 20			
5.70 - 6.15	D 21			
6.50	ES 22	PID=<1.0 ppmv		
6.50				
6.70 - 7.15	UT 23	50 blows 100% rec	2.50	Dry
7.20 - 7.65	SPTS	N=20 (2,3/4,5,5,6)	2.50	Dry
7.20	D 24			
7.20 - 7.65	D 25			
8.00	ES 26	PID=1.0 ppmv		
8.00				
8.20 - 8.65	UT 27	70 blows 100% rec	2.50	Dry
8.70 - 9.15	SPTS	N=18 (2,3/3,4,5,6)	2.50	Dry
8.70	D 28			
8.70 - 9.15	D 29			
9.50	ES 30	PID=<1.0 ppmv		
9.50				
9.70 - 10.15	UT 31	80 blows 100% rec	2.50	Dry

Strata Description

Main	Detail	Depth, Level (Thickness)
Soft to firm brown slightly gravelly, sandy CLAY. Sand is fine. Gravel is sub-angular to sub-rounded, fine to coarse chert. Rare angular fine brick gravel. (MADE GROUND)		(0.90)
Brown, gravelly, slightly clayey SAND. Sand is medium to coarse. Gravel is sub-angular to rounded, fine to coarse chert. (SUPERFICIAL DEPOSITS)		0.90 +7.97 (0.70)
Stiff, brown mottled grey CLAY. With rare relic roots. Rare pockets of fine orangish brown sand. (LONDON CLAY)		1.60 +7.27 (5.60)
Stiff grey very closely fissured slightly silty CLAY. (LONDON CLAY)		7.20 +1.67

Legend

Backfill

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
1	1.20	Rose to 1.05 m after 15 minutes.	

Depth Related Remarks

Depths (m)	Remarks
0.00 - 1.60	50mm diameter standpipe installed.
1.20 - 1.60	Water added to assist drilling.

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:57

Project	**NeuConnect Isle of Grain**
Project No.	**G9017-19**
Carried out for	**AECOM**

Borehole

BH112

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	CR	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	8.87 mOD
Logged	LF	09/05/2019	Dando 3000	0.00	20.00	150	2.50	**Coordinates (m)**	E 587587.18
Checked		**End**	Hand dug inspection pit then cable percussion drilling to 20m.					**National Grid**	N 176293.54
Approved		10/05/2019	Checked for water flow at 20m started dry and remained dry after 20 minutes.						

Samples and Tests

Strata Description

Depth	Type & No.	Records	Date / Casing	Time / Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
10.20 - 10.65 10.20 10.20 - 10.65	SPTS D 32 D 33	N=19 (2,3/3,5,5,6)	2.50	Dry	Stiff grey very closely fissured slightly silty CLAY. (LONDON CLAY)				
11.00 11.00 11.20 - 11.65	ES 34 UT 35	PID=1.3 ppmv 70 blows 100% rec	2.50	Dry					
11.70 - 12.15 11.70 11.70 - 12.15	SPTS D 36 D 37	N=18 (2,3/3,4,5,6)	2.50	Dry					
12.50 12.50 12.70 - 13.15	ES 38 UT 39	PID=<1.0 ppmv 70 blows 89% rec	2.50	Dry					
			09/05/19 2.50	1700 Dry					
13.20 - 13.65 13.20 13.20 - 13.65	SPTS D 40 D 41	N=22 (2,3/4,5,6,7)	2.50 10/05/19 2.50	Dry 0800 Dry			(12.80)		
14.00 14.00 14.20 - 14.65	ES 42 UT 43	PID=<1.0 ppmv 65 blows 100% rec	2.50	Dry		14.00-20.00 Small shell fragments.			
14.70 - 15.15 14.70 14.70 - 15.15	SPTS D 44 D 45	N=23 (3,4/5,6,6,6)	2.50	Dry		14.50-20.00 Very fine grained disseminated pyrite?			
15.50 15.50 15.70 - 16.15	ES 46 UT 47	PID=1.1 ppmv 70 blows 89% rec	2.50	Dry					
16.20 - 16.65 16.20 16.20 - 16.65	SPTS D 48 D 49	N=25 (3,4/5,5,7,8)	2.50	Dry					
17.00 17.00 17.20 - 17.65	ES 50 UT 51	PID=<1.0 ppmv 90 blows 100% rec	2.50	Dry		17.00 Nodule of pyrite.			
17.70 - 18.15 17.70 17.70 - 18.15	SPTS D 52 D 53	N=28 (4,4/7,6,7,8)	2.50	Dry					
18.50 18.50 18.70 - 19.15	ES 54 UT 55	PID=<1.0 ppmv 95 blows 100% rec	2.50	Dry					
19.20 - 19.65 19.20 19.20 - 19.65	SPTS D 56 D 57	N=27 (3,5/7,6,6,8)	2.50	Dry					
			10/05/19 2.50	1030 Dry					
~~20.00~~ 20.00	~~ES 58~~	~~PID=<1.0 ppmv~~			END OF EXPLORATORY HOLE		~~20.00~~ ~~-11.13~~		

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:57

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH112

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	TL	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	9.15 mOD
Logged	SW	09/05/2019	Dando 3000 Hand dug inspection pit then cable percussion drilling to 15.2m.	0.00	15.20	200	3.00	**Coordinates (m)**	E 587676.68
Checked		**End**						**National Grid**	N 176297.18
Approved		10/05/2019							

Samples and Tests

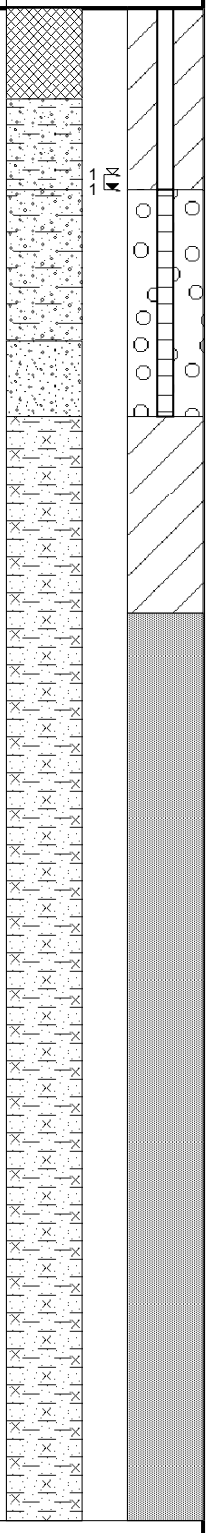
Depth	Type & No.	Records	Date Casing	Time Water
0.10	D 1		09/05/19	0800
0.20	ES 2	PID=<1.0 ppmv	0.00	Dry
0.20	B 3			
0.30 - 0.60				
0.60	ES 5	PID=<1.0 ppmv		
0.60	D 4			
0.60	B 6			
0.70 - 1.00				
1.10	D 7			
1.20 - 1.65	SPTS	N=18 (2,2/3,3,5,7)	0.00	1.10
1.20	ES 10	PID=<1.0 ppmv		
1.20	D 8			
1.20	B 9			
1.20 - 1.65				
1.80	D 11			
2.20 - 2.65	SPTS	N=26 (3,5/5,7,7,7)	2.20	0.50
2.20	ES 14	PID=<1.0 ppmv		
2.20	D 12			
2.20	B 13			
2.20 - 2.70				
2.70	ES 15	PID=<1.0 ppmv		
2.70	B 16			
2.70 - 3.00	D 17			
2.80				
3.20 - 3.65	UT 18	50 blows 100% rec	3.00	Damp
3.65	D 19		3.00	Damp
3.70 - 4.15	SPTS	N=18 (3,3/4,4,5,5)		
3.70	ES 22	PID=<1.0 ppmv		
3.70	D 20			
3.70	B 21			
3.70 - 4.20	UT 23		3.00	Damp
4.20 - 4.65		45 blows 100% rec		
4.65	D 24		3.00	Damp
4.70 - 5.15	SPTS	N=16 (2,2/3,4,4,5)		
4.70	ES 27	PID=<1.0 ppmv		
4.70	D 25			
4.70	B 26			
4.70 - 5.20	UT 28		3.00	Dry
5.20 - 5.65		50 blows 100% rec		
5.65	D 29		3.00	Dry
5.70 - 6.15	SPTS	N=16 (2,2/3,4,4,5)		
5.70	ES 32	PID=<1.0 ppmv		
5.70	D 30		09/05/19	1815
5.70	B 31		3.00	Dry
5.70 - 6.20				
			10/05/19	0800
			3.00	Damp
6.50	D 33			
6.70	UT 34	70 blows 100% rec	3.00	Dry
7.15	D 35		3.00	Dry
7.20 - 7.65	SPTS	N=22 (2,3/4,5,6,7)		
7.20	ES 38	PID=<1.0 ppmv		
7.20	D 36			
7.20	B 37			
7.20 - 7.70	D 39			
7.50				
8.20 - 8.65	UT 40	75 blows 100% rec	3.00	Damp
8.50	D 43			
8.65	D 41		3.00	Damp
8.70 - 9.15	SPTS	N=23 (3,4/4,5,7,7)		
8.70	ES 44	PID=<1.0 ppmv		
8.70	D 42			
8.70 - 9.15				
9.50	D 45			
9.70 - 10.15	UT 46	75 blows 100% rec	3.00	Damp

Strata Description

Main	Detail	Depth, Level (Thickness)
Brown slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is angular to subrounded, fine to coarse flint, quartzite and chalk. Occasional rootlets. (POSSIBLE MADE GROUND?)		(0.60) 0.60 +8.55
Soft orangish brown slightly gravelly very sandy CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of flint.		(0.60) 1.20 +7.95
Orangish brown sandy slightly clayey GRAVEL. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of flint.		(1.00) 2.20 +6.95
Orangish brown slightly gravelly SAND. Sand is fine to coarse. Gravel is angular to subangular fine to medium occasionally coarse flint.		(0.50) 2.70 +6.45
Firm becoming stiff orangish brown with occasional bluish grey slightly sandy slightly silty CLAY. Sand is fine.	3.65 becoming greyish brown 3.70 becoming silty (no sand) 4.65 becoming bluish grey and brown	(7.50)

Legend

Backfill



Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
1	1.20	Rose to 1.10 m after 20 minutes. Seepage	

Depth Related Remarks

Depths (m)	Remarks
0.00 - 2.70	50mm diameter standpipe installed.
1.20 - 2.60	Water added to assist drilling.

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:58

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH113

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	TL	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	9.15 mOD
Logged	SW	09/05/2019	Dando 3000 Hand dug inspection pit then cable percussion drilling to 15.2m.	0.00	15.20	200	3.00	**Coordinates (m)**	E 587676.68
Checked		**End**						**National Grid**	N 176297.18
Approved		10/05/2019							

Samples and Tests

Depth	Type & No.	Records	Date / Casing	Time / Water
10.15	D 47		3.00	Damp
10.20 - 10.65	SPTS	N=25 (3,4/4,5,7,9)		
10.20	ES 49	PID=<1.0 ppmv		
10.20	D 48			
10.20 - 10.65	D 50			
10.50				
11.20 - 11.65	UT 51	70 blows 100% rec	3.00	Dry
11.50	D 54			
11.65	D 52		3.00	Dry
11.70 - 12.15	SPTS	N=24 (3,3/4,6,7,7)		
11.70	ES 55	PID=<1.0 ppmv		
11.70	D 53			
11.70 - 12.15				
12.50	D 56			
12.70 - 13.15	UT 57	75 blows 89% rec	3.00	Dry
13.15	D 58		3.00	Dry
13.20 - 13.65	SPTS	N=27 (4,4/5,6,7,9)		
13.20	ES 60	PID=<1.0 ppmv		
13.20	D 59			
13.20 - 13.65	D 61			
13.50				
14.20 - 14.65	UT 62	80 blows 100% rec	3.00	Dry
14.50	D 65			
14.65	D 63		3.00	Dry
14.70 - 15.15	SPTS	N=27 (4,4/5,6,7,9)		
14.70	ES 66	PID=<1.0 ppmv		
14.70	D 64		10/05/19	1449
14.70 - 15.15			3.00	Dry

Strata Description

Main	Detail	Depth, Level (Thickness)
Firm becoming stiff orangish brown with occasional bluish grey slightly sandy slightly silty CLAY. Sand is fine.		10.20 -1.05
Stiff becoming very stiff bluish grey slightly silty CLAY.	11.65 becoming very stiff (and slightly micaceous)	(5.00)
END OF EXPLORATORY HOLE		15.20 -6.05

Legend

Backfill

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:58

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH113

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	TL	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	9.65 mOD
Logged	SW	15/05/2019	Dando 3000 Hand dug pit then cable percussion drilling to 5.15m. (Hole advanced to 5.7m and abandoned in attempt to retrieve broken spoon) No groundwater encountered.	0.00	5.15	150	3.00	**Coordinates (m)**	E 587696.73
Checked		**End**						**National Grid**	N 176153.03
Approved		15/05/2019							

Samples and Tests

Depth	Type & No.	Records	Date Casing	Time Water
0.10	D 1		15/05/19	0800
0.20	ES 2	PID=<1.0 ppmv	0.00	Dry
0.20	B 3			
0.20 - 0.60				
0.60	ES 5	PID=<1.0 ppmv		
0.60	D 4			
0.60	B 6			
0.60 - 1.00				
1.10	D 7			
1.20 - 1.65	SPTS	N=39 (4,5/8,7,12,12)	0.00	Dry
1.20 - 1.65	D 8			
1.20 - 1.60	B 9			
1.30	ES 10	PID=1.0 ppmv		
1.30	D 11			
1.50	D 12			
1.70	ES 13			
1.80		PID=<1.0 ppmv		
1.80				
2.20 - 2.65	SPTS	N=7 (1,0/1,2,2,2)	2.20	Damp
2.20 - 2.65	D 14			
2.20 - 2.60	B 15			
2.40	ES 16	PID=<1.0 ppmv		
2.40	D 17			
2.60				
3.20 - 3.65	UT 18	50 blows 100% rec	3.00	Dry
3.40	ES 21	PID=<1.0 ppmv		
3.40				
3.60	D 22			
3.65	D 19		3.00	Dry
3.70 - 4.15	SPTS	N=11 (1,2/2,2,3,4)		
3.70	D 20			
4.20 - 4.65	UT 23	50 blows 100% rec	3.00	Dry
4.40	ES 25	PID=<1.0 ppmv		
4.40				
4.60	D 26			
4.65	D 24		3.00	Dry
4.70 - 5.15	SPTS	N=18 (2,2/3,4,5,6)		
			15/05/19	1315
			3.00	Dry

Strata Description

Main	Detail	Depth, Level (Thickness)	Legend	Backfill
Brown gravelly slightly clayey SAND. Sand is fine to coarse. Gravel is angular to subangular fine to coarse flint. Some rootlets. (POSSIBLE MADE GROUND)		(0.60)		
Soft/very soft orangish brown and grey slightly gravelly very sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse quarzite and flint. (SUPERFICIAL DEPOSITS)		0.60 +9.05 (0.70)		
Orangish brown very sandy GRAVEL. Sand is fine to coarse. Gravel is angular to subangular fine to coarse flint. (SUPERFICIAL DEPOSITS)		1.30 +8.35 (0.40)		
Soft orangish brown sandy very gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse flint. (SUPERFICIAL DEPOSITS)		1.70 +7.95 (0.60)		
Firm orangish brown mottled bluish grey sightly sandy CLAY. Sand is fine to coarse. (LONDON CLAY)		2.30 +7.35 (2.85)		
END OF EXPLORATORY HOLE		5.15 +4.50		

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks
5.15	Hole terminated due to losing SPT spoons.

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:58

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH114

Sheet 1 of 1

Borehole Log

PRELIMINARY

SOCOTEC

Drilled TL	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	9.67 mOD
Logged	15/05/2019	Dando 3000 Hand dug pit then cable percussion drilling to 15m	0.00	15.00	150	3.10	**Coordinates (m)**	E 587694.40
Checked	**End**						**National Grid**	N 176154.85
Approved	16/05/2019							

Samples and Tests

Depth	Type & No.	Records	Date Casing	Time Water
			15/05/19	1448
0.20	D 1		0.00	Dry
0.20 - 0.70	B 2			
0.40	ES 3	PID=<1.0 ppmv		
0.40				
0.70	ES 6	PID=<1.0 ppmv		
0.70	D 4			
0.70	B 5			
0.70 - 1.00				
1.10	D 7			
1.20 - 1.65	SPTS	N=8 (1,2/2,2,2,2)	0.00	Dry
1.20 - 1.65	D 8			
1.20 - 1.60	B 9			
1.80	ES 10	PID=<1.0 ppmv		
1.80	D 11			
1.80				
2.20 - 2.65	SPTS	N=10 (2,2/2,2,3,3)	1.60	Dry
2.20 - 2.65	D 12			
2.20 - 2.60	B 13			
2.50	ES 14	PID=<1.0 ppmv		
2.50				
2.80	D 15			
3.20 - 3.65	UT 16	35 blows 100% rec	1.60	Damp
3.50	ES 19	PID=<1.0 ppmv		
3.50	D 17			
3.65	SPTS		1.60	Damp
3.70 - 4.15	D 18	N=10 (2,2/2,2,3,3)		
3.70 - 4.15	B 20			
3.70 - 4.20	D 21			
3.80				
4.20 - 4.65	UT 22	40 blows 100% rec	1.60	Damp
4.50	ES 25	PID=<1.0 ppmv		
4.50				
4.65	D 23		1.60	Damp
4.70 - 5.15	SPTS	N=16 (3,3/3,4,4,5)		
4.70 - 5.15	D 24			
4.80	D 26			
5.20 - 5.65	UT 27	35 blows 100% rec	3.10	Damp
5.50	ES 30	PID=<1.0 ppmv		
5.50	D 28			
5.65	SPTS		3.10	Damp
5.70 - 6.15	D 29	N=16 (3,3/4,4,4,4)		
5.70 - 6.15	D 31			
5.80				
6.50	D 32			
6.70 - 7.15	UT 33	35 blows 100% rec	3.10	Damp
7.00	ES 36	PID=<1.0 ppmv		
7.00	D 34			
7.15	SPTS		3.10	Damp
7.20 - 7.65	D 35	N=21 (3,5/5,5,5,6)		
7.20 - 7.65	D 37			
7.50			15/05/19	1731
			3.10	Damp
			16/05/19	0800
			3.10	Dry
8.20 - 8.65	UT 38	50 blows 100% rec	3.10	Dry
8.50	ES 42	PID=<1.0 ppmv		
8.50	D 41			
8.50	D 39		3.10	Dry
8.65	SPTS			
8.70 - 9.15	D 40	N=21 (2,4/4,6,5,6)		
8.70 - 9.15				
9.50	D 43			
9.70 - 10.15	UT 44	50 blows 100% rec	3.10	Dry

Strata Description

Main	Detail	Depth, Level (Thickness)	Legend	Backfill
Brown slightly clayey gravelly SAND. Sand is fine to coarse. Gravel is angular to subangular fine to coarse flint. Some rootlets. (TOPSOIL)		(0.70)		
Soft/very soft orangish brown and grey slightly gravelly very sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint and quartzite. (SUPERFICIAL DEPOSITS)	1.80 becoming gravelly	0.70 +8.97 (1.60)		
Firm becoming stiff brown mottled bluish grey slightly silty CLAY. (LONDON CLAY)	3.70 becoming slightly gravelly (possible fall in?). Gravel is angular to subangular fine to coarse flint 4.80 becoming greyish brown mottled	2.30 +7.37 (6.40)		
	7.15 becoming greyish brown			
Stiff becoming very stiff bluish grey slightly silty CLAY. (LONDON CLAY)	9.50 becoming very stiff	8.70 +0.97		

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks
0.00 - 14.00	50mm diameter standpipe installed.
7.70 - 15.00	Water added to assist drilling.

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:59

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH114A

Borehole Log

PRELIMINARY

SOCOTEC

Drilled TL	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	9.67 mOD
Logged	15/05/2019	Dando 3000 Hand dug pit then cable percussion drilling to 15m	0.00	15.00	150	3.10	**Coordinates (m)**	E 587694.40
Checked	**End**						**National Grid**	N 176154.85
Approved	16/05/2019							

Samples and Tests

Strata Description

Depth	Type & No.	Records	Date Casing	Time Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
10.00	ES 47	PID=<1.0 ppmv			Stiff becoming very stiff bluish grey slightly silty CLAY. (LONDON CLAY)				
10.00	D 45		3.10	Dry					
10.15	SPTS								
10.20 - 10.65	D 46	N=26 (3,4/5,6,7,8)							
10.20 - 10.65	D 48								
10.50									
11.20 - 11.65	UT 49	50 blows 100% rec	3.10	Dry					
11.50	ES 53	PID=<1.0 ppmv							
11.50	D 52								
11.50	D 50		3.10	Dry					
11.65	SPTS								
11.70 - 12.15	D 51	N=27 (3,4/7,6,5,9)					(6.45)		
11.70 - 12.15									
12.50	D 54								
12.70 - 13.15	UT 55	55 blows 100% rec	3.10	Dry					
13.00	ES 58	PID=<1.0 ppmv							
13.00	D 56								
13.15	SPTS		3.10	Dry					
13.20 - 13.65	D 57	N=26 (4,4/5,7,7,7)							
13.20 - 13.65	D 59								
13.50									
14.20 - 14.65	UT 60	55 blows 100% rec	3.10	Dry					
14.50	ES 64	PID=<1.0 ppmv							
14.50	D 63								
14.50	D 61		3.10	Dry					
14.65	SPTS								
14.70 - 15.15	D 62	N=28 (4,4/7,7,7,7)	16/05/19	1243					
14.70 - 15.15			3.10	Dry					
					END OF EXPLORATORY HOLE		15.15 -5.48		

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:59

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH114A

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	CR	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	9.68 mOD
Logged	LF	15/05/2019	Dando 3000 Hand dug pit then cable percussion drilling to 15m.	0.00	15.00	150	2.80	**Coordinates (m)**	E 587800.69
Checked		**End**						**National Grid**	N 176078.98
Approved		15/05/2019							

Samples and Tests

Depth	Type & No.	Records	Date Casing	Time Water
			15/05/19	0900
			0.00	Dry
0.30	ES 1	PID=1.1 ppmv		
0.30 - 0.40				
1.00	ES 2	PID=1.7 ppmv		
1.00	D 3			
1.00	SPTC		0.00	Wet
1.20 - 1.65	B 4	N=13 (1,3/2,3,3,5)		
1.20 - 1.65				
2.00	ES 5	PID=3.6 ppmv		
2.00				
2.20 - 2.65	SPTS	N=10 (1,2/2,2,3,3)	2.10	Wet
2.20 - 2.65	D 6			
3.00	ES 7	PID=1.0 ppmv		
3.00				
3.20	UT 8	30 blows 100% rec	2.80	Dry
3.70 - 4.15	SPTS	N=13 (1,2/2,3,3,5)	2.80	Dry
3.70	D 9			
3.70 - 4.15	D 10			
4.00	ES 11	PID=<1.0 ppmv		
4.00				
4.20 - 4.65	UT 12	35 blows 100% rec	2.80	Dry
4.70 - 5.15	SPTS	N=15 (2,2/3,3,4,5)	2.80	Dry
4.70	D 13			
4.70 - 5.15	D 14			
5.00	ES 15	PID=<1.0 ppmv		
5.00				
5.20 - 5.65	UT 16	45 blows 89% rec	2.80	Dry
5.70 - 6.15	SPTS	N=17 (2,2/4,4,4,5)	2.80	Dry
5.70	D 17			
5.70 - 6.15	D 18			
6.50	ES 19	PID=<1.0 ppmv		
6.50				
6.70 - 7.15	UT 20	60 blows 89% rec	2.80	Dry
7.20 - 7.65	SPTS	N=18 (2,4/4,4,5,5)	2.80	Dry
7.20	D 21			
7.20 - 7.65	D 22			
8.00	ES 23	PID=<1.0 ppmv		
8.00				
8.20 - 8.65	UT 24	55 blows 89% rec	2.80	Dry
8.70 - 9.15	SPTS	N=21 (2,4/4,5,5,7)	2.80	Dry
8.70	D 25			
8.70 - 9.15	D 26			
9.50	ES 27	PID=<1.0 ppmv		
9.50				
9.70 - 10.15	UT 28	65 blows 89% rec	2.80	Dry

Strata Description

Main	Detail	Depth, Level (Thickness)	Legend	Backfill
Topsoil.		(0.15) 0.15 +9.54		
Soft brown slightly sandy sightly gravelly CLAY. Sand is fine to coarse. Gavel is subrounded to rounded fine to coarse flint and chert. (SUPERFICIAL DEPOSITS?)		(0.55) 0.70 +8.98		
Soft light brown mottled greyish white slightly sandy slightly gravelly CLAY. Sand is medium to coarse. Gravel is subangular to subrounded fine chalk(?) (SUPERFICIAL DEPOSITS?)		(0.40) 1.10 +8.59		1
Orangish brown slightly gravelly clayey SAND. Sand is fine to coarse. Gravel is subrounded fine to coarse chert. (SUPERFICIAL DEPOSITS)		(0.35) 1.45 +8.24		
Firm to stiff brown with grey mottles CLAY with occasional relic rootlets. With occasional pockets of orangish brown sand from 2.7m. Becoming grey with very closely spaced fissures infilled with orangish brown fine sand from 7.20m. (LONDON CLAY)		(6.55)		
Stiff grey very closely fissured slightly silty CLAY with occasional pyrite. (LONDON CLAY)		8.00 +1.68		

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)
1	1.20	No flow	

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:59

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH115

Sheet 1 of 2

Borehole Log

PRELIMINARY

SOCOTEC

Drilled	CR	**Start**	**Equipment, Methods and Remarks**	**Depth from (m)**	**to (m)**	**Diameter (mm)**	**Casing Depth (m)**	**Ground Level**	9.68 mOD
Logged	LF	15/05/2019	Dando 3000 Hand dug pit then cable percussion drilling to 15m.	0.00	15.00	150	2.80	**Coordinates (m)**	E 587800.69
Checked		**End**						**National Grid**	N 176078.98
Approved		15/05/2019							

Samples and Tests

Strata Description

Depth	Type & No.	Records	Date / Time Casing / Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
10.20 - 10.65 10.20 10.20 - 10.65	SPTS D 29 D 30	N=22 (3,3/5,5,6,6)	2.80 Dry	Stiff grey very closely fissured slightly silty CLAY with occasional pyrite. (LONDON CLAY)				
11.00 11.00 11.20 - 11.65	ES 31 UT 32	PID=<1.0 ppmv 75 blows 89% rec	 2.80 Dry			(7.00)		
11.70 - 12.15 11.70 11.70 - 12.15	SPTS D 33 D 34	N=26 (3,3/5,6,7,8)	2.80 Dry					
12.50 12.50 12.70 - 13.15	ES 35 UT 36	PID=<1.0 ppmv 75 blows 89% rec	 2.80 Dry					
13.20 - 13.65	SPTS	N=26 (3,4/5,6,7,8)	2.80 Dry					
13.70 13.70 - 14.15	D 37 D 38							
14.00 14.00 14.20 - 14.65	ES 39 UT 40	PID=<1.0 ppmv 85 blows 100% rec	 2.80 Dry					
14.65 - 15.15 14.70 - 15.15 14.70 15.00	D 42 SPTS D 41 D 43	N=27 (3,4/5,6,7,9)	2.80 Dry 15/05/19 1700 2.80 Dry					
				END OF EXPLORATORY HOLE		15.00 -5.32		

Groundwater Entries

No.	Depth Strike (m)	Remarks	Depth Sealed (m)

Depth Related Remarks

Depths (m)	Remarks

Hard Boring

Depths (m)	Duration (mins)	Tools used

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

24/05/2019 11:52:59

Project NeuConnect Isle of Grain

Project No. G9017-19

Carried out for AECOM

Borehole

BH115

Trial Pit Log

PRELIMINARY

SOCOTEC

Logged SN **Checked** **Approved**	**Start** 09/05/2019 **End** 09/05/2019	**Equipment, Methods and Remarks** Hand dug pit to 1.2m. No groundwater encountered. Hand vane in Superficial Deposits affected by gravel.	**Dimension and Orientation** Width Length A D B C	**Ground Level** 4.45 mOD **Coordinates (m)** E 587649.23 **National Grid** N 176524.30

Samples and Tests

Depth	Type & No.	Records
0.00		PID=<1.0 ppmv
0.00 - 0.40	ES1	
0.00 - 0.40	B1	
0.40 - 0.70	B2	
0.50	HV	p 77kPa, r 38kPa
0.80		PID=<1.0 ppmv
0.80	ES2	
1.00	HV	p 65kPa, r 37kPa
1.00 - 1.20	B3	

Strata Description

Main	Detail	Depth, Level (Thickness)	Legend	Backfill
Friable dark brownish grey slightly sandy, slightly gravelly silty CLAY. Sand is fine to medium. Gravel is fine to medium subangular of chert/ flint. (TOPSOIL)		(0.40) 0.40 +4.05		
Firm orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subrounded to subangular medium to coarse of chert/flint. (SUPERFICIAL DEPOSITS)		(0.50) 0.90 +3.55		
Firm fissured brown CLAY. Fissures are extremely closely spaced, slightly polished. (LONDON CLAY)		(0.30) 1.20 +3.25		
END OF EXPLORATORY HOLE				

Groundwater Entries

No.	Depth Strike (m)	Remarks

Remarks

Depth (m)	Remarks

Stability Stable

Shoring None

Weather

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

24/05/2019 11:52:59

AGS

Project **NeuConnect Isle of Grain**

Project No. **G9017-19**

Carried out for **AECOM**

Trial Pit

CPT106

Trial Pit Log

PRELIMINARY

SOCOTEC

Logged SN **Checked** **Approved**	**Start** 10/05/2019 **End** 10/05/2019	**Equipment, Methods and Remarks** Hand dug pit to 1.2m No groundwater encountered. Hand vane in Superficial Deposits affected by gravel.	**Dimension and Orientation** Width Length A D B C	**Ground Level** 4.18 mOD **Coordinates (m)** E 587502.64 **National Grid** N 176471.66

Samples and Tests

Strata Description

Depth	Type & No.	Records	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
0.00 0.00 - 0.30 0.00 - 0.30	ES1 B1	PID=<1.0 ppmv	Friable dark brownish grey sandy slightly gravelly silty CLAY. Sand is fine to medium. Gravel is fine to medium subangular to subrounded of chert/ flint. (TOPSOIL)		(0.30) 0.30 +3.88		
0.50 0.50	HV B2	p 67kPa, r 45kPa	Firm orange brown sandy slightly gravelly locally gravelly CLAY grading locally to clayey SAND. Gravel is fine to medium rounded to subangular chert/flint. (SUPERFICAL DEPOSITS)		(0.40) 0.70 +3.48		
1.00 1.00 1.00 1.00 - 1.20	HV ES2 B3	PID=<1.0 ppmv p 68kPa, r 38kPa	Firm fissured brown CLAY. Fissures are extremely closely spaced, slightly polished. (LONDON CLAY)		(0.50) 1.20 +2.98		
			END OF EXPLORATORY HOLE				

Groundwater Entries

No.	Depth Strike (m)	Remarks

Remarks

Depth (m)	Remarks

Stability Stable

Shoring None

Weather

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

24/05/2019 11:53:00

AGS

Project **NeuConnect Isle of Grain**

Project No. **G9017-19**

Carried out for **AECOM**

Trial Pit

CPT107

Trial Pit Log

PRELIMINARY

SOCOTEC

Logged SN	**Start** 09/05/2019	**Equipment, Methods and Remarks**	**Dimension and Orientation**	**Ground Level** 7.70 mOD
Checked	**End** 09/05/2019	Hand dug pit to 1.2m. No groundwater encountered. Hand vane in Superficial Deposits affected by gravel.	Width Length A B C D	**Coordinates (m)** E 587701.43 **National Grid** N 176362.88
Approved				

Samples and Tests

Strata Description

Depth	Type & No.	Records	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
0.00 0.00 - 0.30	ES1	PID=<1.0 ppmv	Friable dark brownish grey slightly sandy slightly gravelly silty CLAY. Sand is fine to medium. Gravel is fine to medium subrounded of chert/ flint. (TOPSOIL)		(0.30)		
0.20	D1				0.30 +7.40		
0.50	HV	p 61kPa, r 39kPa	Firm light grey mottled orange slightly sandy to sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded to subangular of chert/flint. (SUPERFICIAL DEPOSITS)				
0.70	D2				(0.75)		
1.00 1.00 1.00	HV ES2	PID=<1.0 ppmv p 51kPa, r 34kPa	Firm fissured brown CLAY. Fissures are extremely closely spaced, slightly polished. (LONDON CLAY)		1.05 +6.65 (0.15)		
1.20	D3		END OF EXPLORATORY HOLE		1.20 +6.50		

Groundwater Entries

No.	Depth Strike (m)	Remarks

Remarks

Depth (m)	Remarks

Stability Stable

Shoring None

Weather

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

24/05/2019 11:53:00

AGS

Project **NeuConnect Isle of Grain**

Project No. **G9017-19**

Carried out for **AECOM**

Trial Pit

CPT108

Sheet 1 of 1

Trial Pit Log

PRELIMINARY

SOCOTEC

Logged SN **Checked** **Approved**	**Start** 10/05/2019 **End** 10/05/2019	**Equipment, Methods and Remarks** Hand dug pit to 1.2m. Hand vane in Superficial Deposits affected by gravel.	**Dimension and Orientation** Width Length A D B C	**Ground Level** 6.76 mOD **Coordinates (m)** E 587486.70 **National Grid** N 176344.99

Samples and Tests

Depth	Type & No.	Records
0.00 - 0.30	B1	
0.30		PID=<1.0 ppmv
0.30 - 0.50	ES1	
0.50	HV	p 83kPa, r 55kPa
0.60	B2	
1.00		PID=<1.0 ppmv
1.00	HV	p 74kPa, r 37kPa
1.00	ES2	
1.00 - 1.20	B3	

Strata Description

Main	Detail	Depth, Level (Thickness)	Legend	Backfill
Friable dark brownish grey sandy slightly gravelly silty CLAY. Sand is fine to medium. Gravel is fine to medium subangular of chert/flint. (TOPSOIL)		(0.30)		
Firm orange brown slightly sandy to sandy slightly gravelly CLAY locally grading to clayey SAND. Sand is fine to coarse. Gravel is fine to coarse subangular of chert/flint. (SUPERFICIAL DEPOSITS)		0.30 +6.46 (0.40)		
Firm fissured brown CLAY. Fissures are extremely closely spaced, slightly polished. (LONDON CLAY)		0.70 +6.06 (0.50)		
END OF EXPLORATORY HOLE		1.20 +5.56	1	

Groundwater Entries

No.	Depth Strike (m)	Remarks
1	1.10	No flow

Remarks

Depth (m)	Remarks

Stability Stable

Shoring None

Weather

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

24/05/2019 11:53:00

AGS

Project **NeuConnect Isle of Grain**

Project No. **G9017-19**

Carried out for **AECOM**

Trial Pit

CPT109

Sheet 1 of 1

Trial Pit Log

PRELIMINARY

SOCOTEC

Logged LF	**Start** 20/05/2019	**Equipment, Methods and Remarks**	**Dimension and Orientation**	**Ground Level**	6.47 mOD
Checked	**End** 20/05/2019	Tracked Excavator Hand dug pit followed by machine excavated trial pit to 3m.	Width 1.50 m Length 2.00 m	**Coordinates (m)**	E 587625.49
Approved				**National Grid**	N 176205.31

Samples and Tests

Strata Description

Depth	Type & No.	Records	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
			Brown sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is subrounded fine to coarse chert and rare brick. (TOPSOIL)		(0.50)		
0.45		PID=<1.0 ppmv					
0.45	ES2				0.50 +5.97		
0.45	D3						
0.45	B1						
0.55	HV	p 59kPa, r 28kPa	Orangish brown clayey slightly gravelly SAND. Becoming gravelly slightly clayey from 0.80m. Gravel is subangular to subrounded fine to coarse chert. Low cobble content. (SUPERFICIAL DEPOSITS)				
1.00		PID=<1.0 ppmv					
1.00	ES4						
1.00	B5			1.10 becoming stiff clay (London Clay) on south side of pit. Gravels extend to 2.40m on north side of pit.	(1.50)		
1.50	D6					1	
2.00		PID=<1.0 ppmv			2.00 +4.47		
2.00	HV	p 80kPa, r 28kPa	Stiff brown mottled bluish grey CLAY with occasional relic rootlets. (LONDON CLAY)				
2.00	ES7						
2.00	B8						
2.50	D9				(1.00)		
3.00		PID=<1.0 ppmv			3.00 +3.47		
3.00	ES10		END OF EXPLORATORY HOLE				
3.00	B11						

Groundwater Entries

No.	Depth Strike (m)	Remarks
1	1.80	Slow water ingress to 2.40m from north and east sides of pit.

Remarks

Depth (m)	Remarks

Stability Stable

Shoring None

Weather

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

24/05/2019 11:53:00

AGS

Project **NeuConnect Isle of Grain**

Project No. **G9017-19**

Carried out for **AECOM**

Trial Pit

TP111

Sheet 1 of 1

Trial Pit Log

PRELIMINARY

SOCOTEC

Logged LF **Checked** **Approved**	**Start** 20/05/2019 **End** 20/05/2019	**Equipment, Methods and Remarks** Tracked Excavator Hand dug pit followed by machine excavated trial pit to 3m.	**Dimension and Orientation** Width 1.50 m Length 2.00 m A, B, C, D	**Ground Level** 9.63 mOD **Coordinates (m)** E 587755.27 **National Grid** N 176110.52

Samples and Tests

Depth	Type & No.	Records
0.30		PID=<1.0 ppmv
0.30	ES1	
0.30	D2	
0.30 - 0.40	B3	
0.50	HV	p 44kPa, r 21kPa
0.50	D4	
0.50 - 0.70	B5	
0.60		PID=<1.0 ppmv
0.60	ES6	
1.00		PID=<1.0 ppmv
1.00	ES7	
1.00	B8	
1.50		PID=<1.0 ppmv
1.50	ES11	
1.50	D9	
1.50	B10	
2.00		PID=<1.0 ppmv
2.00	HV	p 86kPa, r 28kPa
2.00	ES12	
2.00	D13	
2.00	B14	
2.50	D15	
3.00		PID=<1.0 ppmv
3.00	HV	p 97kPa, r 28kPa
3.00	ES16	
3.00	B17	

Strata Description

Main	Detail	Depth, Level (Thickness)
Soft brown sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse chert. (TOPSOIL)		(0.40) 0.40 +9.23
Soft orangish brown very sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is subrounded fine to medium chert. (MADE GROUND)		(0.30) 0.70 +8.93
Soft dark grey mottled reddish brown slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is angular to subrounded fine to coarse chert. Rare glass fragments and one rounded coarse clinker(?) gravel. Lenses with natural gravels on east side of pit. (MADE GROUND)		(0.40) 1.10 +8.53
Orangish brown slightly gravelly slightly clayey SAND. Becoming gravelly to very gravelly between 1.40 and 1.60m. Gravel is subangular to subrounded fine to coarse chert and rare sandstone. (SUPERFICIAL DEPOSITS)		(0.50) 1.60 +8.03
Firm to stiff brown mottled grey CLAY with pockets of frequent relic rootlets. (LONDON CLAY)	2.70 pocket of light grey find sand	(1.40)
END OF EXPLORATORY HOLE		3.00 +6.63

Legend: 1

Backfill

Groundwater Entries

No.	Depth Strike (m)	Remarks
1	1.60	Water seepage

Remarks

Depth (m)	Remarks

Stability Stable

Shoring None

Weather

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

24/05/2019 11:53:01

AGS

Project **NeuConnect Isle of Grain**

Project No. **G9017-19**

Carried out for **AECOM**

Trial Pit

TP112

Sheet 1 of 1

Appendix 9.C – Hydrology

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement

Appendix 9C: Hydrology

NeuConnect Britain Ltd

September 2019

Revision	Revision date	Details	Authorized	Name	Position
1	June 2019	Draft for internal review	Yes	Helen Judd	Principal Consultant
2	July 2019	For client issue	EC	Emily Craven	Associate Director

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Table of Contents

Figures

No table of figures entries found.

Tables

1. Introduction

1.1 This report is to be read in conjunction with the Environmental Statement Water Resources Chapter and Appendix 9B – Outline Drainage Strategy. This report provides details of the hydrological methods used to support the outline drainage strategy. The ReFH2 Plot Scale Application has been used to calculate greenfield and post-development runoff rates and volumes for the selected Site Area.

2. Methodology

1.2 The latest version of the Revitalised Flood Hydrograph Model, (ReFH2), is one of the recommended methods within the current CIRIA SuDS Manual (C753)[1] for undertaking the estimation of greenfield runoff rates using the rural model. In addition, it is also one of the recommended methods for undertaking the estimation of post-development runoff rates and volumes for simple developments using the urban model. For assessing the runoff from development sites it is anticipated that the usual route would be to use a point export from the Flood Estimation Handbook (FEH) Webservice[2]. The software uses plot scale equations at the point of import to calculate Time to Peak and Baseflow Lag.

1.3 Guidance on the method used can be found in The Revitalised Flood Hydrograph Model ReFH 2.2: Technical Guidance[3].

1.4 The runoff rate for both the greenfield and post-development scenarios can be calculated based on the peak flow exported from ReFH2 using the following equation1:

$$Runoff\ Rate = \frac{10 \times Peak\ Flow}{Area}$$

1.5 Units for the runoff rate is l/s/ha, the peak flow is m3/s and the catchment area is km2.

[1] CIRIA (2015) *The SuDS Manual (C753)*, London.
[2] Centre for Ecology & Hydrology, *FEH Webservice*, Available at: https://fehweb.ceh.ac.uk/Account/Login, Accessed: Jan 2019.
[3] Wallingford Hydro Solutions (2016), 'The Revitalised Flood Hydrograph Model ReFH 2.2: Technical Guidance', WHS: Wallingford.

3. Input Data

Area

3.1 The area used to inform the drainage calculations has been taken from the GIS land boundary layer and is 0.084km^2 (8.4ha). This does not include the DC cable route boundary.

3.2 The size of the developed impermeable area has been taken as the plan area of the permanent infrastructure following the completion of the development. This considers the converter station platform (approximately 62500m^2), the substation platform (approximately 6400m^2) and the potential substation expansion site (approximately 6400m^2) all with a 2 m offset, in addition to the access road (approximately 5500m^2) and the sealing end compound (approximately 1050m^2). The total impermeable area is calculated as approximately 8.4ha.

Catchment Descriptors

1.6 The catchment descriptors exported from the FEH Webservice[2] for the development location are listed in Table 3.1.

Table 3.1 Catchment descriptors

Catchment Descriptor	Value	Source
X Coordinate	587559	Point data
Y Coordinate	176472	Point data
BFIHOST	0.479	Point data
PROPWET	0.21	Point data
SAAR	524	Point data
SPRHOST	32.97	Catchment at 587150,176800
URBEXT2000	0.000	Catchment at 587150,176800

3.3 The British Geological Survey (BGS) website[4] defines the underlying geology; with superficial deposits formed from River Terrace Deposits (sand and gravel) overlaying bedrock comprising the London Clay Formation. This correlates with the BFIHOST value of 0.479 that indicates that the site is of moderate permeability. A low PROPWET value of 0.21 indicates that this catchment is wet a low proportion of the year. This value correlates with the low average annual rainfall (SAAR) value of 524.

Climate Change

3.4 3.3.1 In accordance with the Environment Agency guidance on climate change allowances[5], the percentage climate change for the peak rainfall intensity allowance is 20%. This has been taken as the worst case scenario (upper end) incorporating potential change anticipated for the '2050s (2040 to 2069)' as the design life for the development is 40 years to approximately the year 2064 (considering a construction start date in 2021 and construction period of 36 months).

[4] http://mapapps.bgs.ac.uk/geologyofbritain/home.html
[5] Environment Agency, 2016, Flood risk assessments: climate change allowances, available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances, accessed: May 2019

4. ReFH2

Parameters

4.1 The following parameters, detailed in Table 4.1, have been calculated within the ReFH2 software. These parameters have not been altered from the default figures in the software. As the catchment is less than 0.5km^2, the Time to Peak (T_p) and Base Flow Lag (BL) have been taken from the calculations based on an area of 0.5km^2 as recommended in the ReFH2 technical guidance[1].

Table 4.1 Parameters calculated in ReFH2

ReFH2 Parameter	Calculated Value
Cmax (mm)	428.1
Cini (mm)	126.9
Tp (Hr)	3.741
BL	46.605
BR	0.972

4.2 The runoff rate calculations use the critical storm duration of 5.5 hours and a time step of 30 minutes. These are automatically calculated in the ReFH2 software.

4.3 Whereas, the runoff volume for a development site is usually defined as the 1:100 year 6 hour duration design event[6]. Therefore, for the volume calculations, a storm duration of 6 hours and a time step of 40 minutes has been used.

4.4 For the post-development calculations an urban adjustment has been applied in accordance with the technical guidance1. The following parameters have been used.

- Impervious Runoff Factor (IRF) = 1.0
- Imperviousness factor = 1.0

Results

Greenfield Runoff Rate

4.5 The peak flow values for the greenfield runoff rate have been taken from the ReFH2 rural model. These in addition to the subsequent runoff rates are displayed in **Error! Reference source not found.** for the required return periods. This is based on the total developed area of 8.4 ha. Greenfield runoff rate results are presented in **Annex 9C-1**.

Table 4.2 Greenfield Runoff Rate Results

Return Period (1inXXyear)	Total peak flow from rural model (m^3/s)	Greenfield runoff rate (l/s/ha)
2	0.02	2.21
30	0.04	4.83
100	0.06	6.75

[6] Kellagher, R., 2002 Storage requirements for rainfall runoff from greenfield development sites, Version 2, 909 HR Wallingford Report SR580, HR Wallingford, Wallingford

Return Period (1inXXyear)	Total peak flow from rural model (m^3/s)	Greenfield runoff rate (l/s/ha)
100+20%	0.07	8.10
100+40%	0.08	9.45
1000	0.11	13.6

Greenfield Volume

4.6 The total flow volume calculated in ReFH2 for each of the return periods has again been taken from the rural model for the greenfield scenario. This is based on the total developed area of 8.4 ha. The volumes have then been converted to m^3 with the results shown in Table 4.3. Greenfield runoff volume results are presented in **Annex 9C-2**.

Table 4.3 Greenfield total flow volume results

Return Period (1inXXyear)	Total peak flow from urban model (m^3/s)	Post-Development runoff rate (l/s/ha)
2	0.08	9.86
30	0.18	21.4
100	0.24	29.0
100+20%	0.29	34.9
100+40%	0.34	40.7
1000	0.44	52.9

Post-Development Runoff Rate

4.7 For the post-development scenario, an urbanisation adjustment was used as described above. The calculated post-development total peak flow was taken from the urban ReFH2 model with the consequent runoff rate calculated. This is based on the total developed area of 8.4 ha being impermeable. The results of these calculations do not take into account any attenuation or restrictions to flow. These results can be seen in Table 4.4. Post-development runoff rate results are presented in **Annex 9C-3**.

Table 4.4 Post-development runoff rate results

Return Period (1inXXyear)	Total peak flow from urban model (m^3/s)	Post-Development runoff rate (l/s/ha)
2	0.08	9.86
30	0.18	21.4
100	0.24	29.0
100+20%	0.29	34.9
100+40%	0.34	40.7
1000	0.44	52.9

Post-Development Volume

4.8 The post-development total flow volume, calculated in ReFH2 for each of the return periods, has been taken from the urban model. This is based on the total developed area of 8.4 ha, being impermeable. The results of these calculations do not take into account any attenuation or restrictions to flow. The volumes have then been converted to m^3 with the results shown in Table 4.5. Post-development runoff volume results are presented in **Annex 9C-4**.

Table 4.5 Post-development total flow volume results

Return Period (1inXXyear)	Total Flow Volume (ML)	Total Flow Volume (m^3)
2	1.40	1400
30	2.82	2820
100	3.99	3990
100+20%	4.79	4790
100+40%	5.59	5590
1000	7.17	7170

Annex 9C-1

Greenfield Runoff Rate Results

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:42:07 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 606C-70F8

Site name: Greenfield Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH 2013 (mm):	23.61	Total runoff (ML):	0.39
Total Rainfall (mm):	14.63	Total flow (ML):	0.76
Peak Rainfall (mm):	3.32	Peak flow (m³/s):	0.02

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	0.99	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.3211	0.0000	0.0953	0.0000	0.00277	0.00277
00:30:00	0.5380	0.0000	0.1602	0.0000	0.00274	0.00276
01:00:00	0.8967	0.0000	0.2685	0.0001	0.00271	0.00283
01:30:00	1.4827	0.0000	0.4481	0.0003	0.00268	0.00301
02:00:00	2.4129	0.0000	0.7402	0.0007	0.00266	0.0034
02:30:00	3.3239	0.0000	1.0419	0.0015	0.00264	0.00411
03:00:00	2.4129	0.0000	0.7725	0.0027	0.00263	0.00531
03:30:00	1.4827	0.0000	0.4814	0.0044	0.00264	0.00702
04:00:00	0.8967	0.0000	0.2937	0.0064	0.00267	0.00908
04:30:00	0.5380	0.0000	0.1771	0.0086	0.00272	0.0113
05:00:00	0.3211	0.0000	0.1060	0.0107	0.00279	0.0135
05:30:00	0.0000	0.0000	0.0000	0.0127	0.00288	0.0156
06:00:00	0.0000	0.0000	0.0000	0.0143	0.00299	0.0173
06:30:00	0.0000	0.0000	0.0000	0.0153	0.00311	0.0184
07:00:00	0.0000	0.0000	0.0000	0.0154	0.00324	0.0186
07:30:00	0.0000	0.0000	0.0000	0.0149	0.00336	0.0182
08:00:00	0.0000	0.0000	0.0000	0.0139	0.00347	0.0174
08:30:00	0.0000	0.0000	0.0000	0.0128	0.00358	0.0164
09:00:00	0.0000	0.0000	0.0000	0.0115	0.00366	0.0152
09:30:00	0.0000	0.0000	0.0000	0.0102	0.00374	0.0139
10:00:00	0.0000	0.0000	0.0000	0.0090	0.0038	0.0128
10:30:00	0.0000	0.0000	0.0000	0.0079	0.00384	0.0118
11:00:00	0.0000	0.0000	0.0000	0.0070	0.00388	0.0109
11:30:00	0.0000	0.0000	0.0000	0.0062	0.00391	0.0101
12:00:00	0.0000	0.0000	0.0000	0.0055	0.00393	0.00944
12:30:00	0.0000	0.0000	0.0000	0.0048	0.00394	0.00877
13:00:00	0.0000	0.0000	0.0000	0.0042	0.00394	0.00812
13:30:00	0.0000	0.0000	0.0000	0.0035	0.00394	0.00747
14:00:00	0.0000	0.0000	0.0000	0.0029	0.00393	0.00683
14:30:00	0.0000	0.0000	0.0000	0.0023	0.00392	0.00619
15:00:00	0.0000	0.0000	0.0000	0.0017	0.0039	0.00558
15:30:00	0.0000	0.0000	0.0000	0.0012	0.00387	0.00502
16:00:00	0.0000	0.0000	0.0000	0.0007	0.00384	0.00455
16:30:00	0.0000	0.0000	0.0000	0.0004	0.0038	0.00419
17:00:00	0.0000	0.0000	0.0000	0.0002	0.00376	0.00396

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:30:00	0.0000	0.0000	0.0000	0.0001	0.00373	0.00381
18:00:00	0.0000	0.0000	0.0000	0.0000	0.00369	0.00372
18:30:00	0.0000	0.0000	0.0000	0.0000	0.00365	0.00365
19:00:00	0.0000	0.0000	0.0000	0.0000	0.00361	0.00361
19:30:00	0.0000	0.0000	0.0000	0.0000	0.00357	0.00357
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00353	0.00353
20:30:00	0.0000	0.0000	0.0000	0.0000	0.00349	0.00349
21:00:00	0.0000	0.0000	0.0000	0.0000	0.00346	0.00346
21:30:00	0.0000	0.0000	0.0000	0.0000	0.00342	0.00342
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00338	0.00338
22:30:00	0.0000	0.0000	0.0000	0.0000	0.00335	0.00335
23:00:00	0.0000	0.0000	0.0000	0.0000	0.00331	0.00331
23:30:00	0.0000	0.0000	0.0000	0.0000	0.00328	0.00328
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00324	0.00324
24:30:00	0.0000	0.0000	0.0000	0.0000	0.00321	0.00321
25:00:00	0.0000	0.0000	0.0000	0.0000	0.00317	0.00317
25:30:00	0.0000	0.0000	0.0000	0.0000	0.00314	0.00314
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00311	0.00311
26:30:00	0.0000	0.0000	0.0000	0.0000	0.00307	0.00307
27:00:00	0.0000	0.0000	0.0000	0.0000	0.00304	0.00304
27:30:00	0.0000	0.0000	0.0000	0.0000	0.00301	0.00301
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00298	0.00298
28:30:00	0.0000	0.0000	0.0000	0.0000	0.00294	0.00294
29:00:00	0.0000	0.0000	0.0000	0.0000	0.00291	0.00291
29:30:00	0.0000	0.0000	0.0000	0.0000	0.00288	0.00288
30:00:00	0.0000	0.0000	0.0000	0.0000	0.00285	0.00285
30:30:00	0.0000	0.0000	0.0000	0.0000	0.00282	0.00282
31:00:00	0.0000	0.0000	0.0000	0.0000	0.00279	0.00279

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:43:50 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 606C-70F8

Site name: Greenfield Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 30 year

Summary of results

Rainfall - FEH 2013 (mm):	52.11	Total runoff (ML):	0.91
Total Rainfall (mm):	32.28	Total flow (ML):	1.79
Peak Rainfall (mm):	7.34	Peak flow (m^3/s):	0.04

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	0.99	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.7088	0.0000	0.2106	0.0000	0.00277	0.00277
00:30:00	1.1874	0.0000	0.3555	0.0001	0.00274	0.00279
01:00:00	1.9790	0.0000	0.5999	0.0003	0.00271	0.00298
01:30:00	3.2723	0.0000	1.0120	0.0007	0.00268	0.00342
02:00:00	5.3254	0.0000	1.7003	0.0016	0.00267	0.00431
02:30:00	7.3360	0.0000	2.4508	0.0033	0.00267	0.00595
03:00:00	5.3254	0.0000	1.8578	0.0060	0.00269	0.00873
03:30:00	3.2723	0.0000	1.1744	0.0100	0.00274	0.0127
04:00:00	1.9790	0.0000	0.7224	0.0147	0.00284	0.0176
04:30:00	1.1874	0.0000	0.4378	0.0198	0.00299	0.0228
05:00:00	0.7088	0.0000	0.2629	0.0248	0.00319	0.028
05:30:00	0.0000	0.0000	0.0000	0.0296	0.00344	0.033
06:00:00	0.0000	0.0000	0.0000	0.0334	0.00373	0.0372
06:30:00	0.0000	0.0000	0.0000	0.0358	0.00405	0.0399
07:00:00	0.0000	0.0000	0.0000	0.0363	0.00438	0.0406
07:30:00	0.0000	0.0000	0.0000	0.0351	0.0047	0.0398
08:00:00	0.0000	0.0000	0.0000	0.0330	0.005	0.038
08:30:00	0.0000	0.0000	0.0000	0.0303	0.00528	0.0355
09:00:00	0.0000	0.0000	0.0000	0.0272	0.00552	0.0328
09:30:00	0.0000	0.0000	0.0000	0.0241	0.00573	0.0299
10:00:00	0.0000	0.0000	0.0000	0.0213	0.0059	0.0272
10:30:00	0.0000	0.0000	0.0000	0.0188	0.00605	0.0248
11:00:00	0.0000	0.0000	0.0000	0.0166	0.00617	0.0228
11:30:00	0.0000	0.0000	0.0000	0.0148	0.00626	0.021
12:00:00	0.0000	0.0000	0.0000	0.0131	0.00634	0.0194
12:30:00	0.0000	0.0000	0.0000	0.0115	0.0064	0.0179
13:00:00	0.0000	0.0000	0.0000	0.0099	0.00644	0.0164
13:30:00	0.0000	0.0000	0.0000	0.0084	0.00647	0.0149
14:00:00	0.0000	0.0000	0.0000	0.0069	0.00648	0.0134
14:30:00	0.0000	0.0000	0.0000	0.0055	0.00647	0.0119
15:00:00	0.0000	0.0000	0.0000	0.0041	0.00645	0.0105
15:30:00	0.0000	0.0000	0.0000	0.0028	0.00642	0.00922
16:00:00	0.0000	0.0000	0.0000	0.0017	0.00638	0.0081
16:30:00	0.0000	0.0000	0.0000	0.0010	0.00632	0.00728
17:00:00	0.0000	0.0000	0.0000	0.0005	0.00626	0.00675

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:30:00	0.0000	0.0000	0.0000	0.0002	0.0062	0.00642
18:00:00	0.0000	0.0000	0.0000	0.0001	0.00613	0.00621
18:30:00	0.0000	0.0000	0.0000	0.0000	0.00607	0.00608
19:00:00	0.0000	0.0000	0.0000	0.0000	0.006	0.006
19:30:00	0.0000	0.0000	0.0000	0.0000	0.00594	0.00594
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00588	0.00588
20:30:00	0.0000	0.0000	0.0000	0.0000	0.00581	0.00581
21:00:00	0.0000	0.0000	0.0000	0.0000	0.00575	0.00575
21:30:00	0.0000	0.0000	0.0000	0.0000	0.00569	0.00569
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00563	0.00563
22:30:00	0.0000	0.0000	0.0000	0.0000	0.00557	0.00557
23:00:00	0.0000	0.0000	0.0000	0.0000	0.00551	0.00551
23:30:00	0.0000	0.0000	0.0000	0.0000	0.00545	0.00545
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00539	0.00539
24:30:00	0.0000	0.0000	0.0000	0.0000	0.00534	0.00534
25:00:00	0.0000	0.0000	0.0000	0.0000	0.00528	0.00528
25:30:00	0.0000	0.0000	0.0000	0.0000	0.00522	0.00522
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00517	0.00517
26:30:00	0.0000	0.0000	0.0000	0.0000	0.00511	0.00511
27:00:00	0.0000	0.0000	0.0000	0.0000	0.00506	0.00506
27:30:00	0.0000	0.0000	0.0000	0.0000	0.005	0.005
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00495	0.00495
28:30:00	0.0000	0.0000	0.0000	0.0000	0.0049	0.0049
29:00:00	0.0000	0.0000	0.0000	0.0000	0.00485	0.00485
29:30:00	0.0000	0.0000	0.0000	0.0000	0.00479	0.00479
30:00:00	0.0000	0.0000	0.0000	0.0000	0.00474	0.00474
30:30:00	0.0000	0.0000	0.0000	0.0000	0.00469	0.00469
31:00:00	0.0000	0.0000	0.0000	0.0000	0.00464	0.00464
31:30:00	0.0000	0.0000	0.0000	0.0000	0.00459	0.00459
32:00:00	0.0000	0.0000	0.0000	0.0000	0.00454	0.00454
32:30:00	0.0000	0.0000	0.0000	0.0000	0.00449	0.00449
33:00:00	0.0000	0.0000	0.0000	0.0000	0.00445	0.00445
33:30:00	0.0000	0.0000	0.0000	0.0000	0.0044	0.0044
34:00:00	0.0000	0.0000	0.0000	0.0000	0.00435	0.00435
34:30:00	0.0000	0.0000	0.0000	0.0000	0.00431	0.00431
35:00:00	0.0000	0.0000	0.0000	0.0000	0.00426	0.00426

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
35:30:00	0.0000	0.0000	0.0000	0.0000	0.00421	0.00421
36:00:00	0.0000	0.0000	0.0000	0.0000	0.00417	0.00417
36:30:00	0.0000	0.0000	0.0000	0.0000	0.00412	0.00412
37:00:00	0.0000	0.0000	0.0000	0.0000	0.00408	0.00408
37:30:00	0.0000	0.0000	0.0000	0.0000	0.00404	0.00404
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00399	0.00399
38:30:00	0.0000	0.0000	0.0000	0.0000	0.00395	0.00395
39:00:00	0.0000	0.0000	0.0000	0.0000	0.00391	0.00391
39:30:00	0.0000	0.0000	0.0000	0.0000	0.00387	0.00387
40:00:00	0.0000	0.0000	0.0000	0.0000	0.00383	0.00383
40:30:00	0.0000	0.0000	0.0000	0.0000	0.00379	0.00379
41:00:00	0.0000	0.0000	0.0000	0.0000	0.00375	0.00375
41:30:00	0.0000	0.0000	0.0000	0.0000	0.00371	0.00371
42:00:00	0.0000	0.0000	0.0000	0.0000	0.00367	0.00367
42:30:00	0.0000	0.0000	0.0000	0.0000	0.00363	0.00363
43:00:00	0.0000	0.0000	0.0000	0.0000	0.00359	0.00359
43:30:00	0.0000	0.0000	0.0000	0.0000	0.00355	0.00355
44:00:00	0.0000	0.0000	0.0000	0.0000	0.00351	0.00351
44:30:00	0.0000	0.0000	0.0000	0.0000	0.00347	0.00347
45:00:00	0.0000	0.0000	0.0000	0.0000	0.00344	0.00344
45:30:00	0.0000	0.0000	0.0000	0.0000	0.0034	0.0034
46:00:00	0.0000	0.0000	0.0000	0.0000	0.00336	0.00336
46:30:00	0.0000	0.0000	0.0000	0.0000	0.00333	0.00333
47:00:00	0.0000	0.0000	0.0000	0.0000	0.00329	0.00329
47:30:00	0.0000	0.0000	0.0000	0.0000	0.00326	0.00326
48:00:00	0.0000	0.0000	0.0000	0.0000	0.00322	0.00322
48:30:00	0.0000	0.0000	0.0000	0.0000	0.00319	0.00319
49:00:00	0.0000	0.0000	0.0000	0.0000	0.00315	0.00315
49:30:00	0.0000	0.0000	0.0000	0.0000	0.00312	0.00312
50:00:00	0.0000	0.0000	0.0000	0.0000	0.00309	0.00309
50:30:00	0.0000	0.0000	0.0000	0.0000	0.00305	0.00305
51:00:00	0.0000	0.0000	0.0000	0.0000	0.00302	0.00302
51:30:00	0.0000	0.0000	0.0000	0.0000	0.00299	0.00299
52:00:00	0.0000	0.0000	0.0000	0.0000	0.00296	0.00296
52:30:00	0.0000	0.0000	0.0000	0.0000	0.00293	0.00293
53:00:00	0.0000	0.0000	0.0000	0.0000	0.0029	0.0029

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
53:30:00	0.0000	0.0000	0.0000	0.0000	0.00286	0.00286
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00283	0.00283
54:30:00	0.0000	0.0000	0.0000	0.0000	0.0028	0.0028

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:44:45 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 606C-70F8

Site name: Greenfield Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH 2013 (mm):	71.06	Total runoff (ML):	1.29
Total Rainfall (mm):	44.02	Total flow (ML):	2.54
Peak Rainfall (mm):	10.00	Peak flow (m^3/s):	0.06

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	0.99	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.9666	0.0000	0.2876	0.0000	0.00277	0.00277
00:30:00	1.6194	0.0000	0.4867	0.0001	0.00274	0.00281
01:00:00	2.6989	0.0000	0.8247	0.0004	0.00271	0.00307
01:30:00	4.4626	0.0000	1.4010	0.0010	0.00269	0.0037
02:00:00	7.2625	0.0000	2.3794	0.0023	0.00268	0.00493
02:30:00	10.0045	0.0000	3.4794	0.0045	0.00268	0.00721
03:00:00	7.2625	0.0000	2.6723	0.0084	0.00272	0.0111
03:30:00	4.4626	0.0000	1.7032	0.0139	0.00281	0.0167
04:00:00	2.6989	0.0000	1.0526	0.0206	0.00296	0.0235
04:30:00	1.6194	0.0000	0.6397	0.0278	0.00318	0.0309
05:00:00	0.9666	0.0000	0.3848	0.0350	0.00347	0.0384
05:30:00	0.0000	0.0000	0.0000	0.0417	0.00383	0.0455
06:00:00	0.0000	0.0000	0.0000	0.0473	0.00425	0.0515
06:30:00	0.0000	0.0000	0.0000	0.0508	0.00471	0.0555
07:00:00	0.0000	0.0000	0.0000	0.0515	0.00519	0.0567
07:30:00	0.0000	0.0000	0.0000	0.0500	0.00566	0.0557
08:00:00	0.0000	0.0000	0.0000	0.0470	0.00611	0.0531
08:30:00	0.0000	0.0000	0.0000	0.0432	0.00651	0.0497
09:00:00	0.0000	0.0000	0.0000	0.0389	0.00686	0.0457
09:30:00	0.0000	0.0000	0.0000	0.0345	0.00717	0.0416
10:00:00	0.0000	0.0000	0.0000	0.0304	0.00743	0.0378
10:30:00	0.0000	0.0000	0.0000	0.0268	0.00765	0.0344
11:00:00	0.0000	0.0000	0.0000	0.0237	0.00783	0.0316
11:30:00	0.0000	0.0000	0.0000	0.0211	0.00798	0.0291
12:00:00	0.0000	0.0000	0.0000	0.0187	0.0081	0.0268
12:30:00	0.0000	0.0000	0.0000	0.0164	0.00819	0.0246
13:00:00	0.0000	0.0000	0.0000	0.0142	0.00827	0.0225
13:30:00	0.0000	0.0000	0.0000	0.0120	0.00831	0.0203
14:00:00	0.0000	0.0000	0.0000	0.0099	0.00834	0.0182
14:30:00	0.0000	0.0000	0.0000	0.0078	0.00834	0.0162
15:00:00	0.0000	0.0000	0.0000	0.0058	0.00832	0.0142
15:30:00	0.0000	0.0000	0.0000	0.0040	0.00829	0.0123
16:00:00	0.0000	0.0000	0.0000	0.0025	0.00823	0.0107
16:30:00	0.0000	0.0000	0.0000	0.0014	0.00816	0.00956
17:00:00	0.0000	0.0000	0.0000	0.0007	0.00809	0.0088

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:30:00	0.0000	0.0000	0.0000	0.0003	0.00801	0.00832
18:00:00	0.0000	0.0000	0.0000	0.0001	0.00792	0.00804
18:30:00	0.0000	0.0000	0.0000	0.0000	0.00784	0.00786
19:00:00	0.0000	0.0000	0.0000	0.0000	0.00776	0.00776
19:30:00	0.0000	0.0000	0.0000	0.0000	0.00767	0.00767
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00759	0.00759
20:30:00	0.0000	0.0000	0.0000	0.0000	0.00751	0.00751
21:00:00	0.0000	0.0000	0.0000	0.0000	0.00743	0.00743
21:30:00	0.0000	0.0000	0.0000	0.0000	0.00735	0.00735
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00727	0.00727
22:30:00	0.0000	0.0000	0.0000	0.0000	0.00719	0.00719
23:00:00	0.0000	0.0000	0.0000	0.0000	0.00712	0.00712
23:30:00	0.0000	0.0000	0.0000	0.0000	0.00704	0.00704
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00697	0.00697
24:30:00	0.0000	0.0000	0.0000	0.0000	0.00689	0.00689
25:00:00	0.0000	0.0000	0.0000	0.0000	0.00682	0.00682
25:30:00	0.0000	0.0000	0.0000	0.0000	0.00675	0.00675
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00667	0.00667
26:30:00	0.0000	0.0000	0.0000	0.0000	0.0066	0.0066
27:00:00	0.0000	0.0000	0.0000	0.0000	0.00653	0.00653
27:30:00	0.0000	0.0000	0.0000	0.0000	0.00646	0.00646
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00639	0.00639
28:30:00	0.0000	0.0000	0.0000	0.0000	0.00633	0.00633
29:00:00	0.0000	0.0000	0.0000	0.0000	0.00626	0.00626
29:30:00	0.0000	0.0000	0.0000	0.0000	0.00619	0.00619
30:00:00	0.0000	0.0000	0.0000	0.0000	0.00613	0.00613
30:30:00	0.0000	0.0000	0.0000	0.0000	0.00606	0.00606
31:00:00	0.0000	0.0000	0.0000	0.0000	0.00599	0.00599
31:30:00	0.0000	0.0000	0.0000	0.0000	0.00593	0.00593
32:00:00	0.0000	0.0000	0.0000	0.0000	0.00587	0.00587
32:30:00	0.0000	0.0000	0.0000	0.0000	0.00581	0.00581
33:00:00	0.0000	0.0000	0.0000	0.0000	0.00574	0.00574
33:30:00	0.0000	0.0000	0.0000	0.0000	0.00568	0.00568
34:00:00	0.0000	0.0000	0.0000	0.0000	0.00562	0.00562
34:30:00	0.0000	0.0000	0.0000	0.0000	0.00556	0.00556
35:00:00	0.0000	0.0000	0.0000	0.0000	0.0055	0.0055

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
35:30:00	0.0000	0.0000	0.0000	0.0000	0.00544	0.00544
36:00:00	0.0000	0.0000	0.0000	0.0000	0.00539	0.00539
36:30:00	0.0000	0.0000	0.0000	0.0000	0.00533	0.00533
37:00:00	0.0000	0.0000	0.0000	0.0000	0.00527	0.00527
37:30:00	0.0000	0.0000	0.0000	0.0000	0.00521	0.00521
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00516	0.00516
38:30:00	0.0000	0.0000	0.0000	0.0000	0.0051	0.0051
39:00:00	0.0000	0.0000	0.0000	0.0000	0.00505	0.00505
39:30:00	0.0000	0.0000	0.0000	0.0000	0.005	0.005
40:00:00	0.0000	0.0000	0.0000	0.0000	0.00494	0.00494
40:30:00	0.0000	0.0000	0.0000	0.0000	0.00489	0.00489
41:00:00	0.0000	0.0000	0.0000	0.0000	0.00484	0.00484
41:30:00	0.0000	0.0000	0.0000	0.0000	0.00479	0.00479
42:00:00	0.0000	0.0000	0.0000	0.0000	0.00473	0.00473
42:30:00	0.0000	0.0000	0.0000	0.0000	0.00468	0.00468
43:00:00	0.0000	0.0000	0.0000	0.0000	0.00463	0.00463
43:30:00	0.0000	0.0000	0.0000	0.0000	0.00458	0.00458
44:00:00	0.0000	0.0000	0.0000	0.0000	0.00454	0.00454
44:30:00	0.0000	0.0000	0.0000	0.0000	0.00449	0.00449
45:00:00	0.0000	0.0000	0.0000	0.0000	0.00444	0.00444
45:30:00	0.0000	0.0000	0.0000	0.0000	0.00439	0.00439
46:00:00	0.0000	0.0000	0.0000	0.0000	0.00435	0.00435
46:30:00	0.0000	0.0000	0.0000	0.0000	0.0043	0.0043
47:00:00	0.0000	0.0000	0.0000	0.0000	0.00425	0.00425
47:30:00	0.0000	0.0000	0.0000	0.0000	0.00421	0.00421
48:00:00	0.0000	0.0000	0.0000	0.0000	0.00416	0.00416
48:30:00	0.0000	0.0000	0.0000	0.0000	0.00412	0.00412
49:00:00	0.0000	0.0000	0.0000	0.0000	0.00407	0.00407
49:30:00	0.0000	0.0000	0.0000	0.0000	0.00403	0.00403
50:00:00	0.0000	0.0000	0.0000	0.0000	0.00399	0.00399
50:30:00	0.0000	0.0000	0.0000	0.0000	0.00395	0.00395
51:00:00	0.0000	0.0000	0.0000	0.0000	0.0039	0.0039
51:30:00	0.0000	0.0000	0.0000	0.0000	0.00386	0.00386
52:00:00	0.0000	0.0000	0.0000	0.0000	0.00382	0.00382
52:30:00	0.0000	0.0000	0.0000	0.0000	0.00378	0.00378
53:00:00	0.0000	0.0000	0.0000	0.0000	0.00374	0.00374

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
53:30:00	0.0000	0.0000	0.0000	0.0000	0.0037	0.0037
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00366	0.00366
54:30:00	0.0000	0.0000	0.0000	0.0000	0.00362	0.00362
55:00:00	0.0000	0.0000	0.0000	0.0000	0.00358	0.00358
55:30:00	0.0000	0.0000	0.0000	0.0000	0.00354	0.00354
56:00:00	0.0000	0.0000	0.0000	0.0000	0.00351	0.00351
56:30:00	0.0000	0.0000	0.0000	0.0000	0.00347	0.00347
57:00:00	0.0000	0.0000	0.0000	0.0000	0.00343	0.00343
57:30:00	0.0000	0.0000	0.0000	0.0000	0.0034	0.0034
58:00:00	0.0000	0.0000	0.0000	0.0000	0.00336	0.00336
58:30:00	0.0000	0.0000	0.0000	0.0000	0.00332	0.00332
59:00:00	0.0000	0.0000	0.0000	0.0000	0.00329	0.00329
59:30:00	0.0000	0.0000	0.0000	0.0000	0.00325	0.00325
60:00:00	0.0000	0.0000	0.0000	0.0000	0.00322	0.00322
60:30:00	0.0000	0.0000	0.0000	0.0000	0.00318	0.00318
61:00:00	0.0000	0.0000	0.0000	0.0000	0.00315	0.00315
61:30:00	0.0000	0.0000	0.0000	0.0000	0.00312	0.00312
62:00:00	0.0000	0.0000	0.0000	0.0000	0.00308	0.00308
62:30:00	0.0000	0.0000	0.0000	0.0000	0.00305	0.00305
63:00:00	0.0000	0.0000	0.0000	0.0000	0.00302	0.00302
63:30:00	0.0000	0.0000	0.0000	0.0000	0.00298	0.00298
64:00:00	0.0000	0.0000	0.0000	0.0000	0.00295	0.00295
64:30:00	0.0000	0.0000	0.0000	0.0000	0.00292	0.00292
65:00:00	0.0000	0.0000	0.0000	0.0000	0.00289	0.00289
65:30:00	0.0000	0.0000	0.0000	0.0000	0.00286	0.00286
66:00:00	0.0000	0.0000	0.0000	0.0000	0.00283	0.00283
66:30:00	0.0000	0.0000	0.0000	0.0000	0.0028	0.0028

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:45:28 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 606C-70F8

Site name: Greenfield Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 1000 year

Summary of results

Rainfall - FEH 2013 (mm):	129.69	Total runoff (ML):	2.63
Total Rainfall (mm):	80.34	Total flow (ML):	5.19
Peak Rainfall (mm):	18.26	Peak flow (m^3/s):	0.11

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	0.99	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	1.7640	0.0000	0.5264	0.0000	0.00277	0.00277
00:30:00	2.9554	0.0000	0.8983	0.0001	0.00274	0.00288
01:00:00	4.9255	0.0000	1.5424	0.0007	0.00271	0.00338
01:30:00	8.1443	0.0000	2.6747	0.0019	0.0027	0.00456
02:00:00	13.2541	0.0000	4.6840	0.0042	0.0027	0.00689
02:30:00	18.2581	0.0000	7.1244	0.0085	0.00274	0.0113
03:00:00	13.2541	0.0000	5.6596	0.0160	0.00283	0.0189
03:30:00	8.1443	0.0000	3.6812	0.0270	0.00303	0.0301
04:00:00	4.9255	0.0000	2.3015	0.0405	0.00335	0.0438
04:30:00	2.9554	0.0000	1.4081	0.0551	0.00381	0.0589
05:00:00	1.7640	0.0000	0.8502	0.0700	0.00441	0.0744
05:30:00	0.0000	0.0000	0.0000	0.0840	0.00517	0.0892
06:00:00	0.0000	0.0000	0.0000	0.0959	0.00604	0.102
06:30:00	0.0000	0.0000	0.0000	0.1037	0.00701	0.111
07:00:00	0.0000	0.0000	0.0000	0.1057	0.00803	0.114
07:30:00	0.0000	0.0000	0.0000	0.1030	0.00902	0.112
08:00:00	0.0000	0.0000	0.0000	0.0971	0.00996	0.107
08:30:00	0.0000	0.0000	0.0000	0.0894	0.0108	0.1
09:00:00	0.0000	0.0000	0.0000	0.0806	0.0116	0.0922
09:30:00	0.0000	0.0000	0.0000	0.0715	0.0123	0.0838
10:00:00	0.0000	0.0000	0.0000	0.0630	0.0128	0.0758
10:30:00	0.0000	0.0000	0.0000	0.0556	0.0133	0.0689
11:00:00	0.0000	0.0000	0.0000	0.0492	0.0137	0.0629
11:30:00	0.0000	0.0000	0.0000	0.0437	0.014	0.0577
12:00:00	0.0000	0.0000	0.0000	0.0387	0.0143	0.053
12:30:00	0.0000	0.0000	0.0000	0.0340	0.0145	0.0486
13:00:00	0.0000	0.0000	0.0000	0.0295	0.0147	0.0443
13:30:00	0.0000	0.0000	0.0000	0.0251	0.0148	0.04
14:00:00	0.0000	0.0000	0.0000	0.0208	0.0149	0.0357
14:30:00	0.0000	0.0000	0.0000	0.0165	0.015	0.0314
15:00:00	0.0000	0.0000	0.0000	0.0124	0.0149	0.0273
15:30:00	0.0000	0.0000	0.0000	0.0086	0.0149	0.0235
16:00:00	0.0000	0.0000	0.0000	0.0054	0.0148	0.0202
16:30:00	0.0000	0.0000	0.0000	0.0030	0.0147	0.0177
17:00:00	0.0000	0.0000	0.0000	0.0016	0.0146	0.0161

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:30:00	0.0000	0.0000	0.0000	0.0007	0.0144	0.0151
18:00:00	0.0000	0.0000	0.0000	0.0002	0.0143	0.0145
18:30:00	0.0000	0.0000	0.0000	0.0000	0.0141	0.0142
19:00:00	0.0000	0.0000	0.0000	0.0000	0.014	0.014
19:30:00	0.0000	0.0000	0.0000	0.0000	0.0138	0.0138
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0137	0.0137
20:30:00	0.0000	0.0000	0.0000	0.0000	0.0135	0.0135
21:00:00	0.0000	0.0000	0.0000	0.0000	0.0134	0.0134
21:30:00	0.0000	0.0000	0.0000	0.0000	0.0132	0.0132
22:00:00	0.0000	0.0000	0.0000	0.0000	0.0131	0.0131
22:30:00	0.0000	0.0000	0.0000	0.0000	0.013	0.013
23:00:00	0.0000	0.0000	0.0000	0.0000	0.0128	0.0128
23:30:00	0.0000	0.0000	0.0000	0.0000	0.0127	0.0127
24:00:00	0.0000	0.0000	0.0000	0.0000	0.0125	0.0125
24:30:00	0.0000	0.0000	0.0000	0.0000	0.0124	0.0124
25:00:00	0.0000	0.0000	0.0000	0.0000	0.0123	0.0123
25:30:00	0.0000	0.0000	0.0000	0.0000	0.0121	0.0121
26:00:00	0.0000	0.0000	0.0000	0.0000	0.012	0.012
26:30:00	0.0000	0.0000	0.0000	0.0000	0.0119	0.0119
27:00:00	0.0000	0.0000	0.0000	0.0000	0.0118	0.0118
27:30:00	0.0000	0.0000	0.0000	0.0000	0.0116	0.0116
28:00:00	0.0000	0.0000	0.0000	0.0000	0.0115	0.0115
28:30:00	0.0000	0.0000	0.0000	0.0000	0.0114	0.0114
29:00:00	0.0000	0.0000	0.0000	0.0000	0.0113	0.0113
29:30:00	0.0000	0.0000	0.0000	0.0000	0.0111	0.0111
30:00:00	0.0000	0.0000	0.0000	0.0000	0.011	0.011
30:30:00	0.0000	0.0000	0.0000	0.0000	0.0109	0.0109
31:00:00	0.0000	0.0000	0.0000	0.0000	0.0108	0.0108
31:30:00	0.0000	0.0000	0.0000	0.0000	0.0107	0.0107
32:00:00	0.0000	0.0000	0.0000	0.0000	0.0106	0.0106
32:30:00	0.0000	0.0000	0.0000	0.0000	0.0105	0.0105
33:00:00	0.0000	0.0000	0.0000	0.0000	0.0103	0.0103
33:30:00	0.0000	0.0000	0.0000	0.0000	0.0102	0.0102
34:00:00	0.0000	0.0000	0.0000	0.0000	0.0101	0.0101
34:30:00	0.0000	0.0000	0.0000	0.0000	0.01	0.01
35:00:00	0.0000	0.0000	0.0000	0.0000	0.00991	0.00991

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
35:30:00	0.0000	0.0000	0.0000	0.0000	0.0098	0.0098
36:00:00	0.0000	0.0000	0.0000	0.0000	0.0097	0.0097
36:30:00	0.0000	0.0000	0.0000	0.0000	0.00959	0.00959
37:00:00	0.0000	0.0000	0.0000	0.0000	0.00949	0.00949
37:30:00	0.0000	0.0000	0.0000	0.0000	0.00939	0.00939
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00929	0.00929
38:30:00	0.0000	0.0000	0.0000	0.0000	0.00919	0.00919
39:00:00	0.0000	0.0000	0.0000	0.0000	0.00909	0.00909
39:30:00	0.0000	0.0000	0.0000	0.0000	0.009	0.009
40:00:00	0.0000	0.0000	0.0000	0.0000	0.0089	0.0089
40:30:00	0.0000	0.0000	0.0000	0.0000	0.00881	0.00881
41:00:00	0.0000	0.0000	0.0000	0.0000	0.00871	0.00871
41:30:00	0.0000	0.0000	0.0000	0.0000	0.00862	0.00862
42:00:00	0.0000	0.0000	0.0000	0.0000	0.00853	0.00853
42:30:00	0.0000	0.0000	0.0000	0.0000	0.00844	0.00844
43:00:00	0.0000	0.0000	0.0000	0.0000	0.00835	0.00835
43:30:00	0.0000	0.0000	0.0000	0.0000	0.00826	0.00826
44:00:00	0.0000	0.0000	0.0000	0.0000	0.00817	0.00817
44:30:00	0.0000	0.0000	0.0000	0.0000	0.00808	0.00808
45:00:00	0.0000	0.0000	0.0000	0.0000	0.008	0.008
45:30:00	0.0000	0.0000	0.0000	0.0000	0.00791	0.00791
46:00:00	0.0000	0.0000	0.0000	0.0000	0.00783	0.00783
46:30:00	0.0000	0.0000	0.0000	0.0000	0.00774	0.00774
47:00:00	0.0000	0.0000	0.0000	0.0000	0.00766	0.00766
47:30:00	0.0000	0.0000	0.0000	0.0000	0.00758	0.00758
48:00:00	0.0000	0.0000	0.0000	0.0000	0.0075	0.0075
48:30:00	0.0000	0.0000	0.0000	0.0000	0.00742	0.00742
49:00:00	0.0000	0.0000	0.0000	0.0000	0.00734	0.00734
49:30:00	0.0000	0.0000	0.0000	0.0000	0.00726	0.00726
50:00:00	0.0000	0.0000	0.0000	0.0000	0.00718	0.00718
50:30:00	0.0000	0.0000	0.0000	0.0000	0.00711	0.00711
51:00:00	0.0000	0.0000	0.0000	0.0000	0.00703	0.00703
51:30:00	0.0000	0.0000	0.0000	0.0000	0.00695	0.00695
52:00:00	0.0000	0.0000	0.0000	0.0000	0.00688	0.00688
52:30:00	0.0000	0.0000	0.0000	0.0000	0.00681	0.00681
53:00:00	0.0000	0.0000	0.0000	0.0000	0.00673	0.00673

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
53:30:00	0.0000	0.0000	0.0000	0.0000	0.00666	0.00666
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00659	0.00659
54:30:00	0.0000	0.0000	0.0000	0.0000	0.00652	0.00652
55:00:00	0.0000	0.0000	0.0000	0.0000	0.00645	0.00645
55:30:00	0.0000	0.0000	0.0000	0.0000	0.00638	0.00638
56:00:00	0.0000	0.0000	0.0000	0.0000	0.00631	0.00631
56:30:00	0.0000	0.0000	0.0000	0.0000	0.00625	0.00625
57:00:00	0.0000	0.0000	0.0000	0.0000	0.00618	0.00618
57:30:00	0.0000	0.0000	0.0000	0.0000	0.00611	0.00611
58:00:00	0.0000	0.0000	0.0000	0.0000	0.00605	0.00605
58:30:00	0.0000	0.0000	0.0000	0.0000	0.00598	0.00598
59:00:00	0.0000	0.0000	0.0000	0.0000	0.00592	0.00592
59:30:00	0.0000	0.0000	0.0000	0.0000	0.00586	0.00586
60:00:00	0.0000	0.0000	0.0000	0.0000	0.00579	0.00579
60:30:00	0.0000	0.0000	0.0000	0.0000	0.00573	0.00573
61:00:00	0.0000	0.0000	0.0000	0.0000	0.00567	0.00567
61:30:00	0.0000	0.0000	0.0000	0.0000	0.00561	0.00561
62:00:00	0.0000	0.0000	0.0000	0.0000	0.00555	0.00555
62:30:00	0.0000	0.0000	0.0000	0.0000	0.00549	0.00549
63:00:00	0.0000	0.0000	0.0000	0.0000	0.00543	0.00543
63:30:00	0.0000	0.0000	0.0000	0.0000	0.00538	0.00538
64:00:00	0.0000	0.0000	0.0000	0.0000	0.00532	0.00532
64:30:00	0.0000	0.0000	0.0000	0.0000	0.00526	0.00526
65:00:00	0.0000	0.0000	0.0000	0.0000	0.00521	0.00521
65:30:00	0.0000	0.0000	0.0000	0.0000	0.00515	0.00515
66:00:00	0.0000	0.0000	0.0000	0.0000	0.00509	0.00509
66:30:00	0.0000	0.0000	0.0000	0.0000	0.00504	0.00504
67:00:00	0.0000	0.0000	0.0000	0.0000	0.00499	0.00499
67:30:00	0.0000	0.0000	0.0000	0.0000	0.00493	0.00493
68:00:00	0.0000	0.0000	0.0000	0.0000	0.00488	0.00488
68:30:00	0.0000	0.0000	0.0000	0.0000	0.00483	0.00483
69:00:00	0.0000	0.0000	0.0000	0.0000	0.00478	0.00478
69:30:00	0.0000	0.0000	0.0000	0.0000	0.00473	0.00473
70:00:00	0.0000	0.0000	0.0000	0.0000	0.00468	0.00468
70:30:00	0.0000	0.0000	0.0000	0.0000	0.00463	0.00463
71:00:00	0.0000	0.0000	0.0000	0.0000	0.00458	0.00458

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
71:30:00	0.0000	0.0000	0.0000	0.0000	0.00453	0.00453
72:00:00	0.0000	0.0000	0.0000	0.0000	0.00448	0.00448
72:30:00	0.0000	0.0000	0.0000	0.0000	0.00443	0.00443
73:00:00	0.0000	0.0000	0.0000	0.0000	0.00438	0.00438
73:30:00	0.0000	0.0000	0.0000	0.0000	0.00434	0.00434
74:00:00	0.0000	0.0000	0.0000	0.0000	0.00429	0.00429
74:30:00	0.0000	0.0000	0.0000	0.0000	0.00425	0.00425
75:00:00	0.0000	0.0000	0.0000	0.0000	0.0042	0.0042
75:30:00	0.0000	0.0000	0.0000	0.0000	0.00416	0.00416
76:00:00	0.0000	0.0000	0.0000	0.0000	0.00411	0.00411
76:30:00	0.0000	0.0000	0.0000	0.0000	0.00407	0.00407
77:00:00	0.0000	0.0000	0.0000	0.0000	0.00402	0.00402
77:30:00	0.0000	0.0000	0.0000	0.0000	0.00398	0.00398
78:00:00	0.0000	0.0000	0.0000	0.0000	0.00394	0.00394
78:30:00	0.0000	0.0000	0.0000	0.0000	0.0039	0.0039
79:00:00	0.0000	0.0000	0.0000	0.0000	0.00385	0.00385
79:30:00	0.0000	0.0000	0.0000	0.0000	0.00381	0.00381
80:00:00	0.0000	0.0000	0.0000	0.0000	0.00377	0.00377
80:30:00	0.0000	0.0000	0.0000	0.0000	0.00373	0.00373
81:00:00	0.0000	0.0000	0.0000	0.0000	0.00369	0.00369
81:30:00	0.0000	0.0000	0.0000	0.0000	0.00365	0.00365
82:00:00	0.0000	0.0000	0.0000	0.0000	0.00361	0.00361
82:30:00	0.0000	0.0000	0.0000	0.0000	0.00358	0.00358
83:00:00	0.0000	0.0000	0.0000	0.0000	0.00354	0.00354
83:30:00	0.0000	0.0000	0.0000	0.0000	0.0035	0.0035
84:00:00	0.0000	0.0000	0.0000	0.0000	0.00346	0.00346
84:30:00	0.0000	0.0000	0.0000	0.0000	0.00343	0.00343
85:00:00	0.0000	0.0000	0.0000	0.0000	0.00339	0.00339
85:30:00	0.0000	0.0000	0.0000	0.0000	0.00335	0.00335
86:00:00	0.0000	0.0000	0.0000	0.0000	0.00332	0.00332
86:30:00	0.0000	0.0000	0.0000	0.0000	0.00328	0.00328
87:00:00	0.0000	0.0000	0.0000	0.0000	0.00325	0.00325
87:30:00	0.0000	0.0000	0.0000	0.0000	0.00321	0.00321
88:00:00	0.0000	0.0000	0.0000	0.0000	0.00318	0.00318
88:30:00	0.0000	0.0000	0.0000	0.0000	0.00314	0.00314
89:00:00	0.0000	0.0000	0.0000	0.0000	0.00311	0.00311

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
89:30:00	0.0000	0.0000	0.0000	0.0000	0.00308	0.00308
90:00:00	0.0000	0.0000	0.0000	0.0000	0.00304	0.00304
90:30:00	0.0000	0.0000	0.0000	0.0000	0.00301	0.00301
91:00:00	0.0000	0.0000	0.0000	0.0000	0.00298	0.00298
91:30:00	0.0000	0.0000	0.0000	0.0000	0.00295	0.00295
92:00:00	0.0000	0.0000	0.0000	0.0000	0.00292	0.00292
92:30:00	0.0000	0.0000	0.0000	0.0000	0.00289	0.00289
93:00:00	0.0000	0.0000	0.0000	0.0000	0.00285	0.00285
93:30:00	0.0000	0.0000	0.0000	0.0000	0.00282	0.00282
94:00:00	0.0000	0.0000	0.0000	0.0000	0.00279	0.00279

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

Annex 9C-2

Greenfield Runoff Volume Results

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:55:56 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 4D6B-AB9F

Site name: Greenfield Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH 2013 (mm):	24.15	Total runoff (ML):	0.40
Total Rainfall (mm):	15.29	Total flow (ML):	0.80
Peak Rainfall (mm):	4.16	Peak flow (m³/s):	0.02

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.4369	0.0000	0.1297	0.0000	0.00277	0.00277
00:40:00	0.8198	0.0000	0.2446	0.0000	0.00273	0.00277
01:20:00	1.5243	0.0000	0.4590	0.0002	0.00269	0.00292
02:00:00	2.7845	0.0000	0.8524	0.0007	0.00266	0.00332
02:40:00	4.1582	0.0000	1.3066	0.0016	0.00264	0.00421
03:20:00	2.7845	0.0000	0.8976	0.0033	0.00263	0.0059
04:00:00	1.5243	0.0000	0.4990	0.0057	0.00266	0.0084
04:40:00	0.8198	0.0000	0.2706	0.0086	0.00272	0.0113
05:20:00	0.4369	0.0000	0.1449	0.0114	0.00282	0.0143
06:00:00	0.0000	0.0000	0.0000	0.0139	0.00295	0.0169
06:40:00	0.0000	0.0000	0.0000	0.0155	0.00311	0.0187
07:20:00	0.0000	0.0000	0.0000	0.0158	0.00329	0.0191
08:00:00	0.0000	0.0000	0.0000	0.0150	0.00345	0.0184
08:40:00	0.0000	0.0000	0.0000	0.0135	0.0036	0.0171
09:20:00	0.0000	0.0000	0.0000	0.0118	0.00372	0.0156
10:00:00	0.0000	0.0000	0.0000	0.0101	0.00382	0.0139
10:40:00	0.0000	0.0000	0.0000	0.0085	0.0039	0.0124
11:20:00	0.0000	0.0000	0.0000	0.0073	0.00395	0.0112
12:00:00	0.0000	0.0000	0.0000	0.0062	0.00399	0.0102
12:40:00	0.0000	0.0000	0.0000	0.0052	0.00401	0.00921
13:20:00	0.0000	0.0000	0.0000	0.0043	0.00402	0.00829
14:00:00	0.0000	0.0000	0.0000	0.0034	0.00401	0.00739
14:40:00	0.0000	0.0000	0.0000	0.0025	0.004	0.00651
15:20:00	0.0000	0.0000	0.0000	0.0017	0.00397	0.00568
16:00:00	0.0000	0.0000	0.0000	0.0010	0.00393	0.00495
16:40:00	0.0000	0.0000	0.0000	0.0005	0.00389	0.0044
17:20:00	0.0000	0.0000	0.0000	0.0002	0.00384	0.00406
18:00:00	0.0000	0.0000	0.0000	0.0001	0.00378	0.00387
18:40:00	0.0000	0.0000	0.0000	0.0000	0.00373	0.00375
19:20:00	0.0000	0.0000	0.0000	0.0000	0.00368	0.00368
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00363	0.00363
20:40:00	0.0000	0.0000	0.0000	0.0000	0.00357	0.00357
21:20:00	0.0000	0.0000	0.0000	0.0000	0.00352	0.00352
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00347	0.00347
22:40:00	0.0000	0.0000	0.0000	0.0000	0.00342	0.00342

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
23:20:00	0.0000	0.0000	0.0000	0.0000	0.00337	0.00337
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00333	0.00333
24:40:00	0.0000	0.0000	0.0000	0.0000	0.00328	0.00328
25:20:00	0.0000	0.0000	0.0000	0.0000	0.00323	0.00323
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00319	0.00319
26:40:00	0.0000	0.0000	0.0000	0.0000	0.00314	0.00314
27:20:00	0.0000	0.0000	0.0000	0.0000	0.0031	0.0031
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00305	0.00305
28:40:00	0.0000	0.0000	0.0000	0.0000	0.00301	0.00301
29:20:00	0.0000	0.0000	0.0000	0.0000	0.00297	0.00297
30:00:00	0.0000	0.0000	0.0000	0.0000	0.00293	0.00293
30:40:00	0.0000	0.0000	0.0000	0.0000	0.00288	0.00288
31:20:00	0.0000	0.0000	0.0000	0.0000	0.00284	0.00284
32:00:00	0.0000	0.0000	0.0000	0.0000	0.0028	0.0028

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:56:16 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 4D6B-AB9F

Site name: Greenfield Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 30 year

Summary of results

Rainfall - FEH 2013 (mm):	53.08	Total runoff (ML):	0.95
Total Rainfall (mm):	33.61	Total flow (ML):	1.87
Peak Rainfall (mm):	9.14	Peak flow (m^3/s):	0.04

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.9605	0.0000	0.2858	0.0000	0.00277	0.00277
00:40:00	1.8022	0.0000	0.5420	0.0001	0.00273	0.00283
01:20:00	3.3510	0.0000	1.0279	0.0005	0.00269	0.0032
02:00:00	6.1213	0.0000	1.9454	0.0015	0.00267	0.00414
02:40:00	9.1412	0.0000	3.0680	0.0035	0.00266	0.00618
03:20:00	6.1213	0.0000	2.1636	0.0074	0.0027	0.0101
04:00:00	3.3510	0.0000	1.2215	0.0131	0.0028	0.0159
04:40:00	1.8022	0.0000	0.6678	0.0197	0.00299	0.0227
05:20:00	0.9605	0.0000	0.3590	0.0265	0.00327	0.0297
06:00:00	0.0000	0.0000	0.0000	0.0324	0.00363	0.0361
06:40:00	0.0000	0.0000	0.0000	0.0364	0.00405	0.0404
07:20:00	0.0000	0.0000	0.0000	0.0371	0.0045	0.0416
08:00:00	0.0000	0.0000	0.0000	0.0353	0.00494	0.0402
08:40:00	0.0000	0.0000	0.0000	0.0320	0.00533	0.0374
09:20:00	0.0000	0.0000	0.0000	0.0280	0.00567	0.0337
10:00:00	0.0000	0.0000	0.0000	0.0239	0.00595	0.0299
10:40:00	0.0000	0.0000	0.0000	0.0202	0.00617	0.0264
11:20:00	0.0000	0.0000	0.0000	0.0172	0.00634	0.0236
12:00:00	0.0000	0.0000	0.0000	0.0147	0.00647	0.0211
12:40:00	0.0000	0.0000	0.0000	0.0123	0.00657	0.0189
13:20:00	0.0000	0.0000	0.0000	0.0102	0.00663	0.0168
14:00:00	0.0000	0.0000	0.0000	0.0081	0.00666	0.0147
14:40:00	0.0000	0.0000	0.0000	0.0060	0.00666	0.0127
15:20:00	0.0000	0.0000	0.0000	0.0041	0.00664	0.0108
16:00:00	0.0000	0.0000	0.0000	0.0025	0.00659	0.00906
16:40:00	0.0000	0.0000	0.0000	0.0013	0.00652	0.00777
17:20:00	0.0000	0.0000	0.0000	0.0006	0.00644	0.00699
18:00:00	0.0000	0.0000	0.0000	0.0002	0.00635	0.00656
18:40:00	0.0000	0.0000	0.0000	0.0000	0.00627	0.00631
19:20:00	0.0000	0.0000	0.0000	0.0000	0.00618	0.00618
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00609	0.00609
20:40:00	0.0000	0.0000	0.0000	0.0000	0.006	0.006
21:20:00	0.0000	0.0000	0.0000	0.0000	0.00592	0.00592
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00583	0.00583
22:40:00	0.0000	0.0000	0.0000	0.0000	0.00575	0.00575

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
23:20:00	0.0000	0.0000	0.0000	0.0000	0.00567	0.00567
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00559	0.00559
24:40:00	0.0000	0.0000	0.0000	0.0000	0.00551	0.00551
25:20:00	0.0000	0.0000	0.0000	0.0000	0.00543	0.00543
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00535	0.00535
26:40:00	0.0000	0.0000	0.0000	0.0000	0.00528	0.00528
27:20:00	0.0000	0.0000	0.0000	0.0000	0.0052	0.0052
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00513	0.00513
28:40:00	0.0000	0.0000	0.0000	0.0000	0.00506	0.00506
29:20:00	0.0000	0.0000	0.0000	0.0000	0.00498	0.00498
30:00:00	0.0000	0.0000	0.0000	0.0000	0.00491	0.00491
30:40:00	0.0000	0.0000	0.0000	0.0000	0.00484	0.00484
31:20:00	0.0000	0.0000	0.0000	0.0000	0.00477	0.00477
32:00:00	0.0000	0.0000	0.0000	0.0000	0.00471	0.00471
32:40:00	0.0000	0.0000	0.0000	0.0000	0.00464	0.00464
33:20:00	0.0000	0.0000	0.0000	0.0000	0.00457	0.00457
34:00:00	0.0000	0.0000	0.0000	0.0000	0.00451	0.00451
34:40:00	0.0000	0.0000	0.0000	0.0000	0.00444	0.00444
35:20:00	0.0000	0.0000	0.0000	0.0000	0.00438	0.00438
36:00:00	0.0000	0.0000	0.0000	0.0000	0.00432	0.00432
36:40:00	0.0000	0.0000	0.0000	0.0000	0.00426	0.00426
37:20:00	0.0000	0.0000	0.0000	0.0000	0.0042	0.0042
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00414	0.00414
38:40:00	0.0000	0.0000	0.0000	0.0000	0.00408	0.00408
39:20:00	0.0000	0.0000	0.0000	0.0000	0.00402	0.00402
40:00:00	0.0000	0.0000	0.0000	0.0000	0.00396	0.00396
40:40:00	0.0000	0.0000	0.0000	0.0000	0.00391	0.00391
41:20:00	0.0000	0.0000	0.0000	0.0000	0.00385	0.00385
42:00:00	0.0000	0.0000	0.0000	0.0000	0.0038	0.0038
42:40:00	0.0000	0.0000	0.0000	0.0000	0.00374	0.00374
43:20:00	0.0000	0.0000	0.0000	0.0000	0.00369	0.00369
44:00:00	0.0000	0.0000	0.0000	0.0000	0.00364	0.00364
44:40:00	0.0000	0.0000	0.0000	0.0000	0.00359	0.00359
45:20:00	0.0000	0.0000	0.0000	0.0000	0.00354	0.00354
46:00:00	0.0000	0.0000	0.0000	0.0000	0.00349	0.00349
46:40:00	0.0000	0.0000	0.0000	0.0000	0.00344	0.00344

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
47:20:00	0.0000	0.0000	0.0000	0.0000	0.00339	0.00339
48:00:00	0.0000	0.0000	0.0000	0.0000	0.00334	0.00334
48:40:00	0.0000	0.0000	0.0000	0.0000	0.00329	0.00329
49:20:00	0.0000	0.0000	0.0000	0.0000	0.00324	0.00324
50:00:00	0.0000	0.0000	0.0000	0.0000	0.0032	0.0032
50:40:00	0.0000	0.0000	0.0000	0.0000	0.00315	0.00315
51:20:00	0.0000	0.0000	0.0000	0.0000	0.00311	0.00311
52:00:00	0.0000	0.0000	0.0000	0.0000	0.00306	0.00306
52:40:00	0.0000	0.0000	0.0000	0.0000	0.00302	0.00302
53:20:00	0.0000	0.0000	0.0000	0.0000	0.00298	0.00298
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00294	0.00294
54:40:00	0.0000	0.0000	0.0000	0.0000	0.00289	0.00289
55:20:00	0.0000	0.0000	0.0000	0.0000	0.00285	0.00285
56:00:00	0.0000	0.0000	0.0000	0.0000	0.00281	0.00281

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:57:00 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 4D6B-AB9F

Site name: Greenfield Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH 2013 (mm):	72.74	Total runoff (ML):	1.35
Total Rainfall (mm):	46.06	Total flow (ML):	2.67
Peak Rainfall (mm):	12.53	Peak flow (m^3/s):	0.06

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	1.3163	0.0000	0.3921	0.0000	0.00277	0.00277
00:40:00	2.4697	0.0000	0.7467	0.0001	0.00273	0.00287
01:20:00	4.5921	0.0000	1.4262	0.0007	0.00269	0.00339
02:00:00	8.3885	0.0000	2.7325	0.0020	0.00267	0.00471
02:40:00	12.5269	0.0000	4.3865	0.0049	0.00268	0.00756
03:20:00	8.3885	0.0000	3.1423	0.0103	0.00275	0.013
04:00:00	4.5921	0.0000	1.7898	0.0184	0.00291	0.0213
04:40:00	2.4697	0.0000	0.9829	0.0279	0.00319	0.0311
05:20:00	1.3163	0.0000	0.5297	0.0375	0.00359	0.0411
06:00:00	0.0000	0.0000	0.0000	0.0461	0.00412	0.0502
06:40:00	0.0000	0.0000	0.0000	0.0519	0.00474	0.0566
07:20:00	0.0000	0.0000	0.0000	0.0531	0.0054	0.0585
08:00:00	0.0000	0.0000	0.0000	0.0506	0.00604	0.0567
08:40:00	0.0000	0.0000	0.0000	0.0460	0.00662	0.0526
09:20:00	0.0000	0.0000	0.0000	0.0403	0.00712	0.0474
10:00:00	0.0000	0.0000	0.0000	0.0344	0.00753	0.0419
10:40:00	0.0000	0.0000	0.0000	0.0291	0.00786	0.037
11:20:00	0.0000	0.0000	0.0000	0.0248	0.00813	0.0329
12:00:00	0.0000	0.0000	0.0000	0.0211	0.00833	0.0294
12:40:00	0.0000	0.0000	0.0000	0.0177	0.00848	0.0262
13:20:00	0.0000	0.0000	0.0000	0.0146	0.00858	0.0232
14:00:00	0.0000	0.0000	0.0000	0.0116	0.00864	0.0203
14:40:00	0.0000	0.0000	0.0000	0.0087	0.00866	0.0174
15:20:00	0.0000	0.0000	0.0000	0.0060	0.00863	0.0146
16:00:00	0.0000	0.0000	0.0000	0.0036	0.00858	0.0122
16:40:00	0.0000	0.0000	0.0000	0.0018	0.00849	0.0103
17:20:00	0.0000	0.0000	0.0000	0.0008	0.00839	0.00921
18:00:00	0.0000	0.0000	0.0000	0.0003	0.00828	0.00858
18:40:00	0.0000	0.0000	0.0000	0.0001	0.00816	0.00824
19:20:00	0.0000	0.0000	0.0000	0.0000	0.00805	0.00805
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00793	0.00793
20:40:00	0.0000	0.0000	0.0000	0.0000	0.00782	0.00782
21:20:00	0.0000	0.0000	0.0000	0.0000	0.00771	0.00771
22:00:00	0.0000	0.0000	0.0000	0.0000	0.0076	0.0076
22:40:00	0.0000	0.0000	0.0000	0.0000	0.00749	0.00749

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
23:20:00	0.0000	0.0000	0.0000	0.0000	0.00739	0.00739
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00728	0.00728
24:40:00	0.0000	0.0000	0.0000	0.0000	0.00718	0.00718
25:20:00	0.0000	0.0000	0.0000	0.0000	0.00708	0.00708
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00698	0.00698
26:40:00	0.0000	0.0000	0.0000	0.0000	0.00688	0.00688
27:20:00	0.0000	0.0000	0.0000	0.0000	0.00678	0.00678
28:00:00	0.0000	0.0000	0.0000	0.0000	0.00668	0.00668
28:40:00	0.0000	0.0000	0.0000	0.0000	0.00659	0.00659
29:20:00	0.0000	0.0000	0.0000	0.0000	0.00649	0.00649
30:00:00	0.0000	0.0000	0.0000	0.0000	0.0064	0.0064
30:40:00	0.0000	0.0000	0.0000	0.0000	0.00631	0.00631
31:20:00	0.0000	0.0000	0.0000	0.0000	0.00622	0.00622
32:00:00	0.0000	0.0000	0.0000	0.0000	0.00613	0.00613
32:40:00	0.0000	0.0000	0.0000	0.0000	0.00605	0.00605
33:20:00	0.0000	0.0000	0.0000	0.0000	0.00596	0.00596
34:00:00	0.0000	0.0000	0.0000	0.0000	0.00588	0.00588
34:40:00	0.0000	0.0000	0.0000	0.0000	0.00579	0.00579
35:20:00	0.0000	0.0000	0.0000	0.0000	0.00571	0.00571
36:00:00	0.0000	0.0000	0.0000	0.0000	0.00563	0.00563
36:40:00	0.0000	0.0000	0.0000	0.0000	0.00555	0.00555
37:20:00	0.0000	0.0000	0.0000	0.0000	0.00547	0.00547
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00539	0.00539
38:40:00	0.0000	0.0000	0.0000	0.0000	0.00532	0.00532
39:20:00	0.0000	0.0000	0.0000	0.0000	0.00524	0.00524
40:00:00	0.0000	0.0000	0.0000	0.0000	0.00517	0.00517
40:40:00	0.0000	0.0000	0.0000	0.0000	0.00509	0.00509
41:20:00	0.0000	0.0000	0.0000	0.0000	0.00502	0.00502
42:00:00	0.0000	0.0000	0.0000	0.0000	0.00495	0.00495
42:40:00	0.0000	0.0000	0.0000	0.0000	0.00488	0.00488
43:20:00	0.0000	0.0000	0.0000	0.0000	0.00481	0.00481
44:00:00	0.0000	0.0000	0.0000	0.0000	0.00474	0.00474
44:40:00	0.0000	0.0000	0.0000	0.0000	0.00467	0.00467
45:20:00	0.0000	0.0000	0.0000	0.0000	0.00461	0.00461
46:00:00	0.0000	0.0000	0.0000	0.0000	0.00454	0.00454
46:40:00	0.0000	0.0000	0.0000	0.0000	0.00448	0.00448

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
47:20:00	0.0000	0.0000	0.0000	0.0000	0.00441	0.00441
48:00:00	0.0000	0.0000	0.0000	0.0000	0.00435	0.00435
48:40:00	0.0000	0.0000	0.0000	0.0000	0.00429	0.00429
49:20:00	0.0000	0.0000	0.0000	0.0000	0.00423	0.00423
50:00:00	0.0000	0.0000	0.0000	0.0000	0.00417	0.00417
50:40:00	0.0000	0.0000	0.0000	0.0000	0.00411	0.00411
51:20:00	0.0000	0.0000	0.0000	0.0000	0.00405	0.00405
52:00:00	0.0000	0.0000	0.0000	0.0000	0.00399	0.00399
52:40:00	0.0000	0.0000	0.0000	0.0000	0.00394	0.00394
53:20:00	0.0000	0.0000	0.0000	0.0000	0.00388	0.00388
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00383	0.00383
54:40:00	0.0000	0.0000	0.0000	0.0000	0.00377	0.00377
55:20:00	0.0000	0.0000	0.0000	0.0000	0.00372	0.00372
56:00:00	0.0000	0.0000	0.0000	0.0000	0.00366	0.00366
56:40:00	0.0000	0.0000	0.0000	0.0000	0.00361	0.00361
57:20:00	0.0000	0.0000	0.0000	0.0000	0.00356	0.00356
58:00:00	0.0000	0.0000	0.0000	0.0000	0.00351	0.00351
58:40:00	0.0000	0.0000	0.0000	0.0000	0.00346	0.00346
59:20:00	0.0000	0.0000	0.0000	0.0000	0.00341	0.00341
60:00:00	0.0000	0.0000	0.0000	0.0000	0.00336	0.00336
60:40:00	0.0000	0.0000	0.0000	0.0000	0.00332	0.00332
61:20:00	0.0000	0.0000	0.0000	0.0000	0.00327	0.00327
62:00:00	0.0000	0.0000	0.0000	0.0000	0.00322	0.00322
62:40:00	0.0000	0.0000	0.0000	0.0000	0.00318	0.00318
63:20:00	0.0000	0.0000	0.0000	0.0000	0.00313	0.00313
64:00:00	0.0000	0.0000	0.0000	0.0000	0.00309	0.00309
64:40:00	0.0000	0.0000	0.0000	0.0000	0.00304	0.00304
65:20:00	0.0000	0.0000	0.0000	0.0000	0.003	0.003
66:00:00	0.0000	0.0000	0.0000	0.0000	0.00296	0.00296
66:40:00	0.0000	0.0000	0.0000	0.0000	0.00292	0.00292
67:20:00	0.0000	0.0000	0.0000	0.0000	0.00287	0.00287
68:00:00	0.0000	0.0000	0.0000	0.0000	0.00283	0.00283
68:40:00	0.0000	0.0000	0.0000	0.0000	0.00279	0.00279

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 10:57:23 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 4D6B-AB9F

Site name: Greenfield Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 1000 year

Summary of results

Rainfall - FEH 2013 (mm):	132.58	Total runoff (ML):	2.78
Total Rainfall (mm):	83.94	Total flow (ML):	5.49
Peak Rainfall (mm):	22.83	Peak flow (m³/s):	0.12

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	2.3990	0.0000	0.7177	0.0000	0.00277	0.00277
00:40:00	4.5010	0.0000	1.3829	0.0003	0.00273	0.00299
01:20:00	8.3690	0.0000	2.6970	0.0013	0.0027	0.00398
02:00:00	15.2880	0.0000	5.3491	0.0038	0.0027	0.00647
02:40:00	22.8301	0.0000	9.0044	0.0092	0.00275	0.0119
03:20:00	15.2880	0.0000	6.7103	0.0198	0.00291	0.0227
04:00:00	8.3690	0.0000	3.9046	0.0359	0.00325	0.0392
04:40:00	4.5010	0.0000	2.1676	0.0553	0.00384	0.0591
05:20:00	2.3990	0.0000	1.1746	0.0752	0.00468	0.0799
06:00:00	0.0000	0.0000	0.0000	0.0933	0.00578	0.0991
06:40:00	0.0000	0.0000	0.0000	0.1060	0.00707	0.113
07:20:00	0.0000	0.0000	0.0000	0.1093	0.00846	0.118
08:00:00	0.0000	0.0000	0.0000	0.1048	0.00982	0.115
08:40:00	0.0000	0.0000	0.0000	0.0955	0.0111	0.107
09:20:00	0.0000	0.0000	0.0000	0.0839	0.0121	0.096
10:00:00	0.0000	0.0000	0.0000	0.0716	0.013	0.0847
10:40:00	0.0000	0.0000	0.0000	0.0606	0.0138	0.0744
11:20:00	0.0000	0.0000	0.0000	0.0516	0.0143	0.0659
12:00:00	0.0000	0.0000	0.0000	0.0439	0.0148	0.0587
12:40:00	0.0000	0.0000	0.0000	0.0370	0.0152	0.0522
13:20:00	0.0000	0.0000	0.0000	0.0306	0.0154	0.046
14:00:00	0.0000	0.0000	0.0000	0.0244	0.0156	0.04
14:40:00	0.0000	0.0000	0.0000	0.0184	0.0156	0.0341
15:20:00	0.0000	0.0000	0.0000	0.0128	0.0156	0.0284
16:00:00	0.0000	0.0000	0.0000	0.0078	0.0156	0.0233
16:40:00	0.0000	0.0000	0.0000	0.0040	0.0154	0.0194
17:20:00	0.0000	0.0000	0.0000	0.0018	0.0152	0.017
18:00:00	0.0000	0.0000	0.0000	0.0007	0.015	0.0157
18:40:00	0.0000	0.0000	0.0000	0.0002	0.0148	0.015
19:20:00	0.0000	0.0000	0.0000	0.0000	0.0146	0.0146
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0144	0.0144
20:40:00	0.0000	0.0000	0.0000	0.0000	0.0142	0.0142
21:20:00	0.0000	0.0000	0.0000	0.0000	0.014	0.014
22:00:00	0.0000	0.0000	0.0000	0.0000	0.0138	0.0138
22:40:00	0.0000	0.0000	0.0000	0.0000	0.0136	0.0136

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
23:20:00	0.0000	0.0000	0.0000	0.0000	0.0134	0.0134
24:00:00	0.0000	0.0000	0.0000	0.0000	0.0132	0.0132
24:40:00	0.0000	0.0000	0.0000	0.0000	0.013	0.013
25:20:00	0.0000	0.0000	0.0000	0.0000	0.0129	0.0129
26:00:00	0.0000	0.0000	0.0000	0.0000	0.0127	0.0127
26:40:00	0.0000	0.0000	0.0000	0.0000	0.0125	0.0125
27:20:00	0.0000	0.0000	0.0000	0.0000	0.0123	0.0123
28:00:00	0.0000	0.0000	0.0000	0.0000	0.0121	0.0121
28:40:00	0.0000	0.0000	0.0000	0.0000	0.012	0.012
29:20:00	0.0000	0.0000	0.0000	0.0000	0.0118	0.0118
30:00:00	0.0000	0.0000	0.0000	0.0000	0.0116	0.0116
30:40:00	0.0000	0.0000	0.0000	0.0000	0.0115	0.0115
31:20:00	0.0000	0.0000	0.0000	0.0000	0.0113	0.0113
32:00:00	0.0000	0.0000	0.0000	0.0000	0.0111	0.0111
32:40:00	0.0000	0.0000	0.0000	0.0000	0.011	0.011
33:20:00	0.0000	0.0000	0.0000	0.0000	0.0108	0.0108
34:00:00	0.0000	0.0000	0.0000	0.0000	0.0107	0.0107
34:40:00	0.0000	0.0000	0.0000	0.0000	0.0105	0.0105
35:20:00	0.0000	0.0000	0.0000	0.0000	0.0104	0.0104
36:00:00	0.0000	0.0000	0.0000	0.0000	0.0102	0.0102
36:40:00	0.0000	0.0000	0.0000	0.0000	0.0101	0.0101
37:20:00	0.0000	0.0000	0.0000	0.0000	0.00993	0.00993
38:00:00	0.0000	0.0000	0.0000	0.0000	0.00979	0.00979
38:40:00	0.0000	0.0000	0.0000	0.0000	0.00965	0.00965
39:20:00	0.0000	0.0000	0.0000	0.0000	0.00952	0.00952
40:00:00	0.0000	0.0000	0.0000	0.0000	0.00938	0.00938
40:40:00	0.0000	0.0000	0.0000	0.0000	0.00925	0.00925
41:20:00	0.0000	0.0000	0.0000	0.0000	0.00912	0.00912
42:00:00	0.0000	0.0000	0.0000	0.0000	0.00899	0.00899
42:40:00	0.0000	0.0000	0.0000	0.0000	0.00886	0.00886
43:20:00	0.0000	0.0000	0.0000	0.0000	0.00873	0.00873
44:00:00	0.0000	0.0000	0.0000	0.0000	0.00861	0.00861
44:40:00	0.0000	0.0000	0.0000	0.0000	0.00849	0.00849
45:20:00	0.0000	0.0000	0.0000	0.0000	0.00837	0.00837
46:00:00	0.0000	0.0000	0.0000	0.0000	0.00825	0.00825
46:40:00	0.0000	0.0000	0.0000	0.0000	0.00813	0.00813

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
47:20:00	0.0000	0.0000	0.0000	0.0000	0.00802	0.00802
48:00:00	0.0000	0.0000	0.0000	0.0000	0.0079	0.0079
48:40:00	0.0000	0.0000	0.0000	0.0000	0.00779	0.00779
49:20:00	0.0000	0.0000	0.0000	0.0000	0.00768	0.00768
50:00:00	0.0000	0.0000	0.0000	0.0000	0.00757	0.00757
50:40:00	0.0000	0.0000	0.0000	0.0000	0.00746	0.00746
51:20:00	0.0000	0.0000	0.0000	0.0000	0.00736	0.00736
52:00:00	0.0000	0.0000	0.0000	0.0000	0.00725	0.00725
52:40:00	0.0000	0.0000	0.0000	0.0000	0.00715	0.00715
53:20:00	0.0000	0.0000	0.0000	0.0000	0.00705	0.00705
54:00:00	0.0000	0.0000	0.0000	0.0000	0.00695	0.00695
54:40:00	0.0000	0.0000	0.0000	0.0000	0.00685	0.00685
55:20:00	0.0000	0.0000	0.0000	0.0000	0.00675	0.00675
56:00:00	0.0000	0.0000	0.0000	0.0000	0.00666	0.00666
56:40:00	0.0000	0.0000	0.0000	0.0000	0.00656	0.00656
57:20:00	0.0000	0.0000	0.0000	0.0000	0.00647	0.00647
58:00:00	0.0000	0.0000	0.0000	0.0000	0.00638	0.00638
58:40:00	0.0000	0.0000	0.0000	0.0000	0.00629	0.00629
59:20:00	0.0000	0.0000	0.0000	0.0000	0.0062	0.0062
60:00:00	0.0000	0.0000	0.0000	0.0000	0.00611	0.00611
60:40:00	0.0000	0.0000	0.0000	0.0000	0.00602	0.00602
61:20:00	0.0000	0.0000	0.0000	0.0000	0.00594	0.00594
62:00:00	0.0000	0.0000	0.0000	0.0000	0.00585	0.00585
62:40:00	0.0000	0.0000	0.0000	0.0000	0.00577	0.00577
63:20:00	0.0000	0.0000	0.0000	0.0000	0.00569	0.00569
64:00:00	0.0000	0.0000	0.0000	0.0000	0.00561	0.00561
64:40:00	0.0000	0.0000	0.0000	0.0000	0.00553	0.00553
65:20:00	0.0000	0.0000	0.0000	0.0000	0.00545	0.00545
66:00:00	0.0000	0.0000	0.0000	0.0000	0.00537	0.00537
66:40:00	0.0000	0.0000	0.0000	0.0000	0.00529	0.00529
67:20:00	0.0000	0.0000	0.0000	0.0000	0.00522	0.00522
68:00:00	0.0000	0.0000	0.0000	0.0000	0.00514	0.00514
68:40:00	0.0000	0.0000	0.0000	0.0000	0.00507	0.00507
69:20:00	0.0000	0.0000	0.0000	0.0000	0.005	0.005
70:00:00	0.0000	0.0000	0.0000	0.0000	0.00493	0.00493
70:40:00	0.0000	0.0000	0.0000	0.0000	0.00486	0.00486

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
71:20:00	0.0000	0.0000	0.0000	0.0000	0.00479	0.00479
72:00:00	0.0000	0.0000	0.0000	0.0000	0.00472	0.00472
72:40:00	0.0000	0.0000	0.0000	0.0000	0.00465	0.00465
73:20:00	0.0000	0.0000	0.0000	0.0000	0.00459	0.00459
74:00:00	0.0000	0.0000	0.0000	0.0000	0.00452	0.00452
74:40:00	0.0000	0.0000	0.0000	0.0000	0.00446	0.00446
75:20:00	0.0000	0.0000	0.0000	0.0000	0.0044	0.0044
76:00:00	0.0000	0.0000	0.0000	0.0000	0.00433	0.00433
76:40:00	0.0000	0.0000	0.0000	0.0000	0.00427	0.00427
77:20:00	0.0000	0.0000	0.0000	0.0000	0.00421	0.00421
78:00:00	0.0000	0.0000	0.0000	0.0000	0.00415	0.00415
78:40:00	0.0000	0.0000	0.0000	0.0000	0.00409	0.00409
79:20:00	0.0000	0.0000	0.0000	0.0000	0.00403	0.00403
80:00:00	0.0000	0.0000	0.0000	0.0000	0.00398	0.00398
80:40:00	0.0000	0.0000	0.0000	0.0000	0.00392	0.00392
81:20:00	0.0000	0.0000	0.0000	0.0000	0.00386	0.00386
82:00:00	0.0000	0.0000	0.0000	0.0000	0.00381	0.00381
82:40:00	0.0000	0.0000	0.0000	0.0000	0.00376	0.00376
83:20:00	0.0000	0.0000	0.0000	0.0000	0.0037	0.0037
84:00:00	0.0000	0.0000	0.0000	0.0000	0.00365	0.00365
84:40:00	0.0000	0.0000	0.0000	0.0000	0.0036	0.0036
85:20:00	0.0000	0.0000	0.0000	0.0000	0.00355	0.00355
86:00:00	0.0000	0.0000	0.0000	0.0000	0.0035	0.0035
86:40:00	0.0000	0.0000	0.0000	0.0000	0.00345	0.00345
87:20:00	0.0000	0.0000	0.0000	0.0000	0.0034	0.0034
88:00:00	0.0000	0.0000	0.0000	0.0000	0.00335	0.00335
88:40:00	0.0000	0.0000	0.0000	0.0000	0.0033	0.0033
89:20:00	0.0000	0.0000	0.0000	0.0000	0.00325	0.00325
90:00:00	0.0000	0.0000	0.0000	0.0000	0.00321	0.00321
90:40:00	0.0000	0.0000	0.0000	0.0000	0.00316	0.00316
91:20:00	0.0000	0.0000	0.0000	0.0000	0.00312	0.00312
92:00:00	0.0000	0.0000	0.0000	0.0000	0.00307	0.00307
92:40:00	0.0000	0.0000	0.0000	0.0000	0.00303	0.00303
93:20:00	0.0000	0.0000	0.0000	0.0000	0.00299	0.00299
94:00:00	0.0000	0.0000	0.0000	0.0000	0.00294	0.00294
94:40:00	0.0000	0.0000	0.0000	0.0000	0.0029	0.0029

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
95:20:00	0.0000	0.0000	0.0000	0.0000	0.00286	0.00286
96:00:00	0.0000	0.0000	0.0000	0.0000	0.00282	0.00282
96:40:00	0.0000	0.0000	0.0000	0.0000	0.00278	0.00278

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

Annex 9C-3

Post-Development Runoff Rate Results

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:06:18 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: F5D9-4557

Site name: Post-Development Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH 2013 (mm):	23.61	Total runoff (ML):	1.24
Total Rainfall (mm):	14.76	Total flow (ML):	1.35
Peak Rainfall (mm):	3.35	Peak flow (m^3/s):	0.08

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.3240	0.0000	0.3240	0.0000	0.00277	0.00277
00:30:00	0.5428	0.0000	0.5428	0.0004	0.00274	0.00309
01:00:00	0.9047	0.0000	0.9047	0.0016	0.00271	0.00435
01:30:00	1.4960	0.0000	1.4960	0.0045	0.00268	0.00718
02:00:00	2.4345	0.0000	2.4345	0.0099	0.00265	0.0126
02:30:00	3.3537	0.0000	3.3537	0.0188	0.00262	0.0214
03:00:00	2.4345	0.0000	2.4345	0.0322	0.00259	0.0348
03:30:00	1.4960	0.0000	1.4960	0.0491	0.00257	0.0516
04:00:00	0.9047	0.0000	0.9047	0.0655	0.00254	0.0681
04:30:00	0.5428	0.0000	0.5428	0.0772	0.00251	0.0797
05:00:00	0.3240	0.0000	0.3240	0.0803	0.00248	0.0828
05:30:00	0.0000	0.0000	0.0000	0.0759	0.00246	0.0784
06:00:00	0.0000	0.0000	0.0000	0.0670	0.00243	0.0695
06:30:00	0.0000	0.0000	0.0000	0.0562	0.00241	0.0586
07:00:00	0.0000	0.0000	0.0000	0.0454	0.00238	0.0478
07:30:00	0.0000	0.0000	0.0000	0.0353	0.00235	0.0376
08:00:00	0.0000	0.0000	0.0000	0.0262	0.00233	0.0286
08:30:00	0.0000	0.0000	0.0000	0.0183	0.0023	0.0207
09:00:00	0.0000	0.0000	0.0000	0.0118	0.00228	0.014
09:30:00	0.0000	0.0000	0.0000	0.0068	0.00226	0.00902
10:00:00	0.0000	0.0000	0.0000	0.0036	0.00223	0.0058
10:30:00	0.0000	0.0000	0.0000	0.0017	0.00221	0.00392
11:00:00	0.0000	0.0000	0.0000	0.0007	0.00218	0.00288
11:30:00	0.0000	0.0000	0.0000	0.0002	0.00216	0.00237
12:00:00	0.0000	0.0000	0.0000	0.0000	0.00214	0.00216

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:06:43 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: F5D9-4557

Site name: Post-Development Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 30 year

Summary of results

Rainfall - FEH 2013 (mm):	52.11	Total runoff (ML):	2.74
Total Rainfall (mm):	32.57	Total flow (ML):	2.85
Peak Rainfall (mm):	7.40	Peak flow (m³/s):	0.18

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.7151	0.0000	0.7151	0.0000	0.00277	0.00277
00:30:00	1.1981	0.0000	1.1981	0.0008	0.00274	0.00351
01:00:00	1.9968	0.0000	1.9968	0.0036	0.00271	0.00633
01:30:00	3.3017	0.0000	3.3017	0.0099	0.00268	0.0126
02:00:00	5.3731	0.0000	5.3731	0.0219	0.00265	0.0246
02:30:00	7.4018	0.0000	7.4018	0.0414	0.00262	0.0441
03:00:00	5.3731	0.0000	5.3731	0.0711	0.00259	0.0737
03:30:00	3.3017	0.0000	3.3017	0.1083	0.00257	0.111
04:00:00	1.9968	0.0000	1.9968	0.1446	0.00254	0.147
04:30:00	1.1981	0.0000	1.1981	0.1704	0.00251	0.173
05:00:00	0.7151	0.0000	0.7151	0.1773	0.00248	0.18
05:30:00	0.0000	0.0000	0.0000	0.1676	0.00246	0.17
06:00:00	0.0000	0.0000	0.0000	0.1479	0.00243	0.15
06:30:00	0.0000	0.0000	0.0000	0.1241	0.00241	0.126
07:00:00	0.0000	0.0000	0.0000	0.1003	0.00238	0.103
07:30:00	0.0000	0.0000	0.0000	0.0779	0.00235	0.0802
08:00:00	0.0000	0.0000	0.0000	0.0579	0.00233	0.0602
08:30:00	0.0000	0.0000	0.0000	0.0405	0.0023	0.0428
09:00:00	0.0000	0.0000	0.0000	0.0259	0.00228	0.0282
09:30:00	0.0000	0.0000	0.0000	0.0149	0.00226	0.0172
10:00:00	0.0000	0.0000	0.0000	0.0079	0.00223	0.0101
10:30:00	0.0000	0.0000	0.0000	0.0038	0.00221	0.00598
11:00:00	0.0000	0.0000	0.0000	0.0015	0.00218	0.00373
11:30:00	0.0000	0.0000	0.0000	0.0005	0.00216	0.00261
12:00:00	0.0000	0.0000	0.0000	0.0000	0.00214	0.00218

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:07:04 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: F5D9-4557

Site name: Post-Development Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH 2013 (mm):	71.06	Total runoff (ML):	3.73
Total Rainfall (mm):	44.42	Total flow (ML):	3.84
Peak Rainfall (mm):	10.09	Peak flow (m^3/s):	0.24

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.9752	0.0000	0.9752	0.0000	0.00277	0.00277
00:30:00	1.6339	0.0000	1.6339	0.0011	0.00274	0.00379
01:00:00	2.7231	0.0000	2.7231	0.0049	0.00271	0.00765
01:30:00	4.5026	0.0000	4.5026	0.0135	0.00268	0.0162
02:00:00	7.3276	0.0000	7.3276	0.0299	0.00265	0.0325
02:30:00	10.0941	0.0000	10.0941	0.0565	0.00262	0.0591
03:00:00	7.3276	0.0000	7.3276	0.0969	0.00259	0.0995
03:30:00	4.5026	0.0000	4.5026	0.1477	0.00257	0.15
04:00:00	2.7231	0.0000	2.7231	0.1972	0.00254	0.2
04:30:00	1.6339	0.0000	1.6339	0.2324	0.00251	0.235
05:00:00	0.9752	0.0000	0.9752	0.2418	0.00248	0.244
05:30:00	0.0000	0.0000	0.0000	0.2285	0.00246	0.231
06:00:00	0.0000	0.0000	0.0000	0.2017	0.00243	0.204
06:30:00	0.0000	0.0000	0.0000	0.1692	0.00241	0.172
07:00:00	0.0000	0.0000	0.0000	0.1368	0.00238	0.139
07:30:00	0.0000	0.0000	0.0000	0.1062	0.00235	0.109
08:00:00	0.0000	0.0000	0.0000	0.0789	0.00233	0.0813
08:30:00	0.0000	0.0000	0.0000	0.0552	0.0023	0.0575
09:00:00	0.0000	0.0000	0.0000	0.0354	0.00228	0.0376
09:30:00	0.0000	0.0000	0.0000	0.0204	0.00226	0.0226
10:00:00	0.0000	0.0000	0.0000	0.0107	0.00223	0.013
10:30:00	0.0000	0.0000	0.0000	0.0051	0.00221	0.00735
11:00:00	0.0000	0.0000	0.0000	0.0021	0.00218	0.00429
11:30:00	0.0000	0.0000	0.0000	0.0006	0.00216	0.00278
12:00:00	0.0000	0.0000	0.0000	0.0001	0.00214	0.00219

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:07:20 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: F5D9-4557

Site name: Post-Development Runoff Rate

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 1000 year

Summary of results

Rainfall - FEH 2013 (mm):	129.69	Total runoff (ML):	6.81
Total Rainfall (mm):	81.07	Total flow (ML):	6.92
Peak Rainfall (mm):	18.42	Peak flow (m³/s):	0.44

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	05:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	1.7798	0.0000	1.7798	0.0000	0.00277	0.00277
00:30:00	2.9818	0.0000	2.9818	0.0019	0.00274	0.00466
01:00:00	4.9697	0.0000	4.9697	0.0090	0.00271	0.0117
01:30:00	8.2173	0.0000	8.2173	0.0247	0.00268	0.0274
02:00:00	13.3729	0.0000	13.3729	0.0545	0.00265	0.0572
02:30:00	18.4218	0.0000	18.4218	0.1031	0.00262	0.106
03:00:00	13.3729	0.0000	13.3729	0.1769	0.00259	0.179
03:30:00	8.2173	0.0000	8.2173	0.2695	0.00257	0.272
04:00:00	4.9697	0.0000	4.9697	0.3599	0.00254	0.362
04:30:00	2.9818	0.0000	2.9818	0.4242	0.00251	0.427
05:00:00	1.7798	0.0000	1.7798	0.4413	0.00248	0.444
05:30:00	0.0000	0.0000	0.0000	0.4171	0.00246	0.42
06:00:00	0.0000	0.0000	0.0000	0.3681	0.00243	0.371
06:30:00	0.0000	0.0000	0.0000	0.3088	0.00241	0.311
07:00:00	0.0000	0.0000	0.0000	0.2496	0.00238	0.252
07:30:00	0.0000	0.0000	0.0000	0.1938	0.00235	0.196
08:00:00	0.0000	0.0000	0.0000	0.1440	0.00233	0.146
08:30:00	0.0000	0.0000	0.0000	0.1008	0.0023	0.103
09:00:00	0.0000	0.0000	0.0000	0.0645	0.00228	0.0668
09:30:00	0.0000	0.0000	0.0000	0.0372	0.00226	0.0394
10:00:00	0.0000	0.0000	0.0000	0.0196	0.00223	0.0218
10:30:00	0.0000	0.0000	0.0000	0.0094	0.00221	0.0116
11:00:00	0.0000	0.0000	0.0000	0.0038	0.00218	0.00603
11:30:00	0.0000	0.0000	0.0000	0.0011	0.00216	0.00329
12:00:00	0.0000	0.0000	0.0000	0.0001	0.00214	0.00224

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

Annex 9C-4

Post-Development Runoff Volume Results

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:11:38 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: DBDA-3D36

Site name: Post-Development Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH 2013 (mm):	24.15	Total runoff (ML):	1.28
Total Rainfall (mm):	15.29	Total flow (ML):	1.40
Peak Rainfall (mm):	4.16	Peak flow (m³/s):	0.08

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.4369	0.0000	0.4369	0.0000	0.00277	0.00277
00:40:00	0.8198	0.0000	0.8198	0.0006	0.00273	0.00336
01:20:00	1.5243	0.0000	1.5243	0.0031	0.00269	0.00577
02:00:00	2.7845	0.0000	2.7845	0.0089	0.00265	0.0115
02:40:00	4.1582	0.0000	4.1582	0.0195	0.00261	0.0221
03:20:00	2.7845	0.0000	2.7845	0.0369	0.00257	0.0395
04:00:00	1.5243	0.0000	1.5243	0.0584	0.00254	0.0609
04:40:00	0.8198	0.0000	0.8198	0.0754	0.0025	0.0779
05:20:00	0.4369	0.0000	0.4369	0.0797	0.00247	0.0822
06:00:00	0.0000	0.0000	0.0000	0.0725	0.00243	0.0749
06:40:00	0.0000	0.0000	0.0000	0.0596	0.0024	0.062
07:20:00	0.0000	0.0000	0.0000	0.0457	0.00236	0.0481
08:00:00	0.0000	0.0000	0.0000	0.0324	0.00233	0.0348
08:40:00	0.0000	0.0000	0.0000	0.0210	0.0023	0.0233
09:20:00	0.0000	0.0000	0.0000	0.0119	0.00226	0.0142
10:00:00	0.0000	0.0000	0.0000	0.0058	0.00223	0.00807
10:40:00	0.0000	0.0000	0.0000	0.0025	0.0022	0.00471
11:20:00	0.0000	0.0000	0.0000	0.0009	0.00217	0.00306
12:00:00	0.0000	0.0000	0.0000	0.0002	0.00214	0.00233
12:40:00	0.0000	0.0000	0.0000	0.0000	0.00211	0.00211

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:11:56 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: DBDA-3D36

Site name: Post-Development Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 30 year

Summary of results

Rainfall - FEH 2013 (mm):	53.08	Total runoff (ML):	2.82
Total Rainfall (mm):	33.61	Total flow (ML):	2.94
Peak Rainfall (mm):	9.14	Peak flow (m^3/s):	0.18

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.9605	0.0000	0.9605	0.0000	0.00277	0.00277
00:40:00	1.8022	0.0000	1.8022	0.0014	0.00273	0.00411
01:20:00	3.3510	0.0000	3.3510	0.0068	0.00269	0.00946
02:00:00	6.1213	0.0000	6.1213	0.0195	0.00265	0.0222
02:40:00	9.1412	0.0000	9.1412	0.0429	0.00261	0.0455
03:20:00	6.1213	0.0000	6.1213	0.0812	0.00257	0.0838
04:00:00	3.3510	0.0000	3.3510	0.1283	0.00254	0.131
04:40:00	1.8022	0.0000	1.8022	0.1658	0.0025	0.168
05:20:00	0.9605	0.0000	0.9605	0.1752	0.00247	0.178
06:00:00	0.0000	0.0000	0.0000	0.1594	0.00243	0.162
06:40:00	0.0000	0.0000	0.0000	0.1311	0.0024	0.133
07:20:00	0.0000	0.0000	0.0000	0.1005	0.00236	0.103
08:00:00	0.0000	0.0000	0.0000	0.0713	0.00233	0.0737
08:40:00	0.0000	0.0000	0.0000	0.0461	0.0023	0.0484
09:20:00	0.0000	0.0000	0.0000	0.0262	0.00226	0.0285
10:00:00	0.0000	0.0000	0.0000	0.0128	0.00223	0.0151
10:40:00	0.0000	0.0000	0.0000	0.0055	0.0022	0.00772
11:20:00	0.0000	0.0000	0.0000	0.0020	0.00217	0.00412
12:00:00	0.0000	0.0000	0.0000	0.0004	0.00214	0.00257
12:40:00	0.0000	0.0000	0.0000	0.0000	0.00211	0.00211

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:12:11 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: DBDA-3D36

Site name: Post-Development Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH 2013 (mm):	72.74	Total runoff (ML):	3.87
Total Rainfall (mm):	46.06	Total flow (ML):	3.99
Peak Rainfall (mm):	12.53	Peak flow (m^3/s):	0.24

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	1.3163	0.0000	1.3163	0.0000	0.00277	0.00277
00:40:00	2.4697	0.0000	2.4697	0.0019	0.00273	0.00463
01:20:00	4.5921	0.0000	4.5921	0.0093	0.00269	0.012
02:00:00	8.3885	0.0000	8.3885	0.0267	0.00265	0.0294
02:40:00	12.5269	0.0000	12.5269	0.0588	0.00261	0.0614
03:20:00	8.3885	0.0000	8.3885	0.1113	0.00257	0.114
04:00:00	4.5921	0.0000	4.5921	0.1759	0.00254	0.178
04:40:00	2.4697	0.0000	2.4697	0.2272	0.0025	0.23
05:20:00	1.3163	0.0000	1.3163	0.2401	0.00247	0.243
06:00:00	0.0000	0.0000	0.0000	0.2184	0.00243	0.221
06:40:00	0.0000	0.0000	0.0000	0.1796	0.0024	0.182
07:20:00	0.0000	0.0000	0.0000	0.1377	0.00236	0.14
08:00:00	0.0000	0.0000	0.0000	0.0978	0.00233	0.1
08:40:00	0.0000	0.0000	0.0000	0.0632	0.0023	0.0655
09:20:00	0.0000	0.0000	0.0000	0.0360	0.00226	0.0382
10:00:00	0.0000	0.0000	0.0000	0.0176	0.00223	0.0198
10:40:00	0.0000	0.0000	0.0000	0.0076	0.0022	0.00977
11:20:00	0.0000	0.0000	0.0000	0.0027	0.00217	0.00485
12:00:00	0.0000	0.0000	0.0000	0.0006	0.00214	0.00273
12:40:00	0.0000	0.0000	0.0000	0.0000	0.00211	0.00211

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Wednesday, July 10, 2019 11:12:27 AM by Laura.Soothill
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: DBDA-3D36

Site name: Post-Development Runoff Volume

Easting: 587559

Northing: 176472

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.08 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 1000 year

Summary of results

Rainfall - FEH 2013 (mm):	132.58	Total runoff (ML):	7.05
Total Rainfall (mm):	83.94	Total flow (ML):	7.17
Peak Rainfall (mm):	22.83	Peak flow (m³/s):	0.44

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [05:30:00]	Yes
Timestep (hh:mm:ss)	00:40:00 [00:30:00]	Yes
SCF (Seasonal correction factor)	0.63	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	126.89	No
Cmax (mm)	428.13	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	3.74 [2.27]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	46.61 [40.7]	Yes
BR	0.97	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0.08 [0]	Yes
Urbext 2000	0.64 [0]	Yes
Impervious runoff factor	1 [0.7]	Yes
Imperviousness factor	1 [0.3]	Yes
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	2.3990	0.0000	2.3990	0.0000	0.00277	0.00277
00:40:00	4.5010	0.0000	4.5010	0.0035	0.00273	0.00619
01:20:00	8.3690	0.0000	8.3690	0.0169	0.00269	0.0196
02:00:00	15.2880	0.0000	15.2880	0.0487	0.00265	0.0514
02:40:00	22.8301	0.0000	22.8301	0.1071	0.00261	0.11
03:20:00	15.2880	0.0000	15.2880	0.2028	0.00257	0.205
04:00:00	8.3690	0.0000	8.3690	0.3205	0.00254	0.323
04:40:00	4.5010	0.0000	4.5010	0.4140	0.0025	0.417
05:20:00	2.3990	0.0000	2.3990	0.4375	0.00247	0.44
06:00:00	0.0000	0.0000	0.0000	0.3980	0.00243	0.4
06:40:00	0.0000	0.0000	0.0000	0.3274	0.0024	0.33
07:20:00	0.0000	0.0000	0.0000	0.2509	0.00236	0.253
08:00:00	0.0000	0.0000	0.0000	0.1782	0.00233	0.18
08:40:00	0.0000	0.0000	0.0000	0.1152	0.0023	0.118
09:20:00	0.0000	0.0000	0.0000	0.0655	0.00226	0.0678
10:00:00	0.0000	0.0000	0.0000	0.0321	0.00223	0.0343
10:40:00	0.0000	0.0000	0.0000	0.0138	0.0022	0.016
11:20:00	0.0000	0.0000	0.0000	0.0049	0.00217	0.00705
12:00:00	0.0000	0.0000	0.0000	0.0011	0.00214	0.00321
12:40:00	0.0000	0.0000	0.0000	0.0000	0.00211	0.00211

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.48	No
PROPWET (mm)	0.21	No
SAAR (mm)	524	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

Appendix 10.A – Traffic Scenario

AADT

*baseline taken from ATCs and DfT counter points, see AADT Raw) 2021 and 2023 factored up using Tempro, see future years sheet

					Base Year			2021								2023							
		*indicates speed limit	Base Year of Survey	Dev. Distribution	Baseline			Baseline			With Construction			Increase		Baseline			With Construction			Increase	
DfT Cour	Count Number Location	Av. Speed			HGV	All	HGV %	HGV	All	HGV %	HGV	All	HGV %	HGV	All	HGV	All	HGV %	HGV	All	HGV %	HGV	All
N/A	ATC 1 B2001 Power Station Road	43.4mph	2018	0.0%	390	2946	13.2%	410	3099	13.2%	410	3099	13.2%	0.0%	0.0%	422	3188	13.2%	422	3188	13.2%	0.0%	0.0%
N/A	ATC 2 A228 Grain Road Lower St	42.5mph	2018	100.0%	312	2947	10.6%	328	3100	10.6%	423	3275	12.9%	28.9%	5.6%	338	3189	10.6%	433	3364	12.9%	28.1%	5.5%
N/A	ATC 3 B2001 W of Access	37.0mph	2017	100.0%	818	4241	19.3%	861	4462	19.3%	956	4637	20.6%	11.0%	3.9%	885	4590	19.3%	980	4765	20.6%	10.7%	3.8%
56776	1 A228 Grain Road	*40mph	2017	100.0%	1584	8582	18.5%	1695	9181	18.5%	1790	9356	19.1%	5.6%	1.9%	1714	9444	18.2%	1809	9619	18.8%	5.5%	1.9%
56827	2 A228 Four Elms Hill Beaco	*40mph	2017	99.0%	1355	33024	4.1%	1491	35329	4.1%	1585	35502	4.5%	6.3%	0.5%	1466	36343	4.0%	1560	36516	4.3%	6.4%	0.5%
70385	3 A289 Wainscott Primary Sc	*70mph	2017	16.8%	2169	43021	5.0%	2387	46024	5.0%	2403	46053	5.2%	0.7%	0.1%	2347	47345	5.0%	2363	47374	5.0%	0.7%	0.1%
56816	4 A228 Frindsbury Road	*30mph	2017	4.9%	376	15904	2.4%	414	17014	2.4%	418	17023	2.5%	1.1%	0.1%	407	17502	2.3%	412	17511	2.4%	1.2%	0.0%
70384	5 A2 Chatham Docks	*40mph	2017	16.8%	686	34242	2.0%	755	36632	2.0%	771	36661	2.1%	2.1%	0.1%	742	37683	2.0%	758	37713	2.0%	2.1%	0.1%
70386	6 A2 opposite Featherby Rd	*40mph	2017	16.8%	594	34882	1.7%	654	37317	1.7%	670	37346	1.8%	2.4%	0.1%	643	38388	1.7%	659	38417	1.7%	2.5%	0.1%
70381	7 A289 between A226 and B	*70mph	2017	39.3%	3313	52386	6.3%	3646	56043	6.3%	3683	56111	6.6%	1.0%	0.1%	3585	57651	6.2%	3623	57720	6.3%	1.0%	0.1%
56415	8 A228 Gun Lane	*30mph	2017	0.0%	146	6787	2.2%	161	7261	2.2%	161	7261	2.2%	0.0%	0.0%	158	7469	2.1%	158	7469	2.1%	0.0%	0.0%
6099	9 Rochester Bridge	*30mph	2017	15.9%	448	35138	1.3%	493	37591	1.3%	508	37618	1.4%	3.1%	0.1%	485	38669	1.3%	500	38697	1.3%	3.1%	0.1%
56008	10 M2 btwn J1 & J2	*70mph	2017	22.0%	10650	100486	10.6%	11720	107500	10.6%	11741	107538	10.9%	0.2%	0.0%	11525	110585	10.4%	11546	110623	10.4%	0.2%	0.0%
6010	11 M2 btwn J2 & J3	*70mph	2017	22.0%	9823	99296	9.9%	10810	106227	9.9%	10831	106265	10.2%	0.2%	0.0%	10630	109275	9.7%	10651	109314	9.7%	0.2%	0.0%
73645	12 M2 btwn J4 & J5	*70mph	2017	11.8%	6928	69055	10.0%	7624	73875	10.0%	7636	73896	10.3%	0.1%	0.0%	7497	75995	9.9%	7509	76016	9.9%	0.1%	0.0%
78142	13 A287 btwn A2 & M2	*50mph	2017	0.0%	1146	35681	3.2%	1261	38172	3.2%	1261	38172	3.3%	0.0%	0.0%	1240	39267	3.2%	1240	39267	3.2%	0.0%	0.0%
36100	14 A2 w of J1 of M2	*70mph	2017	39.3%	10217	126325	8.1%	11244	135142	8.1%	11281	135211	8.3%	0.3%	0.1%	11057	139021	8.0%	11094	139090	8.0%	0.3%	0.0%
16092	15 A2 btwn M25 & B255	*70mph	2017	30.2%	10849	131863	8.2%	11939	141067	8.2%	11968	141120	8.5%	0.2%	0.0%	11741	145115	8.1%	11769	145168	8.1%	0.2%	0.0%
38792	16 A282 Dartford Crossing	*50mph	2014	2.9%	18578	115926	16.0%	20848	130092	16.0%	20851	130097	16.0%	0.0%	0.0%	20105	133825	15.0%	20108	133830	15.0%	0.0%	0.0%
7824	17 M25 S of A2	*70mph	2017	0.0%	13997	114976	12.2%	15404	123001	12.2%	15404	123001	12.5%	0.0%	0.0%	15148	126531	12.0%	15148	126531	12.0%	0.0%	0.0%
36099	18 A2 W of M25	*70mph	2017	19.6%	4919	108301	4.5%	5413	115860	4.5%	5432	115895	4.7%	0.3%	0.0%	5323	119185	4.5%	5342	119219	4.5%	0.3%	0.0%

Client: Neuconnect

Title: 24 hr AADT Traffic Flows

AECOM

Project: Isle of Grain, Kent

Revision:
Date: 29/05/2019

Drawn: MB
Checked: PK
Approved JS


River Thames
2.9%
50mph
Dartford
Greenhithe
Swanscombe
Bluewater
Shopping Centre
30.2%
70mph
19.6%
70mph
Bean
0%
70mph
Darenth
Sutton at Hone
Swanley Park
South Darenth
Longfield
Swanley
M25
Horton Kirby


East Tilbury
Tilbury
Cliffe
Allhallows
St Mary Hoo
Lower Stoke
Upper Stoke
100%
42.5mph
Isle of Grain
100%
43.4mph
Gravesend
Cliffe Woods
River Medway
99%
40mph
Queenborough
Shorne
39.3%
70mph
16.8%
70mph
St Mary's Island
39.3%
70mph
0%
30mph
4.9%
30mph
16.8%
40mph
22%
70mph
15.9%
30mph
Cobham
Rochester
Gillingham
Chatham
Upchurch
Meopham
Cuxton
16.8%
40mph
Rainham
Kemsley
22%
70mph
0%
50mph
Newington
Bobbing
Sittingbourne
11.8%
70mph
Snodland
Blue Bell Hill
Bredhurst
Aylesford
West Malling
Ditton
Milstead

Appendix 11.A – Environmental Liability Desk Study

AECOM Imagine it. Delivered.

J Clubb Limited & E.E.M. Limited Land, Isle of Grain

Environmental Liability Review
Proposed Sub-Sea Cable Landfall Site

NeuConnect Britain Limited

Project number: 60571593

16 August 2018

CONFIDENTIAL

Quality information

Prepared by	Checked by	Verified by	Approved by
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Revision History

Revision	Revision date	Details	Authorized	Name	Position
Rev0	16 August 2018	First Issue		Phil Tyson	Technical Director

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LIMITATIONS

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The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken between May 2018 and August 2018 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances. AECOM disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to AECOM's attention after the date of the Report.

Any risks identified in this Report are perceived risks, based on the information reviewed during the desk study and therefore partially based on conjecture from available information. The study is limited by the non-intrusive nature of the work and actual risks can only be assessed following a physical investigation of the site.

It should be noted that the effects of ground and water borne contamination on the environment are constantly under review, and authoritative guidance values are potentially subject to change. The conclusions presented herein are based on the guidance values available at the time this Report was prepared, however, no liability by AECOM can be accepted for the retrospective effects of any changes or amendments to these values.

The opinions expressed in this report and the comments and recommendations given are based on a desk assessment of readily available information. At this stage intrusive investigations have yet to be undertaken at site to establish actual ground and groundwater conditions and to provide data for an assessment of the geo-environmental status of the site.

Unless otherwise stated in this Report, the assessments made assume that the sites and facilities will continue to be used for their current purpose without significant changes.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

Reference to historical Ordnance Survey (OS) maps and/or data provides invaluable information regarding the land use history of a site. However, it should be noted that historical evidence will be incomplete for the period pre-dating the first edition and between the release of successive maps and/or data.

Costs may vary outside the ranges quoted. Whilst cost estimates are provided for individual issues in this Report these are based upon information at the time which can be incomplete. Cost estimates for such issues may therefore vary from those provided. Where costs are supplied, these estimates should be considered in aggregate only. No reliance should be made in relation to any division of aggregate costs, including in relation to any issue, site or other subdivision.

No allowance has been made for changes in prices or exchange rates or changes in any other conditions which may result in price fluctuations in the future. Where assessments of works or costs necessary to achieve compliance have been made, these are based upon measures which, in AECOM's experience, could normally be negotiated with the relevant authorities under present legislation and enforcement practice, assuming a pro-active and reasonable approach by site management.

Forecast cost estimates do not include such costs associated with any negotiations, appeals or other non-technical actions associated with the agreement on measures to meet the requirements of the authorities, nor are potential business loss and interruption costs considered that may be incurred as part of any technical measures.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. AECOM specifically does not guarantee or warrant any estimate or projections contained in this Report.

Table of Contents

Figures

Tables

Executive Summary

This report presents the findings of a review of potential environmental liabilities that could be incurred by NeuConnect Britain Limited (NeuConnect) if it acquires the land at, and to the north of, Perry's Farm, Isle of Grain, Kent, UK for a proposed a sub-sea cable landfall site. It has been prepared on behalf of NeuConnect by AECOM Limited (AECOM) under project number 60571593 and the associated contractual terms.

NeuConnect is planning to acquire three parcels of land on the Isle of Grain, Kent in which to develop the UK landfall site for the sub-sea cable. Based on information provided by NeuConnect, these are:

- Perry's Farm: Land parcel to be acquired from J Clubb Limited (J Clubb) and a private farm landowner in which the cable route, converter station and substation would be developed. This parcel is sub-divided into 'Area 1', 'Area 2' and 'Area 3';
- J Clubb Land: Land parcel to be acquired from J Clubb Limited in which the cable route would be developed; and
- E.E.M. Land: Land parcel to be acquired from E.E.M. Limited in which the cable route would be developed.

The objective of the due diligence study is to assess environmental liabilities associated with the three parcels of land to inform NeuConnect's negotiation of the Option Agreements for the purchase of the land. Potential ground constraints on the proposed development have also been identified. This was achieved through a desktop review of relevant data sources.

Perry's Farm

The key liabilities identified for the site relate to the on-going operation and management of the Perry's Farm landfill site. The relevant regulatory regime under which these liabilities would occur are the Environmental Permitting Regulations (2016).

The review of the permitting and operation of the Perry's Farm landfill site indicates that there is an on-going leachate management issue at the site, with previous release of leachate at the landfill surface. Permit conditions have been breached, specifically those relating to release of leachate to land, plus exceedance of trigger levels for leachate head in the waste, plus parameter levels in surface water and groundwater. A notice of non-compliance against the permit was issued by the Environment Agency (EA) in 2018, but has since been discharged. Measures have been implemented (drainage and the installation of a 'siltbuster') to address this, and further treatment is proposed (polishing lagoons). However, the EA has also raised the prospect of re-capping the landfill site (for Area 1).

With the Perry's Farm landfill and associated permit still operational, although not currently receiving waste, the development and use of the interconnector and associated infrastructure would have to be managed alongside the permitted activities. [redacted]

J Clubb and E.E.M. Land

For the E.E.M. and J Clubb land parcels (cable route) to the north of Perry's Farm landfill, the relevant regulatory regime in relation to risks from land contamination is considered to be Part 2A of the Environmental Protection Act (1990) and, in respect of the new development, the planning regime.

The potential liabilities associated with these areas relate to risks to sensitive receptors from possible sources of ground contamination due to previous land use. [redacted]

1. Introduction

1.1 General Introduction

This report presents the findings of a review of potential environmental liabilities that could be incurred by NeuConnect Britain Limited (NeuConnect) if it acquires the land at, and to the north of, Perry's Farm, Isle of Grain, Kent, UK for a proposed a sub-sea cable landfall site. It has been prepared on behalf of NeuConnect by AECOM Limited (AECOM) under project number 60571593 and the associated contractual terms.

1.2 Background

NeuConnect is planning to acquire three parcels of land on the Isle of Grain, Kent on which to develop the UK landfall site for the sub-sea cable. Based on information provided by NeuConnect, these are:

- **Perry's Farm:** Land parcel to be acquired from J Clubb Limited (J Clubb) and a private farm landowner in which the cable route (understood likely to be below ground), converter station and substation would be developed. This parcel is sub-divided into 'Area 1', 'Area 2' and 'Area 3';
- **J Clubb Land:** Land parcel to be acquired from J Clubb Limited in which the cable route would be developed; and
- **E.E.M. Land**: Land parcel to be acquired from E.E.M. Limited in which the cable route would be developed.

These parcels of land are shown on **Figure A** and described in more detail in **Table A** below,

Figure A: Site Layout

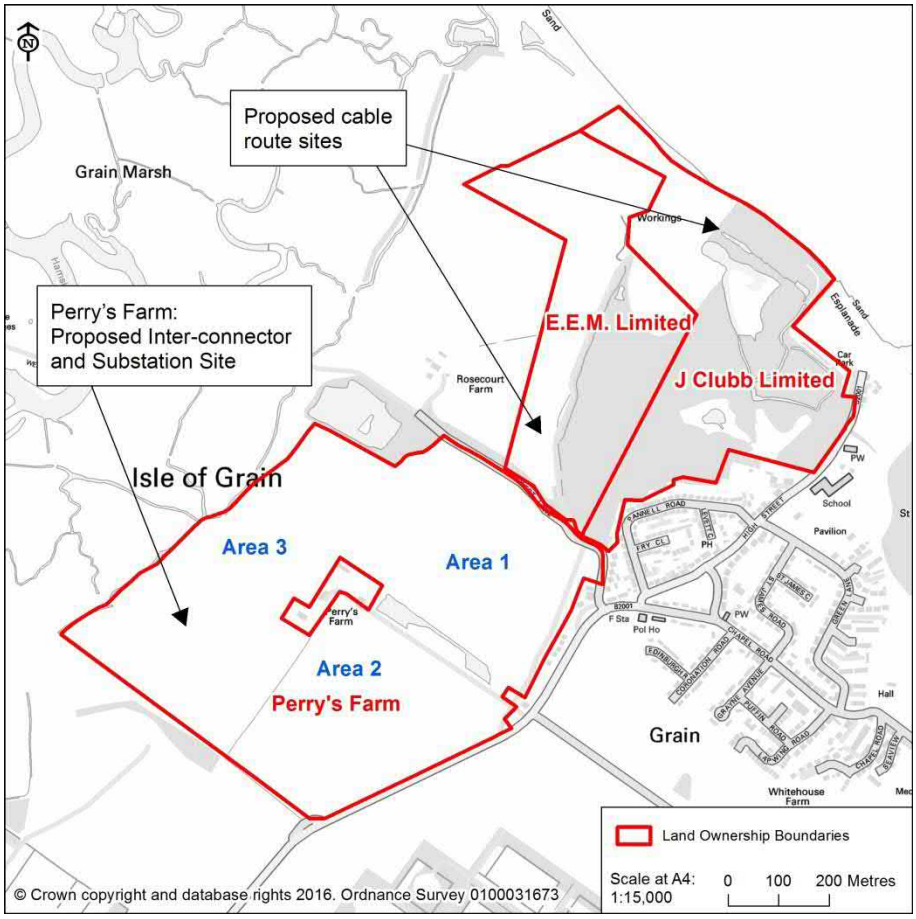


Table A – **Site Information**

Site Name	Proposed Landfall Sites, Isle of Grain
Site Operation	**Perry's Farm** is currently an active landfill site, but is understood to be no longer receiving waste, with some areas have been returned to agricultural use, and others never developed from agricultural use. This area is largely owned by J Clubb. However there is a farm property in the centre of the overall parcel which is not owned by J Clubb; details of current ownership not provided to AECOM.
	J Clubb Land is a second land parcel owned by J Clubb. This parcel is not part of the active landfill site, but is adjacent and to the northeast of it. The northern part of the parcel is understood to contain former sand and gravel workings, with a water body occupying a former quarry and a current, loading / storage / parking area at the northern boundary, on the coast. Based on review of aerial photography, the central part of the land parcel appears to be heavily vegetated and undeveloped, apart from possible agricultural use.
	E.E.M Land lies directly west of J Clubb Land and forms part of the same former sand and gravel workings, located in the northern part of the land parcel. Three water bodies occupy the former workings, one of which is largely off-site. It is understood that the discharge to surface water from the leachate management treatment plant ('siltbuster') discharges to the main water body. A track runs through the central / southern part of the land parcel from Perry's Farm to the south, running northwards to the loading / storage / parking area in the adjacent J Clubb Land. Based on review of aerial photography, east of the track, the land is heavily vegetated, while the land to the west appears to be cultivated agricultural fields. It is understood that a variation to the Environmental Permit for the waste operation at Perry's Farm was submitted in 2017 to extend the permitted area into this land parcel. The purpose of the variation was to use the southern part of the land to construct a secondary treatment system for landfill leachate.
Site Location	The site is located to the west and northwest of the village of Isle of Grain, which is at the easternmost point of the Hoo Peninsula in Medway, Kent. The site is bounded by the B2001 road to the south. West Lane runs through the centre of the site.
Grid Reference (easting and northing)	The site is centred approximately around National Grid Reference 588100 / 176700.
Reported Site Area	Approximately 80 hectares

The site location and layout, including the boundaries of the areas subject to the proposed land acquisition, is shown on **Figure 1** (see **Appendix A**).

1.3 Objectives

The objective of due diligence study is to assess potential environmental liabilities associated with the three parcels of land to inform NeuConnect's negotiation of the Option Agreements for the land. This includes consideration of:

- Liabilities associated with the acquisition of an permitted, operational, landfill site at Perry's Farm;
- Liability for potential soil and groundwater contamination associated with the Perry's Farm land;
- Liability for the historical landfills and potential soil and groundwater contamination associated with the cable route sites; and
- Options going forwards regarding liability and land-blight (land-use) management, e.g. reduction of permit area for Perry's Farm to more tightly encompass deposited waste, thus de-blighting virgin land.

1.4 Scope of Work

The Scope of Work for this Phase 1 Assessment includes:

- Completion of a desktop review of relevant data sources;
- Development of a Preliminary Conceptual Site Model;
- Completion of a Preliminary Risk Assessment with respect to risks from existing soil and groundwater contamination ;
- Completion of a preliminary review of ground conditions that could impose constraints upon the proposed landfall site; and
- Identification of potential environmental liabilities and management options.

This assessment has been limited to desk-based review of available information and discussion of the site with current owner and operator, J Clubb. Due to access constraints, it was not possible to complete a site walkover during the assessment.

1.5 Sources of Information

This report is based on information provided by the client as well as publically accessible sources of information.

AECOM has reviewed relevant documentation provided by J Clubb in relation to the site. These were obtained via the following sources:

- Via NeuConnect upon project commencement;
- Via email from J Clubb on 8th June 2018;
- Via NeuConnect's solicitor on 18th June 2018; and
- At a meeting between AECOM and J Clubb at the latter's office on 22nd June 2018.

The majority of the documents were obtained during the meeting on the 22nd June, during which J Clubb provided AECOM with an overview of the site history and current status, and answered questions about these aspects. A copy of AECOM's original document request is presented in **Appendix B**, and a list of documents provided is presented in **Appendix C**. References to documents in **Appendix C** within the report text are by the ref. number assigned to each document in the appendix (e.g.: ref. 02, 03).

Written responses to AECOM's request for information (RFI) were also provided by J Clubb and its consultant, WSP. These are presented in **Appendix D**.

Publically available sources of information consulted were as follows:

- Data obtained from public sources via Landmark in Geographic Information System (GIS) format (Landmark Envirocheck);
- British Geological Survey (BGS) Onshore GeoIndex website (http://mapapps2.bgs.ac.uk/geoindex/home.html) accessed June 2018;
- The Department for Environment, Food and Rural Affairs (DEFRA) MAGIC interactive mapping tool (http://magic.defra.gov.uk/MagicMap.aspx), accessed June 2018;
- Google maps (www.maps.google.co.uk), accessed June 2018;
- Details of establishments that are covered by the Control of Major Accident Hazards (COMAH) Regulations 2015 (http://www.hse.gov.uk/comah/comah-establishments.htm, accessed August 2018); and
- Aerial photography for 1940 to 2017, available via Google Earth Pro.

2. Site Setting

2.1 Introduction

This section presents a summary of the site history and environmental setting. This information will then provide the basis for assessing the environmental risks posed by the site, or surrounding land that may be impacting upon the site and giving rise to potential liabilities.

For the purpose of this assessment, the "site" refers to the overall landfall site, which comprises all three land parcels described in **Section 1.2**.

2.2 Site History – On-Site

A summary of the site history is provided below. This is based on documentation and information provided by J Clubb, aerial photography, plus historical mapping of the site obtained as points of interest data via Landmark.

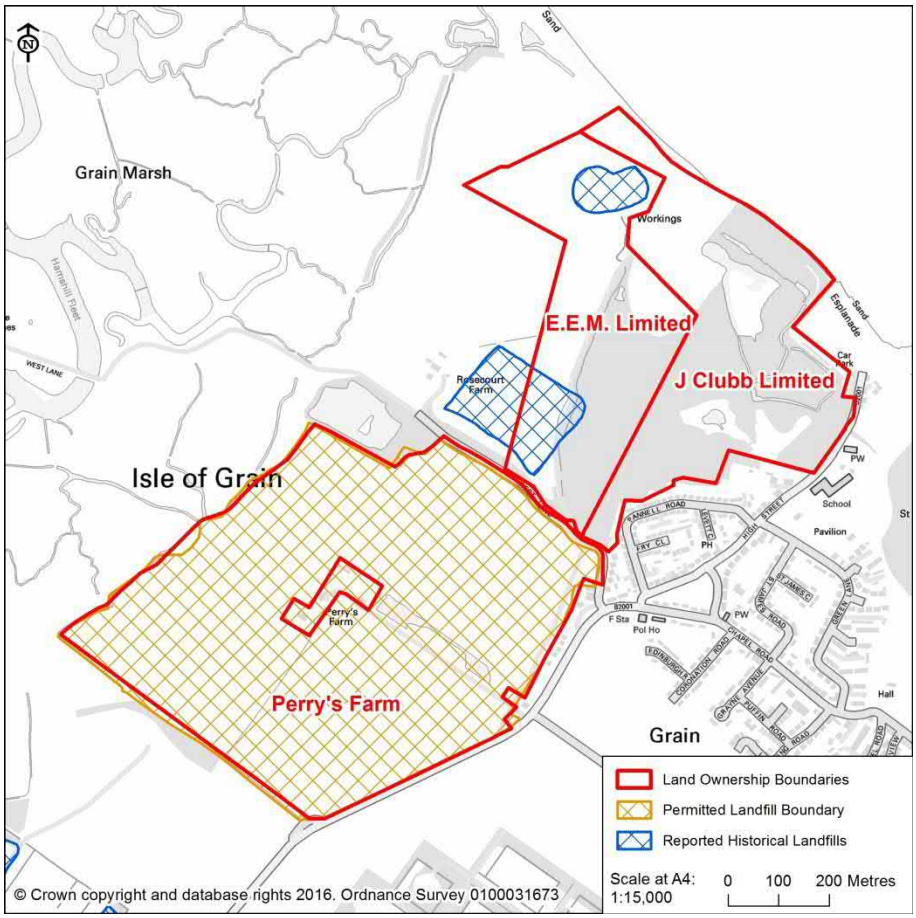
2.2.1 Perry's Farm

The Perry's Farm land parcel was historically quarried for sand and gravel, and is currently comprises a permitted landfill, operated in the past by J Clubb, although it is not currently receiving waste. The boundary of the Perry's Farm land (as shown on **Figure A**) corresponds to the Permitted Boundary of the Landfill.

In summary, the history of the Perry's Farm land parcel is as follows:

- J Clubb acquired the site in the late 1980s (ref. 02, 03). Prior to this, available aerial photography and mapping indicates the site to have comprised agricultural land;
- Planning permission for aggregate extraction and backfilling with waste was granted in 1990 by Kent County Council (KCC) (ref. 04);
- The site is reported to have been licensed to accept cement precipitator waste (also known as CDK, cement kiln dust, used hereafter) in 1990 (ref. 09) and the site continued to do so until 1999, ending due to cessation of cement manufacture by the waste producer;
- An Environmental Permit (ref. BP3335SR) was issued for the Perry's Farm landfill on 9th November 2005 (ref. 11). Further details of the permitting and operation of the landfill are presented in **Section 3**.

Figure B: Perry's Farm Permit Area and Reported Historical Landfills



The Perry's farm land parcel comprises three areas (shown on **Figure A**):

- The north-eastern area (**Area 1**) is reported to have been worked for sand and gravel extraction, landfilled with CKD, covered (capped) with clay and restoration topsoil, and then returned to agricultural use;
- The south-eastern area (**Area 2**) has been worked for sand and gravel, was still nominally operational (receiving waste) as of May 2017, although it is understood no waste has been deposited since;
- The western part of the Perry's Farm land parcel (**Area 3**) is understood to comprise agricultural land from which sand and gravel have never been extracted due to limited sand and gravel reserves in this part of the site. However, despite not forming part of the current or restored landfill, it still lies within the extent of the site's Environmental Permit, as authorised by the EA, and will be subject to the same regulatory controls as the rest of the Perry's Farm landfill.

2.2.2 J Clubb and E.E.M. Land

This area is understood to have been worked for sand and gravel and has been restored. In summary, its history is as follows:

- Planning permission for extraction of sand and gravel was granted to Clubb Estates Limited by KCC in 1977 for a site identified as Whitehall Farm. The former location of the farm is within the J Clubb Limited land. The former workings in both this and the E.E.M. Limited land are referred to as Whitehall Farm in documents provided by J Clubb for review (ref. 16);
- Prior to this, available aerial photography and mapping indicates the site to have comprised mostly agricultural land, with a possible military installation present along the shoreline in 1940 (photographs obtained via Google Earth Pro);
- Washing plant is reported within this area during the extraction of aggregate at the sand and gravel workings at the Perry's Farm land. Material is understood to have been transferred to the washing plant via

a conveyor located along the eastern edge of the Perry's Farm workings. This passed under West Lane via a culvert, which is still present;

- Despite the reported historical landfills in this area (see
- **Figure** B and **Table B**) after being worked for sand and gravel it is reported to have been restored to a lower level than the surrounding land rather than used for waste deposition (ref. 16 and written response from WSP [**Appendix D**]). J Clubb also stated that no waste had been deposited in this Area at the meeting on 22nd June 2018.

2.3 Site History – Off-Site

The area surrounding the whole site appears to have comprised a mixture of industrial, residential and agricultural / natural land uses. Tanks associated with an oil refinery / storage depot, were developed within 100 m southeast of the Perry's Farm land by 1960. A historical railway station was located at the head of a pier on the River Medway estuary to the south of the site until 1951 (Port Victoria Railway Station). Two historical landfills are indicated to the southwest of the site.

The main industrial area is to the south and southeast of the site. Current operators include:

- National Grid LNG Terminal;
- BP Aviation Bitumen Terminal;
- SSE Plc, Medway Power Station;
- Midland Steel Reinforcement Supplies;
- London Thamesport Ltd (shipping company).

Note: whilst all of these operations may not necessarily be close enough to the landfall site to be of concern for assessment of potentially contaminative activities, it is noted that some fall under the COMAH Regulations (2015). As such, proximity between them and the landfall site could be a consideration under the Planning Regime. Details as recorded in the Public Information Record are given below (distances based on post code entries for each establishment as given in the Public Information Record; actual establishment boundaries may be closer):

- National Grid Grain LNG Limited, Isle of Grain LNG Site Upper Tier, for fuel storage/distribution, 1.4 km southwest. In the case of this establishment, the boundary may lie within 500 m of Perry's Farm;
- BP Oil UK Limited, Isle of Grain, Upper Tier, for fuel storage/distribution, 1.8 km southwest;
- Monarch Chemicals Limited, Sheerness, Lower Tier, for chemical installations, 3.7 km northwest;
- Aesica Queenborough Limited, Queenborough, Lower Tier, for production of pharmaceuticals, 4.5 km northwest.

2.4 Potentially Contaminative Activities

A summary of regulatory information and other land use information is provided in **Table B** and **Table C** below. This is based on the Envirocheck GIS data and supplementary information taken from the review of documents provided by J Clubb. The information is limited to the categories provided in the GIS layers and a search radius of 500m from the full extent of the site.

Only features that are considered to be potentially relevant to the environmental or geotechnical constraints at the site have been included in the tables below.

Table B – On-Site Regulatory Information

Discharge Consents	• No entries
Pollution Incidents	• No entries
Pollution Incidents Register	**Perry's Farm:** • Pollution incident – environmental impact – Land: Significant Incident (Cat 2); Water: Minor Incident (Cat 3). Incident date 19/09/2013
Integrated Pollution Prevention Controls	**Perry's Farm:** • Two entries for J Clubb Limited, ref. BP3335SR, effective date 31/03/2008 and YP3733MV (both listed as revoked)
Registered and Historical Landfill Sites	**Perry's Farm:** • J Clubb Ltd, Perry's Farm. Medium input (between 25,000 and 75,000 tonnes per year). No known restriction on source of waste. Operational as far as is known (since 1996). Reference: P/03/34. In addition, there is a superseded record (from 1990) for this ref. stating large input (Equal to or greater than 75,000 and less than 250,000 tonnes per year), with no known restriction on source of waste.
	J Clubb and E.E.M. land: • J Clubb Ltd, Whitehall Farm. Deposited waste included inert waste. First input 1983, last input 1993. References: EAHLD19253 & P/06/25, P/03/25, 21DP. Medium input (between 25,000 and 75,000 tonnes per year). No known restriction on source of waste. Licence lapsed/cancelled/defunct/not applicable/surrendered.
Licensed Waste Management Facilities	**Perry's Farm:** • J Clubb Limited (expired). Class: A4: Household, Commercial & Industrial Waste Landfill, ref. 19397. Issue date: 02/07/1990 • J Clubb Limited (modified). Process: Inert Landfill. Issue date: 09/11/2005; modified date: 12/05/2010
BGS Recorded Mineral Sites	**Perry's Farm:** • Perry's Farm (ceased). Opencast, sand and gravel, ref 50748 • Perry's Farm Quarry (dormant). Opencast, sand and gravel, ref 5882
	J Clubb Land: • Rose Court Farm (ceased). Opencast, sand and gravel, ref 2527
	J Clubb and E.E.M. land: • Whitehall Farm Quarry (active). Opencast, common clay and shale, ref 2502 • Rose Court Farm (ceased). Opencast, sand and gravel, ref 50746
Hazardous Substances Consents	**Perry's Farm:** • Perry's Farm, storage of unknown hazardous substances (status unknown). Reference MC2007/2081, dated 21/12/2007
Historical Tanks	• No entries
Trade Directory Entries	**J Clubb and E.E.M. land:** • J Clubb Ltd. Office - sand, gravel and other aggregates (inactive)
Contaminative Land Uses	**Perry's Farm:** • Drawings provided by J Clubb (ref. 05, 25) indicate an oil pipeline runs approximately northwest to southeast through the centre of the Perry's Farm land. This is reported to be disused **J Clubb Limited land:** • Mineral railway (1908) in northeastern corner, running perpendicular to coastline • Unspecified pit in centre of site (1968)
Points of Interest	**Perry's Farm:** • 5no. entries for conveyors on Area 1 (manufacturing and production) • 3no. entries for sand, gravel and clay extraction and merchants (sand pit) on Area 1 • 2no. electricity pylons in southern part of Area 1, running northwest to southeast.
	J Clubb Limited land: • 2no. entries for conveyors (manufacturing and production) • 1no. entry for sand, gravel and clay extraction and merchants (sand and gravel works) • 1no. entry for DIY and Home Improvement (retail) in northwestern part of land parcel • Electricity substation in northwestern part of J Clubb Land • Weighbridge in northern part of J Clubb Land

Table B – On-Site Regulatory Information

	E.E.M. land: • 1no. entry for conveyors (manufacturing and production) • 2no. entries for sand, gravel and clay extraction and merchants (sand pit) (extractive industries)

Table C – Off-Site Regulatory Information (within 500m of whole site)

Discharge Consents	• 455m southwest of Perry's Farm: CB&I UK Ltd. Domestic Property (single) (incl. farm house) at Isle of Grain tanks expansion [project adjacent to long storage] facility, Ref P20665. Discharge Type: sewage discharges – final / treated effluent – not water company. Receiving Water: The Millmarsh Fleet.
Pollution Incidents	• 140m northeast of J Clubb Land: Grain Village; Boats/Ships. Pollutant: Oil Slick / Oils – diesel (including agricultural), Date: 1993. Category 3 – Minor Incident.
Pollution Incident Register	• 55m northeast of Perry's Farm: pollution incident – environmental impact – Land: Significant Incident (Cat 2); Water: Minor Incident (Cat 3). Incident date 27/05/2014
Integrated Pollution Prevention Controls	• No entries shown within 500m radius of site.
Historical Landfill Sites	• 370m southwest of Perry's Farm: BP British Gas. Deposited waste included inert and special waste. First input not listed, last input not listed. References: EAHLD19264 & P/03/1A. • 375m southwest of Perry's Farm: BP British Gas. Deposited waste included inert and special waste. First input 1952, last input 1992. References: EAHLD19260 & P/03/01, P/03/1A, 21EG. • 510m south of Perry's Farm: BP British Gas. Deposited waste included inert and special waste. First input 1977, last input 1992. References: EAHLD19270 & P/03/1A, 21EF.
Licensed Waste Management Facilities	• No entries shown within 500m radius of site.
Hazardous Substances Consents	• No entries shown within 500m radius of site.
Historical Tanks	• 80m east of J Clubb Land: historical tanks point (1972). Isle of Grain village • 180m – 500m south of Perry's Farm: 17no. historical tank entries within oil refinery land (various dates: 1968, 1969, 1972, 1983) • 275 and 360m southeast of J Clubb Land: historical tanks point classed as electrical substation facilities (1972). Isle of Grain village • 375m south of Perry's Farm: historical tanks point classed as electrical substation facilities (1987)
Trade Directory Entries	• 115m southeast of J Clubb Land: office, air conditioning and refrigeration contractors (inactive) • 150m southeast of J Clubb Land: business at home, cladding suppliers and installers (inactive) • 240m southeast of J Clubb Land: business at home, cleaning services – commercial (inactive)
Contaminative Land Uses	• 25m north of E.E.M. Land: military land (1961) • 120m southeast of Perry's Farm: tanks (1968) • 150m southeast of J Clubb Land: military land (1869) • 250m east of J Clubb Land: transport support and cargo handling (1869) • 260m south of Perry's Farm: pipeline running approx. southwest to northeast (1968, 1969) • 370m southwest of Perry's Farm: Kent Oil Refinery (1968, 1969) • 440m northeast of Perry's Farm: dismantled railway running approx. southwest to northeast (1968)

Table C – Off-Site Regulatory Information (within 500m of whole site)

Points of Interest	• 10m east of Perry's Farm: Medway Skip Hire Ltd – waste storage, processing and disposal • 80m southeast of J Clubb Land: tank for manufacturing and production • 130m east of Perry's Farm: Grain Fire Station • 150m – 500m southeast of Perry's Farm: 12no. tanks for manufacturing and production • 340m east of Perry's Farm: Electricity Substation • 460m east of Perry's Farm: Electricity Substation • 510m east of Perry's Farm: Electricity Substation • 525m southeast of J Clubb Land: Granite 4 You stone quarrying and preparation, extractive industries

2.5 Environmental Setting

Details of the site surface cover are provided in **Table D**, whilst the surrounding land use is described in **Table E**. Further site-specific environmental information is provided in **Table F**.

Table D – Site Surface

Perry's Farm:	Aerial photography shows Area 1 and Area 3 surface cover to comprise agricultural land and access roads to Perry's Farm and the southern edge of the Area 1. Cover in Area 2 comprises bare surface (soil / mineral), vegetation and possible stockpiled material, with possible small water-body
J Clubb Land:	Vegetation with a possible open area in the north-western corner
E.E.M. Land:	Vegetation, access track with a pond in the north-western corner

Table E – Surrounding Land Use

North	Undeveloped, vegetated areas with Grain Marsh beyond
South	Agricultural land with the Oil Storage Facility and Grain Power Station beyond
East	Agricultural land and Grain village
West	Agricultural land, farm buildings (Rosecourt Farm), with Grain Marsh beyond

Note, Perry's Farm and associated buildings are located within the centre of the Perry's Farm land. At the date of reporting, it is not known if this will form part of the land for development.

Table F – Site-Specific Information – Topography, Hydrology, Hydrogeology and Geology

Site Elevation and Topography	The site falls from an approximate elevation of 12 metres above Ordnance Datum (maOD) around the eastern edge of Perry's Farm to approximately 3 mAOD along the western edge of the Perry's Farm land parcel. A shallow slope to the northwest is shown across Areas 1 / 2 on plans provided by J Clubb (ref. 25). There is then a break in slope along the south-eastern edge of Area 3 and a steeper gradient across this part of the site. The J Clubb and E.E.M. land falls from approximately 12 mAOD in the south to sea level in the north.

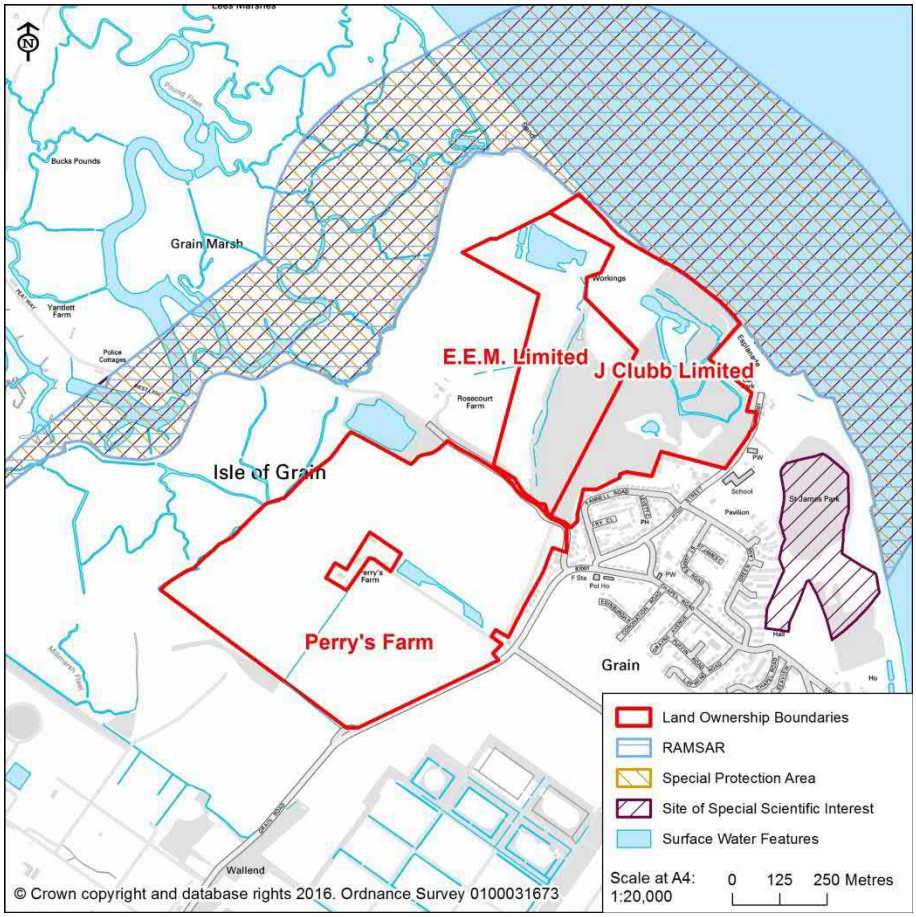
Table F – Site-Specific Information – Topography, Hydrology, Hydrogeology and Geology

Environmentally Sensitive Areas (e.g. SSSI)	**The Envirocheck information indicates that the site is within 500 m of the following environmentally sensitive areas:** • South Thames Estuary and Marshes Site of Special Scientific Interest (SSSI) borders the northeast shoreline of the J Clubb and E.E.M. land and then extends westwards, being situated approximately 100 m west of the western edge of the of the whole site; • Medway Estuary and Marshes SSSI lies approximately 150 m south of the J Clubb Limited land; • Thames Estuary & Marshes Special Protection Area (SPA) and RAMSAR site borders the northeast shoreline of the J Clubb and E.E.M. land and then extends westwards, being situated approximately 100 m west of the western edge of the whole site; • Medway Estuary Marine Nature Reserve (MNR) borders the northeast shoreline of the J Clubb and E.E.M. land; and • North Kent Marshes Environmentally Sensitive Area (ESA) borders the whole site to the west. These are illustrated on **Figure C**.
Surface Water Features	Surface water features within 500 m of the site comprise: • A small water body lies in the southwestern corner of Area 2 of the Perry's Farm landfill; • A pond lies within the northern part of the E.E.M. Limited land and is fed by a drainage ditch that run southwards from the Perry's Farm land parcel. This is understood to form part of the drainage from the landfill and to be founded on the London Clay (ref. 16); • A pond and drainage ditches are located within the J Clubb land; • A pond is located adjacent to the north-west corner of Perry's Farm. During the meeting of 22nd June, J Clubb reported this is used by a local fishing club; • A pond is located in centre of the Perry's Farm land, orientated north-west to south-east, along the access road to the Farm; • Numerous creeks and streams are located in the Grain Marshes, west of the whole site; and • The J Clubb and E.E.M. land extend to the shoreline of Thames Estuary, an Estuarine and Coastal Water Body under the Water Framework Directive (WFD).
Flood Vulnerability	The western part of the Perry's Farm land lies within an area classified as having a low risk of flooding from rivers or sea, whilst the northern most part of the J Clubb land parcel lies within areas with medium, or high risk of such flooding. Lower-lying parts of the land parcels may be susceptible to flooding by surface water and groundwater.
Made Ground and Superficial Geology	BGS data does not show the presence of artificial deposits, such as made ground or fill. The Quaternary, superficial geology are reported to comprise River Terrace Deposits, comprising sand and gravel. In the south west of the Perry's Farm land parcel, Head Deposits are indicated. These comprise clay, silt, sand and gravel. BGS borehole record, TQ87NE45, located immediately east of Perry's Farm (grid ref.: 588120, 176130) indicates approximately 4.7 m of sand, loam and gravel, overlying the London Clay. At TQ87NE40 located east of Perry's Farm (grid ref.: 587500, 176270) 1.9 m of sand, gravel and loam, overlies the London Clay Within the Perry's Farm landfill, the documents provided by J Clubb (ref. 08, 09) indicate: • Area 1: approximately 5 m thickness of River Terrace Deposits sand and gravels; • Area 2: approximately 2 m thickness of gravelly clay; • No economically viable sand and gravels were present in Area 3 of Perry's Farm and this area has not been subject to sand and gravel extraction; • Area 1 has been restored to pre-extraction level through landfilling (described in Section 3) and Area 2 has not yet been in-filled or restored. (Note: borehole logs for the monitoring locations around the landfill were not available to AECOM for review). In the J Clubb and E.E.M. land parcels to the northeast, the River Terrace sand and gravel is reported to have been extracted down to the London Clay. It is understood that this area was not infilled with waste following extraction ending (ref. 09, 16 and written response from WSP [**Appendix D**]) and was restored at a lower level than the surrounding land.

Table F – Site-Specific Information – Topography, Hydrology, Hydrogeology and Geology

Bedrock Geology	BGS data indicates that the site is underlain by the London Clay. This comprises blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt, plus sometimes silt and layers of sandy clay. Documents provided by J Clubb (Ref. 25) indicates that the London Clay was encountered at 7.6 maOD at chamber IC3 during the installation of the leachate collection drainage in 2016, compared with 8.8 maOD in the northwest and southeast of the Perry's Farm land. BGS borehole record, TQ87NE45, located immediately east of Perry's Farm (grid ref.: 588120, 176130) reports that the London Clay was encountered at approximately 6.5 maOD. At TQ87NE40 located east of Perry's Farm (grid ref.: 587500, 176270), the London Clay was encountered at approximately 6.2 maOD. No faulting is reported in the area of the site.
Groundwater	The London Clay bedrock is classified as Unproductive strata. These are defined as geological strata with low permeability with negligible significance for water supply or river base flow. The River Terrace Deposits are classified as a Secondary A aquifer. These are defined as permeable strata capable of supporting water supplies at a local scale and, in places, form an important source of base flow to rivers. Groundwater in monitoring wells at the Perry's Farm land has been measured at between approximately 6 maOD and 12 maOD (ref. 08, 09). Based on the information provided about the geology, this places it within the River Terrace Deposits. The inferred direction of groundwater flow is broadly to the northwest. Long-term groundwater monitoring data are discussed further in **Section 3**.
Groundwater Abstractions	The Envirocheck information does not list groundwater abstractions.
Source Protection Zones	The site is not located within a Source Protection Zone (SPZ).
Other Information Coal Mining; Radon; Ground Stability Hazards; Landslides.	The site is not considered to not be located in an area likely to be affected by coal mining or radon gas. The Envirocheck data gives the following information regarding ground stability hazards: • Collapsible ground – very low to no hazard; • Landslide – very low hazard; • Running sand – very low hazard; • Shrink-swell clays – moderate to no hazard; • Compressible ground – moderate to no hazard; and • Ground dissolution – no hazard.

Figure C: Environmentally Sensitive Areas and Surface Water Features



2.6 Summary

The review of the site's environmental setting has identified a number of potential sources that could result in soil and groundwater contamination and give rise to potential environmental liabilities (including current and historical use of the site for waste deposition), receptors that could be adversely effected (including surrounding surface waters, ecologically sensitive sites, residents of neighbouring properties) and pathways by which such impacts could take effect (e.g. migration in permeable sub-surface strata). These are described further in **Section 4**.

3. Landfill and Waste Management Operations

3.1 Introduction

The section presents a summary of the permitting and operation of the Perry's Farm landfill site, based on documents provided by J Clubb, written responses by J Clubb and WSP and information presented at the meeting between J Clubb and AECOM on 22nd June 2018. At this stage, no information has been obtained from regulators and AECOM were not authorised to contact them regarding the site.

The historical landfills reported in the E.E.M. and J Clubb land parcels to the north have not been assessed further in this section, given the information presented in **Section 2** which reported that they had not been subject to infilling with waste.

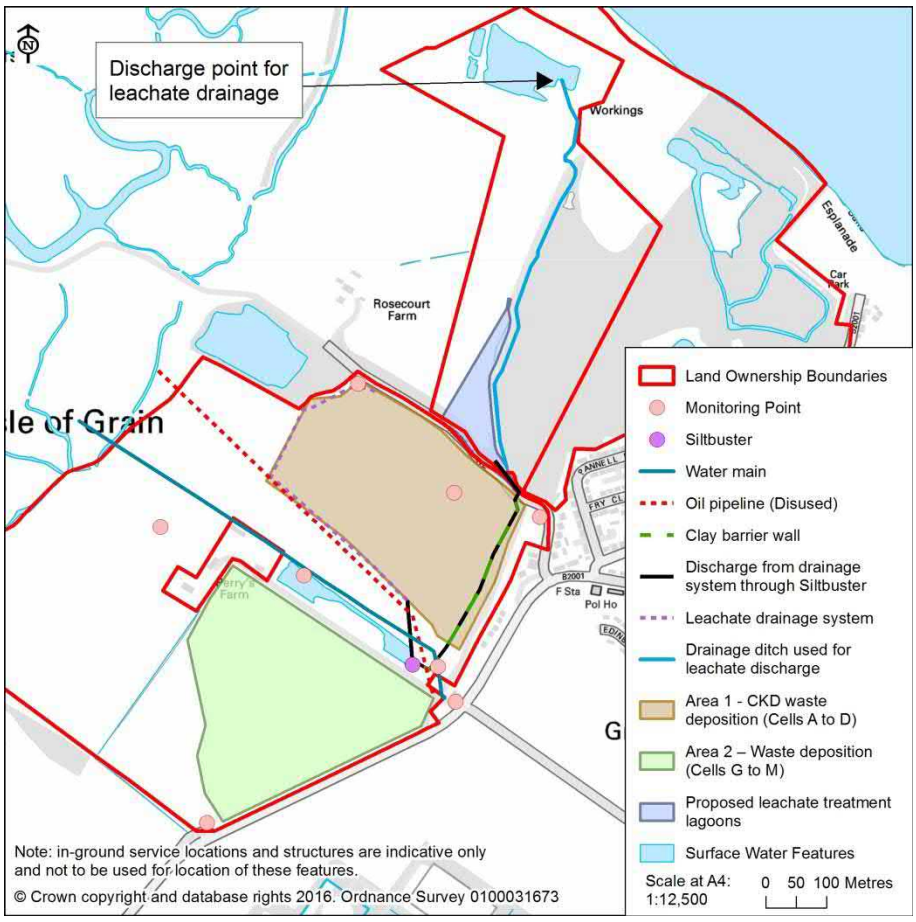
3.2 Overview

Permit BP3335SR, an authorisation to deposit waste to land (subject to conditions), covers all parts of the Perry's Farm land parcel, which comprises the landfill site (LFS). It is understood that this reference was now been superseded and the site is now operated in accordance with environmental permit reference EPR/GP3899LW (Waste Management Licence 210005; not seen by AECOM).

Permit BP3335SR was issued 9th November 2005 (ref. 11) as a transfer of the previous Waste Management Licence (WML; reference P/3/34) into the IPPC (Integrated Pollution Prevention and Control) regime, for the deposit of what at the time was considered inert and non-hazardous waste to land at Perry's Farm; it was prefaced by the submission of a number of documents in 2002, the Regulation 15 Assessment (ref. 08) and the Site Conditioning Report (ref. 09). The 2005 EPR PB3335SR permit document (ref. 11) references less than 20,000m^3 capacity remaining.

Significant features of the landfill are presented on **Figure D**, below.

Figure D: Perry's Farm Landfill Layout and Infrastructure



3.2.1 Initial Operation

WML P/3/34 (not seen by AECOM) was issued in 1990 (month unknown), at which time the site received both inert waste and what was then classed as non-hazardous waste, namely CKD in the majority of what is referred to as Area 1 of the site. This disposal area was subdivided into a series of 13 north-west to south-east aligned cells (designated A to M), as shown on plans provided by J Clubb (ref. 05). CKD is now classified as hazardous waste.

The deposit of CKD took place in cells A to D inclusive. It is noted that the footprint of the cells defined on the J Clubb plan of the LFS (ref. 05) do not exactly match the CKD disposal Area 1 as per the WSP permit variation application drawings (ref. 16, 23, 25).

The 2005 EPR PB3335SR permit document (ref. 11) states that Cells A to D had been filled with inert and non-hazardous waste and restored. Cells E and F had not been worked due to the presence of deep-lying services. Plans provided by J Clubb (ref. 05) indicate these comprise a water main and disused oil pipeline.

3.2.2 Later Operation

Since issue, EPR BP3335SR has been modified once, dated 12th May 2010, in order to restrict the waste to be accepted at the remainder of the site (Area 2 only thus far) to inert waste only, at less than 24,999 tonnes per annum, thereby triggering its removal from IPPC management requirements as an installation, into its regulation as a waste operation.

The site is now operated in accordance with environmental permit reference EPR/GP3899LW.

3.2.3 Current Status

At the date of this report (July 2018) EPR/GP3899LW (previous reference BP3335SR) remains active, and the site is not in formal closure, although no waste has been received for some years, noting:

- Area 1 ceased to receive waste by the end of 1999, has since been capped, and is therefore effectively non-operational (see **Section 3.3.1**);
- Area 2 contains the remaining disposal capacity (air space), but remains unfinished (see **Section 3.3.2**);
- Area 3 has never received waste, there being insufficient sand and gravel to extract in order to create air space (see **Section 3.3.3**).

3.2.4 Permit Variations

An application to vary EPR/GP3899LW (formerly EPR BP3335SR) was made (by WSP, acting on behalf of J Clubb) in May 2017 in order to provide for the installation and operation of a system to manage, treat and dispose (to surface water course) high pH leachate emanating from Area 1, following unplanned leachate discharge which commenced during 2013 (precise date unknown) (ref. 16) – treatment using the 'siltbuster'.

3.2.5 Permit Compliance

A notice of non-compliance against EPR/GP3899LW (previous reference BP3335SR) was issued by the EA against J Clubb on 27th April 2018 (dated 9th May 2018) as a result of uncontrolled discharge of leachate to land, despite the prior installation of a management system, which has since been confirmed as discharged to the satisfaction of the EA, effective from 15th June 2018 (ref. 37, 38, 39, 40).

3.2.6 Monitoring

Gas and groundwater monitoring of the Perry's Farm landfill has been carried out since at least 2006. The monitoring locations include up-gradient and down-gradient groundwater monitoring wells, one landfill leachate monitoring well in Area 1 and one surface water body monitoring point within the Perry's Farm land, to the west of Area 1. Formal quarterly notifications for permit exceedances are provided to the Environment Agency.

The results of the monitoring have not been assessed in detail at this stage. However notable observations made during a review of the results include the following:

- Significantly elevated chloride, sulphate and ammoniacal nitrogen have been detected in the landfill leachate samples (W6) compared to samples of surrounding groundwater (e.g. sulphate levels measured in W6 were on average approximately six times the average concentration in the groundwater monitoring wells). The leachate concentrations are significantly higher (up to nine times greater) than the trigger values used in the monitoring reports (250 mg/l), which indicate potential risks to Controlled Waters, if leachate was to escape the landfill;
- Minor exceedances of the trigger limits for downgradient groundwater have also been recorded consistently since the monitoring began, in particular for sulphate (on average 1.5 times greater than the trigger value);
- In addition, the head of leachate above the base of the waste (as measured in W6) has been higher than the 2005 permit limits since the monitoring began (circa 2006) with an average head of approximately 2.5 m compared to a limit of 1 m;
- Since 2016, an overall increase in the concentration of sulphate, as well as higher pH has been recorded in the leachate (W6), compared with previous years;
- A steady increase in the alkalinity / water hardness of the on-site surface water feature was recorded between 2015 and 2017 consistent with the deposit of CKD. From 2017 to 2018, the water hardness in the surface water has levelled off at approximately 360 mg/l $CaCO_3$. Concentrations were typically <300 mg/l before 2016;
- Chloride concentrations were above the trigger level used in the monitoring reports (250 mg/l) in one up-gradient monitoring well (W1A) on three occasions in 2017;
- Ground gas concentrations recorded since 2010 were generally low, with a maximum of 0.4 % v/v methane (CH_4), 13.7 % v/v carbon dioxide (CO_2) and a maximum flow rate of 16.5 l/hr. The lowest recorded oxygen (O_2) concentration was 0.4 % v/v;
- During the most recent gas monitoring period reported (February 2017 to February 2018) concentrations of CO_2 were above the maximum permissible limit of the current permit (1.5% v/v) on a number of locations at position W1. The permitted limit is given as 1.5% v/v above natural background levels but the monitoring reports reviewed did not specify the background level.

Monitoring locations are shown on **Figure D**.

It is understood that a primary leachate treatment system was installed in 2016, including a leachate capture drain around Area 1 (see section 3.3.1) and a siltbuster, a simple treatment system which uses gaseouos CO_2 in roder to reduce the pH of the leachate, prior to off-site discharge. Review of the monitoring data indicates a number of changes in long term concentration trends at around the same date, as indicated in the above summary. The extent to which the changes in drainage could potentially be affecting downgradient groundwater and surface water quality, however, has not been assessed.

It is noted that the monitoring locations do not include potential surface water receptors, such as the adjacent fishing pond to the northwest of Area 1, or any groundwater monitoring points within the partially landfilled area in Area 2.

AECOM has not been given access to any routine monitoring data for the leachate immediately following treatment with CO_2 or at the current discharge point, which would demonstrate the effectiveness of the initial treatment. The chemical quality of the leachate was recorded by laboratory analysis during the period between June 2014 and February 2017 (ref. 24) to inform the leachate treatment system design.

A Compliance Assessment Report (CAR) was issued by the EA in response to the reported breach of trigger levels during 2017 (ref. 35). This documented the non-compliance, stated that compliance limits must be met and noted that although the EA would not take further action in relation to the non-compliance at this time, this did not preclude action being taken at a later date.

Additional work would be required to assess the potential geochemical evolution of the leachate, groundwater and surface water at the site.

3.2.7 Subsistence and Financial Provision

As Permit BP3335SR remains active, all annual subsistence charges remain to be paid at their current level (as a minimum), subject to any changes resulting from the variation application currently with the EA (ref. 16). [redacted]

3.2.8 Permit Transfer, Closure and Surrender

[redacted]

3.3 Area-Specific Details

3.3.1 Area 1

Area 1 received CKD for deposit across the 1990's (approximately 165,000 tonnes in all [details provided by J Clubb; see **Appendix D**]) in accordance with the development / operational requirements of the day, i.e. it was deposited into individual cells, underlain by in-situ London Clay (currently considered as a geological barrier, then considered as a low permeability liner), separated from the adjacent unworked sand and gravel by engineered London Clay. It is noted that clay placement was not compacted to a specification, as would be required currently, until later in the 1990's (ref. 09).

Area 1 was capped on completion of the deposit of CKD (date not known), using re-worked London Clay, in accordance with the standards of the day (ref. 09) which provided for a 500 mm thick cap. It is noted that current standards would be for a minimum of 1,000 mm thick clay layer by way of a cap.

In 2013 an issue with the discharge of high pH leachate derived from the CKD within Area 1 was noticed. This was addressed in 2016 with the installation of a collection, treatment and discharge system, comprising pipework and pumping chambers running along the north-western and south-western site boundaries, interim storage tanks and a treatment system (so-called silt-buster, which used gaseous CO_2 to reduce the pH of the treated liquid) close to the site access (south-western corner) and a discharge pipe running along the southern site boundary, discharging to a surface water pond in what was the Rose Court Farm clay working as shown on **Figure D**. Interim polishing lagoons are proposed to complete this treatment system (ref. 16). The permit variation application proposes that these are to be excavated to the northeast of West Lane (approximate locations are shown on **Figure D**).

This system is operational, but requires high levels of management input and is not yet considered overly robust; recent issues with intense rain fall coupled with a shortage of CO_2 resulted in the enforcement notice previously referred to (ref. 37, 38, 39, 40).

The driver for leachate emissions has never been fully determined, although J Clubb has, since 2013 (2016, it is understood) installed a new engineered clay barrier to the south-east corner of Area 1 in an attempt to better isolate shallow groundwater in the unworked sands and gravels, the excavation of which resulted in the air space into which waste has been / can still be deposited. The approximate location of this barrier is shown on **Figure D**.

The EA has not yet determined the application to vary EPR/GP3899LW, and may yet require additional management and / or technical underpinning before it does so. As part of recent discussions (see ref. 40), the EA has introduced the possibility of the site needing to be re-capped to today's standards, as it perceives the driver for leachate emissions is infiltrating rainfall, as the site has a dome of far gentler gradient than what would be accepted against today's standards.

3.3.2 Area 2

Area 2 contains the remaining saleable airspace at Perry's Farm LFS, this this now comprising less than approximately 20,000m^3.

Area 2 is maintained by J Clubb in an unfinished state as a matter of principle, pending a decision by Peel Holdings regarding its possible Development Consent Order (DCO) application for the development of a hazardous waste landfill site across Areas 2 and (part of) Area 3, although a possible time-line for such a development is not known. Little further information is available concerning this option, and no definitive timescale exists for its development, as confirmed by J Clubb.

[redacted]

3.3.3 Area 3

Area 3 is contained within the boundary of EPR/GP3899LW, but is effectively untouched by it, as no sand and gravel have been removed from it and no waste deposited in it.

3.4 Transfer, Closure and Surrender

3.4.1 Transfer

[redacted]

3.4.2 Closure

[redacted]

3.4.3 Surrender

[redacted]

3.5 Summary

The review of the permitting and operation of the Perry's Farm landfill site indicates that there is an on-going leachate management issue at the site, with previous discharge of leachate at the landfill surface. Measures have been implemented (drainage and 'siltbuster') to address this and further treatment is proposed (the polishing lagoons). However, the EA has also raised the prospect of re-capping the site. Permit conditions have been breached, specifically those relating to release of leachate to land, plus exceedance of trigger levels for leachate head in the waste, plus parameter levels in surface water and groundwater.

With the Perry's Farm landfill and associated permit still operational, the development and use of the interconnector and associated infrastructure would have to be managed alongside the permitted activities. [redacted]

4. Preliminary Conceptual Site Model and Risk Assessment

4.1 Approach

A conceptual site model (CSM) and preliminary risk assessment (PRA) has been completed for the site. This identifies the potential sources, pathways, and receptors for the site, in order to assess the potential risks posed to human health, Controlled Waters, statutory ecologically receptors and property by the identified potential sources. When required, the viability of the Source-Pathway-Receptor pollutant linkage must be evaluated further to assess whether an actual risk is present.

The methodology adopted in this report is based upon the UK Defra and EA "best practice" in regard to the assessment of contaminated land. The approach taken reflects that promoted in CLR11[1] and R&D Publication 66[2] and the supporting guidance referenced within them.

Whilst this approach has been followed to provide a consistent CSM and PRA for the whole site, it should be noted that the operational landfill at Perry's Farm is regulated under the Environmental Permitting Regulations and can only be discharged from this by surrender of the permit once it has been demonstrated to the EA that the site is capable of being managed in closure such that it no longer poses an unacceptable risk to its surrounding environment. For the cable route land to the north, the relevant regulatory regime, with respect to risks from land contamination are considered to be Part 2A of the 1990 Environmental Protection Act and, in respect of the new development, the planning regime.

The scope of this risk assessment did not extend to assessment of geotechnical risk to existing proposed structures, archaeological aspects of the site (if present) or unexploded ordnance (UXO).

4.2 Potential Sources

On-site - Historical

- Historical landfills in cable route land;
- Disused oil pipeline through Perry's Farm;
- Historical quarrying operations in all areas of the site;
- Historical mineral railway on J Clubb land;
- Possible military land uses.

On-site - Current

- Landfill containing CKD waste in Area 1, Perry's Farm;
- Landfill in Area 2, Perry's Farm;
- Leachate breakthrough at surface (Area 1);
- Siltbuster plant and leachate drainage;
- Agricultural activities.

Off-site - Historical

- Historical tank farms to south (oil depot);
- Historical landfills to southwest;
- Historical pipeline to southwest;
- Military land uses in surrounding area;
- Historical railway station to south (Port Victoria).

[1] Environment Agency, 2004. Model Procedures for the Management of Land Contamination, Contaminated Land Report 11.
[2] Environment Agency, Chartered Institute of Environmental Health and National House Building Council, 2008. R&D Publication 66, Guidance for the Safe Development of Housing on Land Affected by Contamination.

Off-site - Current

- Industrial area to the south, including:
  - National Grid LNG Terminal;
  - BP Aviation Bitumen Terminal;
  - SSE Plc, Medway Power Station;
  - Midland Steel Reinforcement Supplies;
- London Thamesport Ltd (shipping company);
- Military land use to east and west of site.

4.3 Chemicals of Potential Concern (COPC)

Based on these potential sources, the following COPC may be present in soil or groundwater at the site:

- Cement waste and landfill leachate – high pH, sulphate, chloride, metals;
- On-site and off-site industrial activities – total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), metals (arsenic, boron, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, vanadium and zinc);
- Asbestos – potentially in the Made Ground arising from demolition of the former structures or within the landfill areas if present in demolition or construction waste;
- Agricultural use – fuel oil, plus pesticides, herbicides and fertilizers;
- Ground gases including methane and carbon dioxide.

4.4 Potential Pathways

Potential pathways associated with the proposed development of the site have been identified as the following:

Human Health

- Ingress of ground gas or vapour into buildings. Inhalation of VOC or ground gas;
- Ingestion of, inhalation of and dermal contact with soil particulates;
- Dermal contact with or ingestion of leachate following uncontrolled discharge at the landfill surface;
- Permeation of plastic potable water supply pipes by VOC or hydrocarbons.

Property (including buried infrastructure)

- Ingress of ground gas or vapour into buildings or service conduits;
- Direct contact with COPC in soil, groundwater or contact with leachate;
- Ingestion / uptake by crops and livestock.

Controlled Waters

- Partitioning / leaching of COPC from soil into pore water;
- Migration of COPC in recharge to groundwater in the River Terrace Deposit or other superficial deposits;
- Lateral migration of COPC in shallow groundwater present in the River Terrace Deposits or other superficial deposits with discharge as basal flow into surface water receptors;
- Overland flow into surface water features and shallow groundwater arising from uncontrolled leachate discharge at the landfill surface.

Ecology

- Lateral migration of COPC in shallow groundwater present in the River Terrace Deposits or other superficial deposits with discharge as basal flow into protected areas (e.g. SSSI);
- Overland flow into protected areas, arising from uncontrolled leachate discharge at the landfill surface.

4.5 Potential Receptors

The potential receptors associated with proposed development of the site have been identified as follows:

Human Health

- Construction and maintenance workers;
- On-site staff;
- On-site general public and visiting staff (such as contractors, including those conducting excavation works);
- Off-site residents and workers in Isle of Grain village;
- Off-site workers in industrial area to southwest of the site.

Property

- Existing or future buildings and structures;
- Proposed interconnector cable and associated infrastructure;
- Other buried services or conduits;
- Crops and livestock on the reclaimed landfill or on neighbouring land.

Potential Receptors - Controlled Waters

- Surface water (fishing pond and watercourses to west of site; on-site surface water features; creeks within marshes north and west of site; Thames Estuary to northeast of site).

The critical Controlled Waters receptor is considered to be the fishing pond adjacent to Area 1 of Perry's Farm (to the west), assuming this is downgradient of the landfill and receives base flow from shallow groundwater in the superficial deposits. The on-site surface water features are considered to be of lower sensitivity in comparison to the fishing pond; however this may need to be reviewed following any future site visits or assessments.

The River Terrace Deposits are classified as a Secondary A aquifer. However, these are reported to have been extracted across much of the site, with the exception of Area 3 of the Perry's Farm land. Where present, they are considered to be of more relevance as a potential pathway than as a receptor. In this respect, COPC could migrate via the groundwater in these Deposits to off-site surface water features such as the creeks in the marsh areas to the north and west, or to the Thames estuary, and to the associated ecological receptors.

Potential Receptors - Ecological

- Thames Estuary to the northeast and north (SSSI, SPA, RAMSAR);
- North Kent Marshes to the west (SSSI, SPA, RAMSAR, ESA);
- Medway Estuary Marine Nature Reserve (MNR) to the northeast; and
- Medway Estuary and Marshes to the south (SSSI).

4.6 Review of Potential Source-Pathway-Receptor Linkages

The pollutant linkages identified are summarised in Table G and Table H, below.

Table G – Human Health and Property CSM

Source	Pathway	Receptor	Likelihood of Pollutant Linkage Presenting an Unacceptable Risk
COPC in soil / leachate / groundwater / ground gas from the site and identified potential off-site sources.	Ingress of ground gas or vapour into buildings or service conduits. Inhalation of VOC or ground gas.	On-site staff, on-site general public and visiting staff (such as contractors, including those conducting construction, maintenance or excavation works).	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site, given the low levels of methane recorded during monitoring to date and reported waste types disposed of at the site considered to have a low potential for putrescible material or volatile organic compounds. However, risks may be greater within the landfill areas, particularly in Area 1 of Perry's Farm, based on the detected levels of CO2. Risks to contractors and staff during ground works, construction or maintenance should be controlled using appropriate health and safety procedures.
		Off-site residents and workers in Isle of Grain village, and off-site workers in industrial area to southwest of the site.	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site, given the low levels of methane recorded during monitoring to date and reported waste types disposed of at the site considered to have a low potential for putrescible material or volatile organic compounds.
		Existing or future buildings and structures, proposed interconnector cable and associated infrastructure, plus other buried services or conduits.	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site, given the low levels of methane recorded during monitoring to date and reported waste types disposed of at the site considered to have a low potential for putrescible material or volatile organic compounds.
	Ingestion of, inhalation of and dermal contact with soil particulates.	On-site staff, on-site general public and visiting staff (such as contractors, including those conducting construction, maintenance or excavation works).	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site. Presence of the existing cap in Area 1 of Perry's Farm landfill may mitigate risks from the CKD, but removal or breakage of the cap during ground works at the site could increase risks, albeit temporarily. Risks to contractors and staff during ground works, construction or maintenance should be controlled using appropriate health and safety procedures.
		Off-site residents and workers in Isle of Grain village, and off-site workers in industrial area to southwest of the site.	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site. However, risks may be elevated within or close to the landfill areas.
	Ingestion / uptake by crops and livestock.	Crops and livestock on the reclaimed landfill or on neighbouring land.	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site. However, the likelihood of a pollutant linkage occurring in Area 1 of Perry Farm landfill is considered to be higher, based on the previous occurrence of leachate breakout.

Source	Pathway	Receptor	Likelihood of Pollutant Linkage Presenting an Unacceptable Risk
	Dermal contact with or ingestion of leachate following uncontrolled discharge at the landfill surface.	On-site staff, on-site general public and visiting staff (such as contractors, including those conducting construction, maintenance or excavation works).	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site. However, the likelihood of a pollutant linkage occurring in Area 1 of Perry Farm landfill is considered to be higher, based on the previous occurrence of leachate breakout.
		Off-site residents and workers in Isle of Grain village, and off-site workers in industrial area to southwest of the site.	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low.
	Direct contact with COPC in soil, groundwater or contact with leachate.	Existing or future buildings and structures, proposed interconnector cable and associated infrastructure, plus other buried services or conduits.	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site. However, the likelihood of a pollutant linkage occurring in Area 1 of Perry Farm landfill is considered to be higher, based on the high pH of the cement kiln dust, which may have potential to damage buried structures or services placed in or near that area depending upon the type of materials used.
	Permeation of plastic potable water supply pipes by VOC or hydrocarbons.	On-site staff, on-site general public and visiting staff (such as contractors, including those conducting construction, maintenance or excavation works).	A potentially significant pollutant linkage may occur, if potable water pipes are located within or near to the landfill areas at Perry's Farm.
		Off-site residents and workers in Isle of Grain village, and off-site workers in industrial area to southwest of the site.	A potentially significant pollutant linkage may occur, if potable water pipes are located within or near to the landfill areas at Perry's Farm.

Potential risks to site staff or visiting contractors undertaking intrusive works / ground works should be managed by appropriate health and safety controls such as risk assessment and method statements, plus personal protective equipment (PPE).

Table H – Controlled Waters and Ecological Receptors CSM

Source	Pathway	Receptor	Likelihood of Pollutant Linkage Presenting an Unacceptable Risk
COPC in soil / leachate / groundwater from the site and identified potential off-site sources.	Partitioning / leaching of COPC from soil into pore water. Migration of COPC in recharge to groundwater in the River Terrace Deposits or other superficial deposits. Lateral migration of COPC in shallow groundwater present in the River Terrace Deposits or other superficial deposits with discharge as basal flow into surface water receptors.	Surface water (fishing pond and watercourses to west of site; on-site surface water features; creeks within marshes north and west of site; Thames Estuary to northeast of site).	The site is not located within a groundwater SPZ. In the absence of information on groundwater abstractions in the area of the site, the critical Controlled Waters receptor is considered to be the fishing lake adjacent to the site to the west. However a number of surface water features are present within the area of the site. Groundwater in the River Terrace Deposits is considered a potential pathway rather than a receptor. COPC could migrate via these Deposits to off-site surface water features such as the creeks in the marsh areas to the north and west, or to the Thames estuary, and to the associated ecological receptors. Based on review of the available data, a pollutant linkage has been identified and there is a possibility of the risk occurring, although there is no certainty that it will do so.
		Thames Estuary to the northeast and north (SSSI, SPA, RAMSAR); North Kent Marshes to the west (SSSI, SPA, RAMSAR, ESA); Medway Estuary Marine Nature Reserve (MNR) to the northeast; and Medway Estuary and Marshes to the south (SSSI).	
	Overland flow arising from uncontrolled leachate discharge at the landfill surface.	Surface water (fishing pond and watercourses to west of site; on-site surface water features; creeks within marshes north and west of site).	Based on review of the available data, the likelihood of a pollutant linkage occurring that would present an unacceptable risk is considered to be low for most areas of the site. However, the likelihood of a pollutant linkage occurring in Area 1 of Perry Farm landfill is considered to be higher, based on the previous occurrence of leachate breakout.
		Thames Estuary to the northeast and north (SSSI, SPA, RAMSAR); North Kent Marshes to the west (SSSI, SPA, RAMSAR, ESA); Medway Estuary Marine Nature Reserve (MNR) to the northeast; and Medway Estuary and Marshes to the south (SSSI).	

5. Preliminary Ground Constraints Review

5.1 Introduction

Based on the preliminary CSM, site environmental setting and review of landfill and waste operations, a number of potential environmental and geotechnical constraints on the proposed development have been identified for the site. These are summarised below and are described in relation to the three separate land parcels proposed for acquisition (Perry's Farm, plus the cable route land [J Clubb and E.E.M. land]).

Note that the constraints are based on information available at the time of writing. Other constraints, for example other oil or gas pipelines or buried services, may be present that have not been identified at this stage.

5.2 Perry's Farm Land Parcel

The following potential ground constraints have been identified for the Perry's Farm area:

1. Area 1 – landfill containing CKD waste:

- Risk of chemical attack (e.g. on foundations, pipework and cables);
- Unsuitable ground conditions for redevelopment (including partially cemented areas);
- Variable ground conditions of the landfill and surrounding area could result in differential settlement;
- Hazardous waste classification and associated disposal for excavated materials;
- Potential for creation of new contamination pathways if hazardous waste is disturbed or existing landfill cover is breached;
- A leachate treatment system is in place, including a drainage ditch and buried delivery main, which could affect suitable routes for cables / other structures;
- A clay barrier wall is in place along the eastern margin of the landfill (below ground) which cannot be breached by the development works (see **Figure D**);
- Area 1 may need to be re-capped to current standards to reduce infiltration into the landfill material, although whether this would by through the addition of clay or the use of a manufactured equivalent (geomembrane (FML) or geosynthetic clay layer (GCL) remains undecided. The likelihood of this is subject to the decision of the EA;
- Additional / alternative leachate treatment measures may need to be developed if the proposed leachate treatment system is not proven to be effective over time, which could result in further development constraints;
- A large linear surface water feature is located between the landfilled cells of Area 1 and Area 2 which may be a constraint if located in a proposed area for development works, although options for this to be infilled could be pursued once its use is known (see **Figure D**);
- A water main runs northwest to southeast between the landfilled cells of Area 1 and Area 2 which could cut across a proposed cable route from Perry's Farm to the other land parcels and the landfall (see **Figure D**). This could potentially require the cable crossing above or below the main with agreement of the water main operator or rerouting of the water main;
- A disused oil pipeline runs from southeast to northwest, along the southwestern edge of the landfill (see **Figure D**) which is likely to cut across the proposed cable route. The likelihood of others is not currently known;
- Two electricity pylons are located in Area 1 – one is in the western corner and one in the south-eastern corner (see **Figure D**). The overhead lines are expected to run northwest to southeast between the landfilled cells of Area 1 and Area 2.

- There is potential for other buried utilities (existing or redundant) to be present;
- Existing monitoring wells would need to be retained or replaced.

The landfilled area potentially covers the whole area between the Perry's Farm land parcel and the J Clubb / E.E.M. land parcels, which may limit options to avoid the intersection of the landfill material and interconnector cable route (see **Figure B**). Ground investigation works would be necessary to assess the extent, depth and type of waste. The drainage ditch surrounds the landfill to the west and south, which could also cut across potential cable route sites. The buried delivery main runs along the eastern edge of the landfill (see **Figure D**).

The disused oil pipeline would also need to be investigated to assess if it can be left in-situ or would need to be removed. There could be contamination risks associated with the pipe if left in-situ (if damaged); however new contamination pathways could be created by removing the pipe or sections of the pipe if the work is not carried out appropriately.

2. Area 2 – landfill containing inert waste:

- Restoration to infill unfinished areas of the landfill to required engineering specifications (the remaining capacity could be 20,000m^3) although it might be possible to agree a lower level of restoration with regulators;
- Ground conditions may be unsuitable for development or require ground improvement;
- Variable ground conditions of the landfill and surrounding area could result in differential settlement;
- There is potential for contamination to migrate from Area 1 into Area 2 which could impact structures and services as well as humans and environmental receptors;
- The disused oil pipeline described for Area 1 also cuts across the eastern corner of Area 2;
- There is potential for other utilities (existing or redundant) to be present;
- Existing monitoring wells would need to be retained or replaced.

3. Area 3 – unworked area of permitted landfill site:

- Ground improvement may be required for structures depending upon sequence and structure of the Superficial deposits and the design of the proposed development;
- There is potential for flooding in the western part of Area 3 (Flood Zones 2 and 3), but this may be mitigated by local flood defences;
- There is potential for contamination to migrate from Area 1 into Area 3 , i.e. down topographic gradient and along inferred groundwater flow vectors, which could impact structures and services as well as humans and environmental receptors;
- The water main described for Area 1 also runs northwest to southeast through Area 3 (see **Figure D**). This could potentially require the cable crossing above or below the main with agreement of the water main operator or rerouting of the water main;
- The disused oil pipeline described for Area 1 also runs through Area 3 from southeast to northwest (see **Figure D**) which is likely to cut across the proposed cable route;
- An overhead electricity line crosses Area 3 from east to west (see **Figure D**). This may be connected to underground electricity services within the site;
- There is potential for other utilities (existing or redundant) to be present;
- Existing monitoring wells would need to be retained or replaced.

4. Farm Buildings:

- Disturbance of the buildings at Perry's Farm, or access road (West Lane). The Perry's Farm buildings are surrounded by the landfill land parcel. At this time, they not part of the J Clubb property and as such, the assessment has assumed the area would not be developed;

- There is potential for contaminated leachate to migrate from Area 1 which could impact structures and services as well as humans and environmental receptors.

5.3 E.E.M Limited Land Parcel and J Clubb Land Parcel

Unless otherwise stated, the following ground constraints apply to both the E.E.M. and J Clubb land parcels that comprise the cable route land:

- The proposed site for the secondary leachate treatment system (polishing lagoons) within the southern part of the E.E.M land parcel (see **Figure D**). The construction of the lagoons could constrain possible locations for the cable route or other development features;
- Former workings (quarries) are indicated as historical landfills but are reported not to have been infilled significantly (see **Figure B**). There may still be constraints due to topographical depressions caused by worked areas and by the surface water bodies that have formed in the former quarry (see **Figure D**);
- There is potential for aggressive ground conditions to be present;
- There is potential for buried structures to be present in locations of former buildings or sand and gravel extraction operations;
- There is potential for utilities (existing or redundant) to be present;
- There is potential for contamination related to the historical sand and gravel extraction operations, including the former mineral railway, historical military land uses and historical / current shipping activities to the northeast;
- There is potential for localised contamination of Controlled Waters / ecological receptors arising from discharge of the partially treated landfill leachate into the E.E.M land parcel via the drainage ditch;
- There is evidence on aerial mapping of dense vegetation in some areas. Ecological surveys are likely to be required in advance of any disturbance of vegetation or ecological habitats;
- Potential UXO risk;
- There is potential for flooding, particularly in the northern part of the J Clubb land parcel and a small area of the E.E.M. land parcel (Flood Zones 2 and 3).

6. Environmental Liability Review

6.1 Introduction

A review of potential environmental liabilities was completed for the three land parcels. [redacted] This identified key issues that could pose a material liability to NeuConnect if it purchases the three land parcels.

The liability assessment considered the following aspects of the site:

- Leachate breakout;
- Ground conditions;
- Transfer of the permit;
- On-going operation;
- Financial provisioning;
- Formal closure; and
- Permit surrender.

[redacted]

6.2 Identified Potential Liabilities

6.2.1 Perry's Farm Land Parcel

The key environmental liabilities identified for the site relate to the on-going operation and management of the Perry's Farm landfill site. The relevant regulatory regime under which these liabilities would occur are the Environmental Permitting Regulations (2016).

The identified potential liabilities include the following:

Table I: Potential Liabilities Identified in Relation to the Perry's Farm Landfill Site

Category	Description	Details
Leachate Breakout	Permit variation	In 2016 a leachate collection and treatment system (drainage and 'siltbuster') was installed to manage the discharge of high pH leachate derived from the CKD within Area 1. An application to vary the site's Environmental Permit (EP) to retrospectively approve the treatment system was submitted to the EA in 2017, which also seeks approval for the proposed polishing lagoons sited in the EEM Ltd land. As of June 2018, the EA has not determined this variation (no details for the EA's considerations with respect to this variation were available to AECOM).
	Lagoon installation	The application to vary the site's EP allows for interim polishing lagoons for leachate treatment. As of June 2018, they are yet to be installed.
	Recapping of Area 1	Recent issues (2018) with intense rainfall coupled with a shortage of CO_2 for the leachate treatment system resulted in release of leachate to land followed by the EA issuing an enforcement notice against J Clubb. Subsequent exchanges of correspondence provided by J Clubb confirm that, in response, the EA has raised the issue of re-capping Area 1 to today's standards in order to better manage leachate. [redacted]

Category	Description	Details
Operation	Completion of Area 2	[redacted]
		[redacted]
[redacted]	[redacted]	[redacted]
		[redacted]
Formal Closure	End of waste deposition	On cessation of all disposal activities, there are time- and annual-cost benefits to be gained from seeking to put the site into formal closure, resulting in reduced monitoring activity and cost. This is a formal transition, is different from the site no longer accepting wastes. It will not obviate the new holder from compliance regarding the management of leachate. This is a process which has the potential to take between 2 and 5 years, and which is unlikely to be countenanced by the EA unless and until the management of leachate at the site is better demonstrated over the medium term, making re-capping a more favourable option.
Surrender	Surrender of permit	In principle, once the site has been demonstrated to be capable of being managed in formal closure such that it no longer poses an unacceptable risk to its surrounding environment (including humans), an application can be made to surrender the permit to the EA. In practice it would be prudent to assume that this is unlikely to happen within a period of 60 years from the date of formal closure, and may never be accepted by the EA, given the presence of CKD in Area 1. The FP will need to be maintained for however long the permit remains un-surrendered.

[redacted]

[redacted]

[redacted]

6.2.2 E.E.M Limited Land Parcel and J Clubb Land Parcel

For the cable route land to the north of Perry's Farm (E.E.M. and J Clubb land parcels), the relevant regulatory regime, in relation to risks from land contamination, is considered to be Part 2A of the Environmental Protection Act (1990) and, in respect of the new development, the planning regime.

The potential liabilities associated with these areas would relate to risks to sensitive receptors from potential sources of contamination as described in **Table G** and **Table H**. Possible sources identified in this area of the site are:

- Historical landfills;
- Historical quarrying operations;
- Historical mineral railway; and
- Possible military land uses.

[redacted]

- Historical landfills are reported in this area. However, review of topographic maps suggests the area of the northern most landfill now contains the pond to which the drainage ditch discharges (compare **Figure B** and **Figure C)**. Comments made in the 2017 permit variation and communication from WSP indicate that the area was restored at a lower level than the surrounding land, on top of the London Clay, and shows no evidence of waste deposition (ref. 16 and **Appendix D**). This suggests that landfilling may have been limited and the areas pose a lower level of risk. However, this assumption should be tested through a topographic survey and intrusive investigation of the area;
- Potential contaminative sources might be associated with the former sand and gravel workings, mineral railway and military land, such as possible former use of fuel or lubricating oils in mechanical plant on site. [redacted] Again, this assumption should be tested through an intrusive investigation.

7. Conclusions and Recommendations

7.1 Conclusions

7.1.1 Perry's Farm

The key liabilities identified for the site relate to the on-going operation and management of the Perry's Farm landfill site. The relevant regulatory regime under which these liabilities would occur are the Environmental Permitting Regulations (2016).

Permit BP3335SR, an authorisation to deposit waste to land (subject to conditions), covers all of the Perry's Farm landfill site (LFS). It is understood that this reference was now been superseded and the site is now operated in accordance with environmental permit reference EPR/GP3899LW (Waste Management Licence 210005).

AECOM's review of the permitting and operation of the Perry's Farm landfill site indicates that there is an on-going leachate management issue at the site, with previous release of leachate at the landfill surface. Permit conditions have been breached, specifically those relating to release of leachate to land, plus exceedance of trigger levels for leachate head in the waste, plus parameter levels in surface water and groundwater. A notice of non-compliance against the permit was issued by the Environment Agency (EA) in 2018, but has since been discharged. Measures have been implemented (drainage and siltbuster) to address leachate discharge and further treatment is proposed (polishing lagoons). However, the EA has also raised the prospect of re-capping that part of the site. Area 1, into which leachate generating waste (CKD) has been deposited.

With the Perry's Farm landfill and associated permit still operational, the development and use of the interconnector and associated infrastructure would have to be managed alongside the permitted activities. [redacted]

Potential liabilities have been identified as follows:

- Those associated with ownership and operation of the landfill site, if the permit is transferred. Such a transfer has been assumed in completing this liability assessment as it would provide NeuConnect with control of site to implement the proposed development;
- Liabilities resulting from with operation of the permit. These include on-going operation, maintenance and monitoring of the site in accordance with the conditions of the permit, plus addressing the leachate management issue and completion of Area 2. They also take in the existing application for variation of the permit for installation of the proposed lagoons and retrospective approval for the leachate drainage system and 'siltbuster' and, subject to the requirements of the EA, could extend to needing to re-cap Area 1 of the landfill;
- The on-going operation would also include payment of the annual permit subsistence charges and maintaining / topping up the Financial Provision that has to be maintained for the site;
- [redacted]
- The responsibility and associated liability would continue into Formal Closure and Surrender of the permit:
  - [redacted]

Whilst these items are identified as the key potential liabilities associated with the Perry's Farm land, the disused oil pipeline reported to cross the site could represent a source of land contamination, relevant under Part 2A of the Environmental Protection Act (1990) and the planning regime. [redacted]This assumption should be tested through further investigation of the pipeline, its location, condition and potential impact upon soil and groundwater. [redacted]

Possible development constraints identified in this area which could require management during the development of the interconnector include:

- Those relating to unsuitable or variable ground conditions in landfilled areas, and management of waste in terms of risk to in-ground infrastructure and disposal if excavated;
- Constraints resulting from the need to avoid creating new contamination pathways if hazardous waste is disturbed or the existing landfill cover, walls or buried infrastructure are damaged during development;
- The presence of other existing in-ground infrastructure;
- Limited space for the cable route between the site boundary and the waste in Area 1;
- Restoration of unfinished parts of Area 2 to the required engineering specification; and
- Further constraints that may arise if additional measures are required by the EA to address leachate release, including re-capping or re-profiling of the site, or additional / alternative leachate treatment measures.

7.1.2 E.E.M Limited J Clubb Land

For the E.E.M. and J Clubb land parcels (cable route) to the north of Perry's Farm landfill, the relevant regulatory regime in relation to risks from land contamination is considered to be Part 2A of the Environmental Protection Act (1990) and, in respect of the new development, the planning regime.

The potential liabilities associated with these areas relate to risks to sensitive receptors from possible sources of ground contamination. Possible sources identified in this area of the site are:

- Historical landfills;
- Historical quarrying operations;
- Historical mineral railway; and
- Possible military land uses.

[redacted]

Other preliminary development constraints identified in this area which may require management during the development include:

- Those relating to unsuitable or variable ground conditions in quarried areas;
- Buried structures present at the locations of former buildings or sand and gravel extraction operations;
- The presence of other existing in-ground infrastructure; and
- The proposed site for the secondary leachate treatment system (lagoons) within the southern part of the E.E.M land parcel. Its installation may constrain possible locations for the cable route or other development features.

7.2 Recommendations

[redacted]

[redacted]

Appendix A – Figures

APPROVED: DR
CHECKED: KS
PRODUCED: LC
CONSULTANT: AECOM

Filename: \\eu.aecomnet.com\euprojectvol\UKNCL2-EI\Environmental Group Management\GIS Management\NeuConnect\Map Documents\Env Liability Desk Study\NC_ELDS_1_180713_Site_Location_and_Layout_v1.mxd

North Level
Lees Marshes
Mean High Water
Pound Fleet
Sand
Bucks Pounds
Grain Marsh
Wharf
PEAT WAY
Yantlett Farm
Hamshill Fleet
Police Cottages
Floodgate
WEST LANE
Rosecourt Farm
Workings
The Flats
E.E.M. Limited
J Clubb Limited
Sand Esplanade
Car Park
Isle of Grain
Area 3
Area 1
Perry's Farm
Perry's Farm
Area 2
PW
School
St James Park
CANNELL ROAD
EASTCO
PH
HIGH STREET
FRY CL
Pavilion
B2001
F Sta
Pol Ho
PW
CHAPEL ROAD
EDINBURGH
CORONATION ROAD
GRAVNE AVENUE
QUEEN ROAD
LAPWING ROAD
CHAPEL ROAD
SEAVIEW
GREEN LANE
Grain
Hall
Whitehouse Farm
Medtha
Ho
SMITHFIELD ROAD
Hard
Millmarsh Fleet
POWER STATION ROAD
GRAIN ROAD
Wallend
Smithfield Marshes
PORT VICTORIA ROAD
Hard
Hard
Mean High Water

0 500 1,000 Metres

AECOM

LEGEND

Land Ownership Boundaries

REVISION:

REV.	DATE	DESCRIPTION
1	13/07/18	ORIGINAL ISSUE

FIGURE NO.

NC_180713_ELDS_1

FIGURE TITLE

SITE LOCATION AND LAYOUT

SHEET NUMBER

1 of 1

NOTES

Date: 13/07/18

Scale at A3: 1:10,000

Appendix B – Document Request

Appendix B
Perry's Farm Landfill Site
Neuconnect

ID	Document file name	Author	Date	Description
01	Planning Permission - TH_6_72_621.pdf	Kent County Council	18-Oct-77	Letter re. plannning permission
02	Let to P Osenton & F Osenton Limited 18.06.1985.pdf	J Clubb	18-Jun-85	Letter re. purchase of land
03	Let to Mr A Osenton 24.10.1988.pdf	J Clubb	24-Oct-88	Letter re. purchase of land
04	Planning Permission - ME_88_1389.pdf	Kent County Council	30-Jan-90	Letter re. plannning permission
05	Excerpt of Drawing no. 93/4/995	J Clubb Limited	Apr-93	Drawing showing planned extraction workings at Perry's Farm
06	Water Resources Act 1991 Licence 13 September 1993.pdf	National Rivers Authority	13-Sep-93	Abstraction Licence documents
07	River Works Licence 09 April 1996 (Part 2).pdf	Port of London Authority	09-Apr-96	Documents re. licence for surface water outfall
08	Regulation 15 Assessment.pdf	Hyder Consulting Ltd	Feb-02	Sumary of desk study and monitoring, and risk assessment
09	Site Conditioning Plan Accompanying Report.pdf	Hyder Consulting Ltd	Jul-02	Part of the site conditioning plan submission and contians additional info requested
10	Deed of Trust and email.pdf	Environment Agency	03-Nov-05	Deed of Trust
11	Pollution Prevention and Control Licence - Perry_s Farm.pdf	Environment Agency	09-Nov-05	Permit
12	Finanical Provision.pdf	Environment Agency	07-Jun-11	Finanical Provision letter
13	River Works Licence 09 April 1996.pdf	J Clubb; Humberts for Crown Estates; Port of London Authority	14-Aug-14;05-Aug-14; 09-Apr-96	Documents re. licence for surface water outfall
14	ESG Annual & Quarterly Monitoring Report - January 2017.pdf	ESG	Jan-17	Monitoring report
15	Perry_s Farm Environmental Permit Variation Application - May 2017.docx	WSP	May-17	Permit variation application
16	170531 Perrys Farm EP Variation Application_r3_ formatted.pdf	WSP / Parsons Brinkerhoff	May-17	Overview of the application for variation of a waste management operation - same as ID08
17	Application Form A 12.4.17.pdf	Form completed by J Clubb Limited	12-Apr-17	Appendix to ID23, Application for an environmental Part A – About you
18	Application Form C2 25.5.17.pdf	Form completed by J Clubb Limited	25-May-17	Appendix to ID23, Application for an environmental permit – Part C2 – General – varying a bespoke permit
19	Application Form C4 21.07.17.pdf	Form completed by J Clubb Limited	21-Jul-17	Appendix to ID23, Application for an environmental permit Part C4 – Varying a bespoke waste operation permit
20	Application Form C4 25.5.17.pdf	Form completed by J Clubb Limited	25-May-17	Appendix to ID23, Application for an environmental permit Part C4 – Varying a bespoke waste operation permit

Appendix B
Perry's Farm Landfill Site
Neuconnect

ID	Document file name	Author	Date	Description
21	Application Form F 23.5.17.pdf	Form completed by J Clubb Limited	31-May-17	Appendix to ID23, Application for an environmental permit Part F1 – Opra, charges and declarations
22	APP B_Figure 1_287127C-F01 Rev C.pdf	Parsons Brinkerhoff	30-May-17	Appendix to ID23, Figure - general arrangement of Perrys Farm Landfill
23	APP B_Figure 2_287127C-F02 Rev A.pdf	Parsons Brinkerhoff	17-May-17	Appendix to ID23, Figure - preliminary long section sketch of balancing ponds
24	APP C_Perrys Farm_Leachate Treatment (Rev C).pdf	Parsons Brinkerhoff	10-May-17	Appendix to ID23, Description of proposed leachate treatment and disposal
25	APP D Perrys Farm CQA Report_Issue No.2 formatted for print.pdf	WSP / Parsons Brinkerhoff	Nov-16	Appendix to ID23, Perry's farm landfill - installation of perimeter leachate drainage - construction quality assurance report
26	APP E Perrys Farm SCR_Final formatted.pdf	WSP / Parsons Brinkerhoff	May-17	Appendix to ID23, Site Condition Report
27	APP E SCR Figure 1 - Site Location.pdf	WSP	31-May-17	Appendix to ID23, Figure - Site Location Plan
28	APP E SCR Figure 2 - 287127C-F01 Rev C.pdf	Parsons Brinkerhoff	30-May-17	Appendix to ID23, Figure - general arrangement of Perrys Farm Landfill, Permit variation
29	APP F RPS leachate In vitro irritancy 1808901_rep.pdf	Envigo	11-Apr-17	Appendix to ID23, In-vitro leachate testing report
30	APP G_170530 Perrys Farm LTP H1 ERA formatted for print.pdf	WSP / Parsons Brinkerhoff	May-17	Appendix to ID23, Environmental Risk Assessment
31	APP H I Rayner WAMITAB & continuing competence.PDF	WAMITAB	27-Apr-99 , 08-Feb-16	Appendix to ID23, Certificate of Technical Compliance
32	Perrys Farm EPR 110717.PDF	Environment Agency	11-Jul-17	Compliance Assessment Report
32	Annual & Quarterly Monitoring Report - January 2018.pdf	Socotec	Feb-18	Monitoring report
33	EA Financial Provision.PDF	Environment Agency	09-May-17; 12-Jul-17	Correspondence relating to Financial provisions
34	o0243PF_AMR2018 socotec annual report 2017-18.pdf	Socotec	Feb-18	Monitoring report
35	Perrys Farm EPR 180418.PDF	Environment Agency	18-Apr-18	Compliance Assessment Report
36	o0243PF_Q12018 socotec qtly report q1 perrys Grain.pdf	Socotec	May-18	Monitoring report
37	Perrys Farm EPR 090518.PDF	Environment Agency	09-May-18	Compliance Assessment Report
38	Perrys Farm Enforcement Notice.PDF	Environment Agency	17-May-18	Enforcement Notice
39	Enforcement Notice.pdf	Environment Agency	17-May-18	Details of enforcement notice
40	Enforcement notice email chain and siltbuster method statement.pdf	Environment Agency	21-Jun-18	Enforcement notice email chain and siltbuster method statement

Appendix C – Document Review List

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14 May 2018 - by email

Our Reference
60571593

Mr. J Lovett
J Clubb Ltd
Church Hill
Wilmington
Dartford
Kent
DA2 7DZ

Request For Information - Perry's Farm Landfill Site

Dear Jon

AECOM are conducting an environmental desk study of the landfill site located at Perry's Farm, Isle of Grain, on behalf of NeuConnect. Kevin Lee has provided your details as a contact for a request for information in relation to this site.

We understand that J Clubb is the holder of the permit for the Perry's Farm landfill site and would be grateful if you could please provide answers to the following questions and copies of the documents listed below.

If J Clubb does not hold any of the information listed, then we would be grateful if you could please confirm this via return email. AECOM will then make a request for publically held records in relation to the site's permit number from the Environment Agency (EA).

Perry's Farm (extant site)

Please confirm the following:

- Is the site still receiving waste, and if not, is it in formal closure? If the latter, please provide evidence of formal closure / agreement with the EA; and
- Has waste ever been deposited in the southern part of the site (area reported to have been worked for minerals but yet to be land filled).

Please provide copies of the following documents:

1. All and every application for authorisations, including but not limited to planning, permitting, etc., as well as copies of all such issue documents arising therefrom, e.g. planning permissions, permits, etc. plus copies of any issued variations to the same - note this also includes the same for the Leachate Treatment Plant (LTP);
2. All correspondence with the EA, including but not limited to Compliance Assessment Reports (CAR), etc.;
3. Evidence relating to any Financial Provisions (FP), including how this may need to be increased regards the LTP;
4. All designs and the equivalent Construction Quality Assurance (CQA) records, or other construction records, evidencing their delivery;
5. All monitoring information / periodic reports to the Environment Agency (EA);
6. Evidence of the amount and type(s) of waste accepted and the locations deposited within site;
7. All communications between the site operator and the EA regards the need for the LTP;
8. All correspondence with Kent County Council (KCC) as mineral planning authority;
9. All correspondence relating to the LTP, including with the prospective supplier, also to include evidence of planning permission and the determination process relating to the application to vary the permit;

10. Evidence of fit and proper persons compliance;
11. Evidence of off-site nuisance, including correspondence with the planning authority, local authority (if different) and stakeholder groups;
12. Confirmation of any outcome regards the historical Development Consents Order (DCO) application for additional hazardous waste capacity (SLR on behalf of Peel Holdings);
13. Evidence of ongoing fees payable to the EA;
14. Evidence of on-going costs for operation and monitoring of the site and compliance with the Permit, including the LTP;
15. If the site is in formal closure, copies of the formal closure plan agreed with the EA.

We appreciate this is a considerable volume of information. Our priority are items numbered 1, 2 and 3 in the list above. As noted before, if you don't hold any of the documents requested, please confirm this.

Historical Landfill Site – Whitehall Farm

We understand J Clubb was also named as permit holder for a historical landfill site located at Whitehall Farm to the northeast of Perry's Farm. EA records (available at https://data.gov.uk/dataset/historic-landfill) indicate two areas of historical landfilling at the Whitehall Farm site.

Please confirm if there is a live permit for these landfilled areas. If there is a live permit, please provide a copy of the permit.

In the case that there is no permit, please provide evidence of its surrender, the site's movement into formal closure, and the acceptance of this by the EA and/or its predecessor organisations.

If available, please provide copies of any of the following information for each landfilled area:

1. Waste types deposited;
2. Any evidence of engineering / operations during the sites operation;
3. Any monitoring information which may be available;
4. All correspondence between the permit holder and the regulator (EA or otherwise); and
5. Any evidence of on- or off-site emissions / nuisance, and how (and if) this was addressed.

Thank you for your assistance with this request. If you have any questions about our request, please contact me at the numbers below.

Yours sincerely,

Kevin Shepherd

Kevin Shepherd
Associate Geoscientist
AECOM Limited
T: +44 (0) 121 214 8227
M: +44 (0) 7775 538 527
E: kevin.shepherd@aecom.com

cc: Kevin Lee, NeuConnect
David Moore, NeuConnect
Mike Bains, AECOM

Appendix D – [redacted]

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Appendix 11.B – Contaminated Land Assessment Methodology, Risk and Impact Assessment

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement

Appendix 11B – Contaminated Land Assessment Methodology, Risk and Impact Assessment

NeuConnect Britain Ltd

September 2019

Prepared for:

NeuConnect Britain Ltd
C/O Fulcrum
105 Piccadilly
London, W1J 7NJ
United Kingdom

Prepared by:

AECOM Infrastructure & Environment UK Limited
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United Kingdom

T: +44 131 301 8600
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Table of Contents

1. Contaminated Land Assessment Methodology

Risk and Impact Assessment

Assessment Methodology

Table 11.B1.1: Proximity Definition

Zone	Definition
Zone 1	All land within, or within 10 m of, the application boundary.
Zone 2	All land from between 10m and 50m of the application boundary.
Zone 3	All land from between 50m and 250m of the application boundary.

Table 11.B1.2: Potentially Contaminative Land Uses

Class	Description	Example land uses(1)
Class 1	Low risk of potential contamination, or less hazardous chemicals in use	Farms (ancillary buildings and areas for storing chemicals, fuel etc.)
		Warehouses
		Goods yards
		Hospitals
		Builders yards
		Retail and business parks
Class 2	Medium risk of potential contamination, more hazardous chemicals in possible use	Engineering workshops
		Railways/ disused railway lines
		Brick works
		Dry cleaners (retail)
		Sewage works
		Former clay pits and quarries
		Cement/asphalt works
		Car breakers
		Garage workshops
		Waste transfer facilities
		Paper works
		Power stations
		Glass works
		Timber treatment works
		Foot and mouth burials

Class	Description	Example land uses[1]
		Metal manufacturing and plating
		Depots
		Scrap yards
Class 3	High risk of potential contamination, hazardous chemicals likely to be present	Gas and coke works
		Landfills and historical landfills
		Petrol filling stations
		Oil depots
		Iron and steel works
		Historical foundries
		Chemical works

[1] The list of land uses defined in Table 11.B1.2 is not intended to be an exhaustive list and professional judgement has been applied accordingly.

Table 11.B1.3: Determination of Site Rating

Potentially contaminative land use class	Proximity	Relationship to cut/fill/construction work	Site rating
Class 1 Low Risk	Zone 1	Earthworks fill	2
		Earthworks cut/at grade	3
		Bored excavation	0
	Zone 2	Earthworks fill	1
		Earthworks cut/at grade	2
		Bored excavation	0
	Zone 3	Earthworks fill	0
		Earthworks cut/at grade	1
		Bored excavation	0
Class 2 Medium Risk	Zone 1	Earthworks fill	3
		Earthworks cut/at grade	4
		Bored excavation	2
	Zone 2	Earthworks fill	2
		Earthworks cut/at grade	3
		Bored excavation	2
	Zone 3	Earthworks fill	1
		Earthworks cut/at grade	2
		Bored excavation	1
Class 3 High Risk	Zone 1	Earthworks fill	4
		Earthworks cut/at grade	5
		Bored excavation	3

Potentially contaminative land use class	Proximity	Relationship to cut/fill/construction work	Site rating
	Zone 2	Earthworks fill	3
		Earthworks cut/at grade	4
		Bored excavation	3
	Zone 3	Earthworks fill	2
		Earthworks cut/at grade	3
		Bored excavation	2

Screening Assessment

Table 11.B2.1: Summary of sites excluded from Risk and Impact Assessment.

Area reference	Site description	Location/orientation	Proximity	Land use class	Relationship to cut/fill/ construction work	Baseline site rating
CL02	Current Farm	North of the Site to the north of West Lane	3	1	Earthworks cut	1
CL04	Current Fire station	East of the cable route on Chapel Road	3	1	Earthworks cut	1
CL08	Current undeveloped land/ former pond (assumed infilled)	North of the Site near West Lane	3	1	Earthworks cut	1

1. The area defined as the application boundary is interchangeably referred to as the 'Site' as appropriate within this table

Table 11.B2.2: Summary of sites included in Risk and Impact Assessment.

Area reference	Site description	Location/orientation	Proximity	Land use class	Relationship to cut/fill/ construction work	Baseline site rating
CL01	Current residential land use / former Perry's Farm (including current storage of farm activity related materials)	Adjacent the Site east of proposed substation/ converter station area	1	1	Earthworks cut	3
CL03	Current Farm	Partially on the Site/ adjacent east of the cable route on Grain Road	1	1	Earthworks cut	3
CL05	Current undeveloped land / former Perry's Farm Landfill and buried disused oil pipeline	On the Site, extending off Site, south of West Lane and west of Grain Road	1	3	Earthworks cut	5
CL06	Current undeveloped land / former military land use	West of northern part of cable route near the coast line	3	3	Earthworks cut	3
CL07	Current unoccupied land / former Kent Oil Refinery	South of the Site south of Grain Road	3	3	Earthworks cut	3
CL09	Current pond / former pond (assumed infilled)	North of the substation/ converter station area to the south of West lane	1	1	Earthworks cut	3

Area reference	Site description	Location/orientation	Proximity	Land use class	Relationship to cut/fill/ construction work	Baseline site rating
CL10	Current undeveloped land / former pond (assumed infilled)	West of the Site off farm track	2	2	Earthworks cut	3
CL11	Current undeveloped land / former mineral workings and historical landfills (assumed potentially infilled)	On the Site across the northern part of the cable route and extending off Site to the west and east.	1	3	Earthworks cut	5
CL12	Buried disused oil pipeline	On the Site, extending off the Site, south of West Lane and west of Grain Road	1	3	Earthworks cut	5

1. The area defined as the application boundary is interchangeably referred to as the 'Site' as appropriate within this table

Risk and Impact Assessment – Historical infilled land and landfills (within and extending outside of the application boundary)

Table 11.B3.1: Risk and impact assessment for historical infilled land and landfills within and extending outside of the application boundary.

Site ID (IDS)	**CL05, CL11**
Site group	Historical infilled land and landfills (within and extending outside of the application boundary)
Site title (Site ID) and land use class	Current undeveloped land / former Perry's Farm Landfill and buried disused oil pipeline (CL05) - Class 3. Current undeveloped land / former mineral workings and historical landfills (assumed potentially infilled) (CL11) – Class 3.

Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
Current undeveloped land / former Perry's Farm Landfill and buried disused oil pipeline (CL05) - Class 3.	On-site: Agricultural workers, landfill management operatives Off-site: Residential and farm users Off-site (post-construction only): Employees at the substation/ converter station	Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.	Pond between adjacent to the Perry's Farm access track and pond directly north of the application boundary	None	Off-site: residential, farm buildings On-site (post-construction only): Buildings, foundations, services	None
Current undeveloped land / former mineral workings and historical landfills (assumed potentially infilled) (CL11) – Class 3.	Off-site: Residential and farm users, St James' Church of England Primary School	Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.	Thames Estuary, small ponds and connecting streams on site. Larger pond to the south west	South Thames Estuary and Marshes and Medway Estuary and Marshes (Sites of Special Scientific Interest (SSSI), RAMSAR, Special Protection Area (SPA), Marine Nature Reserve (NMR) present to the north	Off-site: residential, farm buildings and St James' Church of England Primary School	None
Post-construction development description						

Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other

CL05 and CL11 – Located partly within the footprint of the application boundary, where earthworks (cut) are proposed.

Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Baseline CSM and Qualitative Risk Assessment: Historical infilled land and landfills within and extending outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: metals, metalloids, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, polyaromatic hydrocarbons (PAH), solvents, lubricants, fuel oils, alkalis, volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCB), methane, hydrogen sulphide and carbon dioxide.	On-site Site users (e.g. agricultural workers, landfill management operatives)	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood	Medium	Moderate/low risk
	Off-site Residential Farm users and St James' Church of England Primary School	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood	Medium	Moderate/low risk
	Controlled waters – Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Likely	Mild	Moderate/low risk
	Controlled waters – Ponds	Groundwater migration, direct run-off from site.	Likely	Mild	Moderate/low risk
	Controlled waters – Thames Estuary	Groundwater migration, direct run-off from site.	Low likelihood	Medium	Moderate/low risk
	Ecological receptors – SSSI, NMR, RAMSAR and SPA present to the north	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Medium	Moderate/low risk
	Property receptors –	Exposure to explosive gases.	Low likelihood	Mild	Low risk

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
	Buildings, foundations, services (off-site)	Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. Sites are assessed against baseline condition without construction of the proposed interconnector and associated substation/ converter station infrastructure.
2. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Construction CSM and Qualitative Risk Assessment: Historical infilled land and landfills within and extending outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Soil, leachate and groundwater contamination. Ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: metals, metalloids, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, polyaromatic hydrocarbons (PAH), solvents, lubricants, fuel oils, alkalis, volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCB), methane, hydrogen sulphide and carbon dioxide.	On-site Site users (e.g. agricultural workers, landfill management operatives)	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood to likely	Medium	Moderate/low to moderate risk
	Off-site Residential Farm buildings and St James' Church of England Primary School	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood to likely	Medium	Moderate/low to moderate risk
	Controlled waters – Superficial deposits: Secondary A aquifer. Secondary Undifferentiated Aquifer.	Vertical and lateral migration.	Likely	Mild to medium	Moderate/low to moderate risk
	Controlled waters – Ponds	Groundwater migration, direct run-off from site.	Likely	Mild	Moderate/low risk
	Controlled waters – Thames Estuary	Groundwater migration, direct run-off from site.	Low likelihood	Medium	Moderate/low risk
	Ecological receptors – SSSI, NMR, RAMSAR and SPA present to the north	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Medium	Moderate/low risk

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
	Property receptors – Buildings, foundations, services (off-site)	Exposure to explosive gases.	Low likelihood to likely	Mild	Low to moderate/low risk
		Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. It is assumed that ground investigations will be undertaken specific to the application boundary prior to construction.
2. During construction standard mitigation procedures are assumed to be implemented. Construction and on-site workers have been excluded from assessment due to the use of PPE and risk management.
3. Whilst the measures detailed in a Construction Environmental Management Plan (CEMP) (which will be prepared prior to the commencement of construction activities and signed off by Medway Council) will make it unlikely that there will be adverse consequences associated with construction for example through the control of surface run-off and dust, it is considered that there may still be temporary adverse effects during the construction period that might arise through ground disturbance. The adoption of a CEMP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline.
4. It is assessed that earthworks will require a cut operation to which might temporarily worsen groundwater quality, for example, as a result of dewatering activities, which may potentially draw contaminated groundwater away from the sources or alter ground gas pathways which may cause a temporary worsening in groundwater quality or increased ground gas risk compared to baseline.
5. The area of the source sites which lie within the footprint of the application boundary may require remediation. The majority of the source sites lie outside of the application boundary and so it is assumed that these parts will not be remediated.
6. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Post-construction CSM and Qualitative Risk Assessment: Historical infilled land and landfills within and extending outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction
Soil, leachate and groundwater contamination. Ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: metals, metalloids, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, polyaromatic hydrocarbons (PAH), solvents, lubricants, fuel oils, alkalis, volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCB), methane, hydrogen sulphide and carbon dioxide.	On-site Site users (e.g. agricultural workers, landfill management operatives)	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely to low likelihood	Medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely to low likelihood	Medium	Low to moderate/low risk
		Inhalation of ground gases.	Unlikely to low likelihood	Medium	Low to moderate/low risk
	Off-site Employees at the substation/ converter station	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Medium	Low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Medium	Low risk
		Inhalation of ground gases.	Unlikely	Medium	Low risk
	Off-site Residential Farm buildings and school	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood	Medium	Moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated Aquifer.	Vertical and lateral migration.	Likely	Mild	Moderate/low risk
	Controlled waters – Ponds	Groundwater migration, direct run-off from site.	Likely	Mild	Moderate/low risk

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction
	Controlled waters – Thames Estuary	Groundwater migration, direct run-off from site.	Low likelihood	Medium	Moderate/low risk
	Ecological receptors – SSSI, NMR, RAMSAR and SPA present to the north	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Medium	Moderate/low risk
	Property receptors – Buildings, foundations, services (on-site and off-site)	Exposure to explosive gases.	Low likelihood	Mild	Low risk
		Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. Assumes remediation required has been undertaken and construction works are complete.
2. The Site is proposed for a 1400 megawatt (MW) interconnector and associated substation/ converter station infrastructure and associated off-site post-development receptors have been considered in this CSM. Maintenance workers have been excluded from the assessment due to the use of PPE and risk management.
3. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Impact Assessment: Historical infilled land and landfills within and extending outside of the application boundary.

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction impact significance	Post-construction impact significance
Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils (on-site agricultural workers, landfill management operatives)	Moderate/low risk	Moderate/low risk	Low to moderate/low risk	Neutral	Neutral to minor beneficial effect
Direct contact, ingestion, inhalation of vapour with/from contaminated waters (on-site agricultural workers, landfill management operatives)	Moderate/low risk	Moderate/low risk	Low to moderate/low risk	Neutral	Neutral to minor beneficial effect
Inhalation of ground gases (on-site agricultural workers, landfill management operatives)	Moderate/low risk	Moderate/low to moderate risk	Low to moderate/low risk	Neutral to minor adverse	Neutral to minor beneficial effect
Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils (off-site employees at the substation/ converter station)	N/A	N/A	Low risk	N/A	N/A
Direct contact, ingestion, inhalation of vapour with/from contaminated waters (off -site employees at the substation/converter station)	N/A	N/A	Low risk	N/A	N/A
Inhalation of ground gases (off-site employees at the substation/ converter station)	N/A	N/A	Low risk	N/A	N/A
Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils (off-site residential and farm buildings and school)	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Direct contact, ingestion, inhalation of vapour with/from contaminated waters (off-site residential and farm buildings and school)	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction impact significance	Post-construction impact significance
Inhalation of ground gases (off-site residential and farm buildings and school)	Moderate/low risk	Moderate/low to moderate	Moderate/low risk	Neutral to minor adverse	Neutral
Contaminated soil, leachate/groundwater and pollution of aquifers	Moderate/low risk	Moderate/low to moderate	Moderate/low risk	Neutral to minor adverse	Neutral
Contaminated soil, leachate/groundwater and impact on surface watercourses: Ponds	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on surface watercourses: Thames Estuary	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on Ecological receptors	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Impact on property receptors, on-site and off-site (exposure to explosive gases)	Low risk	Low risk	Low risk	Neutral	Neutral
Impact on property receptors, on-site and off-site (aggressive ground conditions)	Low risk	Low risk	Low risk	Neutral	Neutral
Overall significance				Neutral to minor adverse	Neutral to minor beneficial effect

Notes/assumptions

1. The construction impact significance column may report a range of outcomes for a site. The CEMP is designed to mitigate effects, and it is considered that up to only temporary minor adverse effects during the construction period may occur from ground disturbance.
2. The post-construction impact column assumes remediation required has been undertaken and the benefits of remediation realised. Assumes construction works are complete.
3. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Risk and Impact Assessment – Buried disused oil pipeline (within and extending outside of the application boundary)

Table 11.B4.1: Risk and impact risk assessment for buried disused oil pipeline located within and extending outside of the application boundary.

Site ID (IDS)	**CL12**
Site group	Buried disused oil pipeline (within and extending outside of the application boundary)
Site title (Site ID) and land use class	Current buried disused oil pipeline (CL12) – Class 3

Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
Current buried disused oil pipeline (CL12) – Class 3	On-site: agricultural workers, potential landfill management operatives	Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.	Pond / drain to the south west in Perry's Farm Land and drain to the west of the northern section.	Environmentally Sensitive Area (ESA) (North Kent Marshes)	On-site: disused buried oil pipeline	None

Post-construction development description
CL12 – Located within and extending outside of the footprint of the application boundary, where earthworks (cut) are proposed. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Baseline CSM and Qualitative Risk Assessment: Buried disused oil pipeline located within and extending outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Ground Gas Potential for oil products.	On-site Site users (e.g. agricultural workers, potential landfill management operatives)	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood	Medium	Moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- Pond / drain to the south west in Perry's Farm Land and drain to the west of the northern section.	Groundwater migration, direct run-off from site.	Unlikely	Minor	Very low risk
	Ecological receptors – ESA (North Kent Marshes)	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Medium	Moderate/low risk
	Property receptors – Buried disused oil pipeline (on-site)	Exposure to explosive gases.	Low likelihood	Mild	Low risk
		Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. Site is assessed against baseline condition without construction of the proposed interconnector and associated substation/ converter station infrastructure.
2. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Construction CSM and Qualitative Risk Assessment: Buried disused oil pipeline located within and extending outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Soil, leachate and groundwater contamination. Ground Gas Potential for oil products.	On-site Site users (e.g. agricultural workers, landfill management operatives)	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood	Medium	Moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated Aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- Pond / drain to the south west in Perry's Farm Land and drain to the west of the northern section.	Groundwater migration, direct run-off from site.	Unlikely	Minor	Very low risk
	Ecological receptors – ESA (North Kent Marshes)	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Medium	Moderate/low risk
	Property receptors – Buried disused oil pipeline (on-site)	Exposure to explosive gases.	Low likelihood	Mild	Low risk
		Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. It is assumed that ground investigations will be undertaken specific to the application boundary prior to construction.
2. During construction standard mitigation procedures are assumed to be implemented. Construction and on-site workers have been excluded from assessment due to the use of PPE and risk management.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase

3. Whilst the measures detailed in a CEMP will make it unlikely that there will be adverse consequences associated with construction for example through the control of surface run-off and dust, it is considered that there may still be temporary adverse effects during the construction period that might arise through ground disturbance. The adoption of a CEMP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline.
4. The area of the source site which lies within the footprint of the application boundary may require remediation.
5. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Post-construction CSM and Qualitative Risk Assessment: Buried disused oil pipeline located within and extending outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction
Soil, leachate and groundwater contamination. Ground Gas Potential for oil products.	On-site Site users (e.g. agricultural workers, landfill management operatives)	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases.	Low likelihood	Medium	Moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- Pond / drain to the south west in Perry's Farm Land and drain to the west of the northern section.	Groundwater migration, direct run-off from site.	Unlikely	Minor	Very low risk
	Ecological receptors – ESA (North Kent Marshes)	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Medium	Moderate/low risk
	Property receptors – Buried disused oil pipeline (on-site)	Exposure to explosive gases.	Low likelihood	Mild	Low risk
		Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. Assumes remediation required has been undertaken and construction works are complete.
2. The Site is proposed for a 1400 megawatt (MW) interconnector and associated substation/ converter station infrastructure. Assumes baseline conditions will not change at post construction. Maintenance workers have been excluded from the assessment due to the use of PPE and risk management.

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction

3. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Impact Assessment: Buried disused oil pipeline located in the application boundary

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction impact significance	Post-construction impact significance
Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils. (agricultural workers, landfill management operatives)	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Direct contact, ingestion, inhalation of vapour with/from contaminated waters. (agricultural workers, landfill management operatives)	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Inhalation of ground gases (agricultural workers, landfill management operatives)	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and pollution of aquifers	Low risk	Low risk	Low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on surface watercourses	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on Ecological receptors	Moderate/low risk	Moderate/low risk	Moderate/low risk	Neutral	Neutral
Impact on property receptors, on-site (exposure to explosive gases)	Low risk	Low risk	Low risk	Neutral	Neutral
Impact on property receptors, on-site (aggressive ground conditions)	Low risk	Low risk	Low risk	Neutral	Neutral
Overall significance				Neutral	Neutral
Notes/assumptions					

1. The construction impact significance column may report a range of outcomes for a site. The CEMP is designed to mitigate effects, and it is considered that up to only temporary minor adverse effects during the construction period may occur from ground disturbance.
2. Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Risk and Impact Assessment – Former ponds (assumed infilled) (outside of the application boundary)

Table 11.B5.1: Risk and impact assessment for former ponds (assumed infilled) located outside of the application boundary.

Site ID (IDS)	**CL09 and CL10**
Site group	Former ponds (assumed infilled) (outside of the application boundary)
Site title (Site ID) and land use class	Current pond / former pond (assumed infilled) (CL09) – Class 1 Current undeveloped land / former pond (assumed infilled) (CL10) – Class 2

Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
Current pond / former pond (assumed infilled) (CL09) – Class 1	Off-site: agricultural workers, landfill management operatives	Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.	Current on-site pond Drain/stream to the west	ESA (North Kent Marshes)	None	None
Current undeveloped land / former pond (assumed infilled) (CL10) – Class 2	Off-site: agricultural workers, landfill management operatives	Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.	Drain to the south	None	None	None

Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Baseline CSM and Qualitative Risk Assessment: Former ponds (assumed infilled) located outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Ground gas. Infill contaminants unknown, but potential for a range of inorganic and organic contaminants including but not limited to: metals, metalloids, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, PAH, solvents, lubricants, fuel oils, alkalis, VOC, SVOC, PCB, methane, hydrogen sulphide and carbon dioxide.	Off-site Agricultural workers, landfill management operatives	Direct contact, ingestion, inhalation of dust/ vapour with/from contaminated soils.	Low likelihood	Mild to medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Mild to medium	Low to moderate/low risk
		Inhalation of ground gases.	Low likelihood	Mild to medium	Low to moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- On-site and off-site ponds, streams and drains	Groundwater migration, direct run-off from site.	Low likelihood	Mild	Low risk
	Ecological receptors – ESA (North Kent Marshes)	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Mild to medium	Low to moderate/low risk

Notes/assumptions

1. Sites are assessed against baseline condition without construction of the proposed interconnector and associated substation/ converter station infrastructure.
2. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Construction CSM and Qualitative Risk Assessment: Former ponds (assumed infilled) located outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Soil, leachate and groundwater contamination. Ground gas. Infill contaminants unknown, but potential for a range of inorganic and organic contaminants including but not limited to: metals, metalloids, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, PAH, solvents, lubricants, fuel oils, alkalis, VOC, SVOC, PCB, methane, hydrogen sulphide and carbon dioxide.	Off-site Agricultural workers, landfill management operatives	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Mild to medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Mild to medium	Low to moderate/low risk
		Inhalation of ground gases.	Low likelihood	Mild to medium	Low to moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- On-site and off-site ponds, streams and drains	Groundwater migration, direct run-off from site.	Low likelihood	Mild	Low risk
	Ecological receptors – ESA (North Kent Marshes)	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Mild to medium	Low to moderate/low risk

Notes/assumptions

1. As these sites are outside of the application boundary, it is assumed that no ground investigations or remediation will be undertaken on these sites. However, these sites may have the potential to influence conditions on the application boundary site during construction.
2. During construction standard mitigation procedures are assumed to be implemented. Construction and on-site workers have been excluded from assessment due to the use of PPE and risk management.
3. Whilst the measures detailed in a CEMP will make it unlikely that there will be adverse consequences associated with construction for example through the control of surface run-off and dust, it is considered that there may still be temporary adverse effects during the construction period that might arise through ground disturbance. The adoption of a CEMP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase

4. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Post-construction CSM and Qualitative Risk Assessment: Former ponds (assumed infilled) located outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction
Soil, leachate and groundwater contamination. Ground gas. Infill contaminants unknown, but potential for a range of inorganic and organic contaminants including but not limited to: metals, metalloids, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, PAH, solvents, lubricants, fuel oils, alkalis, VOC, SVOC, PCB, methane, hydrogen sulphide and carbon dioxide.	Off-site Agricultural workers, landfill management operatives	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Mild to medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Mild to medium	Low to moderate/low risk
		Inhalation of ground gases.	Low likelihood	Mild to medium	Low to moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- On-site and off-site ponds, streams and drains	Groundwater migration, direct run-off from site.	Low likelihood	Mild	Low risk
	Ecological receptors – ESA (North Kent Marshes)	Lateral migration in shallow groundwater present with discharge as basal flow into protected areas	Low likelihood	Mild to medium	Low to moderate/low risk

Notes/assumptions

1. Assumes remediation required has been undertaken and construction works are complete.
2. The Site is proposed for a 1400 megawatt (MW) interconnector and associated substation/ converter station infrastructure. Assumes baseline conditions will not change at post construction. Maintenance workers have been excluded from the assessment due to the use of PPE and risk management.
3. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Impact Assessment: Former ponds (assumed infilled) located outside of the application boundary.

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction impact significance	Post-construction impact significance
Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils. (agricultural workers, landfill management operatives)	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Direct contact, ingestion, inhalation of vapour with/from contaminated waters. (agricultural workers, landfill management operatives)	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Inhalation of ground gases. (agricultural workers, landfill management operatives)	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and pollution of aquifers	Low risk	Low risk	Low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on surface watercourses	Low risk	Low risk	Low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on Ecological receptors	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Overall significance				Neutral	Neutral
Notes/assumptions					

1. The construction impact significance column may report a range of outcomes for a site. The CEMP is designed to mitigate effects, and it is considered that only temporary minor adverse effects during the construction period may occur from ground disturbance.
2. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Risk and Impact Assessment – Former Kent Oil Refinery (outside of the application boundary)

Table 11.B6.1: Risk and impact risk assessment for former Kent Oil Refinery located outside of the application boundary.

Site ID (IDS)	**CL07**
Site group	Former Kent Oil Refinery (outside of the application boundary)
Site title (Site ID) and land use class	Current unoccupied land / former Kent Oil Refinery (CL07) – Class 3

Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
Current unoccupied land / former Kent Oil Refinery (CL07) – Class 3	Off-site: industrial land users to the south east	Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.	Drains on site and off site to the east and south	None	On-site: Derelict structures	None

Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Baseline CSM and Qualitative Risk Assessment: Former Kent Oil Refinery located outside of the application boundary

Source	*Receptor*	*Pathway*	*Probability*	*Consequence*	*Risk at baseline*
Soil, leachate and groundwater contamination. Possible ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: oils, metals and metal compounds, fuels, hydrocarbons (including petrol additives, petroleum spirit, diesel, PAH), detergent constituents, organochlorines, phenolics, metals, creosote, organic solvents, PCBs, asbestos	Off-site Industrial land users to the south east	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Mild to medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Mild to medium	Low to moderate/low risk
		Inhalation of ground gases.	Low likelihood	Mild to medium	Low to moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- On-site drains and off-site drains to the east and south	Groundwater migration, direct run-off from site.	Low likelihood	Mild	Low risk
	Property- Derelict structures (on-site)	Exposure to explosive gases.	Low likelihood	Minor	Very low risk
		Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. Site is assessed against baseline condition without construction of the proposed interconnector and associated substation/ converter station infrastructure.
2. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Construction CSM and Qualitative Risk Assessment: Former Kent Oil Refinery located outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Possible ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: oils, metals and metal compounds, fuels, hydrocarbons (including petrol additives, petroleum spirit, diesel, PAH), detergent constituents, organochlorines, phenolics, metals, creosote, organic solvents, PCBs, asbestos	Off-site users Industrial land users to the south east	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Mild to medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Mild to medium	Low to moderate/low risk
		Inhalation of ground gases.	Low likelihood	Mild to medium	Low to moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- On-site drains and off-site drains to the east and south	Groundwater migration, direct run-off from site.	Low likelihood	Mild	Low risk
	Property- Derelict structures (on-site)	Exposure to explosive gases.	Low likelihood	Minor	Very low risk
		Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. As this site is outside of the application boundary, it is assumed that no ground investigations or remediation will be undertaken on this site. However, this site may have the potential to influence conditions on the application boundary site during construction.
2. During construction within the application boundary site, standard mitigation procedures are assumed to be implemented. Construction workers have been excluded from assessment due to the use of PPE and risk management.
3. Whilst the measures detailed in a CEMP will make it unlikely that there will be adverse consequences associated with construction for example through the control of surface run-off and dust, it is considered that there may still be temporary adverse effects during the construction period that might arise through ground disturbance. The adoption of a CEMP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline.

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline

4. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Post-construction CSM and Qualitative Risk Assessment: Former Kent Oil Refinery located outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Possible ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: oils, metals and metal compounds, fuels, hydrocarbons (including petrol additives, petroleum spirit, diesel, PAH), detergent constituents, organochlorines, phenolics, metals, creosote, organic solvents, PCBs, asbestos	Off-site Industrial land users to the south east	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Low likelihood	Mild to medium	Low to moderate/low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Low likelihood	Mild to medium	Low to moderate/low risk
		Inhalation of ground gases.	Low likelihood	Mild to medium	Low to moderate/low risk
	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters- On-site drains and off-site drains to the east and south	Groundwater migration, direct run-off from site.	Low likelihood	Mild	Low risk
	Property- Derelict structures (on-site)	Exposure to explosive gases.	Low likelihood	Minor	Very low risk
		Aggressive ground conditions	Low likelihood	Mild	Low risk

Notes/assumptions

1. Assumes remediation required has been undertaken and construction works are complete.
2. The Site is proposed for a 1400 megawatt (MW) interconnector and associated substation/ converter station infrastructure. Assumes baseline conditions will not change at post construction.
3. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Impact Assessment: Former Kent Oil Refinery located outside of the application boundary

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction impact significance	Post-construction impact significance
Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils. (off-site industrial land users)	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Direct contact, ingestion, inhalation of vapour with/from contaminated waters. (off-site industrial land users)	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Inhalation of ground gases. (off-site industrial land users)	Low to moderate/low risk	Low to moderate/low risk	Low to moderate/low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and pollution of aquifers	Low risk	Low risk	Low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on surface watercourses	Low risk	Low risk	Low risk	Neutral	Neutral
Impact on property receptors (exposure to explosive gases)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Impact on property receptors (aggressive ground conditions)	Low risk	Low risk	Low risk	Neutral	Neutral
Overall significance				Neutral	Neutral
Notes/assumptions					

1. The construction impact significance column may report a range of outcomes for a site. The CEMP is designed to mitigate effects, and it is considered that only temporary minor adverse effects during the construction period may occur from ground disturbance.
2. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Risk and Impact Assessment – Former military land use (outside of the application boundary)

Table 11.B7.1: Risk and impact assessment for former military land use located outside of the application boundary.

Site ID (IDS)	**CL06**
Site group	Former military land use (outside of the application boundary)
Site title (Site ID) and land use class	Current undeveloped land / former military land use (CL06)- Class 3

Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
Current undeveloped land / former military land use (CL06)- Class 3	None	Superficial deposits: Secondary A aquifer and Secondary Undifferentiated aquifer.	Pond to the south east	None	None	None

Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Baseline CSM and Qualitative Risk Assessment: Former military land use located outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: heavy metals, ammonia, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, PAHs, solvents, lubricants, fuel oils, alkalis, PBCs, methane and carbon dioxide.	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters – Surface water - pond to the south east	Groundwater migration, direct runoff from site.	Low likelihood	Mild	Low risk

Notes/assumptions

1. Site is assessed against baseline condition without construction of the proposed interconnector and associated substation/ converter station infrastructure.
2. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Construction CSM and Qualitative Risk Assessment: Former military land use located outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Soil, leachate and groundwater contamination. Ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: heavy metals, ammonia, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, PAHs, solvents, lubricants, fuel oils, alkalis, PBCs, methane and carbon dioxide.	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters – Surface water - pond to the south east	Groundwater migration, direct runoff from site.	Low likelihood	Mild	Low risk

Notes/assumptions

1. As this site is outside of the application boundary, it is assumed that no ground investigations or remediation will be undertaken on this site. However, this site may have the potential to influence conditions on the application boundary site during construction.
2. During construction within the application boundary site, standard mitigation procedures are assumed to be implemented. Construction workers have been excluded from assessment due to the use of PPE and risk management.
3. Whilst the measures detailed in a CEMP will make it unlikely that there will be adverse consequences associated with construction for example through the control of surface run-off and dust, it is considered that there may still be temporary adverse effects during the construction period that might arise through ground disturbance. The adoption of a CEMP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline.
4. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Post-construction CSM and Qualitative Risk Assessment: Former military land use located outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction
Soil, leachate and groundwater contamination. Ground gas. Potential for a range of inorganic and organic contaminants including but not limited to: heavy metals, ammonia, acids, organic compounds, inorganic compounds, asbestos, hydrocarbons, PAHs, solvents, lubricants, fuel oils, alkalis, PBCs, methane and carbon dioxide.	Controlled waters- Superficial deposits: Secondary A aquifer. Secondary Undifferentiated aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters – Surface water - pond to the south east	Groundwater migration, direct runoff from site.	Low likelihood	Mild	Low risk

Notes/assumptions

1. Assumes remediation required has been undertaken and construction works are complete.
2. The Site is proposed for a 1400 megawatt (MW) interconnector and associated substation/ converter station infrastructure. Assumes baseline conditions will not change at post construction.
3. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Impact Assessment: Former military land use located outside of the application boundary

Contaminant linkage	Baseline risk	Construction Risk	Post-construction risk	Construction impact significance	Post-construction impact significance
Contaminated soil, leachate/groundwater and pollution of aquifers	Low risk	Low risk	Low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on surface water	Low risk	Low risk	Low risk	Neutral	Neutral
Overall significance				Neutral	Neutral

Notes/assumptions:

1. The construction impact significance column may report a range of outcomes for a site. The CEMP is designed to mitigate effects, and it is considered that only temporary minor adverse effects during the construction period may occur from ground disturbance.
2. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Risk and Impact Assessment – Farm land (outside of the application boundary)

Table 11.B8.1: Risk and impact assessment for farm land located outside of the application boundary.

Site ID (IDS)	**CL01 and CL03**
Site group	Current and former farm land (outside of the application boundary)
Site title (Site ID) and land use class	Current residential land use / former Perry's Farm (including current storage of farm activity related materials)– (CL01) Class 1 Current Farm – (CL03) Class 1

Site title (Site ID)	Sensitive land use (human receptor) (adjacent and/or <50m)	Groundwater, including aquifer designation, SPZ and active groundwater abstractions (within 1km)	Surface water, including watercourses (adjacent and/or <50m) and active surface water abstractions (within 250m)	Geological, or ecological designation (adjacent and/or <50m)	Property e.g. buildings and structures (adjacent and/or <50m)	Other
Current residential land use / former Perry's Farm (including current storage of farm activity related materials)– (CL01) Class 1	On-site: residential/ farm users Off-site agricultural workers, landfill management operatives Off-site (post-construction only): Employees at the substation/ converter station	Superficial deposits: Secondary A aquifer	Pond to the southeast	None	On-site: residential/ farm buildings	None
Current Farm – (CL03) Class 1	On-site: residential/ farm buildings Off-site: residential	Superficial deposits: Secondary A aquifer	None	None	On-site: residential/ farm buildings Off-site: residential	None

Where reference is made to 'on-site' and 'off-site' within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Baseline CSM and Qualitative Risk Assessment: Farm land located outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline
Soil, leachate and groundwater contamination. Possible ground gas. Potential for a range of contaminants including but not limited to asbestos, TPH (diesel range, VOC, lubricating oils, solvents), ammonia, elevated BOD, elevated COD, pesticides, herbicides, burial of animal remains, pathogens, methane and carbon dioxide.	On-site users – residential/ farm buildings	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Mild	Very low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Mild	Very low risk
		Inhalation of ground gases.	Unlikely	Mild	Very low risk
	Off-site residential, agricultural workers, landfill management operatives	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Mild	Very low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Mild	Very low risk
		Inhalation of ground gases.	Unlikely	Mild	Very low risk
	Controlled waters- Superficial deposits: Secondary A aquifer	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters – Surface water - pond	Groundwater migration, direct runoff from site.	Low likelihood	Mild	Low risk
	Property receptors – Buildings, foundations and services (on-site and off-site).	Exposure to explosive gases.	Unlikely	Mild	Very low risk
		Aggressive ground conditions	Unlikely to low likelihood	Mild	Very low to low risk

Notes/assumptions

1. Sites are assessed against baseline condition without construction of the proposed interconnector and associated substation/ converter station infrastructure.
2. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Construction CSM and Qualitative Risk Assessment: Farm land located outside of the application boundary.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase
Soil, leachate and groundwater contamination. Possible ground gas. Potential for a range of contaminants including but not limited to asbestos, TPH (diesel range, VOC, lubricating oils, solvents), ammonia, elevated BOD, elevated COD, pesticides, herbicides, burial of animal remains, pathogens, methane and carbon dioxide.	On-site users – residential/ farm buildings	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Mild	Very low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Mild	Very low risk
		Inhalation of ground gases.	Unlikely	Mild	Very low risk
	Off-site residential, agricultural workers, landfill management operatives	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Mild	Very low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Mild	Very low risk
		Inhalation of ground gases.	Unlikely	Mild	Very low risk
	Controlled waters- Superficial deposits: Secondary A aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters – Surface water - pond	Groundwater migration, direct runoff from site.	Low likelihood	Mild	Low risk
	Property receptors – Buildings, foundations and services (on-site and off-site).	Exposure to explosive gases.	Unlikely	Mild	Very low risk
		Aggressive ground conditions	Unlikely to low likelihood	Mild	Very low to low risk

Notes/assumptions

1. As these sites are outside of the application boundary, it is assumed that no ground investigations or remediation will be undertaken on these sites. However, these sites may have the potential to influence conditions on the application boundary site during construction.
2. During construction within the application boundary site, standard mitigation procedures are assumed to be implemented. Construction workers have been excluded from assessment due to the use of PPE and risk management.

Source	Receptor	Pathway	Probability	Consequence	Risk at construction phase

3. Whilst the measures detailed in a CEMP will make it unlikely that there will be adverse consequences associated with construction for example through the control of surface run-off and dust, it is considered that there may still be temporary adverse effects during the construction period that might arise through ground disturbance. The adoption of a CEMP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline.
4. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Post-construction CSM and Qualitative Risk Assessment: Farm land located outside of the application boundary

Source	Receptor	Pathway	Probability	Consequence	Risk at post-construction
Soil, leachate and groundwater contamination. Possible ground gas. Potential for a range of contaminants including but not limited to asbestos, TPH (diesel range, VOC, lubricating oils, solvents), ammonia, elevated BOD, elevated COD, pesticides, herbicides, burial of animal remains, pathogens, methane and carbon dioxide.	On-site users – residential/ farm buildings	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Mild	Very low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Mild	Very low risk
		Inhalation of ground gases.	Unlikely	Mild	Very low risk
	Off-site residential, agricultural workers, landfill management operatives, employees at the substation/ converter Station	Direct contact, ingestion, inhalation of dust/vapour with/from contaminated soils.	Unlikely	Mild	Very low risk
		Direct contact, ingestion, inhalation of vapour with/from contaminated waters.	Unlikely	Mild	Very low risk
		Inhalation of ground gases.	Unlikely	Mild	Very low risk
	Controlled waters- Superficial deposits: Secondary A aquifer.	Vertical and lateral migration.	Low likelihood	Mild	Low risk
	Controlled waters – Surface water - pond	Groundwater migration, direct runoff from site.	Low likelihood	Mild	Low risk
	Property receptors – Buildings, foundations and services (on-site and off-site).	Exposure to explosive gases.	Unlikely	Mild	Very low risk
		Aggressive ground conditions	Unlikely to low likelihood	Mild	Very low to low risk

Notes/assumptions

1. Assumes remediation required has been undertaken and construction works are complete.
2. The Site is proposed for a 1400 megawatt (MW) interconnector and associated substation/ converter station infrastructure and associated off-site post-development receptors have been considered in this CSM. Assumes baseline conditions will not change at post construction. Maintenance workers have been excluded from the assessment due to the use of PPE and risk management.
3. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Impact Assessment: Farm land located outside of the application boundary

Contaminant linkage	Baseline Risk	Construction risk	Post-construction Risk	Construction impact significance	Post-construction impact significance
Exposure to soil contamination – on-site users (farm/ residential)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Exposure to groundwater contamination – on-site users (farm/ residential)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Exposure to ground gas – on-site users (farm/ residential)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Exposure to soil contamination – off-site (residential, agricultural workers, landfill management operatives, employees at the substation/ converter station)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Exposure to groundwater contamination – off-site (residential, agricultural workers, landfill management operatives, employees at the substation/ converter station)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Exposure to ground gas – off-site (residential, agricultural workers, landfill management operatives, employees at the substation/ converter station)	Very low risk	Very low risk	Very low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and pollution of aquifers	Low risk	Low risk	Low risk	Neutral	Neutral
Contaminated soil, leachate/groundwater and impact on surface watercourses	Low risk	Low risk	Low risk	Neutral	Neutral
Impact on property receptors – on-site and off-site (exposure to explosive gases)	Very low to low risk	Very low to low risk	Very low to low risk	Neutral	Neutral
Impact on property receptors – on-site and off-site (aggressive ground conditions)	Very low to low risk	Very low to low risk	Very low to low risk	Neutral	Neutral

Contaminant linkage	Baseline Risk	Construction risk	Post-construction Risk	Construction impact significance	Post-construction impact significance
Overall significance				Neutral	Neutral

Notes/assumptions:

1. The construction impact significance column may report a range of outcomes for a site. The CEMP is designed to mitigate effects, and it is considered that only temporary minor adverse effects during the construction period may occur from ground disturbance.
2. Where reference is made to ‘on-site’ and ‘off-site’ within this table, this refers to features relating to the identified individual potentially contaminative source site(s) considered.

Appendix 9.A – Flood Risk Assessment

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement

Appendix 9A – Flood Risk Assessment

NeuConnect Britain Ltd

September 2019

Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	June 2019	Draft for internal review	EC	Emily Craven	Associate
2	July 2019	For client issue	EC	Emily craven	Associate

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Table of Contents

Figures

No table of figures entries found.

Tables

1. Introduction

Introduction

1.1 AECOM has been commissioned by NeuConnect Britain Limited (hereafter referred to as the 'Applicant') to prepare an Environmental Statement (ES) that will support the outline planning application for an electricity converter station and substation on the Isle of Grain, Kent. The proposed converter station and substation will form part of a 1400 megawatt (MW) interconnector between Great Britain and Germany.

1.2 This document provides a Flood Risk Assessment (FRA) to inform the ES and forms Appendix 9A of the ES.

1.3 This FRA has been prepared in accordance with the National Planning Policy Framework (NPPF)[1] and supporting Planning Practice Guidance (PPG)[2].

Background to the project

1.4 NeuConnect (the 'Project'), is a 1400 MW interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks and will allow electricity to be passed in either direction. The Project will be formed by over 700 kilometres (km) of subsea and underground High Voltage Direct Current (HDVC) cables, with on-shore converter stations linking into the existing electricity grids in Great Britain and Germany.

1.5 The components of the Project that are 'onshore' in Great Britain – the GB Onshore Scheme – will comprise the interconnector as well as the additional works necessary to facilitate a connection to the National Electricity Transmission System (NETS).

Objectives

1.6 The aim of this FRA is to assess the flood risk to and from the GB Onshore Scheme in accordance with the requirements of the NPPF and suggest measures to avoid and/ or reduce the risks to acceptable levels. The following objectives have been achieved to fulfil this aim:

- Gather desktop information relating to geology, topography and local water features that may influence the risk of flooding to the GB Onshore Scheme;
- Obtain flood modelling outputs from the Environment Agency associated with tidal flooding from the Thames Estuary to determine the risk of tidal flooding to the site over its lifetime, allowing for the effects of climate change;
- Assess the risk of flooding from all sources (tidal, fluvial, surface water, groundwater, sewers and ordinary watercourses) to and from the GB Onshore Scheme allowing for the effects of climate change over the lifetime of the development;
- Identify the potential effects of the GB Onshore Scheme on the surface water flood risk to the site and surrounding area, including alterations to permeable surfacing and surface water flow paths;

[1] *National Planning Policy Framework',* available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/733637/National_Planning_Policy_Framework_web_accessible_version.pdf, accessed 30th May 2019.
[2] *Planning Practice Guidance'* available at https://www.gov.uk/government/collections/planning-practice-guidance, accessed 30th May 2019.

- Identify mitigation measures required to avoid or reduce potential adverse impacts on flood risk to the GB Onshore Scheme or elsewhere, and where possible identify measures to reduce the level of flood risk overall;
- Identify measures to ensure the safe operation of the GB Onshore Scheme and safety of site personnel; and,
- Present the conclusions of the FRA in support of the application of the Exception Test for the GB Onshore Scheme in accordance with the NPPF.

Data sources and consultation

1.7 AECOM has consulted with the Environment Agency to obtain flood risk information and modelling datasets of relevance to the Project Area (shown in FRA Annex 9A-1) and to obtain agreement regarding the parameters for future site planning and design in this location (FRA Annex 9A-2).

1.8 The following sources of information have been used to inform the FRA:

- LiDAR Topographic Survey data.
- Environment Agency online flood risk mapping https://flood-map-for-planning.service.gov.uk/
- Environment Agency 'Product 4' data request (FRA Annex 9A-1).
- Environment Agency, 2015, Kent Coastal Modelling Study.
- Consultation with Environment Agency (FRA Annex 9A-2).
- Consultation with North Kent Marshes Internal Drainage Board.
- Outline Surface Water Drainage Strategy (ES Appendix 9B and 9C).
- Medway Council Strategic Flood Risk Assessment (Mott MacDonald, August 2006).
- Medway Council Local Flood Risk Management Strategy (Capita Symonds URS, July 2014).
- Thames Estuary 2100 Plan, Environment Agency, November 2012.
- Isle of Grain to South Foreland Shoreline Management Plan (2008, and Review Halcrow 2010) extract included in FRA Annex 9A-3.

2. Site Location and Development Proposals

Site Location

2.1 The area in which the GB Onshore Scheme is proposed (the 'Project Area') is entirely within the boundary of Medway Council and is centred on the Isle of Grain located at the tip of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The Project Area is located to the west of the settlement of Grain, NGR 587613,176675 and nearest post code ME3 0AW. The Project Area is approximately 66 hectares (ha) when incorporating the land up to The Mean Low Water Springs (MLWS) level. The site location plan is shown in Figure 9A-1.

2.2 Land use comprises a mix of industrial development to the south, the small settlement of Grain to the southeast and undeveloped land, much of which is designated for ecological interests, to the north (along the coastline) and to the west. There are also some small areas of brownfield or derelict land and some small areas of agricultural land (some of these coincide with brownfield land). The existing 400 kilovolt (kV) overhead line (OHL) which is broadly routed east to west generally marks the boundary between the extent of industrial or brownfield land and settlement or undeveloped coastal land. The only road access to the peninsula is from the B2001 Grain Road.

Geology

2.3 BGS online mapping[3] identifies the superficial geology in the area is reported to comprise River Terrace Deposits, comprising sand and gravel. In the intertidal area between Mean High Water Springs (MHWS) and MLWS the deposits are Beach and Tidal Flat Deposits (Undifferentiated) (Clay, Silt and Sand).

2.4 The superficial deposits at the site are recorded to be underlain by the London Clay. This comprises blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt, plus sometimes silts and layers of sandy clay.

Topography

2.5 LiDAR topographic survey identifies the majority of the Project Area, and the settlement of Grain itself, are located at approximately 7-12 m Above Ordnance Datum (AOD). The north eastern and western fringes of the Project Area slope down towards the marshes. In this part of the Project Area ground levels fall to 3-5 m AOD. The Grain Marshes are located at below 2 m AOD.

Current use

2.6 The Project Area is located on the fringes of industrial land (this is based on the existing 400 kV OHL defining the extent of industrial land) and extends north/ northeast to the coast. Land within the Project Area and in the immediate vicinity is either in agricultural use or is brownfield land which has no current discernible use. The Project Area is located approximately 0.5 km to the west of Grain; however, there are individual unnamed properties in the centre of and to the west (Rose Court Farm) of the Project Area. Access to the Project Area is by a small unnamed road

[3] https://www.bgs.ac.uk/data/mapViewers/home.html

which is connected to Grain Road. An alternative access is from West Lane which is routed along the northern boundary of the Project Area in a broadly east-west direction.

2.7 Land within the Project Area and in the immediate vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill. The historic landfill to the northeast of the proposed substation location has been capped however an existing permitted leachate monitoring system still operates from this landfill (to the east of Perry's Farm) to the pond (to the northeast of Rose Court Farm).

Flood Zone

2.8 The Environment Agency's Flood Map for Planning (Rivers and Sea)[4] shows that the western fringe of the Project Area is located within Flood Zone 3. Flood Zone 3 is defined as land assessed as having a 0.5% or greater annual exceedance probability (AEP) (1 in 200 year or greater annual probability) of flooding from the sea. This area is shown to benefit from flood defences, which are located along the frontage of the Thames Estuary.

GB Onshore Scheme

2.9 The proposed GB Onshore Scheme is presented in Figure 2.2 of the ES. The GB Onshore Scheme will comprise the following main elements extending as far as MLWS:

- A new sealing end compound, to facilitate the connection between the GB Onshore Scheme and the existing OHL.
- A new substation approximately 120 m by 60 m (or up to 0.72 hectare (ha)) with a maximum height of approximately 14 m. The substation will also include down leads from the existing OHL tower.
- An underground Alternating Current (AC) cable route from the substation to the converter station.
- A converter station approximately 250 m by 250 m (or up to 5 ha) with a maximum height of approximately 26 m.
- A new permanent access track from Grain Road (B2001) to the proposed converter station and proposed substation. Access will be achieved by upgrading the existing gravel path that extends along the southern boundary of the Project Area.

Development vulnerability classification

2.10 The GB Onshore Scheme comprises the construction of a converter station and substation and associated infrastructure. In accordance with NPPF Table 2[1], this development is classified as 'Essential Infrastructure'.

2.11 Essential Infrastructure is permitted in Flood Zones 1 and 2. Where Essential Infrastructure is proposed in Flood Zone 3, it must be demonstrated that the Exception Test can be satisfied.

Lifetime of development

2.12 Subject to outline planning permission being granted it is anticipated that construction will start in early 2021 and will take approximately 36 months to complete.

[4] https://flood-map-for-planning.service.gov.uk/

2.13 The lifetime of the development is 40 – 50 years. The development is therefore anticipated to be in place until 2064 – 2074.

Sequential Test

2.14 The Sequential Test is a decision making tool designed to ensure that vulnerable development is directed towards sites at lowest risk of flooding prior to the consideration of sites at greater risk.

2.15 Given the Project's use of subsea cables, a coastal site is required to minimise onshore infrastructure and the extent of associated impacts. The large majority of the Project Area is in Flood Zone 1 and therefore at low probability of flooding. As a result, these components pass the Sequential Test.

2.16 The positioning of the converter station requires careful placement due to a number of sensitive receptors with respect to noise, landscape and visual impact. The edge of the area which will accommodate the converter station is defined as Flood Zone 3, high probability of flooding from the sea.

2.17 Chapter 4 of the ES 'Consideration of Alternatives' provides an overview of the alternative sites that were considered for the Project, and the justification for the selection of this site.

2.18 The PPG (paragraph 34) states that *"it is for local planning authorities, taking advice from the Environment Agency as appropriate, to consider the extent to which Sequential Test considerations have been satisfied, taking into account the particular circumstances in any given case…..Ultimately the local planning authority needs to be satisfied in all cases that the proposed development would be safe and not lead to increased flood risk elsewhere".*

2.19 One of the purposes of this FRA is to demonstrate how the proposed development has been suitable designed to be safe and not lead to increased flood risk elsewhere.

3. Site Specific Flood Risk

Overview

3.1 This chapter provides an assessment of the flood risk to and from the GB Onshore Scheme from all sources of flooding.

Tidal flooding

3.2 The Isle of Grain is located at the mouth of the Thames Estuary. The majority of the Isle of Grain is shown to be within Flood Zone 3 on the Environment Agency's 'Flood Map for Planning'[5] which is defined as areas at High Probability of tidal flooding (greater than a 1 in 200 annual probability, or 0.5% Annual Exceedance Probability (AEP)). The Isle of Grain benefits from the presence of tidal flood defences.

3.3 A map of the flood zones and Areas Benefitting from Defences (ABD) is included in FRA Annex 9A-1.

3.4 The majority of the Project Area, and the settlement of Grain itself, are located at a slightly higher elevation (7-12 m AOD) and are therefore within an area defined as Flood Zone 1 Low Probability of tidal flooding (less than 1 in 1000 annual probability, or 0.1% AEP). The exception is the north eastern and western fringes of the Project Area, where ground levels fall to 3-5 m AOD. The current site layout plan identifies that the western edge of the proposed convertor station and a parcel of laydown area may be located partially within Flood Zones 2 and 3.

3.5 The edge of the Project Area identified within Flood Zone 3 experienced flooding during the tidal flood event of February 1953. A map of this historic flood extent is included in FRA Annex 9A-1.

Flood defences

3.6 An initial review of the Isle of Grain to South Foreland Shoreline Management Plan (2008) identifies existing defences from Yantlet Creek (west of the Project Area) to Horseshoe Point (south of the Project Area) comprising *"a number of clay embankment type, seawalls with concrete/ concrete block front slopes. There are timber groynes at Grain to the north of which is a short section of eroding coastline with no hard defences".*

3.7 The Environment Agency has provided details of the following flood defences in the vicinity of the site in FRA Annex 9A-1:

- Standard of protection – 1:200 (0.5% AEP)
- Asset Maintainer - Environment Agency
- Type and location – 4.8km of Embankment North West of site

- Standard of protection – 1:1000 (0.1% AEP)
- Asset Maintainer - Environment Agency
- Type and location – 1.2km of Embankment South West of site

- Standard of protection – 1:1000 (0.1% AEP)
- Asset Maintainer - Environment Agency

[5] https://flood-map-for-planning.service.gov.uk/

- Asset Owner – Private

3.8 The Isle of Grain to South Foreland Shoreline Management Plan (SMP) sets out the proposed plan for the Allhallows-on-Sea to Grain policy unit 4a01. In the short term, the plan is to hold the line to continue protecting the low lying assets. In the future, the medium and longer term plan is to implement a change of policy to managed realignment, at a set-back position and allowing the current shoreline position to migrate landwards. A policy of managed realignment will allow some inundation and erosion (of the slopes at Grain) and a degree of natural coastal processes seawards of the realigned defence as well as reduce the probability of uncontrolled large scale flooding. Construction of a realigned flood defence may be required whilst the shoreline defences are allowed to fail. An extract from the SMP showing the potential realignment is included in FRA Annex 9A-3.

3.9 The Thames Estuary 2100 Plan[6] also identifies that the policy for this area is to maintain and improve the level of flood defences to keep up with climate change.

North Kent Modelling

3.10 The flood modelling at this location is informed by detailed tidal modelling of the North Kent Coast[7], completed in August 2015. This modelling data has been obtained from the Environment Agency to inform the understanding of the risk of flooding in this location. Outputs from the modelling are included in FRA Annex 9A-1.

3.11 The modelling shows that the Isle of Grain and the Project Area is protected by the flood defences under present conditions for the year 2012. However, with increased tidal levels in the future, as a result of climate change, the Isle of Grain and the edge of the Project Area may be at risk of flooding.

3.12 The modelled flood levels in proximity to the location for the proposed converter station and substation in the south western corner of the Project Area are detailed in Table 3.1 for the years 2070 and 2115.

Table 3.1: Modelled Flood Levels (North Kent Coast Modelling, FRA Annex 9A-1)

Modelled Scenario	Maximum flood level (m AOD) in south west corner of the Project Area
Defended scenario, still water level; 0.5% AEP for the year 2070	Not shown to flood
Defended scenario, still water level; 0.5% AEP for the year 2115	3.1
Defended scenario, wave overtopping; 0.5% AEP for the year 2115*	3.11
Undefended scenario; still water level; 0.5% AEP for the year 2070	5.2
Undefended scenario; still water level; 0.5% AEP for the year 2115	5.83

**a wave overtopping model scenario was not undertaken for the year 2070, therefore only the scenario for 2115 has been referred to.*

[6] Environment Agency, November 2012 Thames Estuary 2100 Plan https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/322061/LIT7540_43858f.pdf
[7] Environment Agency, North Kent Coast Modelling Study, August 2015

Actual Risk

3.13 The results show that over the lifetime of the development to the year 2070, under the defended scenario, parts of the Grain Marsh may experience tidal flooding, but the Project Area is at low risk of tidal flooding.

Residual Risk

3.14 The undefended modelled scenarios identify any areas that could be at residual risk i.e. at risk of flooding in the event the defences are not in place due to a breach of failure.

3.15 During the undefended modelled scenarios, the results show an increased extent of flooding in the Grain Marshes, and the western fringe of the Project Area may therefore be at residual risk of flooding in the future during the undefended 0.5% AEP event for the year 2070.

Fluvial flooding

3.16 There are several land drains and unnamed ponds within the Project Area, and a number of tidal creeks, ponds and ordinary watercourse to the west of the site within the Grain Marsh, including the Hamshill Fleet (ordinary watercourse) and Millmarsh Fleet (Main River).

3.17 The closest watercourses to the Project Area are the network of ditches adjacent to the south western edge of the Project Area which connect to the Hamshill Fleet, located approximately 0.5 km to the west of the Project Area. The LiDAR topographic survey identifies that the Project Area is located above 3 m AOD and the marshland is located below 2 m AOD. The risk of flooding from this watercourse is therefore considered to be low. The Flood Zones in this location are primarily associated with the tidal Thames Estuary and therefore do not provide an indication of the risk of flooding from these watercourses.

Surface water flooding

3.18 There are a number of drains that are present within the Project Area, as well as ponds to the north and on the western boundary (at the end of West Lane). These ponds occupy areas of previous gravel and sand extraction. To the west of the Project Area is the South Thames Estuary and Marshes Site of Special Scientific Interest (SSSI), a low lying wetland area.

3.19 The Environment Agency mapping 'Risk of Flooding from Surface Water'[8] identifies the main risks of surface water flooding close to the Project Area are associated with the drainage ditches in the lower lying areas around the Project Area. The higher elevation of the Project Area means that it is not at risk of surface water flows from adjacent land.

3.20 Development within the Project Area has the potential to increase the amount of surface water runoff to neighbouring areas and should be carefully managed through the site planning and design.

3.21 The risk of surface water flooding to and from the site is considered to be Medium prior to mitigation.

Groundwater flooding

3.22 The Project Area is situated on superficial deposits of sand and gravel, which are classified as a 'Secondary A' aquifer. The bedrock is the London Clay Formation, which is typically impermeable

[8] https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

and has no aquifer classification/designation. Therefore, there is a significant risk of the groundwater level being close to the ground level in this area.

3.23 The Medway Council Local Flood Risk Management Strategy (LFRMS) (Capita Symonds URS, July 2014) includes mapping from the British Geological Survey (BGS) which shows an approximate guide to areas that may be susceptible to groundwater flooding. The mapping shows a band passing north/ south through the centre of the Project Area which may be susceptible to groundwater flooding. However for all new developments, site investigation is required to confirm local groundwater levels and therefore risk of groundwater flooding.

3.24 As part of the Ground Investigation works for the site, monitoring of groundwater levels is currently being undertaken. The results will be used to determine the risk to the site and the implementation of suitable techniques during construction.

Sewers

3.25 No details regarding the sewer network local to the site have been provided to inform the FRA.

Reservoir failure

3.26 The Environment Agency Flood Risk from Reservoirs[9] mapping does not identify the Project Area to be at risk of flooding in the event of uncontrolled release of water associated with the failure of a reservoir.

Summary

3.27 Table 3.2 provides a summary of the risk of flooding to the Project Area from each source.

Table 3.2 Summary of Project Area Flood Risk

Source of flooding	Summary for Project Area
Tidal: Thames Estuary	Actual risk (i.e. defended): Low. Residual risk (i.e. undefended): Western fringe of Project Area at High residual risk when considering the impacts of climate change over the lifetime of the development.
Fluvial: Hamshill Fleet	Low
Surface water	Low – Medium prior to mitigation
Groundwater	To be confirmed following GI
Sewer	Unknown
Reservoir	Not applicable

[9] https://flood-warning-information.service.gov.uk/long-term-flood-risk/

4. Risk Mitigation and Management

Overview

4.1 This chapter provides a summary of the measures that will need to be implemented during the construction and operational phases of the GB Onshore Scheme to mitigate the risk of flooding to and from the Project Area. This includes measures that have been incorporated into the design as well as those that will need to be implemented through a Construction and Environmental Management Plan (CEMP) for the Project Area or by the management authority during the operation of the GB Onshore Scheme.

Construction phase

Works adjacent to flood defences

4.2 The proposed works include the installation of a cable beneath the existing tidal flood defence line. Such activity requires a Flood Risk Activity Permit from the Environment Agency.

4.3 During construction the existing coastal flood defences will be avoided by the use of horizontal directional drilling (HDD) construction methods (as opposed to trenching or cut and cover techniques) to drill underneath the defences. The depth of the defences and appropriate standoff distances will be agreed in consultation with the Environment Agency prior to works being undertaken.

Surface water management

4.4 Suitable arrangements must be put in place to ensure no increase in surface water runoff from the site during the construction phase. Construction phasing should be planned such that sustainable drainage systems (SuDS) features described for the operational phase are constructed first. This would ensure that any rainfall events during construction of the substation and converter building would be captured and stored in the SuDS.

4.5 Details will be provided in the CEMP.

Flood warning

4.6 The Environment Agency issue flood warnings as notification of the potential risk of flooding during tidal surge conditions. It is recommended that those managing the construction phase subscribe to the Environment Agency's Flood Warning Service for the '*Isle of Grain and Stoke'* Flood Warning Area[10] as part of their Flood Warning and Response Plan and incorporates the warnings into the health and safety planning for the construction of the Scheme.

Flood warning and response plan

4.7 A Flood Warning and Response Plan is recommended to be prepared detailing the planned response in the event of receiving a flood warning, and in the event of a breach or overtopping of the flood defences. This is likely to be a part of a health and safety planning prepared for the construction phase.

[10] https://riverlevels.uk/flood-warning-isle-of-grain-and-stoke

Access and egress

4.8 The A228/ B2001 Grain Road is the only road access to the Isle of Grain. Access to the proposed converter station will be via the B2001 Grain Road from the development of a new access point and internal road; this will be the primary point of access during construction and operation of the GB Onshore Scheme. Temporary access for construction of the proposed DC cable route will also be taken from West Lane further to the north which provides access to Rose Court Farm.

4.9 This route provides safe dry access to an area in Flood Zone 1 low probability of tidal flooding.

Operational phase

Finished floor levels

4.10 The converter station and substation are located in the southwestern part of the Project Area, located away from the settlement of Grain and towards the existing industrial developments in the vicinity.

4.11 Correspondence with the Environment Agency (FRA Annex 9A-2) has confirmed that proposed infrastructure associated with the convertor station and substation should be set above the flood level for the defended 0.5% AEP flood event, including climate change over the lifetime of the development. In this location, this corresponds to a flood level of 3.1 m AOD.

4.12 The platform for the converter station and substation will be set above this flood level including a 600 mm freeboard. The exact levels will be confirmed at detailed design stage.

Surface water management

4.13 In order to ensure that the GB Onshore Scheme does not increase the risk of surface water flooding to the site and the surrounding area an Outline Surface Water Drainage Strategy has been prepared (Environmental Statement Chapter 9 and Appendix 9B).

4.14 The Kent County Council Drainage and Planning Policy Statement[11] states that "*the drainage system must be designed to operate without any flooding occurring during any rainfall event up to (and including) the critical 3.33% AEP storm (1 in 30 year). The system must also be able to accommodate the rainfall generated by events of varying durations and intensities up to (and including) the critical, climate change adjusted 1% AEP storm (1 in 100 year) without any on-site property flooding and without exacerbating the off-site flood-risk. Sufficient steps are to be taken to ensure that any surface flows between the 3.33% AEP and 1% AEP events are retained on site. The choice of where these volumes are accommodated may be within the drainage system itself or within other areas designated within the site for conveyance and storage".*

4.15 Consideration needs to be made for the impact of climate change on the risk of surface water flooding over the lifetime of the GB Onshore Scheme in accordance with the NPPF. Table 4 1 provides the range of climate change allowances that should be applied for different time horizons. A climate change allowance of 20% has been used based on a Project design life of 40 years with construction taking 3 years starting in 2021.

[11] Kent County Council (June 2017) Drainage and Planning Policy Statement, Local flood risk management strategy guidance https://www.kent.gov.uk/__data/assets/pdf_file/0003/49665/Drainage-and-Planning-policy-statement.pdf

Table 4.1 Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline) (Planning Practice Guidance[12])

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

4.16 Surface water runoff arising from the areas of hardstanding will be conveyed to a SuDS wetland area via a pipe network. The wetland area will outfall to an existing watercourse in the Grain Marsh, to the west of the Project Area.

4.17 The pipe network will be designed to ensure that no part of the site floods during the 1 in 30 year storm event. Surface water runoff arising from events greater than the 3.33% AEP (1 in 30 year) storm event which cannot be accommodated by the pipe network will be contained within the boundary of the site.

4.18 The Project Area falls from east to west, towards Grain Marsh. During storms greater than the 1% AEP (1 in 100 year) plus 20% climate change event, exceedance flows will be directed away from buildings on the site and towards Grain Marsh due to the local topography of the Project Area.

Flood warning

4.19 It is recommended that the operating company for the Project subscribes to the Environment Agency's Flood Warning Service for the 'Isle of Grain and Stoke' FWA as part of their Flood Warning and Response Plan and incorporates the warnings into the Business Continuity Plan for the operation of the Scheme.

Flood warning and response plan

4.20 A Flood Warning and Response Plan should be prepared detailing the planned response in the event of receiving a flood warning, and in the event of a breach or overtopping of the flood defences. This is likely to be a part of a wider business continuity and health and safety planning prepared by NeuConnect for the GB Onshore Scheme.

Access and egress

4.21 As during construction, access to the proposed converter station will be via the B2001 Grain Road from the development of a new access point and internal road. This route provides safe dry access to an area in Flood Zone 1 low probability of tidal flooding.

Safe refuge

4.22 During ordinary operation the proposed converter station will be staffed by a small team on site with a minimum of two operators present at all times. During normal operation there will be approximately six personnel on site, divided between three shifts over a 24-hour period. During regular maintenance and/ or repairs the number of personnel present on site would increase with

[12] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

the number of staff proportionate to the nature of the maintenance or repair works being undertaken.

4.23 The residual risk is the risk that remains after flood defence measures have been taken into consideration. In order to manage this residual risk it is recommended that a place of safe refuge should be provided within the Project Area.

4.24 The safe refuge will be set above the flood level for the undefended 0.5% AEP flood event including an allowance for climate change over the lifetime of the development i.e. above 5.2 m AOD including a suitable freeboard. It is noted that should the platform for the converter station as a whole be set above this level, this will be a suitable place of safe refuge. The exact levels will be confirmed at the detailed design phase.

5. Applying the Exception Test

5.1 Given that part of the proposed GB Onshore Scheme is partly located within Flood Zone 3, the NPPF requires the Exception Test to be applied.

5.2 The Exception Test includes two parts that require the proposed development to show that:

i. it will provide wider sustainability benefits to the community that outweigh flood risk, and,
ii. it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

5.3 Information to inform part (1) can be found in the Planning Statement.

5.4 This FRA has demonstrated how part (2) can be achieved.

6. Summary and Conclusions

6.1 A review of existing readily available information identifies that there is a risk of surface water flooding to the Project Area and neighbouring area in the event that surface water runoff is not managed effectively. The risk of surface water flooding is considered to be Medium prior to mitigation.

6.2 The site is at low risk of tidal flooding due to the presence of tidal flood defences. However the south western edge of the Project Area is at residual risk of tidal flooding in the future in the event of a breach of the flood defences.

6.3 To manage these risks it is recommended that the following measures are implemented:

- Appropriate building design above the defended 0.5% AEP flood level including an allowance for climate change over the lifetime of the development (3.1 m AOD) including a freeboard of at least 600mm;
- Flood warning and response planning during the construction and operational phases;
- Provision of a place of safe refuge above the undefended 0.5% AEP flood level including an allowance for climate change over the lifetime of the development (5.2 m AOD) including a freeboard;
- Implementation of a surface water management strategy (detailed in Environmental Statement Appendix 9B) to convey runoff to a SuDS attenuation pond prior to discharge to an existing water body within the Grain Marsh.

Annex 9A-1

Environment Agency Product 4

Product 4 (Detailed Flood Risk) for: A site on the Isle of Grain, ME3 0AW
Requested by: Sarah Littlewood - AECOM
Reference: KSL 101725 LB
Date: 5 October 2018

Contents

The information provided is based on the best data available as of the date of this letter.

You may feel it is appropriate to contact our office at regular intervals, to check whether any amendments/ improvements have been made to the data for this location. Should you re-contact us after a period of time, please quote the above reference in order to help us deal with your query.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Flood Map Confirmation

The Flood Map:

Our Flood Map shows the natural floodplain for areas at risk from river and tidal flooding. The floodplain is specifically mapped ignoring the presence and effect of defences. Although flood defences reduce the risk of flooding they cannot completely remove that risk as they may be over topped or breached during a flood event.

The Flood Map indicates areas with a 1% (0.5% in tidal areas), Annual Exceedance Probability (AEP) - the probability of a flood of a particular magnitude, or greater, occurring in any given year, and a 0.1% AEP of flooding from rivers and/or the sea in any given year. The map also shows the location of some flood defences and the areas that benefit from them.

The Flood Map is intended to act as a guide to indicate the potential risk of flooding. When producing it we use the best data available to us at the time, taking into account historic flooding and local knowledge. The Flood Map is updated on a quarterly basis to account for any amendments required. These amendments are then displayed on the internet at www.gov.uk/prepare-for-a-flood.

At this Site:

The Flood Map shows that this parts of this site lie within the outline of the 0.5% chance of flooding in any given year from the sea.

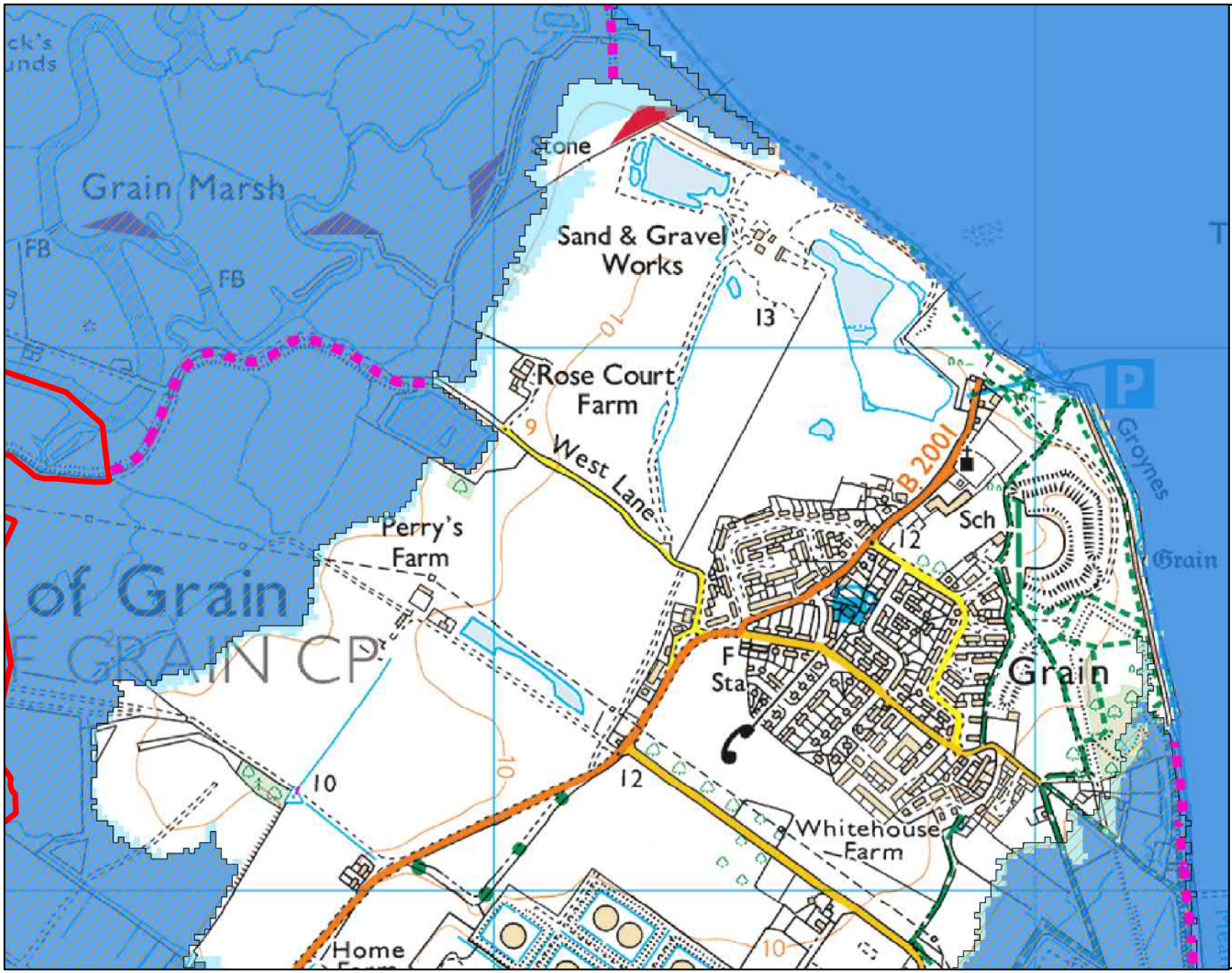
Enclosed is an extract of our Flood Map which shows this information for your area.

Method of production

The Flood Map at this location has been derived using detailed tidal modelling of the North Kent Coast, completed in August 2015.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Flood Map centred on a site on the Isle of Grain, ME3 0AW
Created 05/10/2018 (Ref KSL 101725 LB)



Environment Agency

N

Legend

- Main Rivers
- Flood Defences
- Flood Storage Area
- Areas Benefiting From Flood Defence
- Flood Zone 3
- Flood Zone 2

0 250 500

Meters

Scale 1:10,000

Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

Model Output Data

You have requested flood levels for various return periods at this location.

The modelled flood levels for the closest most appropriate model grid cells, any additional information you may need to know about the modelling from which they are derived and/or any specific use or health warning for their use are set out below.

Using a 2D TuFLOW model the floodplain has been represented as a grid. The flood water levels have been calculated for each grid cell.

A map showing the location of the points from which the data is taken is enclosed. Please note you should read the notice enclosed for your specific use rights.

Table 1: Defended Modelled Tidal Flood levels for Annual Exceedance Probability shown in mAOD

Node Location ID	Modelled Tidal Flood levels for Annual Exceedance Probability shown in mAOD												
	National Grid Ref		Defended - Still Water						Defended - Wave Overtopping				
	Easting	Northing	5% AEP 2012	1.33% AEP 2012	0.5% AEP 2012	0.5% AEP 2070	0.5% AEP 2115	0.1% AEP (2012)	5% AEP 2012	1.33% AEP 2012	0.5% AEP 2012	0.5% AEP 2115	0.1% AEP (2012)
1	587389	176365	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
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35	587789	176815	<Null>	<Null>	<Null>	<Null>	3.10	<Null>	<Null>	<Null>	<Null>	3.11	<Null>
36	587839	176815	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
37	588089	177215	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
38	588139	177215	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
39	588439	177365	<Null>	<Null>	<Null>	<Null>	5.80	<Null>	<Null>	<Null>	<Null>	5.80	<Null>
40	588489	177365	<Null>	<Null>	<Null>	<Null>	5.80	<Null>	4.82	4.82	4.84	5.80	4.86
41	588539	177365	4.18	4.47	4.69	5.17	5.80	5.11	4.18	4.47	4.69	5.80	5.11
42	588589	177365	4.18	4.47	4.69	5.17	5.80	5.11	4.18	4.47	4.69	5.80	5.11
43	588389	177415	<Null>	<Null>	<Null>	<Null>	5.80	<Null>	<Null>	<Null>	<Null>	5.80	<Null>
44	588439	177415	<Null>	<Null>	<Null>	<Null>	5.80	<Null>	4.19	4.20	4.21	5.80	4.49
45	588639	177415	4.18	4.47	4.68	5.17	5.80	5.11	4.18	4.47	4.68	5.80	5.11
46	588689	177465	4.18	4.47	4.68	5.17	5.80	5.11	4.18	4.47	4.68	5.80	5.11
47	588739	177515	4.18	4.47	4.68	5.17	5.80	5.11	4.18	4.47	4.68	5.80	5.11
48	588789	177565	4.18	4.47	4.68	5.17	5.80	5.11	4.18	4.47	4.68	5.80	5.11
49	588839	177615	4.18	4.47	4.68	5.17	5.80	5.11	4.18	4.47	4.68	5.80	5.11

Table 2: Undefended Modelled Tidal Flood levels for Annual Exceedance Probability shown in mAOD

Node Location ID	Modelled Tidal Flood levels for Annual Exceedance Probability shown in mAOD						
	National Grid Ref		Undefended				
	Easting	Northing	5% AEP 2012	0.5% AEP 2012	0.5% AEP 2070	0.5% AEP 2115	0.1% AEP (2012)
1	587389	176365	<Null>	<Null>	<Null>	5.83	<Null>
2	587339	176415	4.18	4.71	5.20	5.83	5.13
3	587389	176415	<Null>	4.71	5.20	5.83	5.13

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Email: kslenquiries@environment-agency.gov.uk

4	587439	176415	<Null>	4.71	5.20	5.83	5.13
5	587489	176415	<Null>	<Null>	<Null>	5.83	<Null>
6	587389	176465	4.18	4.71	5.20	5.83	5.13
7	587439	176465	4.18	4.71	5.20	5.83	5.13
8	587489	176465	4.18	4.72	5.20	5.83	5.13
9	587539	176465	<Null>	<Null>	<Null>	5.83	<Null>
10	587589	176465	<Null>	<Null>	<Null>	5.83	<Null>
11	587639	176465	<Null>	<Null>	<Null>	5.83	<Null>
12	587439	176515	4.18	4.71	5.20	5.83	5.13
13	587489	176515	4.18	4.72	5.20	5.83	5.13
14	587539	176515	4.19	4.72	5.20	5.83	5.13
15	587589	176515	4.19	4.72	5.20	5.83	5.13
16	587639	176515	<Null>	4.72	5.20	5.83	5.13
17	587489	176565	4.19	4.72	5.19	5.83	5.13
18	587539	176565	4.19	4.72	5.20	5.83	5.13
19	587589	176565	4.19	4.72	5.20	5.82	5.13
20	587639	176565	4.19	4.72	5.20	5.83	5.13
21	587539	176615	4.19	4.72	5.19	5.83	5.13
22	587589	176615	4.19	4.72	5.19	5.83	5.13
23	587639	176615	4.19	4.72	5.20	5.83	5.13
24	587689	176615	<Null>	<Null>	<Null>	5.83	<Null>
25	587639	176665	4.19	4.72	5.19	5.83	5.13
26	587689	176665	4.19	4.72	5.20	5.82	5.13
27	587739	176665	<Null>	<Null>	<Null>	5.82	<Null>
28	587689	176715	4.19	4.72	5.19	5.82	5.13
29	587739	176715	4.19	4.73	5.19	5.82	5.13

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

30	587789	176715	4.19	4.73	5.19	5.83	5.13
31	587839	176715	<Null>	4.73	5.19	5.83	5.13
32	587739	176765	4.19	4.73	5.19	5.82	5.13
33	587789	176765	4.19	4.73	5.19	5.82	5.13
34	587839	176765	4.19	4.73	5.19	5.83	5.13
35	587789	176815	4.19	4.73	5.19	5.82	5.13
36	587839	176815	4.19	4.73	5.19	5.82	5.13
37	588089	177215	<Null>	<Null>	5.19	5.82	<Null>
38	588139	177215	<Null>	<Null>	<Null>	5.82	<Null>
39	588439	177365	<Null>	<Null>	<Null>	5.81	<Null>
40	588489	177365	<Null>	<Null>	5.19	5.81	5.11
41	588539	177365	4.18	4.68	5.18	5.81	5.11
42	588589	177365	4.18	4.68	5.18	5.81	5.11
43	588389	177415	<Null>	4.69	5.18	5.81	5.11
44	588439	177415	4.20	4.69	5.18	5.81	5.11
45	588639	177415	4.18	4.68	5.18	5.81	5.11
46	588689	177465	4.18	4.68	5.18	5.81	5.11
47	588739	177515	4.18	4.68	5.17	5.80	5.10
48	588789	177565	4.18	4.68	5.17	5.80	5.10
49	588839	177615	4.18	4.68	5.17	5.80	5.10

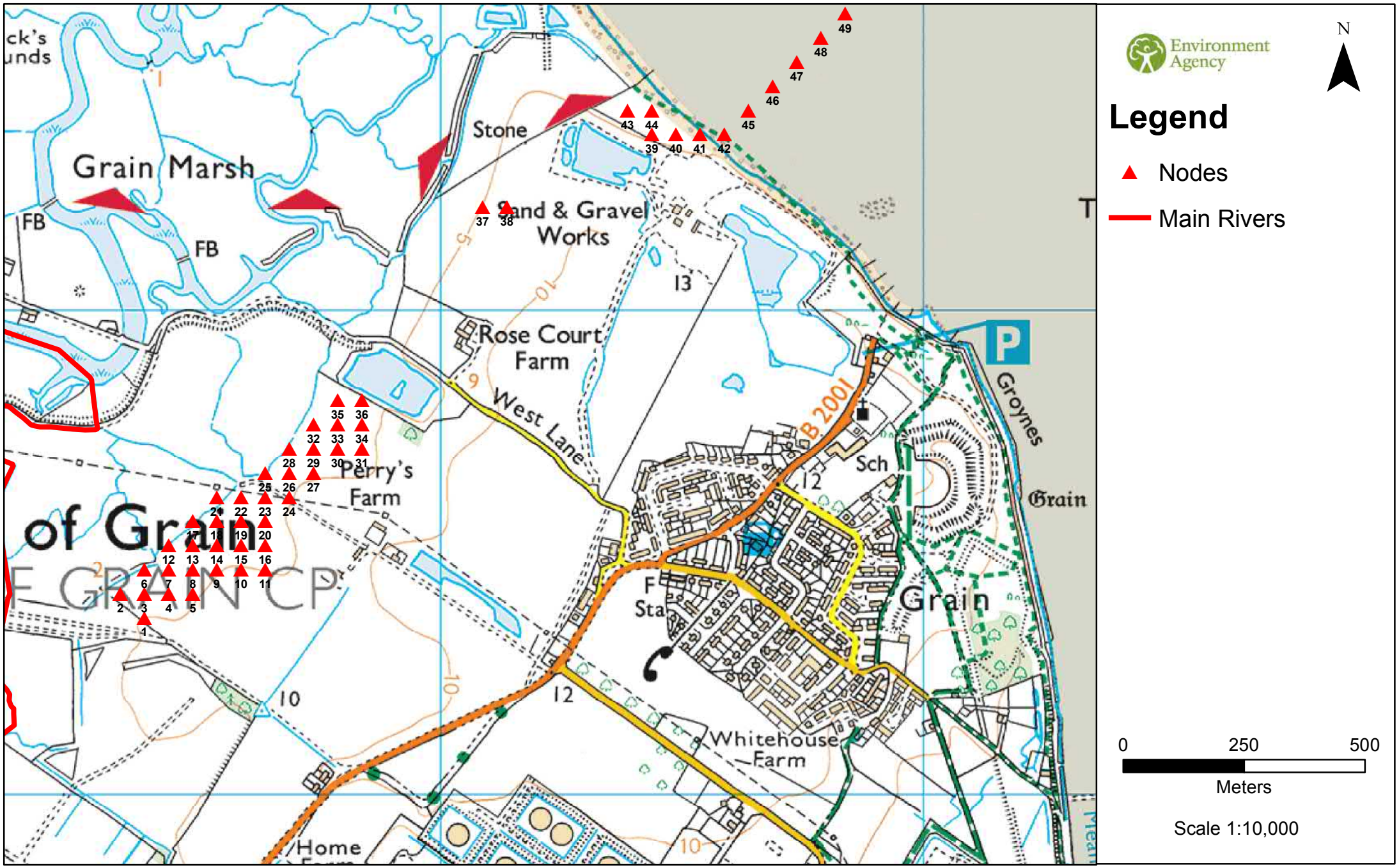
Values of <Null> indicate locations at which the selected points lie outside of a particular modelled flood extent.

Data taken from North Kent Coast Modelling and Mapping Study, completed by JBA Consulting, in August 2015.

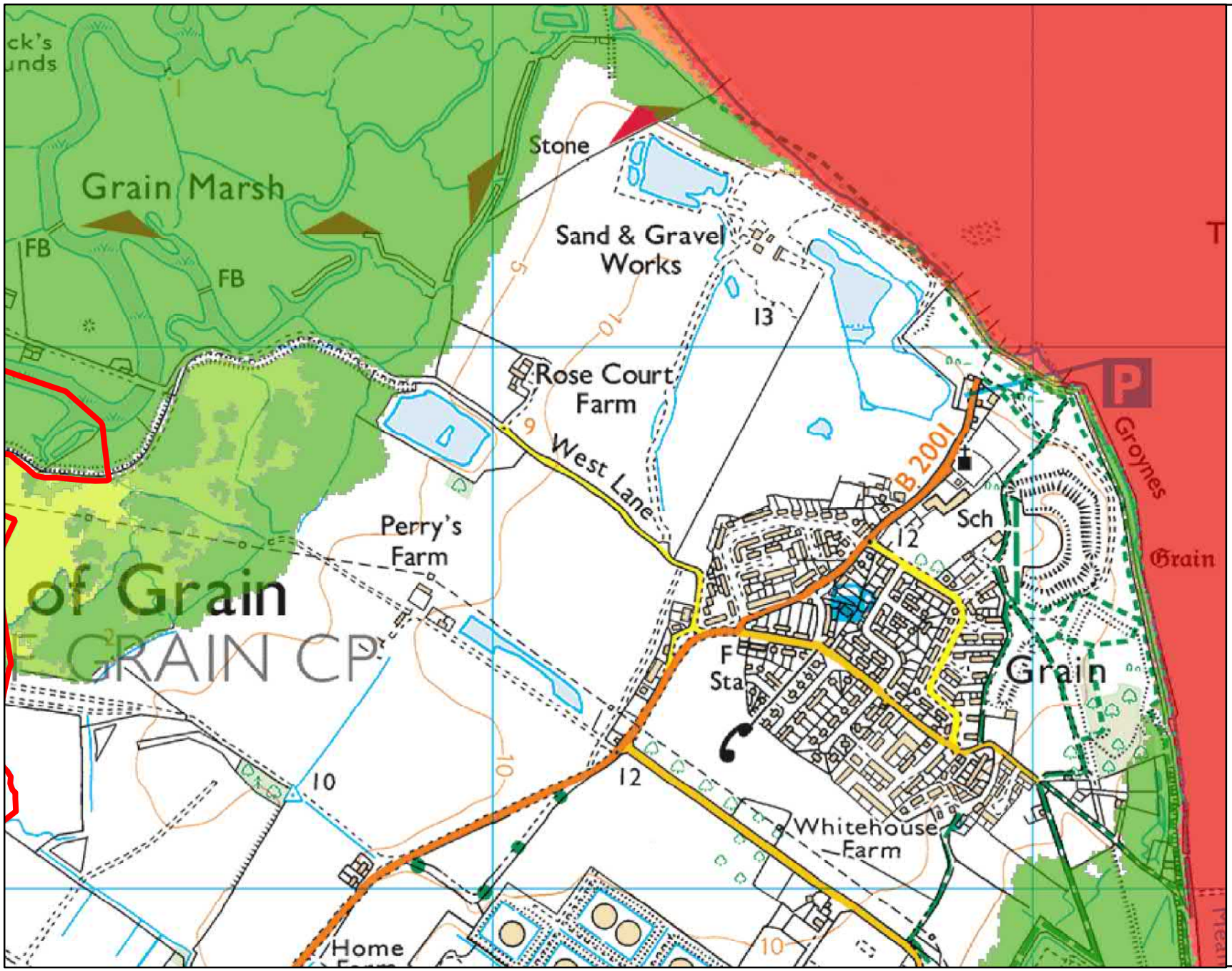
There are no health warnings or additional information for these levels or the model from which they were produced.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Node Map centred on a site on the Isle of Grain, ME3 0AW
Created 05/10/2018 (Ref KSL 101725 LB)



Modelled Maximum Defended Flood Extent (Still Water) centred on a site on the Isle of Grain, ME3 0AW
Created 05/10/2018 (Ref KSL 101725 LB)



Environment Agency

N

Legend

Main Rivers

Defended Scenario - Still Water

AEP (%)

- 5% AEP (2012)
- 1.3% AEP (2012)
- 0.5% AEP (2012)
- 0.1% AEP (2012)
- 0.5% AEP (2070)
- 0.5% AEP (2115)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occuring in any given year.

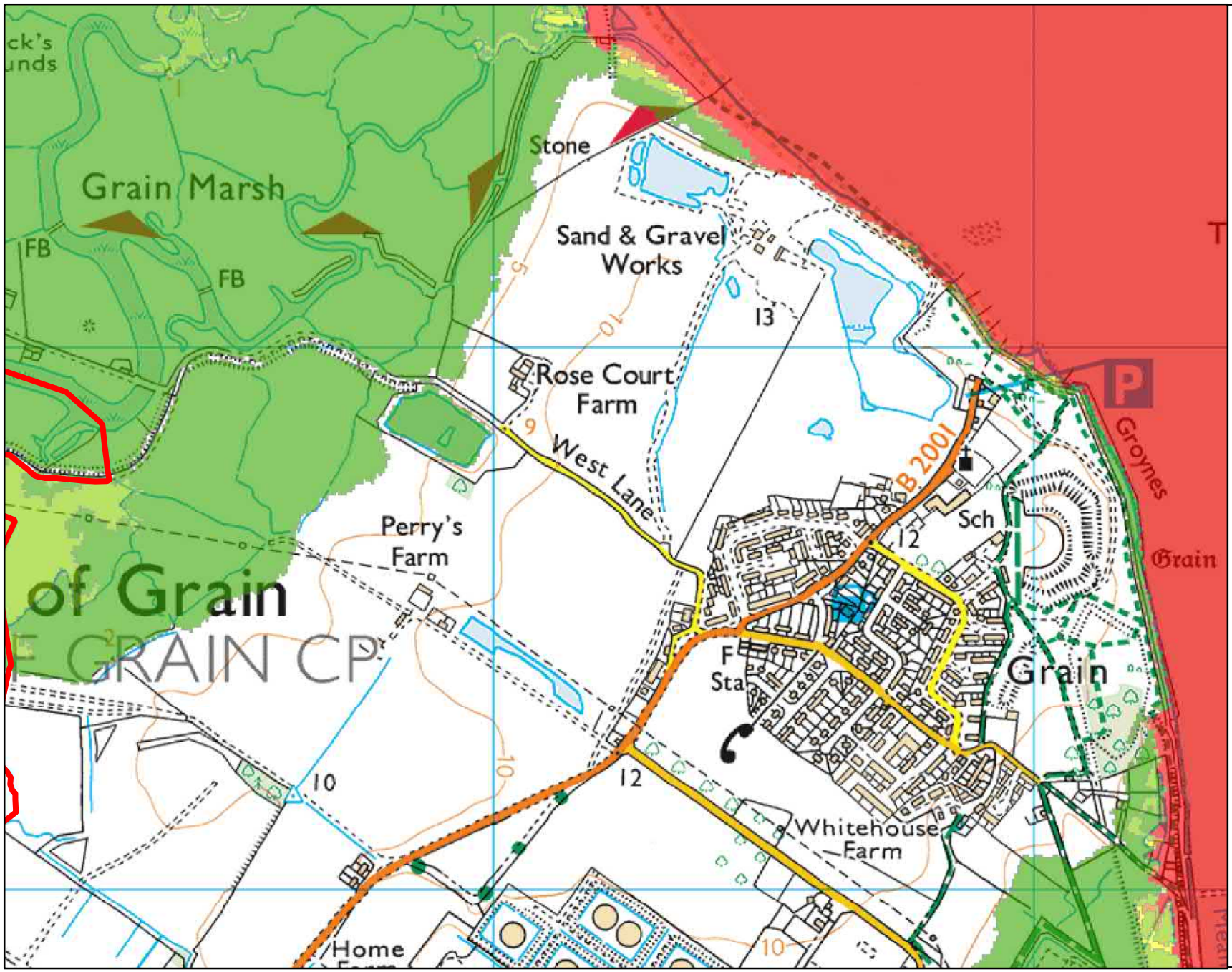
0 250 500

Meters

Scale 1:10,000

Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

Modelled Maximum Defended Flood Extent (Wave Overtopping) centred on a site on the Isle of Grain, ME3 0AW
Created 05/10/2018 (Ref KSL 101725 LB)



Environment Agency

N

Legend

- Main Rivers

Defended Scenario - Wave Overtopping

AEP (%)

- 5% AEP (2012)
- 1.3% AEP (2012)
- 0.5% AEP (2012)
- 0.1% AEP (2012)
- 0.5% AEP (2115)

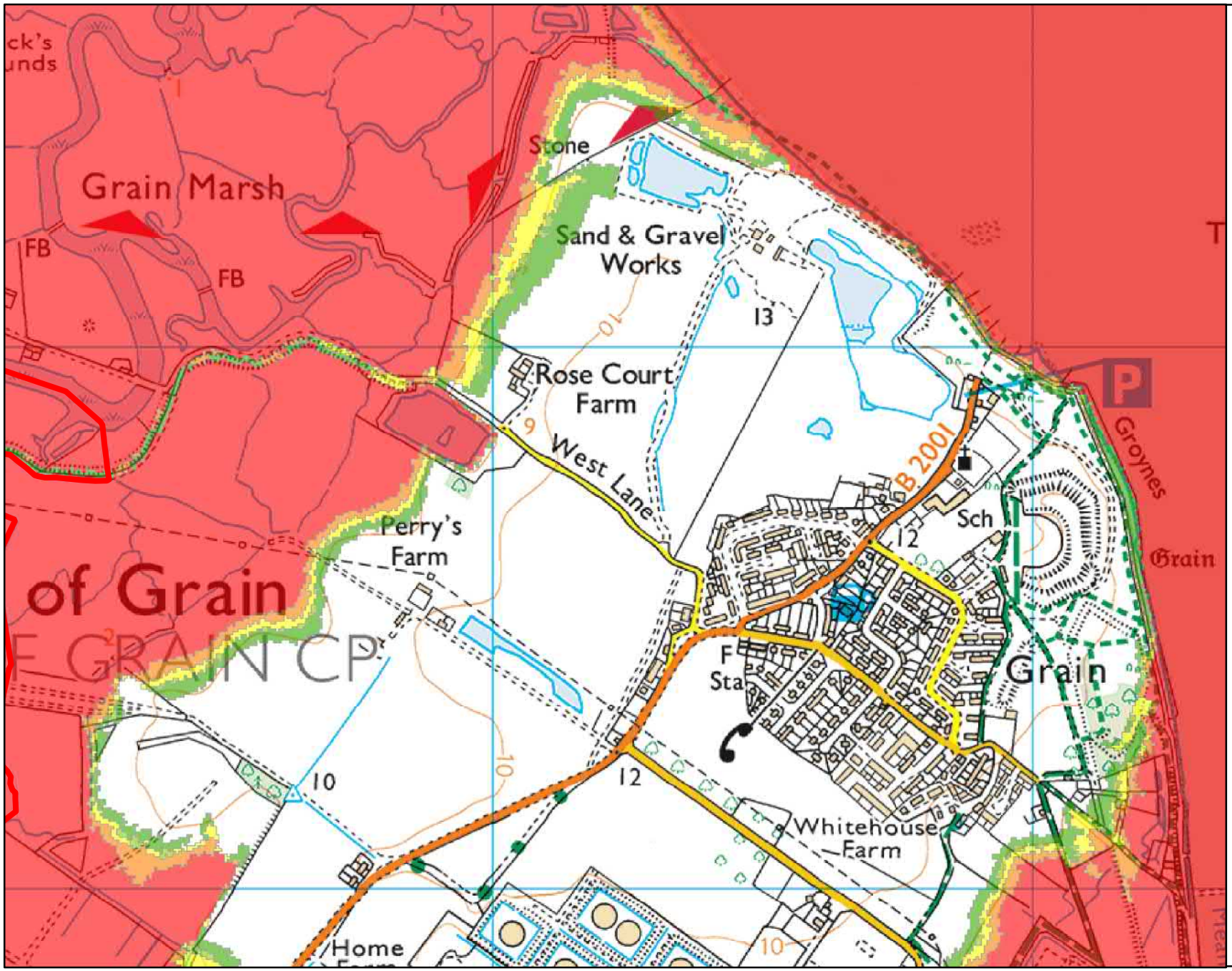
Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occuring in any given year.

0 250 500

Meters

Scale 1:10,000

Modelled Maximum Undefended Flood Extent centred on a site on the Isle of Grain, ME3 0AW
Created 05/10/2018 (Ref KSL 101725 LB)



Environment Agency

N

Legend

Main Rivers

Undefended Scenario

AEP (%)

- 5% AEP (2012)
- 0.5% AEP (2012)
- 0.1% AEP (2012)
- 0.5% AEP (2070)
- 0.5% AEP (2115)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occuring in any given year.

0 250 500

Meters

Scale 1:10,000

Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

Defence Details

Type and location – 737m of Embankment west of site
Standard of protection – 1:200 (0.5% AEP)
Asset Maintainer - Environment Agency

Type and location – 4.8km of Embankment North West of site
Standard of protection – 1:1000 (0.1% AEP)
Asset Maintainer - Environment Agency

Type and location – 1.2km of Embankment South West of site
Standard of protection – 1:1000 (0.1% AEP)
Asset Maintainer - Environment Agency
Asset Owner - Private

Areas Benefiting from Flood Defences

Parts of this site are within an area benefiting from flood defences, as shown on the enclosed extract of our Flood Map. Areas benefiting from flood defences are defined as those areas which benefit from formal flood defences specifically in the event of flooding from rivers with a 1% (1 in 100) chance in any given year, or flooding from the sea with a 0.5% (1 in 200) chance in any given year.

If the defences were not there, these areas would be flooded. An area of land may benefit from the presence of a flood defence even if the defence has overtopped, if the presence of the defence means that the flood water does not extend as far as it would if the defence were not there.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Historic Flood Data

We hold records of historic flood events from rivers and the sea. Information on the floods that may have affected the area local to your site are provided below and in the enclosed map (if relevant).

Flood Event Data

Dates of historic flood events in this area – February 1953

Please note that our records are not comprehensive. We would therefore advise that you make further enquiries locally with specific reference to flooding at this location. You should consider contacting the relevant Local Planning Authority and/or water/sewerage undertaker for the area.

We map flooding to land, not individual properties. Our historic flood event record outlines are an indication of the geographical extent of an observed flood event. Our historic flood event outlines do not give any indication of flood levels for individual properties. They also do not imply that any property within the outline has flooded internally.

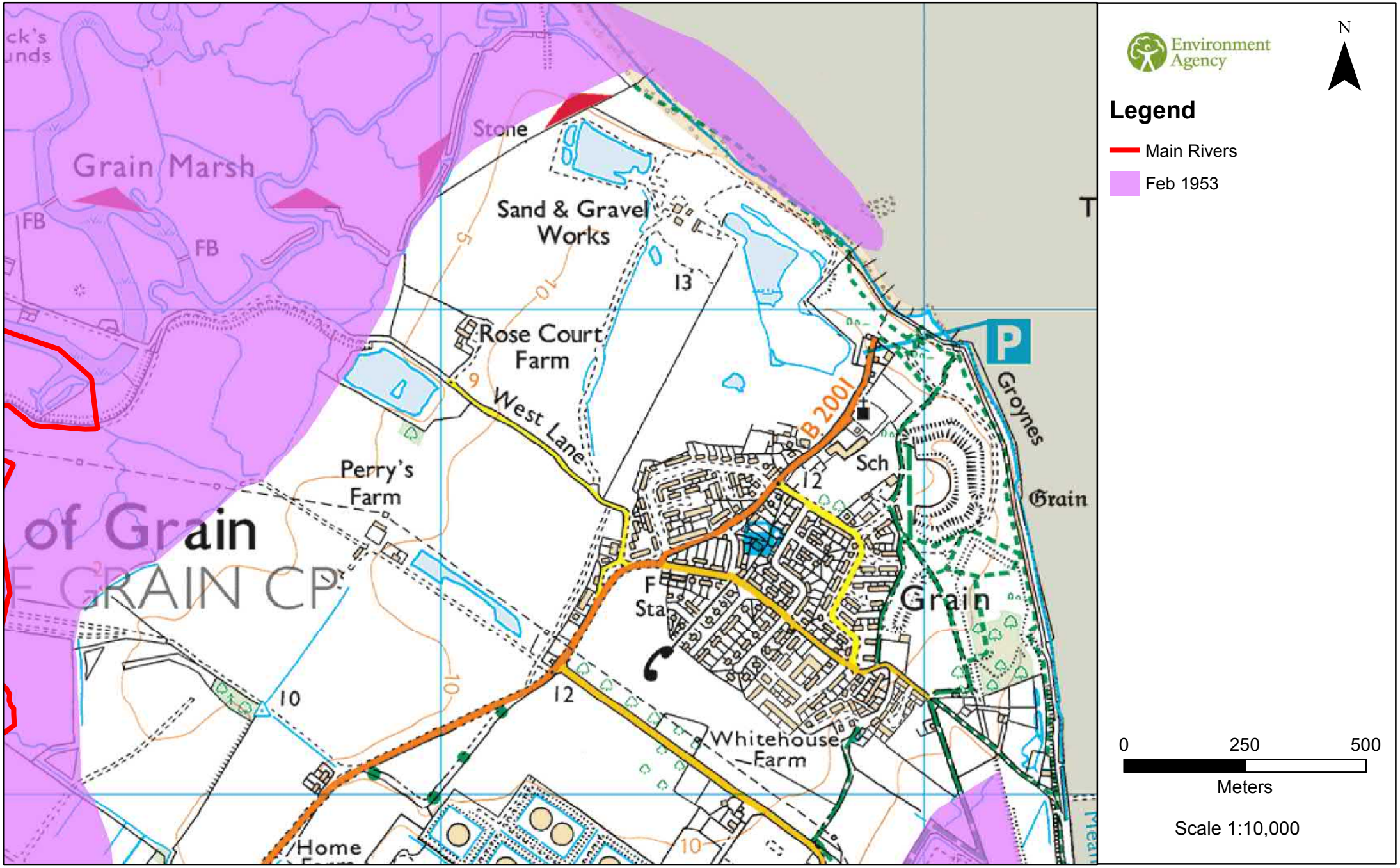
Please be aware that flooding can come from different sources. Examples of these are:

- from rivers or the sea;
- surface water (i.e. rainwater flowing over or accumulating on the ground before it is able to enter rivers or the drainage system);
- overflowing or backing up of sewer or drainage systems which have been overwhelmed,
- groundwater rising up from underground aquifers

Currently the Environment Agency can only supply flood risk data relating to the chance of flooding from rivers or the sea. However you should be aware that in recent years, there has been an increase in flood damage caused by surface water flooding or drainage systems that have been overwhelmed.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Historic Flood Extent centred on a site on the Isle of Grain, ME3 0AW
Created 05/10/2018 (Ref KSL 101725 LB)



Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

Additional Information

Information Warning - OS background mapping

The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.

Planning advice and guidance

The Environment Agency are keen to work with partners to enable development which is resilient to flooding for its lifetime and provides wider benefits to communities. If you have requested this information to help inform a development proposal, then we recommend engaging with us as early as possible by using the pre-application form available from our website:
https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

Complete the form in the link and email back to kslplanning@environment-agency.gov.uk

We recognise the value of early engagement in development planning decisions. This allows complex issues to be discussed, innovative solutions to be developed that both enables new development and protects existing communities. Such engagement can often avoid delays in the planning process following planning application submission, by reaching agreements up-front. We offer a charged pre-application advice service for applicants who wish to discuss a development proposal.
We can also provide a preliminary opinion for free which will identify environmental constraints related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Flood Risk Assessments guidance

Flood risk standing advice for applicants

In preparing your planning application submission, you should refer to the Environment Agency's Flood Risk Standing Advice and the Planning Practice Guidance for information about what flood risk assessment is needed for new development in the different Flood Zones. This information can be accessed via:

https://www.gov.uk/flood-risk-assessment-standing-advice

http://planningguidance.planningportal.gov.uk/

https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

https://www.gov.uk/guidance/flood-risk-and-coastal-change

You should also consult the Strategic Flood Risk Assessment and flood risk local plan policies produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. You should discuss surface water management with your Lead Local Flood Authority.
3. Where a planning application requires a FRA and this is not submitted or deficient, the Environment Agency may well raise an objection due to insufficient information

.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Surface Water

We have provided two national Surface Water maps, under our Strategic Overview for flooding, to your Lead Local Flood Authority – Medway / Kent County Council, who are responsible for local flood risk (i.e. surface runoff, ground water and ordinary watercourse), which alongside their existing local information will help them in determining what best represents surface water flood risk in your area.

Medway / Kent County Council have reviewed these and determined what it believes best represents surface water flood risk. You should therefore contact this authority so they can provide you with the most up to date information about surface water flood risk in your area.

You may also wish to consider contacting the appropriate relevant Local Planning Authority and/or water/sewerage undertaker for the area. They may be able to provide some knowledge on the risk of flooding from other sources. We are working with these organisations to improve knowledge and understanding of surface water flooding.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Annex 9A-2

Environment Agency Correspondence

Littlewood, Sarah

From: Waterman-Gay, Michelle <michelle.waterman-gay@environment-agency.gov.uk>
Sent: 07 March 2019 08:57
To: Littlewood, Sarah
Subject: RE: NeuConnect project - meeting 10/09/2018

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Sarah

Thank you for your email. I can confirm that you can design to the defended level.

Kind regards,

Michelle Waterman-Gay - Planning Advisor (Dartford, Medway, Maidstone)
Sustainable Places, Kent

kslplanning@environment-agency.gov.uk
Telephone: 020 8474 6762

Environment Agency, Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent ME19 5SH

Does your proposal have Environmental Issues or Opportunities? Speak to us Early!

If you are planning a new development, we want to work with you to make the process as easy as possible. We offer a bespoke planning advice service where you will be assigned a project manager who be a single point of contact for you from the Environment Agency, giving you detailed specialist advice within guaranteed timescales. This early engagement can significantly reduce uncertainty and delays to your project. More information can be found here.

Please note – Our hourly charge is now £100 per hour plus VAT from 1st April 2018.

From: Littlewood, Sarah [mailto:sarah.littlewood@aecom.com]
Sent: 27 February 2019 14:33
To: KSLPlanning <KSLPLANNING@environment-agency.gov.uk>
Subject: RE: NeuConnect project - meeting 10/09/2018

Dear Michelle
Many thanks for your email back in November about this site on the Isle of Grain.

Regarding the following statement, “We consider the use of 600mm freeboard above the 0.5% + climate change event to be suitable”, please can you clarify whether this relates to the 0.5% + climate change modelled level for the defended scenario or the undefended scenario. Apologies I didn’t make this clearer in my original email.
I look forward to hearing from you.

Kind regards,
Sarah

Sarah Littlewood BSc (Hons)
Senior Flood Risk Consultant – Water, Ports & Power. EMEA
Working Hours: Tues – Thurs, 8am-4pm
D +44-1256-310-419
sarah.littlewood@aecom.com

From: KSLPlanning [mailto:KSLPLANNING@environment-agency.gov.uk]
Sent: 16 November 2018 13:40
To: Littlewood, Sarah
Subject: RE: NeuConnect project - meeting 10/09/2018

Dear Sarah

Thank you for your email.

The current modelled scenarios modelled within the North Kent Coast model are suitable for use for this site and application. If the lifetime of the development is confirmed at 40-50 years then the 2070 climate change flood levels can be used.

We consider the use of 600mm freeboard above the 0.5% + climate change event to be suitable.

Any elements of the site located within flood zone 1 will be appropriate and will pass the sequential test. However if any elements of the development are located within flood zones 2 or 3 then the sequential test will still apply. I would suggest contacting the local authority to confirm how this needs to be addressed in the planning application.

We have no other specific requirements for the Flood Risk Assessment.

Please note that further advice may fall under our cost recovery programme. Please contact us if you would like us to review the FRA under this before submission to the local planning authority.

If you require any further information, please do not hesitate to contact me.

Michelle Waterman-Gay - Planning Advisor
Sustainable Places, Kent

kslplanning@environment-agency.gov.uk
Telephone: 020 8474 6762

Environment Agency, Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent ME19 5SH

Does your proposal have Environmental Issues or Opportunities? Speak to us Early!

If you are planning a new development, we want to work with you to make the process as easy as possible. We offer a bespoke planning advice service where you will be assigned a project manager who be a single point of contact for you from the Environment Agency, giving you detailed specialist advice within guaranteed timescales. This early engagement can significantly reduce uncertainty and delays to your project. More information can be found here.

Please note – Our hourly charge is now £100 per hour plus VAT from 1st April 2018.

From: Littlewood, Sarah [mailto:sarah.littlewood@aecom.com]
Sent: 18 October 2018 12:40
To: KSLPlanning <KSLPLANNING@environment-agency.gov.uk>; Byne, Jon G <jon.byne@environment-agency.gov.uk>
Cc: Cramond, Tom <Tom.Cramond@aecom.com>
Subject: RE: NeuConnect project - meeting 10/09/2018

Hi Jon

I am working with Tom Cramond on the flood risk assessment work for the NeuConnect site on the Isle of Grain. As per your email below, we have received a product 4 data request through from your enquiries team. Based on the information provided we are keen to clarify a few points regarding requirements for the proposed development on the site as well as the requirements for the supporting FRA to accompany outline planning in due course. I have set out a few points for confirmation below. Please let me know if you require any clarification on would like to arrange a telecom to discuss further.

Tidal Modelling
Water levels from the North Kent Coast Modelling and Mapping Study (JBA Consulting, August 2015) have been provided to us (attached). This provides maximum flood levels in proximity to the site for a range of scenarios and time horizons. We propose to refer to this modelling to inform the site development. Given the lifetime of the development is within the region of 40-50 years, this is considered to be within the range of time horizons that have been modelled within this study with respect to climate change (to the years 2070, 2115). Please can you confirm whether you consider this appropriate, or whether there is a reason we would need to undertake additional modelling to inform development at this site?

Freeboard
Please can you confirm the freeboard requirements that you would be seeking on this site? We are currently assuming 600mm above the 0.5% AEP event including climate change for the lifetime of the development.

Sequential Test
The site is located in Flood Zone 1 and as such is considered to satisfy the requirements of the NPPF flood risk Sequential Test. Please can you confirm that you agree with this position for the purposes of the FRA Report.

Lastly, are there any requirements you would be seeking within the FRA specific to this site or area which we should be aware of at this stage?

I look forward to hearing from you.

Kind regards

Sarah

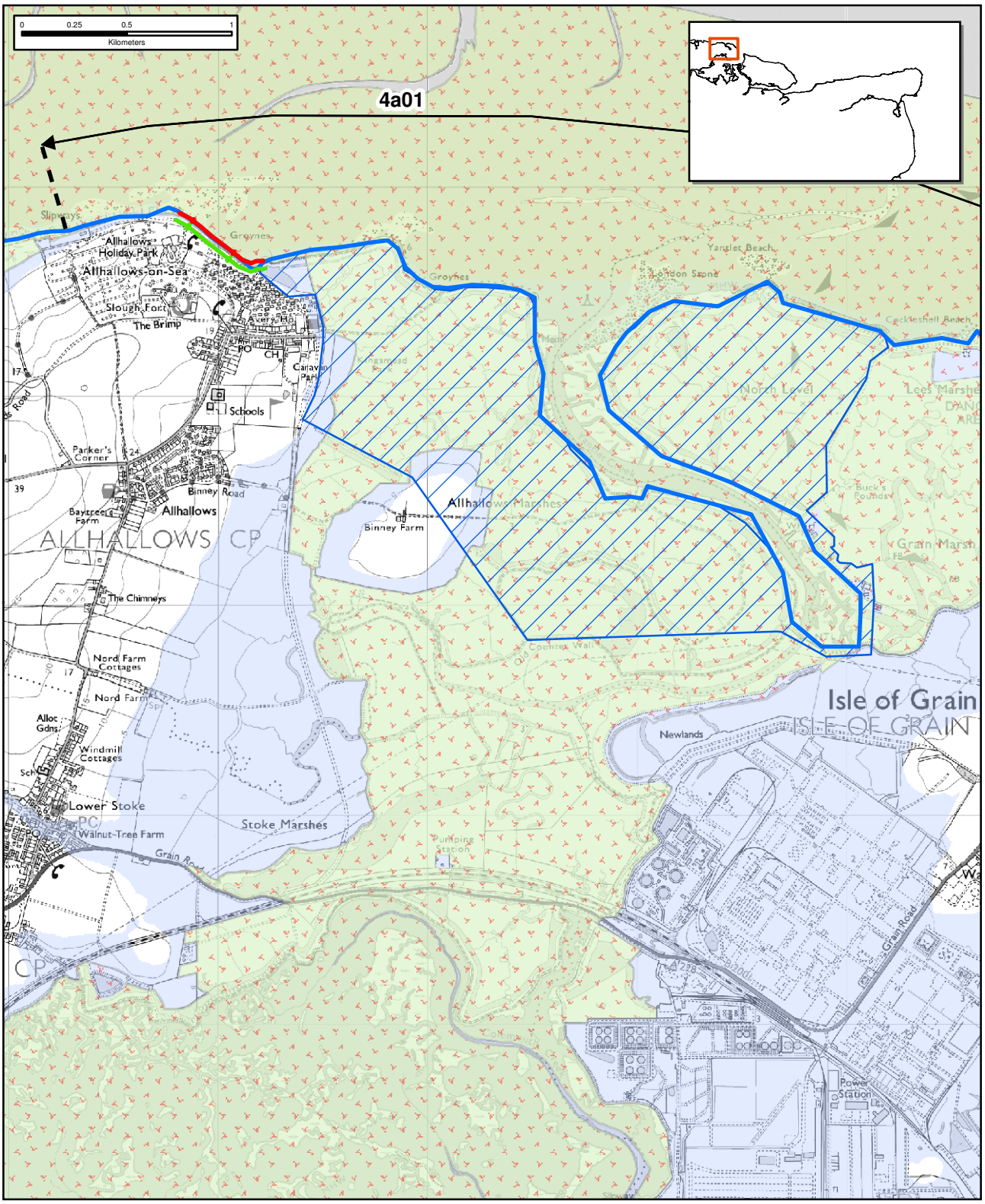
Sarah Littlewood, BSc (Hons)
Senior Consultant, Flood and Water Management
D +44-(0)1256 310419
sarah.littlewood@aecom.com

My working week is Tuesday - Thursday

Annex 9A-3

Extract from Isle of Grain to South Foreland Shoreline Management Plan Review

Isle of Grain to South Foreland Shoreline Management Plan
Policy Unit 4a 01: Allhallows-on-Sea to Grain - Map 1 of 2



Policy

From Present Day:	Medium-Term:	Long-Term:
Hold the Line	Managed Realignment	Managed Realignment

Erosion Lines

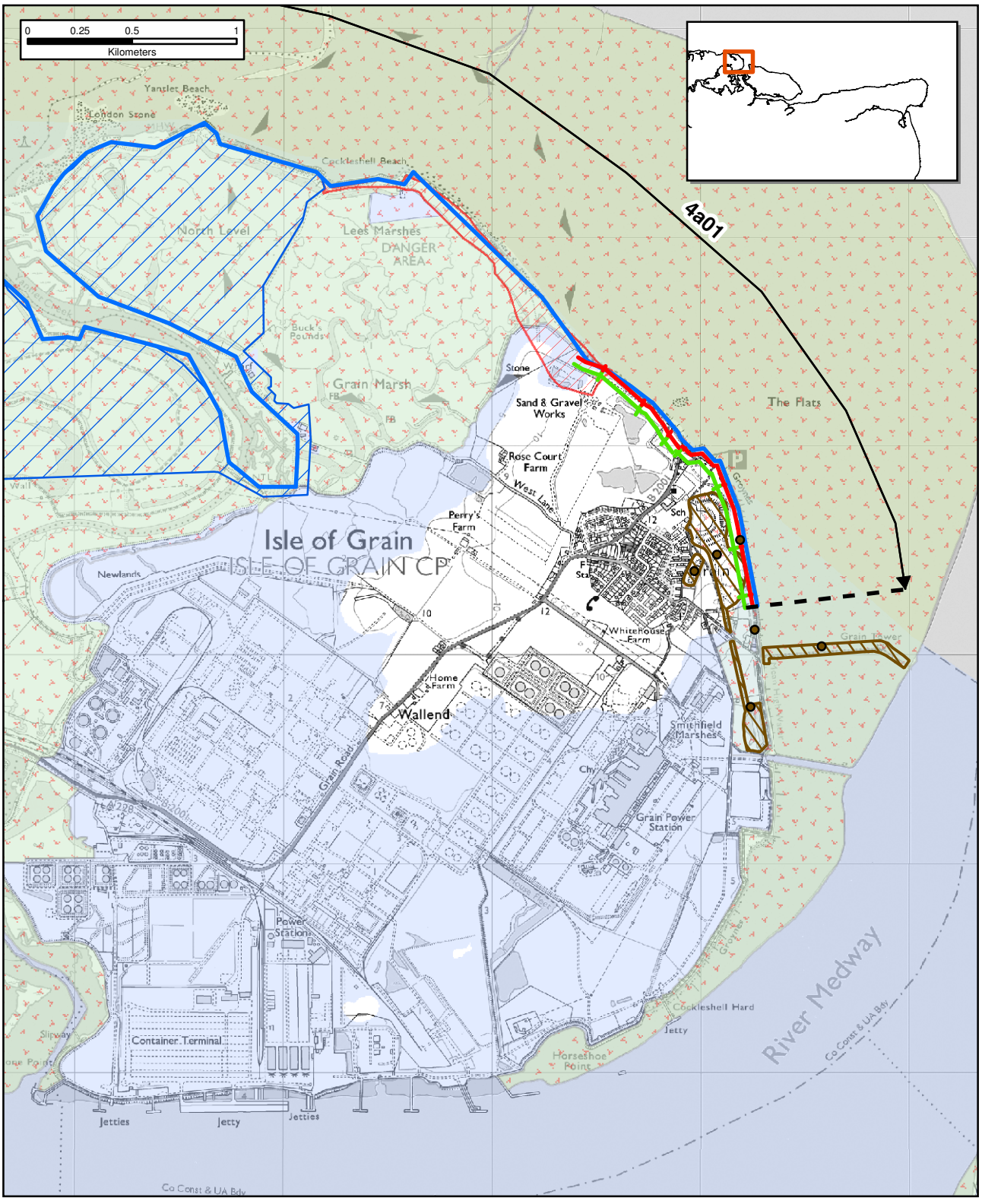
- 0-20 year erosion
- 20-50 year erosion
- 50-100 year erosion
- Policy Unit Boundary
- Current shoreline

- Indicative realignment extent
- 2005 Indicative floodplain © Environment Agency

Environmental/Cultural Heritage

- National Nature Conservation Designation
- International and National Nature Conservation Designation

Isle of Grain to South Foreland Shoreline Management Plan
Policy Unit 4a 01: Allhallows-on-Sea to Grain - Map 2 of 2



Policy

From Present Day:	Medium-Term:	Long-Term:
Hold the Line	Managed Realignment	Managed Realignment

Erosion Lines

- 0-20 year erosion
- 20-50 year erosion
- 50-100 year erosion
- Policy Unit Boundary
- Current shoreline

- Indicative realignment extent
- 2005 Indicative floodplain © Environment Agency

Environmental/Cultural Heritage

- National Nature Conservation Designation
- International and National Nature Conservation Designation
- Important Heritage Sites (Scheduled Monuments)

Location reference:	**Allhallows-on-Sea to Grain**
Policy Unit reference:	**4a01**

SUMMARY OF THE PLAN AND JUSTIFICATION

Plan:

Allhallows-on-Sea to Grain marks the western extremity of the SMP frontage and marks the interface between the open coast and the Medway Estuary (Policy Unit E4 01: Grain Tower to Colemouth Creek – Medway Estuary and Swale SMP. The preferred policies for the estuary unit are Hold the Line in the short, medium and long terms).

In the short term the plan is to continue protecting the low lying assets, which include properties, roads, agricultural land and coastal grazing marsh. However, in the medium and long term the plan is to realign the defences, to realise potential environmental, engineering and coastal process benefits. Under rising sea levels it is anticipated that it will become increasingly difficult to defend the shoreline and maintain a beach on this frontage, due to coastal squeeze and a general lack of natural sediment inputs. This would result in a need for very substantial hard defences, if the current alignment were to be held in the long-term. Managed realignment would avoid the need for such defences, possibly creating cost savings and environmental enhancement. No specific realignment position has been defined under the SMP, only an indicative extent. There is potential for loss of buried unknown heritage with managed realignment in the latter two epochs. This approach would involve the managed loss of assets; however it is intended that the villages of Allhallows and Grain, and the electricity / railway line would be protected.

The marshland is a designated freshwater habitat and its loss needs to be compensated for. Delaying realignment until the 2nd epoch will give time for compensatory habitat to be established and allow for consistency with the TE2100 strategy. Although the hinterland varies, the coastal processes are consistent along the unit and treating this frontage as a single unit is the most appropriate way forward.

Preferred policies to implement Plan:

From present day: The present day policy for Allhallows-on-Sea to Grain is to **hold the line** by maintaining existing defence structures and management practises. This will ensure that current flood protection measures will remain in place.

Medium-term: In the medium term, if the socio-economic, environmental and technical benefits are confirmed, then it will be appropriate to implement a change of policy to **managed realignment**, at a set-back position and allowing the current shoreline position to migrate landwards. A policy of managed realignment will allow some inundation and erosion (of the slopes at Grain) and a degree of natural coastal processes seawards of the realigned defence as well as reduce

The above provides the <u>local</u> details in respect of the SMP-wide Plan; therefore the above <u>must</u> be read in the context of the wider-scale issues, policy implications and funding, as presented in the preceding sections and Appendices to this Plan document.

Location reference:	**Allhallows-on-Sea to Grain**
Policy Unit reference:	**4a01**

	the probability of uncontrolled large scale flooding. No specific realignment position has been identified for the SMP. However, any set back could involve the loss of built assets, and could potentially include properties, roads, agricultural land and freshwater habitat. Realignment would create a coast that will not require ever increasing expenditure to maintain in the coming centuries, together with the creation of important brackish and saline habitats, as well as coastal process benefits i.e. reducing the impact of coastal squeeze. The loss of the designated freshwater habitats would normally require mitigation measures to be implemented, and this aspect will require more detailed appraisal if it is still required in the long term.
Long-term:	Providing the socio-economic, environmental and technical benefits have been confirmed then the long-term policy for Allhallows-on-Sea to Grain is a continuation of **managed realignment**. This policy will continue to deliver technical and environmental benefits and eliminate / reduce the risk of uncontrolled large scale flooding. Depending on the realignment extent the shoreline has the potential to reach a position more in keeping with its natural form. As such, providing sediment supply is sufficient to keep pace with sea level rise, a fronting beach and in the vicinity of Yantlet Creek, mudflats and saltmarsh, could be maintained. *Note: The amount of realignment and subsequent flood (spatial) extent implemented along this frontage, has the potential to (slightly) increase tidal levels in the upstream sections of the Thames Estuary.*

The above provides the local details in respect of the SMP-wide Plan; therefore the above must be read in the context of the wider-scale issues, policy implications and funding, as presented in the preceding sections and Appendices to this Plan document.

Location reference:	***Allhallows-on-Sea to Grain (south)***
Policy Unit reference:	***4a01***

IMPLICATIONS OF THE PLAN FOR THIS LOCATION

Time Period	Management Activities	Property, Built Assets and Land Use	Landscape	Nature Conservation	Historic Environment	Amenity and Recreational Use
2025	No change from the current management practises, construction of a realigned flood defence structure could take place during this epoch.	No built assets will be at risk during this epoch.	The current landscape will be maintained.	Current habitats will be maintained. Constructing a realigned defence structure will disturb the existing habitats.	Existing heritage assets will be maintained. Defence construction may affect heritage assets.	Current amenity usage maintained.
2025 – 2055	Construction / maintenance of a realigned flood defence structure. Current shoreline defences will be allowed to fail.	Some built assets and land anticipated to be at risk, the extent depends upon the position of the realigned defence.	The current landscape will change, giving way to an increasingly natural landscape.	Some freshwater areas give way to saline habitats.	Some unknown heritage assets could be at risk and will therefore need recording and / or relocating.	Improving the landscape and increasing the habitat variety could lead enhance the amenity use.
2055 – 2105	Maintain the realigned flood defence.	Some built assets and land anticipated to be at risk, the extent depends upon the position of the realigned defence.	An increasingly natural landscape will continue to develop.	Further freshwater areas give way to saline habitats. Saline habitats will establish themselves.	Some unknown heritage assets could be at risk and will therefore need recording and / or relocating.	Improving the landscape and increasing the habitat variety could lead enhance the amenity use.

Appendix 9.B – Drainage Strategy

NeuConnect: Great Britain to Germany Interconnector

GB Onshore Scheme

Environmental Statement

Appendix 9B: Outline Drainage Strategy

NeuConnect Britain Ltd

September 2019

Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	June 2019	Draft for internal review	HJ	Helen Judd	Principal Consultant
2	July 2019	For client issue	EC	Emily Craven	Associate Director

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Table of Contents

Figures

No table of figures entries found.

Tables

1. Introduction

Introduction

1.1 NeuConnect (the 'Project'), is a 1400 megawatt (MW) interconnector between Great Britain and Germany. The Project will create the first direct electricity link between Great Britain and German energy networks and will allow electricity to be passed in either direction. The Project will be formed by over 700 kilometres (km) of subsea and underground High Voltage Direct Current (HDVC) cables, with on-shore converter stations linking into the existing electricity grids in Great Britain and Germany.

1.2 The components of the Project that are 'onshore' in Great Britain (the "GB Onshore Scheme") will comprise the interconnector as well as the additional works necessary to facilitate a connection to the National Electricity Transmission System (NETS). AECOM has been commissioned by NeuConnect Britain Limited (hereafter referred to as the 'Applicant') to prepare an Environmental Impact Assessment (EIA) that will support the outline planning application for the GB Onshore Scheme in the Isle of Grain, Kent.

1.3 This document presents an Outline Drainage Strategy to inform the EIA and forms Appendix 9B of the Environmental Statement. This Outline Drainage Strategy has been prepared to demonstrate that surface water arising from the GB Onshore Scheme can be managed and will not increase flood risk elsewhere. A detailed drainage strategy will be produced at a later design stage which will include information on process water and foul water drainage in addition to the surface water drainage. Process and foul water drainage is not included in the scope of this strategy.

Site Description

1.4 The GB Onshore Scheme is entirely within the boundary of Medway Council and is centred on the Isle of Grain, located at the eastern end of the Hoo Peninsula between the Thames Estuary to the north and the Medway Estuary to the south. The area in which the GB Onshore Scheme is proposed (the 'Project Area', land within the application boundary, as illustrated on Figure 2.1 of the Environmental Statement) is located on the fringes of industrial land (this is based on the existing 400 kV overhead line (OHL) defining the extent of industrial land) and extends north/ northeast to the coast. The Project Area is approximately 66 hectares (ha) when incorporating the land up to The Mean Low Water Springs (MLWS) level.

1.5 Land within the Project Area and in the immediate vicinity is either in agricultural use or is brownfield land which has no current discernible use. The Project Area is located approximately 0.5 km to the west of Grain; however, there are individual properties in the centre (Perry's Farm) of and to the west (Rose Court Farm) of the Project Area.

1.6 Grain Marsh, which is immediately west of the Project Area is designated a Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and a RAMSAR site[1].

1.7 The topography across the Project Area peaks at approximately 16 m above ordnance datum (AOD) near Perry's Farm, and falls from east to west to approximately 1 mAOD at the western boundary with Grain Marsh. The British Geological Survey (BGS) website[2] defines the underlying geology; with superficial deposits formed from River Terrace Deposits comprising sand and gravel overlaying bedrock formed from the London Clay Formation. The River Terrace Deposits are classified as a 'Secondary A' aquifer[3]. The London Clay Formation is typically impermeable and has no aquifer classification or designation. Therefore, there is a significant risk of the

[1] https://magic.defra.gov.uk/MagicMap.aspx
[2] http://mapapps.bgs.ac.uk/geologyofbritain/home.html
[3] https://magic.defra.gov.uk/MagicMap.aspx

groundwater level being close to the ground level in this area. Groundwater levels will be confirmed on completion of the ground investigation.

1.8 Based on Environment Agency LiDAR mapping, it can be assumed that surface water runoff generated within the Project Area currently drains westwards via natural processes to Grain Marsh.

1.9 Land within the Project Area and in the wider vicinity has historically been used for the extraction of gravel and sand and the resultant voids used for landfill. Historic landfill sites have been capped, or infilled. However an existing permitted leachate monitoring system still operates from the historic landfill located to the east of Perry's Farm to the pond located to the northeast of Rose Court Farm.

Policy Requirements

Revised National Planning Policy Framework 2018

1.10 The Revised National Planning Policy Framework (NPPF)[4] and associated Planning Practice Guidance states that developments should not increase the risk of flooding elsewhere taking into account the impacts of climate change. To demonstrate this, it is necessary to assess the surface water runoff for the existing Project Area and compare this with the GB Onshore Scheme post development scenario. Alongside this, SuDS should be incorporated where practicable. The Outline Drainage Strategy has been designed in line with the requirements set out by Kent County Council, Medway Council, North Kent Marshes Internal Drainage Board (IDB), the Non-statutory Technical Standards for Sustainable Drainage Systems (SuDS) and the CIRIA SuDS Manual (C753)[5]. The most relevant policies have been detailed below.

Kent County Council Drainage and Planning Policy Statement 2017

1.11 Kent County Council, as the Lead Local Flood Authority and Statutory Consultee, will review drainage strategies associated with major development applications. The guidance provided by Kent County Council's Drainage and Planning Policy Statement sets out what Kent County Council expects from applicants and how drainage proposals will be assessed. The following SuDS specific policies have been set out by Kent County Council and the drainage proposals will be assessed against these:

- **SuDS Policy 1**: Follow the drainage hierarchy

  Surface runoff not collected for use must be discharged according to the following discharge hierarchy:

  – to ground,

  – to a surface water body,

  – a surface water sewer, highway drain, or another drainage system, or

  – to a combined sewer where there are absolutely no other options, and only where agreed in advance with the relevant sewage undertaker.

  The selection of a discharge point should be clearly demonstrated and evidenced.

- **SuDS Policy 2**: Manage Flood Risk Through Design

  It is essential that the drainage scheme proposed:

[4] *National Planning Policy Framework',* available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/733637/National_Planning_Policy_Framework_web_accessible_version.pdf, accessed 30th May 2019

[5] CIRIA, 2015, The SuDS Manual (C753), London.

  - protects people and property on the development site from flooding; and,
  - does not create any additional flood risk outside of the development in any part of the catchment, either upstream or downstream.

  Any drainage scheme must manage all sources of surface water, including exceedance flows and surface flows from offsite, provide for emergency ingress and egress and ensure adequate connectivity.

- **SuDS Policy 3**: Mimic Natural Flows and Drainage Flow Paths

  Drainage schemes should be designed to match greenfield discharge rates, volumes and follow natural drainage routes as far as possible.

- **SuDS Policy 4**: Seek to Reduce Existing Flood Risk

  New development should be designed to take full account of any existing flood risk, irrespective of the source of flooding.

  Where a site or its immediate surroundings have been identified to be at flood risk, all opportunities to reduce the identified risk should be investigated at the masterplanning stage of design and subsequently incorporated at the detailed design stage.

  For brownfield sites, and unless demonstrated to be reasonably impracticable, we would expect a 50% reduction in the peak runoff rate.

- **SuDS Policy 5**: Drainage Sustainability and Resilience

  The proposed drainage system must consider life-time sustainability of the drainage measures and components.

  The design of the drainage system must account for the likely impacts of climate change and changes in impermeable area over the design life of the development. Appropriate allowances should be applied in each case.

  A sustainable drainage approach which considers control of surface runoff at the surface and at source is preferred and should be considered prior to other design solutions.

- **SuDS Policy 6**: Design to be Maintainable

  A drainage scheme maintenance plan should be prepared which demonstrates a schedule of activities, access points, outfalls and any biodiversity considerations.

  The maintenance plan should also include an indication of the adopting or maintaining authority or organisation and may require inclusion within a register of drainage features.

- **SuDS Policy 7**: Safeguard Water Quality

  When designing a surface water management scheme, full consideration should be given to the system's capacity to remove pollutants and to the cleanliness of the water being discharged from the site, irrespective of the receiving system.

  Interception of small rainfall events should be incorporated into the design of the drainage system.

- **SuDS Policy 8**: Design for Amenity and Multi-Functionality

  Drainage design should in the first instance consider opportunities for inclusion of amenity and biodiversity objectives and thus provide multi-functional use of open space with appropriate design for drainage measures within the public realm.

- **SuDS Policy 9**: Enhance Biodiversity

  Drainage design should in the first instance consider opportunities for biodiversity enhancement, through provision of appropriately designed surface systems, consideration of connectivity to adjacent water bodies or natural habitats, and appropriate planting specification.

- **SuDS Policy 10**: Link to Wider Landscape Objectives

Drainage design should consider in the first instance opportunities to contribute to the wider landscape and ensure proposals are coherent with the surrounding landscape character area.

Kent County Council also provide a drainage strategy summary pro-forma for developers to complete, to help with the assessment of schemes. This has been completed and is presented as Annex 9B-1.

Medway Council Local Plan 2003

1.12 The policies within Medway Council's Local Plan seek to set out a strategic path for future development, with an emphasis on sustainability. The policy most relevant to this Outline Drainage Strategy is listed below:

- **POLICY CF12**: Water Supply

  Development will not be permitted where:

  i. it would have a detrimental effect on the quality or yield of water supply; or

  ii. it would prevent or reduce replenishment of groundwater aquifers; or,

  iii. it would have an adverse impact on the flora, fauna (including fisheries interests) and amenity of water courses and other habitats whose nature 296 conservation value is dependent on maintaining water levels;

  iv. it would represent an unacceptable risk to the quality of groundwater resource, unless appropriate measures are taken to adequately protect those resources.

Proposed Development

1.13 The GB Onshore Scheme will comprise the following main elements extending as far as MLWS level:

- A new sealing end compound to facilitate connection of the GB Onshore Scheme to the existing OVL.
- A new substation approximately 80 metres (m) by 80 m (or up to 0.64 ha) with a maximum height of approximately 14 m. The substation will also include down leads from the existing OHL tower.
- An underground Alternating Current (AC) cable route from the substation to the converter station.
- A converter station approximately 250 m by 250 m (or up to 5 ha) with a maximum height of approximately 26 m.
- A new permanent access track from Grain Road (B2001) to the proposed converter station and proposed substation. Access will be achieved by upgrading the existing gravel path that extends along the southern boundary of the Project Area.

2. Outline Drainage Strategy

Site Parameters

1.14 Surface water runoff arising from storm events will require management. Of the total Project Area, approximately 8.4 ha will be classified as impermeable. This impermeable area includes the sealing end compound, access road, converter station and substation platforms with 2m offset and the construction laydown area immediately adjacent to the substation platform as it may be used to expand the substation in the future. The buried DC cable route and the south most construction laydown area are not included as the ground in these areas will be reinstated to the original condition. The existing and proposed permeable and impermeable land within the Project Area has been assessed and is compared in Table 2-1.

Table 2.1 Comparison of permeable and impermeable surfaces for existing and proposed use

	Permeable Area (ha)	Impermeable Area (ha)
Existing	66	0
Proposed	57.6	8.4

Surface Water Runoff Rates

1.15 Runoff rates for a range of storm events have been estimated using Flood Estimation Handbook (FEH) methods. Revitalised Flood Hydrograph method (ReFH2) has been selected as this method is applicable in calculating both Greenfield and Post-Development runoff rates.

1.16 Catchment descriptors have been extracted from the FEH webservice[6] in the form of point data approximately at the centre of the site area. These have been imported into ReFH2 software and applied using the plot scale feature.

1.17 A climate change allowance of 20% has been used in line with guidance set out by the Environment Agency at https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances. The 20% climate change allowance has been derived from Table 2 of the Environment Agency guidance ('peak rainfall intensity allowance in small and urban catchments'), using the 'upper end allowance' for the 'total potential change anticipated for the 2050s (2040 to 2069)'. This has been chosen based on a Project design life of 40 years with construction taking three years starting in 2021.

1.18 The peak runoff rates and volumes arising from the undeveloped area compared to the developed GB Onshore Scheme (assuming no mitigation) are presented in Table 2-2. The critical storm duration according to the ReFH2 calculations is 5.5 hours. Therefore, the estimated volume is based on the 6-hour storm. Runoff rates and volumes for the 1% AEP + 40% climate change event and the 0.1 % AEP event have been included as exceedance events. Calculations supporting the information in Table 2-2 are presented as part of **Appendix 9C**.

[6] Centre for Ecology & Hydrology, FEH Webservice, available at: https://fehweb.ceh.ac.uk/Account/Login, accessed: Jan 2019.

Table 2.2 Comparison of runoff rates and volumes for existing and proposed use

AEP	Existing Rate (l/s/ha)	Existing Rate (8.4 ha)	Volume (m^3)	Proposed Rate (no mitigation) (l/s/ha)	Proposed Rate (No mitigation) (8.4 ha)	Volume (m^3)
50% AEP (Q_{BAR})	2.21	18.6	796	9.86	82.8	1400
3.33% AEP	4.83	40.6	1870	21.4	179.8	2820
1% AEP	6.75	56.7	2670	29.0	243.6	3990
1% AEP +20%cc	8.10	68.0	3200	34.9	293.2	4790
1% AEP +40%cc	9.45	79.4	3740	40.7	341.9	5590
0.1% AEP	13.6	114.2	5490	52.9	444.4	7170

Proposed Surface Water Drainage Strategy

Design Criteria

1.19 Sustainable Drainage Systems (SuDS) are different drainage techniques used to improve water quality, reduce discharged water quantities and provide biodiverse habitats for nature whilst increasing amenity and property values. There is a hierarchy to SuDS, with more preferable systems being above ground and including swales, infiltration basins, wetlands, and green roofs. Below ground systems including soakaways and permeable paving follow on in order of preference, with below ground storage in the form of tanks or oversized pipes towards the least favoured systems. Likewise, there is also a hierarchy to surface water discharge solutions as specified in the CIRIA SuDS Manual (C753)1, which should be adhered to in the following order:

- Infiltration to the maximum extent that is practical - where it is safe and acceptable to do so
- Discharge to surface waters
- Discharge to surface water sewer
- Discharge to combined sewer (last resort).

Proposed SuDS

1.20 Through assessing the location of the GB Onshore Scheme, alongside the LiDAR data for the Project Area, SuDS in the form of swales and attenuation ponds are proposed to be incorporated. The proposed location of the attenuation ponds and swales are adjacent to the western boundary of the Project Area, as illustrated by figures within in **Annex 9B-2**. This location has been identified as the most suitable due to the local topography falling from east to west across the Project Area, which will enable gravity drainage from the proposed impermeable areas to the SuDS features and subsequently to the receiving waterbodies (described further below).

1.21 The total volume of attenuation that will need to be provided to accommodate the 1% AEP + 20% cc event, with the discharge rate restricted to QBAR, is approximately 7,000m3. This value is likely to change as the design progresses. Storage estimate calculations are presented as Annex 9B-3.

1.22 The proposed attenuation ponds are to be located within Flood Zone 3, however this is an area protected by flood defences. As detailed in the Flood Risk Assessment the flood defences are known to protect the area up to 0.5% AEP with climate change allowances up to the year 2115.

1.23 Suitable construction phasing should be used to enable the SuDS features to be constructed at the beginning of the works. This would ensure that any rainfall events during construction of the substation and converter building would be intersected and attenuated by the SuDS before being discharged at a restricted rate into the agreed receiving waterbodies.

Outfall to Existing Waterbodies

1.24 There are numerous existing waterbodies located within Grain Marsh west of the GB Onshore Scheme. As this area is designated a SSSI, SPA and a RAMSAR site, the proposed SuDS sequence provides a treatment train that will ensure no detrimental impact from the GB Onshore Scheme to the surrounding environmentally sensitive areas. It is intended to discharge surface water at greenfield runoff rates to the existing waterbodies west of the Project Area at grid reference TQ 87570 76659.

1.25 A desktop assessment of these waterbodies, alongside correspondence with the IDB, presented as **Annex 9B-4**, has led to the following assumptions:

- Neighbouring waterbodies eventually flow to the mouth of the River Thames
- The waterbodies have the capacity to take flows from the site at greenfield runoff rates
- Waterbodies within Grain Marsh intersect the water table in places.

1.26 Table 2-3 compares the proposed surface water drainage strategy in relation to the discharge hierarchy, demonstrating that more favourable receptors have been selected.

Table 2.3 Proposed surface water drainage with respect to the discharge hierarchy

Hierarchy	Proposed Surface Water Drainage
Infiltration to the maximum extent that is practical - where it is safe and acceptable to do so	Some infiltration is likely to occur within the swales and attenuation ponds. Ground conditions and infiltration rates to be confirmed before detailed design commences
Discharge to surface waters	Surface water collected in the proposed attenuation ponds will be discharged to an existing waterbody via swales
Discharge to surface water sewer	Not required
Discharge to combined sewer (last resort)	Not required

Proposed Surface Water Pipe Network

1.27 Surface water runoff arising from areas of hardstanding will be conveyed to the proposed SuDS features via a pipe network. The pipe network will be designed to ensure no part of the site floods during the 3.33% AEP storm event, as required by Sewers for Adoption 7th Edition[7]. Indicative pipe layouts have been included in the surface water drainage strategy drawing presented as part of **Annex 9B-2**.

1.28 Surface water runoff arising from events greater than the 3.33% AEP storm event which cannot be accommodated by the pipe network will be contained within the boundary of the Project Area. The location of the hardstanding in relation to the SuDS will support surface water runoff to flow towards the SuDS features during storm events of greater intensity.

[7] Sewers for Adoption 7th Edition, August 2012, WRc plc, Wiltshire

Design for Exceedance

1.29 The Site falls from east to west, towards Grain Marsh. During storm events greater than a 0.5% AEP including a 20% allowance for climate change, exceedance flows will be directed away from the buildings within the Project Area and towards Grain Marsh due to the local topography. The proposed exceedance routes have been presented as part of **Annex 9B-2**.

1.30 In the event that the coastal defences are breached, the proposed attenuation may be unable to accommodate runoff arising from the development due to its location and the standard of protection afforded by the existing flood defences protecting this part of the Project Area.

Future Operation and Maintenance

1.31 During operation, the GB Onshore Scheme will generate stormwater runoff, process waste and foul waste from sanitary facilities. Process and foul water management will be addressed as information about the sources of these flows becomes available and the design progresses.

1.32 All surface water will be collected by rainwater pipes, gullies and linear drainage channels from all areas of hardstanding including building roofs, carparks and access roads. Runoff will be attenuated onsite by the proposed SuDS features, prior to being conveyed via swales to discharge at greenfield runoff rates to the agreed receiving waterbodies.

1.33 The operation and maintenance of above ground SuDS is inherently favourable to that of below ground SuDS features. Activities are likely to include periodic vegetation management and inspection of control structures used to restrict flows to the receiving waterbodies.

1.34 In order to ensure the proposed SuDS and associated drainage infrastructure remain operational throughout the design life, an operation and maintenance manual should be included as part of the detailed design for the Applicant to understand the scale of future obligations of the site owner with regard to managing surface water arising from the GB Onshore Scheme.

Annex 9B-1

Kent County Council Drainage Strategy Pro-forma

Drainage Strategy Summary

1. Site details	
Site/development name	NeuConnect
Address including post code	
Grid reference	E N
LPA reference	
Type of application	Outline ☐ Full ☐ Discharge of Conditions ☐ Other ☑
Has pre-application advice been sought from KCC? Yes ☐ No ☑ If so, KCC Reference Number: Pre-application Meeting Date:	
Site condition	Greenfield ☑ Brownfield ☐

2. Existing drainage			Document/Plan where information is stated:
Total site area (ha)			
Impermeable area (ha)			
Final discharge location	Infiltration ☐ Watercourse ☑ Sewer ☐ Tidal reach/sea ☐		
Where applicable specify catchment runoff rates:	Greenfield runoff rates (l/s)	Existing brownfield runoff rates (l/s)	
QBAR (l/s)	18.6		
1 in 1 year (l/s)	—		
1 in 30 year (l/s)	40.6		
1 in 100 year (l/s)	56.7		

3. Proposed drainage areas			Document/Plan where information is stated:
Impermeable area (ha)	Roof	7.763	
	Highway/road	0.55	
	Other paved areas	0.087	
	Total	8.4	
Permeable area (ha)	Open space	57.6	
	Other permeable areas	—	
	Total	57.6	
Final discharge location	Infiltration ☐ Infiltration rate _____ m/s Watercourse ☑ Sewer ☐ Tidal reach/sea ☐		
Climate change allowance included in design	20% ☑ 30% ☐ 40% ☐		

4. Post-Development Discharge rates, with mitigation			Document/Plan where information is stated:
Describe development drainage strategy in general terms: Runoff from hardstanding areas will be directed, via piped network, to attenuation ponds & swales before discharging to the ordinary watercourse on the western boundary of the site. Discharge rate to be restricted to Qbar			
(a) Soil type and discharge	Permeable ☐ No off-site discharge i.e. infiltration ☐	Semi-permeable ☐ Infiltration maximised, QBAR off-site ☑	Impermeable ☐ Staged discharge ☐
(b) Controlled developed discharge rates (l/s)	Qbar ~~1 in 1 year~~	18.6	
	1 in 30 year	18.6	
	1 in 100 year	18.6	
	1 in 100 year + CC	18.6	

5. Discharge Volumes			Document/Plan where information is stated:
	Existing volume (m^3)	Proposed volume (m^3)	
1 in 1 year	796	1400	
1 in 30 year	1870	2820	
1 in 100 year	2670	3990	
1 in 100 year + CC	3200	4790	

6. Plans/Drawings	Document/Plan where information is stated:
A schematic of the drainage strategy has been included? Yes ☑ No ☐	
A schematic of the drainage network model has been included? Yes ☐ No ☑	

All information presented above should be contained within the attached Flood Risk Assessment, Drainage Strategy or Statement and be substantiated through plans and appropriate calculations.

Form completed by	Stephanie Wood
Qualifications	BSc (Hons) MSc CEng MICE
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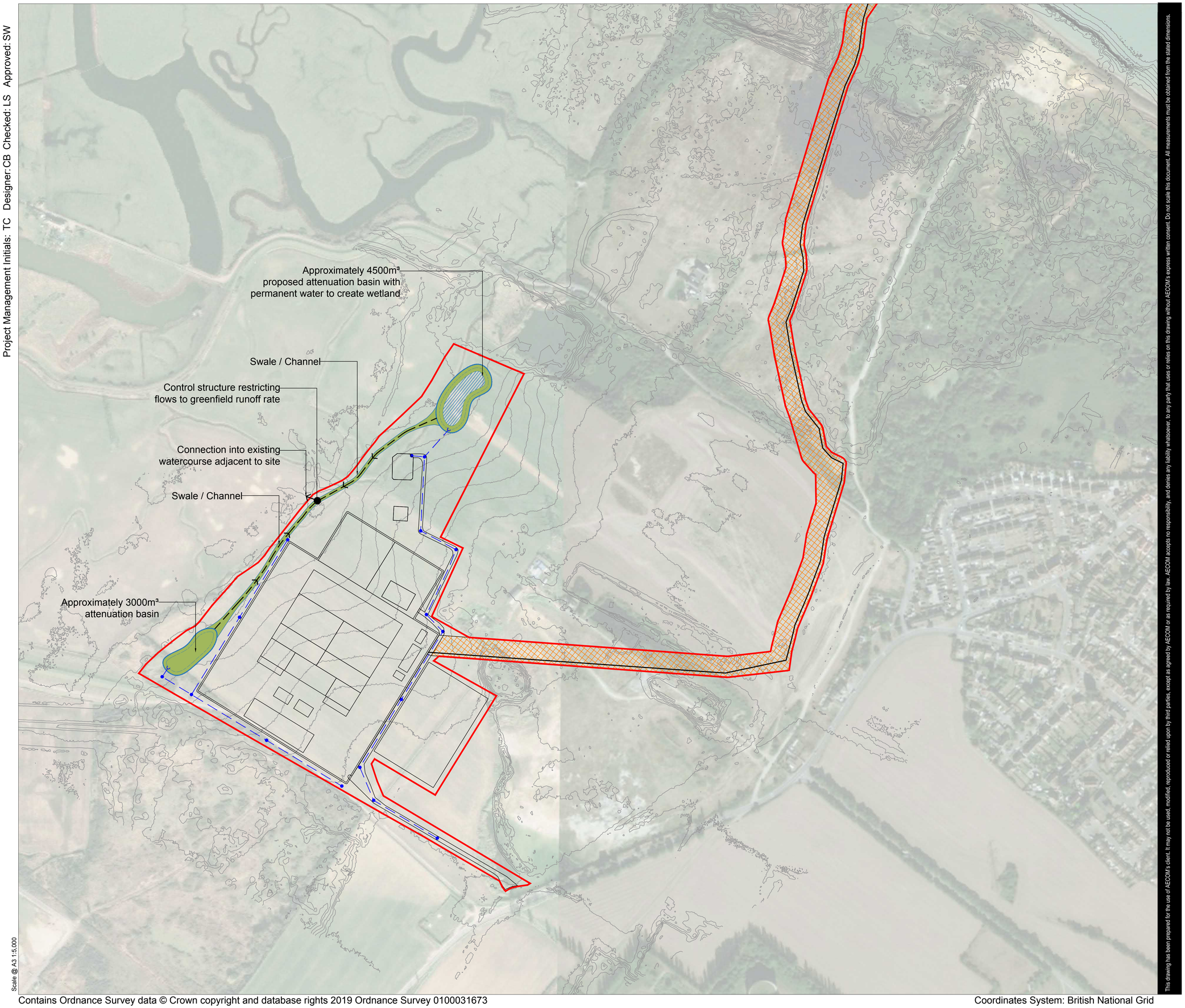
Email	Stephanie.wood@aecom.com
On behalf of (client's details)	NewConnect Britain Limited
Date	11/07/19

Annex 9B-2

Drawings

Project Management Initials: TC Designer: CB Checked: LS Approved: SW



Scale @ A3 1:5,000

Coordinates System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- Attenuation Basin
- Swale / Channel
- Indicative Surface Water Pipe Network
- DC Cable Route

TITLE
FIGURE 9B.2a
CONCEPT DRAINAGE STRATEGY

REFERENCE
NC_190719_UKON_ESA_9B.2a_V1

SHEET NUMBER	DATE
1 of 1	19/07/19

Project Management Initials: TC Designer: CB Checked: LS Approved: SW

Scale @ A3 1:5,000

Coordinates System: British National Grid

AECOM

PROJECT
NEUCONNECT

CLIENT
NeuConnect Britain Ltd.

KEY

- Application Boundary
- Attenuation Basin
- Swale / Channel
- Exceedance Surface Water Flow Routes

TITLE
FIGURE 9B.2b
EXCEEDANCE FLOW ROUTES

REFERENCE
NC_190719_UKON_ESA_9B.2b_V1

SHEET NUMBER
1 of 1

DATE
19/07/19

Annex 9B-3

MicroDrainage Storage Estimate

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.775	0.275	18.5	1951.0	O K
30 min Summer	0.855	0.355	18.6	2522.4	O K
60 min Summer	0.936	0.436	18.6	3096.0	O K
120 min Summer	1.045	0.545	18.6	3867.2	O K
180 min Summer	1.115	0.615	18.6	4368.1	O K
240 min Summer	1.167	0.667	18.6	4734.6	O K
360 min Summer	1.238	0.738	18.6	5242.0	Flood Risk
480 min Summer	1.284	0.784	18.6	5568.7	Flood Risk
600 min Summer	1.315	0.815	18.6	5787.1	Flood Risk
720 min Summer	1.336	0.836	18.6	5937.1	Flood Risk
960 min Summer	1.360	0.860	18.6	6104.1	Flood Risk
1440 min Summer	1.372	0.872	18.6	6193.4	Flood Risk
2160 min Summer	1.355	0.855	18.6	6072.7	Flood Risk
2880 min Summer	1.328	0.828	18.6	5879.1	Flood Risk
4320 min Summer	1.288	0.788	18.6	5592.6	Flood Risk
5760 min Summer	1.257	0.757	18.6	5374.3	Flood Risk
7200 min Summer	1.236	0.736	18.6	5224.2	Flood Risk
8640 min Summer	1.219	0.719	18.6	5106.8	Flood Risk
10080 min Summer	1.206	0.706	18.6	5014.0	Flood Risk
15 min Winter	0.808	0.308	18.6	2186.0	O K
30 min Winter	0.898	0.398	18.6	2826.6	O K
60 min Winter	0.989	0.489	18.6	3470.6	O K
120 min Winter	1.111	0.611	18.6	4338.7	O K
180 min Winter	1.191	0.691	18.6	4905.2	O K
240 min Winter	1.249	0.749	18.6	5320.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	124.582	0.0	1217.3	19
30 min Summer	80.757	0.0	1493.8	34
60 min Summer	49.815	0.0	2527.6	64
120 min Summer	31.372	0.0	2991.1	124
180 min Summer	23.797	0.0	3077.7	184
240 min Summer	19.474	0.0	3033.3	244
360 min Summer	14.549	0.0	2911.4	364
480 min Summer	11.736	0.0	2824.4	482
600 min Summer	9.881	0.0	2764.4	602
720 min Summer	8.555	0.0	2717.4	722
960 min Summer	6.767	0.0	2641.7	962
1440 min Summer	4.817	0.0	2519.4	1442
2160 min Summer	3.400	0.0	5404.8	2160
2880 min Summer	2.658	0.0	5158.3	2624
4320 min Summer	1.895	0.0	4672.2	3328
5760 min Summer	1.504	0.0	8732.0	4096
7200 min Summer	1.273	0.0	9109.0	4904
8640 min Summer	1.120	0.0	9333.0	5792
10080 min Summer	1.011	0.0	9139.1	6648
15 min Winter	124.582	0.0	1350.2	19
30 min Winter	80.757	0.0	1564.6	34
60 min Winter	49.815	0.0	2780.3	64
120 min Winter	31.372	0.0	3099.1	122
180 min Winter	23.797	0.0	3041.0	182
240 min Winter	19.474	0.0	2953.1	242

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	1.330	0.830	18.6	5891.1	Flood Risk
480 min Winter	1.382	0.882	18.6	6260.1	Flood Risk
600 min Winter	1.417	0.917	18.6	6509.7	Flood Risk
720 min Winter	1.441	0.941	18.6	6683.2	Flood Risk
960 min Winter	1.469	0.969	18.6	6883.0	Flood Risk
1440 min Winter	1.488	0.988	18.6	7011.5	Flood Risk
2160 min Winter	1.475	0.975	18.6	6922.5	Flood Risk
2880 min Winter	1.449	0.949	18.6	6738.9	Flood Risk
4320 min Winter	1.395	0.895	18.6	6353.0	Flood Risk
5760 min Winter	1.355	0.855	18.6	6073.9	Flood Risk
7200 min Winter	1.325	0.825	18.6	5855.7	Flood Risk
8640 min Winter	1.299	0.799	18.6	5669.4	Flood Risk
10080 min Winter	1.276	0.776	18.6	5512.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.549	0.0	2852.1	360
480 min Winter	11.736	0.0	2801.5	478
600 min Winter	9.881	0.0	2771.1	596
720 min Winter	8.555	0.0	2750.5	714
960 min Winter	6.767	0.0	2723.3	944
1440 min Winter	4.817	0.0	2671.6	1412
2160 min Winter	3.400	0.0	5488.2	2080
2880 min Winter	2.658	0.0	5281.9	2736
4320 min Winter	1.895	0.0	4893.2	3460
5760 min Winter	1.504	0.0	9700.7	4384
7200 min Winter	1.273	0.0	9985.4	5328
8640 min Winter	1.120	0.0	9810.5	6232
10080 min Winter	1.011	0.0	9369.6	7168

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 587559 176472	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 8.400

Time (mins) From:	To:	Area (ha)
0	4	8.400

Model Details

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	7100.0	1.000	7100.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0192-1860-1000-1860
Design Head (m)	1.000
Design Flow (l/s)	18.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	192
Invert Level (m)	0.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	18.6	Kick-Flo®	0.713	15.8
Flush-Flo™	0.333	18.6	Mean Flow over Head Range	-	15.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.7	0.800	16.7	2.000	25.9	4.000	36.1	7.000	47.4
0.200	17.8	1.000	18.6	2.200	27.1	4.500	38.2	7.500	49.0
0.300	18.6	1.200	20.3	2.400	28.3	5.000	40.2	8.000	50.5
0.400	18.5	1.400	21.8	2.600	29.4	5.500	42.1	8.500	52.0
0.500	18.1	1.600	23.3	3.000	31.5	6.000	44.0	9.000	53.5
0.600	17.5	1.800	24.6	3.500	33.9	6.500	45.7	9.500	54.9

Annex 9B-4

Internal Drainage Board Correspondence

Wood, Stephanie

From: atkinson, daniel <daniel.atkinson@medway.gov.uk>
Sent: 03 May 2019 15:38
To: Wood, Stephanie
Subject: RE: Isle of Grain proposed development

Hi Steph,

No problem.

Following the SuDS hierarchy is what we encourage, ideally we would like to see ponds and swales where possible and if possible permeable paving for an additional means of water quality but I appreciate this is not possible on all sites, especially industrial use.

It will be myself who deal with the application when it comes in so if what you submit meets what I sent previously, we should be all good.

Kind regards,

Dan Atkinson | Flood Risk Officer
Gun Wharf**,** Dock Road**,** Chatham, ME4 4TR
Direct dial: 01634 331607 | **Web:** medway.gov.uk | **Twitter**: @medway_council | **Facebook:** Medway Council

From: Wood, Stephanie <stephanie.wood@aecom.com>
Sent: 03 May 2019 15:32
To: atkinson, daniel <daniel.atkinson@medway.gov.uk>
Subject: RE: Isle of Grain proposed development

Hello Daniel,

Thank you for your email and the information provided.

We are in the process of drafting the Environmental Statement, and water management forms a part of that document. Therefore, I am keen to make sure the SuDS element, including the discharge point, is as high up the SuDS hierarchy as is achievable on this site.

Thanks again.

Steph

Stephanie Wood, BSc (Hons) MSc
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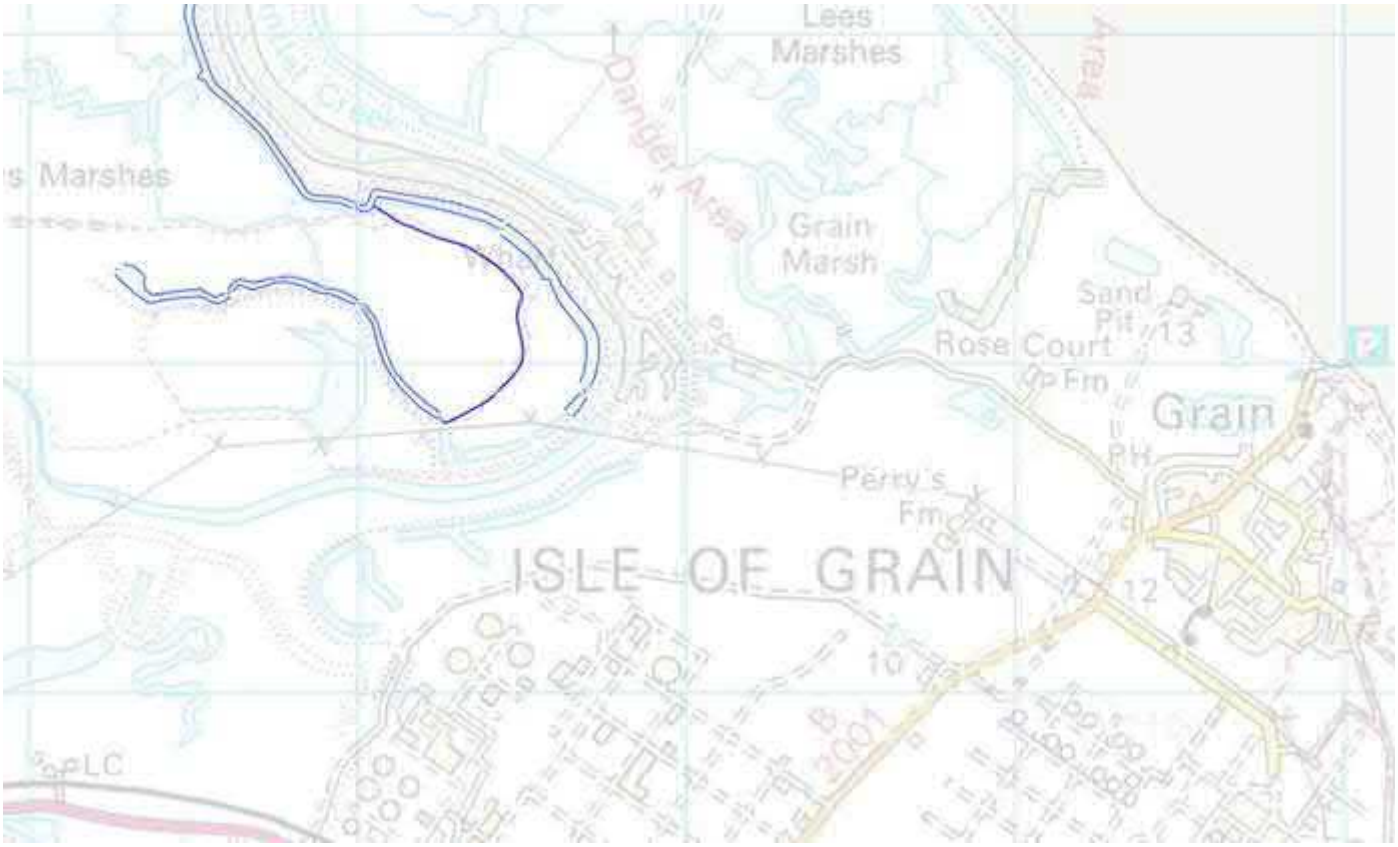
stephanie.wood@aecom.com

From: atkinson, daniel [mailto:daniel.atkinson@medway.gov.uk]
Sent: 03 May 2019 15:06
To: Wood, Stephanie
Subject: RE: Isle of Grain proposed development

Good afternoon Stephanie,

Thank you for the email. Firstly, has this come through as a planning application to the council as generally that is how it would be dealt with?

Fortunately, the LLFA at the council also manage the IDB so I can provide some guidance etc. for you at this stage. In terms of assets, the closest asset that is managed by us is the Allhallows ordinary watercourse (part of the IDB);



As you can see, it is not particularly close to the site, however, there is the opportunity to discharge in to one of the nearby watercourses, which would eventually end up either in this watercourse or the Thames Estuary. This is something we would also highly encourage. As long as the discharge rate is limited to QBar and flood risk is not increase on or off site, we are fairly happy. In terms of a planning application, the following would be the expectations for this particular site based on the information in your email;

Paragraph 079 of National Planning Policy Guidance Flood and Coastal Change states that when considering major development, sustainable drainage systems (SuDs) should be provided unless demonstrated to be inappropriate.

The SuDs scheme should be designed in accordance with SuDs Management Train principles including the prevention of runoff by reducing impermeable areas and utilising source, site and regional controls where necessary.

It should be ensured that there is a maintenance schedule in place for the lifetime of the development to maintain any SuDs, which serve it. All SuDS should be located in publicly accessible areas, unless deemed inappropriate or not possible, to allow for suitable access for maintenance. We will need to see a plan of the frequency of maintenance

for each SuDS feature on site based on guidance in the CIRIA SuDS Manual as well as details of who will carrying out the maintenance.

The receiving watercourse is classified as an 'ordinary watercourse' and under the jurisdiction of the North Kent Marshes Internal Drainage Board for the purposes of its land drainage functions. Any works within the channel of the watercourse including for example construction of a culvert or flow control structure requires prior consent from the North Kent Marshes Internal Drainage Board under the Land Drainage Act 1991.

At a detailed design stage, the Flood Estimation Handbook (FEH) should be used for the design storms, opposed to FSR. For runoff, outputs from both FEH and ICP SuDS should be submitted with the most conservative of the two, being selected.

MicroDrainage outputs (or other industry appropriate software) should be provided for the critical duration for a 2 year, 30 year and 1 in 100 year + 40% intensity climate change scenarios.

I hope this helps but please feel free to contact me with any further queries and I will be happy to help.

Kind regards,

Dan Atkinson | Flood Risk Officer
Gun Wharf**,** Dock Road**,** Chatham, ME4 4TR
Direct dial: 01634 331607 | **Web:** medway.gov.uk | **Twitter**: @medway_council | **Facebook:** Medway Council

From: Wood, Stephanie <stephanie.wood@aecom.com>
Sent: 02 May 2019 11:10
To: northkentmarshesidb <northkentmarshesidb@medway.gov.uk>
Subject: Isle of Grain proposed development

Dear Sir/Madam,

I am currently working on a proposed development for an electricity interconnector near the Isle of Grain. I am specifically working on the SuDS design for this scheme, and would like to find out about your assets in the area and the potential to connect the SuDS to one of the existing land drains in the vicinity of the site. The SuDS will likely take the form of wetlands and swales, with the discharge rate restricted to QBAR.

For your information I have included the draft site layout to give you an idea of the site location and constraints. There is an ordinary watercourse adjacent to the red line boundary (to the west of the site) which currently appears to be a suitable receiving watercourse, however your advice on the matter would be greatly appreciated.

Kind regards

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