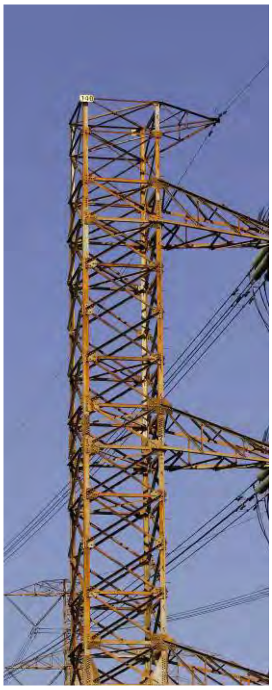
Draft Environmental and Social Impact Assessment

Project Number: 46915-014
October 2015

MON: Combined Heat and Power Plant Number 5 Project

Prepared by Mott MacDonald



CHP5 Environmental and Social Impact Assessment

Volume I: Non-Technical Summary

October 2015

CHP5 Consortium

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Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
A	October 2015	N Court	A Day	A Day	First draft
B	October 2015	L Jones	A Day	A Day	Draft for disclosure

Information class: Standard

Contents

1 Introduction

1.1 Overview

This Non-Technical Summary (NTS) presents the main findings and conclusions of the Environmental and Social Impact Assessment (ESIA) undertaken for the proposed lignite fired combined heat and power (CHP) plant, known as the CHP5 Project (hereinafter referred to as “the Project”). The Project will be located approximately 16 kilometres (km) south east of Ulaanbaatar, Mongolia and will be developed by ENGIE, Sojitz, Posco Energy and Newcom (together referred to as the “**Consortium**”). Figure 1.1 shows the location of the Project in Mongolia.

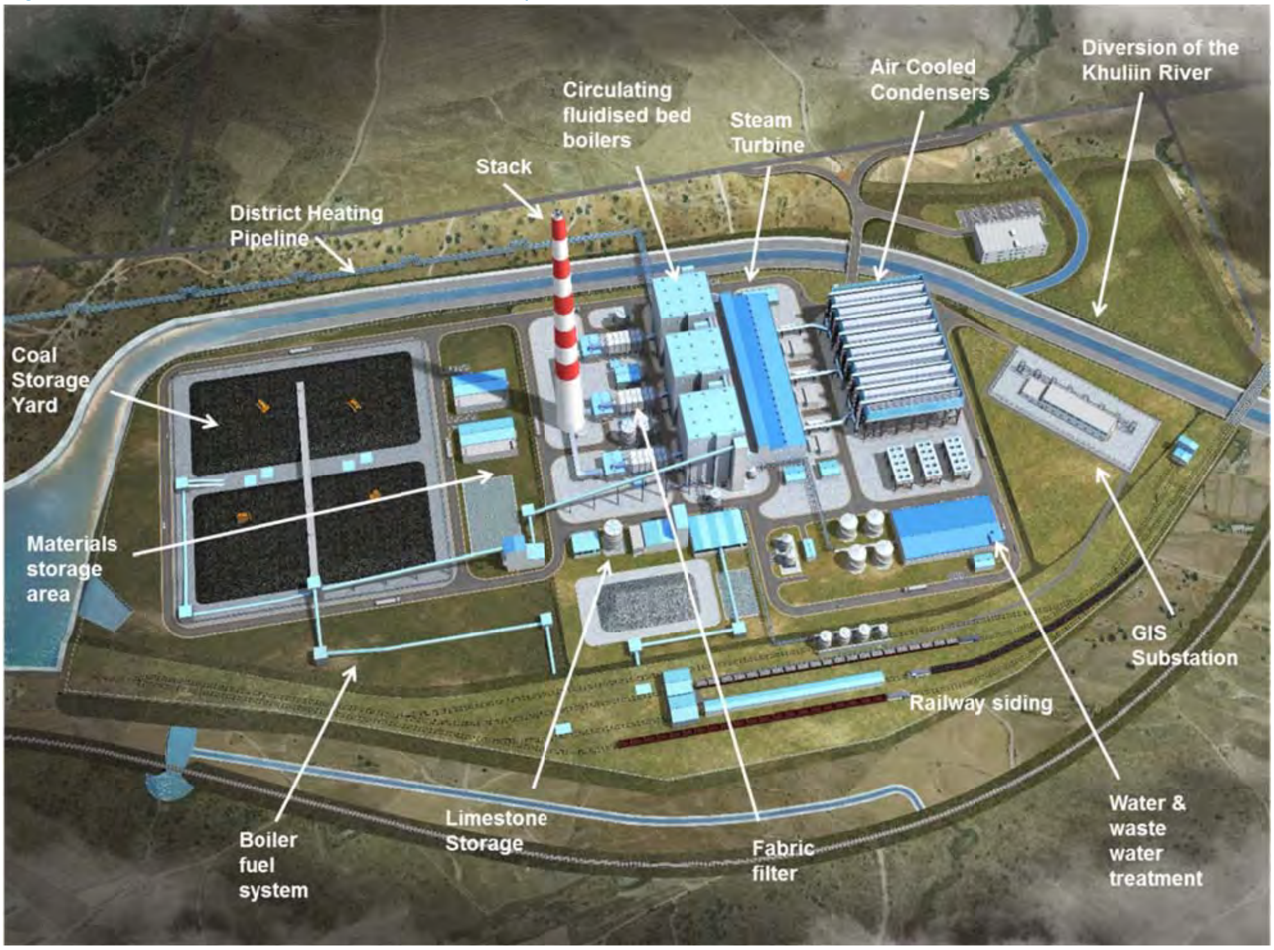
Figure 1.1: Location of Project in Mongolia

Source: Mott MacDonald

The Consortium plans to develop the lignite fired power plant which will generate 463.5 Megawatts (MW) gross of electricity and 587MW of thermal energy for district heating. The Government of Mongolia has identified that a new power plant is required to meet increasing heating and electricity demands and to address the ageing existing heat and power generation facilities in Ulaanbaatar. Construction and commissioning of the Project is expected to take approximately 57 months in total and will be designed in accordance with good international industry practice (GIIP).

A conceptual visual representation of the Project and its layout is shown in Figure 1.2.

Figure 1.2: Overview of main Power Plant Components



The Consortium has commissioned Mott MacDonald Ltd to act as the international environmental consultant to conduct an international ESIA and associated Environmental and Social Management and Monitoring Plan (ESMMP) of the Project to support obtaining international finance for the Project. This international ESIA has been undertaken in parallel with the national Detailed Environmental Impact Assessment (DEIA) which is required by Mongolian legislation. To undertake the DEIA to meet Mongolian national requirements the Consortium has commissioned Nature Friendly LLC.

It is expected that the Project will seek finance from International Financial Institutions, as well as a syndicate of commercial banks. To address the potential environmental and social requirements of a range of potential banks that may wish to finance this Project, this ESIA has been undertaken in line with the following international standards:

- Asian Development Bank's Safeguard Policy Statement (ADB SPS) (2009)

- International Finance Corporation Performance Standards (2012) and relevant Environmental Health and Safety Guidelines
- The European Bank of Reconstruction and Development (EBRD) Environmental and Social Policy and related Performance Requirements (2008)
- The Equator Principles (2013)

The ESIA is comprised of four volumes as follows:
- **Volume I: Non-Technical Summary (this volume)**
- Volume II: Environmental and Social Impact Assessment
- Volume III: Technical Appendices
- Volume IV: Environmental & Social Management and Monitoring Plan

1.2 Who is the Project Developer?

The Consortium, comprising of ENGIE, Sojitz, Posco and Newcom have been appointed by the GoM to develop and operate all power generation assets.
1. **ENGIE** is a global energy player and an expert operator in the three key sectors of electricity, natural gas and energy services.
2. **Posco Energy** is the energy business arm of Posco Group. It is the first and largest Independent Power Producer (IPP) in Korea and operates in the fields of power generation, fuel cell and renewable energy in the domestic market.
3. **Sojitz** is a major investment and trading firm in Japan and its business activities are wide-ranging, covering amongst other things machinery, power, energy and mineral resources, chemicals and plastics.
4. **Newcom Group** is a private investment company with a diverse portfolio of investments across telecommunications, information technology, financial services, energy, real estate and mining services.

1.3 Where can I find more information about the Project?

The ESIA will be available for the purpose of ongoing disclosure to Project affected communities and other interested stakeholders. Copies of the draft ESIA report are disclosed in printed format and made available on the Project and ADB websites which can be viewed at: www.chp5.mn and http://www.adb.org/projects.

The ESIA scoping consultation activities took place in August 2015 when four public consultation and disclosure meetings were held with residents of the directly affected sub-districts. The objectives of these activities were to:
- Disclose information the proposed development of the Project
- Engage key stakeholders by introducing the ESIA process
- Identify additional key stakeholders
- Identify concerns and opportunities to be addressed during the ESIA process

Consultation activities were undertaken with a number of stakeholders, including:

- Governor of Khoroo 11
- NGO representatives
- Directly affected residents of the 11th Khoroo
- Residents of the 10th & 23rd Khoroo (interested parties)

This NTS will be translated into Mongolian by the Consortium and hard copies will be disclosed in the local communities to enable local stakeholders to raise comments and concerns before finalisation of the ESIA. Public consultations during which the ESIA will be discussed will be organised in October 2015.

Further questions and comments on the Project can be addressed to:

Table 1.1: Community Liaison Officer's contact details

Project Proponent	Information
Name of Company	CHP5
Address	10F, Naiman Zovkhis Building 21 Seoul Street Ulaanbaatar 14251, Mongolia
Telephone	976-75555151
E-mail	contact@chp5.mn
Website	www.chp5.mn

2 The Project

2.1 Why is the Project needed?

Coal-fired power plants provide the majority of power generation for Mongolia with a total installed capacity of 836.3MW; however, the actual available power capacity is only 615MW. Due to the growing heating and electricity demands from Ulaanbaatar and aging existing heat and power generation facilities, there is an urgent need for the construction of a new district heating and power supply infrastructure to address the growing vulnerability of heat and power supplies in Ulaanbaatar.

As a result of economic development and an influx in population from rural areas, heating and electricity demands have increased every year by approximately 6% and 5% respectively and is expected to continue rising by 4-5% annually until 2020. Reliable heat supply and electricity is a prerequisite to sustain and increase economic development in Mongolia and its capital city Ulaanbaatar.

2.2 What and where is the Project?

The Project will be capable of generating 463.5 Megawatts (MW) gross of electricity in condensing mode through 3 x 154.5MWe generation units or 587MW of thermal energy for district heating and 426MWe gross of electricity whilst operating in combined heat and power mode. The key items of plant at the site include:

- Coal storage yard, coal conveyor and coal wagon defrosting facility
- Three 154.5MW generation units
- Emergency diesel generator
- Air cooled condenser system (to cool the condensate from the steam turbine)
- Stack (or chimney) and emissions abatement
- One 170m stack
- Ash handling system
- Ash disposal facility (off-site)
- Segregated waste management and chemical storage areas
- Waste water treatment facility
- Electricity sub-station which will be built by the GoM
- Temporary facilities

The Project will also require the development of associated facilities, which are items of infrastructure that are required to enable or support the Project, but do not form part of the Project responsibilities of the Consortium, with other agencies responsible for their development. The associated facilities are their developers are presented in Table 2.1

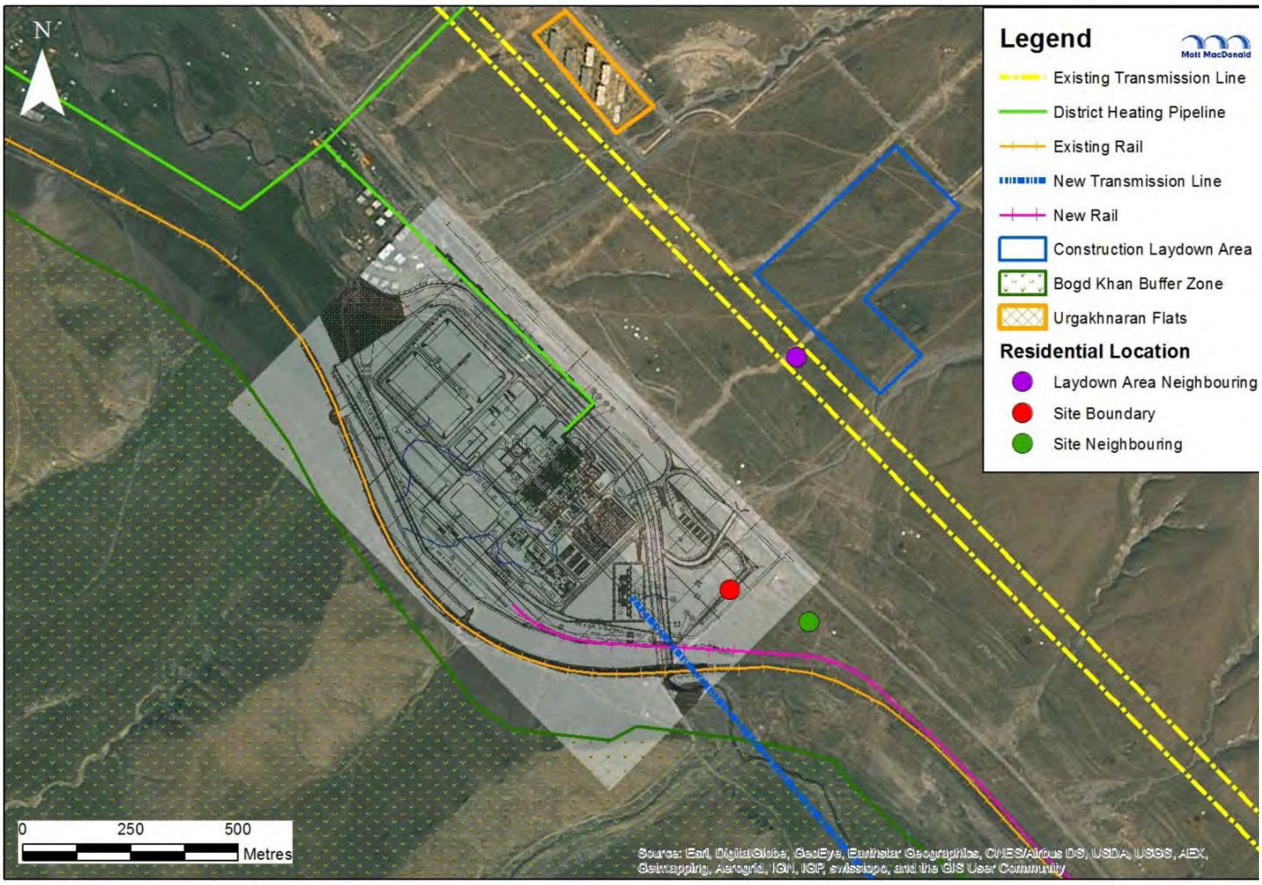
Table 2.1: Associated facilities and their developers

Associated Facility	Developed by
A 220kV transmission line which will connect the Project to the Central Energy System network	Ministry of Energy
District heating pipeline which will connect the Project to Ulaanbaatar's existing district heating network	Ministry of Energy
Additional railway lines/sidings which will connect the CHP5 site from the southeast	Ulaanbaatar Railways

Associated Facility	Developed by
Raw water supply pipeline for use as make-up water in the power plant, as well as for potable use	Water Supply and Sewerage Authority of Ulaanbaatar City (USUG)
Wastewater discharge pipeline to connect discharge wastewater from the plant to the USUG sewerage piping system	USUG
Electricity substation to export the electricity generated at the Plant	Ministry of Energy

The proposed Project site is located within the Khuliin Valley between the paved road that connects Ulaanbaatar with Nalaikh and the existing main railway from Ulaanbaatar to China. The Khuliin Valley is a tributary of the Tuul River and the site is approximately 3km from the Tuul River's southern bank at the confluence with the Khuliin tributary. The location is approximately 16km south-east of Ulaanbaatar and is within the tectonic fractured zone of valley between Bogd Khan and Bayanzurkh mountains (refer to Figure 2.1).

Figure 2.1: CHP5 Project Location



Source: Mott MacDonald

The site is approximately 45 hectares (ha) in area and is located in a currently un-industrialised area with some existing permanent and seasonal residential developments. Although the site itself is located in the valley with a relatively flat valley bed, the study area is characterised by the mountainous landscape. Two mountain ranges run parallel to the valley - Bogd Khan and Bayanzurkh mountains - which curve to the north-west towards Ulaanbaatar and its extensive residential areas. Settlements, although less dense than in the city, spread almost to the site boundary, mainly along the north side. A ger community is located at the sites south-east corner, between the existing highway and the railway line.

The vegetation in the immediate surroundings of the site is sparse, with limited number of trees, mostly located along the river; however, the Project is located adjacent to the Bogd Khan National Park, a sacred site with natural and cultural significance. Photo 2.1 and Photo 2.2 show the landscape of the Project area.

Photo 2.1: Cattle grazing on the Project site

Source: Mott MacDonald

Photo 2.2: Landscape surrounding the Project

Source: Mott MacDonald

2.3 When will the Project happen?

Table 2.2 presents the main development timescales that are currently envisaged for the Project. At the time of writing, construction is due to commence in the first quarter of 2016.

Table 2.2: Project programme

Activity	Status
Feasibility study	Complete
DEIA	Underway (completion Q4 2015)
ESIA	Disclosure October 2015 Final Disclosure Q1 2016
Construction duration (4.5 years)	Q1 2016
Operation duration (25 years)	2020

2.4 How were the Project site and technology selected?

A number of potential site alternatives for the Project have been evaluated through various feasibility studies undertaken on behalf of the Government of Mongolia during the conceptual study of the Project:

1. A new combined heat and power plant to be built in Uliastai Valley on the eastern outskirts of Ulaanbaatar
2. A new condensing power plant to be constructed at the Baganuur coal mine to produce electricity only, while new heat only boilers are installed in Ulaanbaatar for heat supply
3. A new combined heat and power plant built at the existing CHP3 site, utilising most of the existing infrastructure

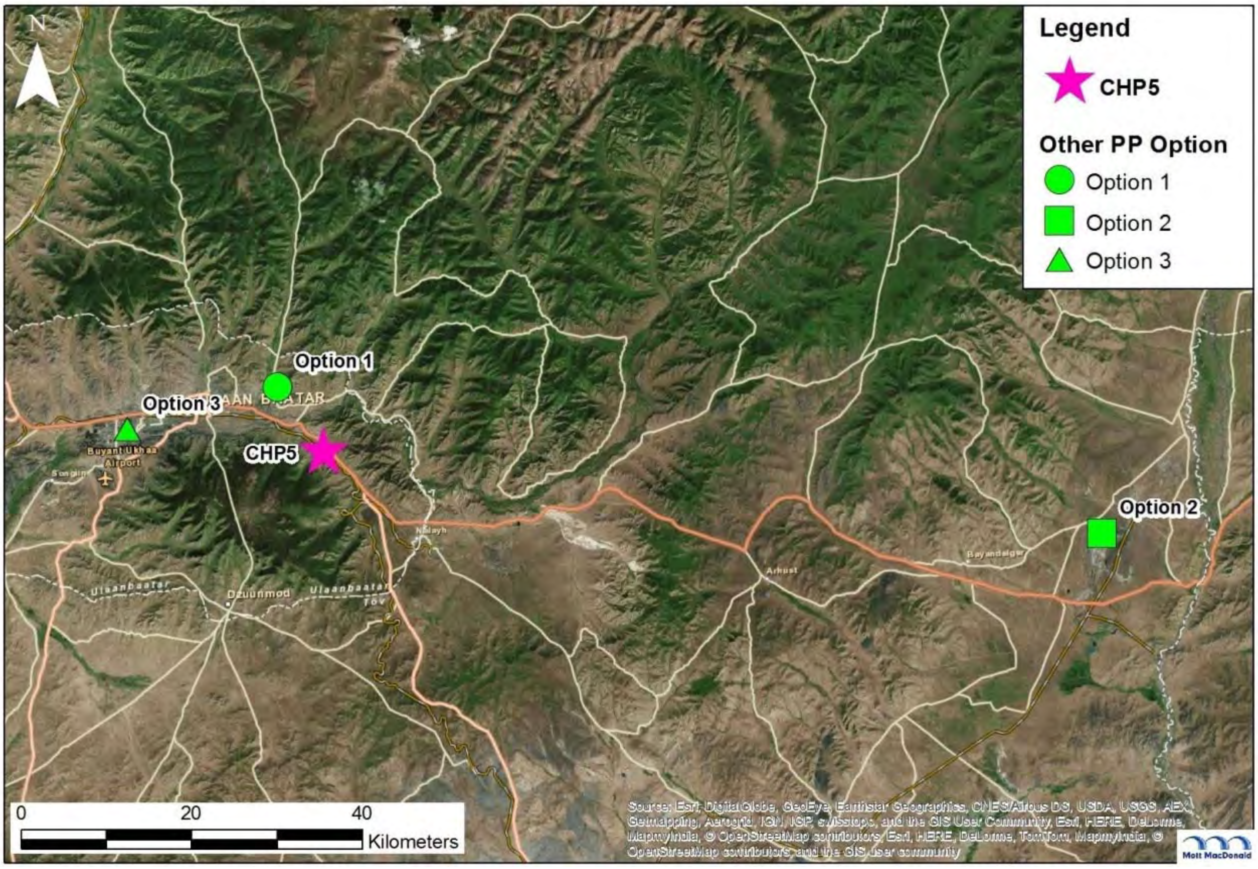
Option three was initially the chosen option for the CHP5 project. However, the Ministry of Energy (MoE) determined that this site was not suitable and an alternative site was subsequently selected:

4. A new combined heat and power plant to be built on a greenfield site approximately 20 kilometres south-east of Ulaanbaatar in the Khuliin Valley.

The benefits of this selection are that it is located in the outskirts of the city, which means there are fewer sensitive receptors in comparison with central Ulaanbaatar, and that it is in close proximity to existing rail transport links.

Figure 2.2 presents the site alternatives in relation to the selected Project site.

Figure 2.2: Alternative site locations



Source: Mott MacDonald

Exploiting the benefits of renewable technology for Mongolia has some attractions in terms of improving the diversification of supply; however, the relative intermittence of renewable energy generation, the very critical need of constant heat supply to Ulaanbaatar during the winter, combined with size of plant required for equivalent supply, when compared to fossil fuel generation, is an important factor to be considered. Therefore a combined heat and power plant was considered to be the most appropriate technology for the following reasons

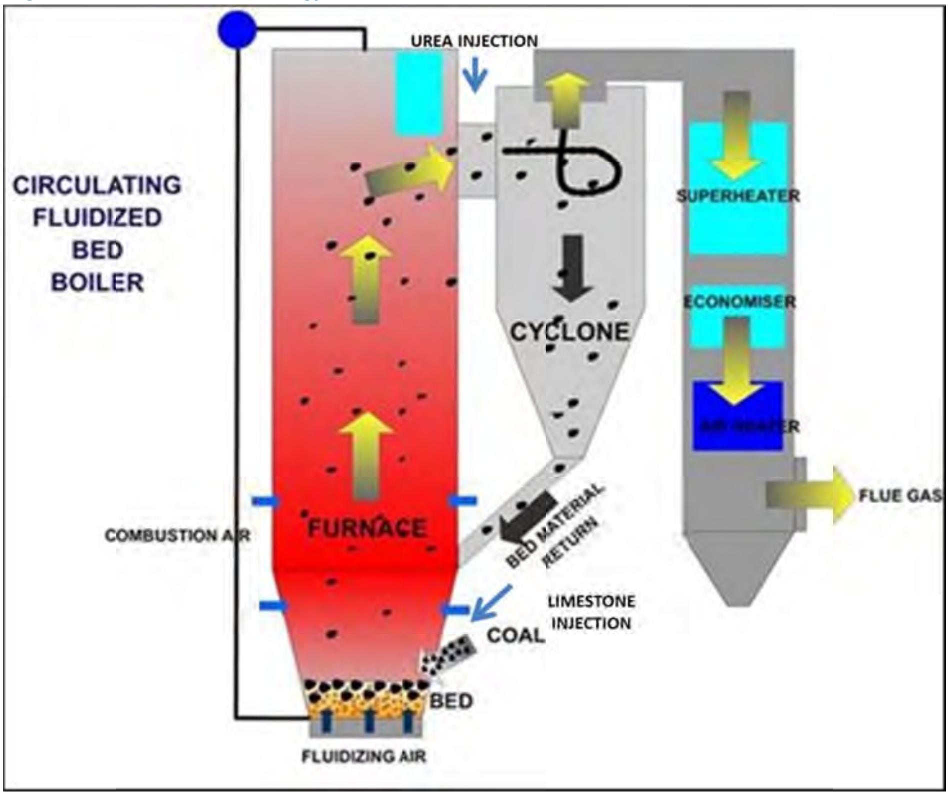
- Well established and understood technology with several large plants operating in Mongolia
- Range of potential national providers for coal/lignite increasing security of supply
- Cogeneration plant produces electricity, hot water for district heating and process steam for industry; heating is especially important for Mongolia because of the extremely cold winters and the heating demand.

The choice of technology used at the facility was based on economic, technical, environmental and local considerations such as the availability of fuels, the operational requirements, market conditions and network requirements. The Project was reviewed against the European Commission's Best Available

Technique (BAT) Reference (BREF) Notes for Large Combustion Plants (LCP) 2006, which is a guidance document used as a basis for setting BAT for a site. The selected combustion technology is a circulating fluidised bed (refer to Figure 2.3) boiler with the following systems:

- Pulse-jet fabric filters to reduce particulate emissions
- The addition of limestone to reduce Sulphur Oxide emissions
- Selective non-catalytic reduction with urea injection to control Nitrogen Oxide emissions
- An air cooled condenser to provide cooling in the absence of a suitable water supply.

Figure 2.3: CFB Technology



Source: Mott MacDonald

As shown in Figure 2.3, the circulating fluidised bed technology proposed uses a cyclone unit in which hot flue gases and solid particles are separated. The larger solid particles that have not been fully combusted in the furnace will be returned to the furnace to undergo the combustion process again. This allows for a higher combustion efficiency of the fuel. Additional benefits of using circulating fluidised bed technology boiler technology are as follows:

- Low levels of nitrogen oxides (NO_x) as a result of the low combustion temperatures.
- Low sulphur dioxide (SO_2) emissions – through the use of limestone and low combustion temperatures.
- Use of low grade coals.
- Fuel flexibility – a wide range of fuel characteristics can be used in a single boiler.

3 Managing Environmental and Social Issues

3.1 What are the Project activities that could affect the environment and people?

It is recognised that a project of this scale and duration has the potential to impact the environment and the community, both in a beneficial and adverse way. The activities that could cause the most important effects include:

- Direct impacts on air quality from the power plant's emissions to air
- Noise and vibration impacts on nearby sensitive receptors
- Contamination of environments due to leakage and spillage of wastes
- Impacts on landscape features
- Impacts on soil related to the modification of the local topography (excavation and spoil disposal)
- Direct and indirect impacts on ecology
- Social impacts associated with:
  - Physical and economic displacement
  - Employment generation
  - Provision of electricity and heating
  - Workers well-being
  - Community health, safety and well-being

3.2 How was the Project assessed?

A thorough appraisal has been undertaken for potential impacts arising from the development of the Project, including the above issues. The appraisal has included an Environmental Impact Assessment and Social Impact Assessment (collectively presented as an ESIA). The assessment included:

- Establishment of the baseline to understand current conditions at and around the proposed Project site
- Prediction of impacts
- Identification of mitigation measures to be included in the design, procedures, development and management of the Project.

The appraisal process was supported by local consultation undertaken to ensure that the Consortium understands and incorporates the concerns of local people from the surrounding villages into the process.

The significance of an impact is described based on a combination of the sensitivity of project affected persons / environmental receptor and the magnitude of impacts. Where the ESIA found that the Project could cause moderate to major significant impacts, then mitigation measures have been developed to avoid, reduce or otherwise mitigate the effects and reduce their significance.

A summary of the key findings and the main mitigation measures identified for the social and environmental impact is set out in this section. The ESIA presents the impacts of the Project in the following chapters:

- Air Quality
- Noise and Vibration
- Hydrology, Hydrogeology and Flood Risk
- Greenhouse Gases

- Biodiversity and Ecology
- Ground Conditions
- Traffic and Transport
- Landscape and Visual
- Waste and Materials Management
- Archaeology and Cultural Heritage
- Social Impact Assessment

3.3 How will people and the environment be affected?

Whilst environmental and social issues interact, the findings of the ESIA broadly cover the following themes:

- Effects on people
- Effects on the natural environment and resources

3.3.1 Effects on people

A major effect on people is the change in use of land resulting in physical resettlement and economic displacement of the households that live on or near the Project site. A Resettlement Plan (RP) will be produced for the Project which identifies all of the assets and people affected and sets out the approach to compensating those affected individuals; both in terms of their homes and their livelihoods. The objective of the RP is that no people will suffer economic loss or be provided with housing that is less than they have now.

The Project is expected to require 3,100 workers at the peak of the construction phase, with approximately 20% of these workers sourced from the local labour market. The generation of employment is a beneficial impact of the Project; this provides opportunities for local people to access jobs and to undertake training to develop new skills.

The construction activities will generate traffic, noise, dust and emissions, and waste. There will be a large increase in the number of vehicles (including heavy goods vehicles or HGV's) using particular routes to transport soil/rock, concrete and steel, and key power plant items. Therefore, measures to manage traffic and prevent accidents will be employed.

In addition to noise from traffic, construction activities such as site preparation, excavation and foundation development, and materials delivery can create a nuisance. This potential nuisance can be reduced through avoiding traffic routing through community areas where possible and undertaking construction activities in accordance with best practice, including the use of acoustic screening (e.g. earth bund or hoarding) along sensitive parts of the site boundary and programming of construction noisy works to daytime periods only. Impacts from dust and emissions will be managed by techniques including dust suppression by dampening, speed limits for trucks and vegetating surfaces of stockpiled soil/rock.

During construction and operation there will be an impact on the landscape features, visual amenity of the area and on the setting of the Bogd Khan Mountain predicted from the creation of new CHP5 related infrastructure. Where possible, landscaping will therefore be used around the site to include native tree species to soften the effect of the new infrastructure.

During operation, the main impacts on air quality as a result of stack emissions will be located away from Ulaanbaatar and either to the south east of the Project or over areas of high ground. The plant has been designed to emit very low concentrations of pollution, which are much lower than the existing CHP plants in Ulaanbaatar; however, emissions from the stack will also be continuously monitored to make sure they remain below the low levels included in the Project design.

There is a potential for the emission of coal dust generated from the coal storage yard and coal handling facilities and conveyors. A number of measures to minimise dust have been included in the design of the plant, for example coal will be transported from the rail wagons to the coal storage yard via an enclosed system, a telescopic chute will be used at coal yard to assure delivered coal falls with lower impact which reduce dust generation and a dust suppression system will be utilised using recycled water. Additional best practice techniques will also be used to mitigate potential impacts, including the use of fences and profiling of coal to reduce wind-blown dust and machinery to compact coal yard.

The operation of the Project will also have a number of positive impacts. The Project will increase the supply of heat and electricity for Mongolia, which will provide essential social services for the region and contribution to economic development and health benefits from reduced household stove usage. In addition, the diversion of the Khuliin River will indirectly have a positive impact on downstream communities through the implementation of a flood warning system.

3.3.2 Effects on the natural environment and resources

The Project is expected to generate some adverse impacts on the local natural environment. In particular, the natural floodplain and river shape/structure will be fundamentally altered through the site area. The required flood mitigation measures to protect the site are significant and alter the natural drainage patterns and there is a risk of flash flooding during both construction and operation. Mitigation measures have been designed to an appropriate flood return period but there remains a residual risk if a larger flood event occurred.

There will be large volumes of spoil generated from the excavation works during construction. The spoil material that cannot be reused in construction activity will be distributed to a spoil disposal site, the location of which is yet to be determined. The location of the site will be selected in accordance with national legislation and international guidelines.

Water consumption during operation is considered to be low for a Project of this nature. The plant has been designed to use air cooled condensers, which use significantly less water than other power plant cooling options. In addition, water conservation and water recycling measures (including use of stormwater) will be used as much as possible to reduce water consumption. Waste water will not be discharged to the Khuliin River and process areas, including the coal yard, will be suitably lined and maintained to minimise the risk of groundwater contamination, as the Khuliin Valley is upstream of some of the drinking water sources for Ulaanbaatar.

Running at full CHP mode and based on the full capacity for 8,000 hours / year the plant will emit approximately 4 million tonnes of carbon dioxide equivalent (tCO_{2e}). These emissions mainly arise from the burning coal to produce heat and electricity. The Project could represent between 10 and 15% of total emissions in Mongolia, while at the same time providing a substantial amount of heat and power; however, the CHP technology used on this Project is key to reducing GHG emissions (principally CO_2) in Mongolia over time.

3.4 Cumulative impacts with other projects and trans-boundary impacts

Cumulative impacts are those impacts that may result from the combination of past, present or future actions of existing or planned activities in a project's area of influence. While a single activity may not itself result in a significant impact, it may, when combined with other impacts in the same geographical area and occurring at the same time, result in a cumulative impact that is significant.

The developments which have been identified as being likely to contribute to cumulative impacts have been identified in Table 3.1.

Table 3.1: Review of planned developments in Ulaanbaatar and the surrounding area

Development	Location	Estimated Schedule	Features
The New Ulaanbaatar International Airport (NUBIA)	Located in the Khushigiin Khundii valley, Sergelen sum, Tuv province, approximately 50km southwest of Ulaanbaatar	2012 - 2016	• The main components of construction include a three-storey passenger terminal building covering an area of 37,000m2, an Air Traffic Control (ATC) tower, an operations building • The development will also include a 28MW heating plant, and a 3,600m long and 45m wide concrete based runway • The runway construction will involve the transfer of about three million cubic metres of earth
Amgalan Heat only Boiler (HOB)	Approximately 10km north of the CHP5 site	Operational late 2015	• Height of Chimney – 120 metres • Height of the boiler – About 40-41 metres • Number of boilers - 3 x 116MW
Associated Facilities			•
Transmission line	From Songino substation to CHP5. The transmission line is 85km long, routed around the southern side of Bogd Khan National Park. The route of the transmission line will be outside of the protected area of Bogd Khan.	2016 – 2019	• Steel lattice structures • 220kV high voltage transmission line
District heating	From the Project site to central and	2016-2019	• Over ground pipeline with diameter of 1,000

Development	Location	Estimated Schedule	Features
pipeline	eastern areas of Ulaanbaatar The route of the district heating pipeline will be outside of the protected area of Bogd Khan.		– 1,200 mm
Railway spurs and stabling:	From the existing railway line that runs to the south of the site The route of the railway spur will be outside of the protected area of Bogd Khan.	2016-2019	• New rail spurs and stablings • Rerouting of the existing rail line
Raw water supply pipeline and wastewater discharge pipeline	Detailed routes of the pipelines are yet to be determined.	2017-2018	Details yet to be determined
Electricity substation located at project site	Within south-eastern corner of the Project site	2017-2019	220kV gas insulated switchgear (GIS) Approximately 0.5ha (including a GIS building of 15 x 50m)

Assessments have been undertaken at a high level in the context of broad development parameters sufficient to provide an understanding of the likely environmental and social impacts of future developments in combination with the development of this Project.

No significant cumulative impacts are expected with the New Ulaanbaatar International Airport or Amgalan HOB; however, it is considered that there might be significant adverse cumulative impacts associated with the construction of the associated facilities. Development of these facilities will be undertaken throughout the construction period of the Project and there might be major adverse impacts to the road network, including noise nuisance, congestion and delays. The associated facilities will need to be assessed in accordance with national legislation and applicable international standards and guidelines. Management of these impacts will be the responsibility of the developer in collaboration with the Consortium.

Any additional future developments will be required to follow the national EIA process and be required to obtain the relevant approvals. In addition, if any future developments seek international funding the project would be required to undertaken an ESIA in accordance with the applicable international guidelines.

Transboundary effects mean serious effects within the jurisdiction of a Party as a result of an industrial accident occurring within the jurisdiction of another Party.[1] The Project will not have any effects on other countries; its effects are on a local / regional scale. Transboundary effects have therefore not been considered as part of this ESIA.

[1] The Convention of Transboundary Effects of Industrial Accidents (1992)

3.5 How will the Consortium manage environmental and social impacts?

The Consortium has developed an ESMMP that draws upon the management and mitigation measures which have been defined in the ESIA. The ESMMP is presented as Volume III of the ESIA documentation. The primary objective of an ESMMP is to safeguard the environment, site staff and the local population from Project activities that may cause harm or nuisance. The ESMMP is the basis of the environmental and social protection measures to be implemented by the Consortium and its contractors.

Responsibilities for implementation are outlined in the ESMMP and fall to either the Consortium or the various contractors. The implementation of the ESMMP ensures Environment Health and Safety performance is in accordance with international standards and best practice.

Moving into the operational phase, the Consortium will develop an environmental and social management system, to cover all Project components, in line with international standards such as International Organisation for Standardization's ISO 14001. This will ensure best practice with regards to environmental and social management are imbedded into the operational philosophy of the Project.

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A	26 October 2015	Various	L Jones	A Day	Draft for Disclosure
B	27 October 2015	Various	L Jones	A Day	Draft for Disclosure (updates to consultation chapter)
C	29 October 2015	Various	L Jones	M. O'Brien	Draft for Disclosure (updates to air quality chapter)

Contents

Acronyms and Abbreviations

Acronym and Abbreviation	Description
ACC	Air Cooled Condensers
ADB	Asian Development Bank
ADMS	Atmospheric Dispersion Modelling System
AIS	Alien Invasive Species
AoI	Area of Influence
AQMP	Air Quality Management Plan
ATC	Air Traffic Control
BAT	Best Available Technique
BOP	Balance of Plant
CBD	Convention on Biological Diversity
CCS	Carbon Capture and Storage
CCW	Coal Combustion Waste
CEMS	Continuous Emission Monitoring System
CEMP	Construction Environmental Management Plan
CES	Central Energy System
CFB	Circulating Fluidized Bed
CHP	Combined Heat and Power
CITES	Convention on Trade in Endangered Species of Fauna and Flora
CMS	Conservation of Migratory Species
CO	Carbon Monoxide
CPI	Corrugated Plate Interceptor
CSR	Corporate Social Responsibility
CTMP	Construction Traffic Management Plan
DEIA	Detailed Environmental Impact Assessment
DEMP	Decommissioning Environmental Management Plan
DMAP	Dust Monitoring Action Plan
DWTS	Demineralized Water Treatment System
EBRD	European Bank for Reconstruction and Development
EHS	Environmental Health and Safety
EMS	Environmental Management System
EPC	Engineering, Procurement and Construction
EPE	European Principles for the Environment
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management and Monitoring Plan
ESP	Environmental and Social Policy
EqPs	Equator Principles
EU	European Union
EWC	European Waste Catalogue
FRA	Floor Risk Assessment
GDP	Gross Domestic Product
GHG	Greenhouse Gases

Acronym and Abbreviation	Description
GIIP	Good International Industry Practice
GIS	Gas Insulated Switchgear
GoM	Government of Mongolia
GRC	Grievance Redress Committee
ha	Hectare
HEC-RAS	Hydrologic Engineering Centers River Analysis System
HES	Health and Safety and Environment
HGV	Heavy Goods Vehicle
HOB	Heat Only Boiler
IBA	Important Bird Areas
IFC	International Finance Corporation
IFI	International Finance Institution
IUCN	International Union for Conservation of Nature and Natural Resources
JBIC	Japanese Bank for International Cooperation
JICA	Japan International Cooperation Agency
KBA	Key Biodiversity Areas
km	Kilometres
kV	Kilovolt
LFO	Light Fuel Oil
MAS	Mongolia Academy of Science
MASIA	Mongolian Academy of Sciences Institute of Archaeology
MEGD	Ministry of Environment and Green Development
MLD	Million Litres per Day
MSDS	Material Safety Data Sheet
MSK	Medvedev-Sponheuer--Karnik
MW	Megawatt
NAMEM	National Agency for Meteorology and Environment Monitoring of Mongolia
NBCAP	National Biodiversity Conservation Action Plan
NDCT	Natural draft cooling tower
NFPA	National Fire Protection Association
NUBIA	New Ulaanbaatar International Airport
NVCP	Noise and Vibration Control Plan
OHS	Occupational Health and Safety
OSAC	US Overseas Security Advisory Council
PAH	Polycyclic Aromatic Hydrocarbon
PGA	Peak Ground Acceleration
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PR	Performance Requirement
PS	Performance Standard
RCAG	Research Centre of Astronomy and Geophysics

Acronym and Abbreviation	Description
SCS	Soil Conservation Service
SIAM	Sediment Impact Assessment Model
SNCR	Selective Non Catalytic Reactor
SOP	Standard Operating Procedure
SPA	Special Protected Area
SPS	Safeguard Policy Statement
SPZ	Special Protection Zones
SWM	Solid Waste Management
SWMP	Site Waste Management Plan
TMP	Traffic Management Plan
UB	Ulaanbaatar
USEPA	United States Environmental Protection Agency
USUG	Sewerage Authority of Ulaanbaatar City
WB	World Bank
WEEE	Waste Electronics and Electrical Equipment
WHO	World Health Organization
WHS	World Heritage Sites
WRA	Water Resources Assessment
WSA	Water Supply Agreement
WWF	World Wildlife Fund
WWTP	Wastewater Treatment Plant

1 Introduction

1.1 Overview

As a result of increasing heating and electricity demands and the ageing existing heat and power generation facilities in Ulaanbaatar, the Government of Mongolia (GoM) has recognised that a new power plant is required to address the vulnerability of heat and power supply in the city. Accordingly, ENGIE, Sojitz, Posco Energy and Newcom (together the "**Consortium**") have been appointed by the GoM to develop a 450MW electricity and 587MW thermal power lignite fired combined heat & power (CHP) plant, known as the CHP5 Project, (hereafter referred to as the '**Project'**). The Project will generate enough electricity to power over 400,000 homes and provide enough heat for nearly 80,000 households in Ulaanbaatar.

A 45 hectare (ha) greenfield site, which is located approximately 16 kilometres (km) south east of Ulaanbaatar city in the Khuliin River Valley, between the paved road that connects Ulaanbaatar with Nalaikh and the main trans Mongolian railway line, has been selected for the Project by the GoM.

The Consortium has commissioned Mott MacDonald Limited to act as the international environmental consultant to conduct an international Environmental and Social Impact Assessment (ESIA) and the associated Environmental and Social Management and Monitoring Plan (ESMMP) for the Project to support obtaining international finance for the Project. This ESIA has been undertaken in parallel with the national Detailed Environmental Impact Assessment (DEIA) which is required by Mongolian legislation. To undertake these national requirements the Consortium has commissioned Nature Friendly LLC.

1.2 Project Summary

The Project will consist of a lignite fired power plant will be capable of generating 463.5 Megawatts (MW) gross of electricity in condensing mode through 3 x 154.5MW_e generation units or 587MW of thermal energy for district heating and 426MW_e gross of electricity whilst operating in combined heat and power mode. The generation of energy in the form of electricity and thermal energy for district heating will be through three extraction turbines, with steam raised in three circulating fluidised bed (CFB) boilers. Electricity generated will be exported to the Mongolian electricity grid. Hot water for distribution to the district heating network shall be produced from the steam extracted from the turbines.

The GoM has selected a site at the existing Baganuur mine where an ash disposal facility will be established for the disposal of ash generated by the plant. The facility will be the responsibility of the Consortium. Ash will be transported from the plant to the ash disposal facility by rail.

The Project will also require the development of associated facilities, which are items of infrastructure that are required to enable or support the Project, but do not form part of the Project responsibilities of the Consortium, with other agencies responsible for their development. These include:

1. 220 kilovolt (kV) gas insulated substation (GIS) which will connect the Project and a 220kV transmission line to the Central Energy System (CES) network. The GIS substation will be located within the site boundary.
2. District heating pipeline which will connect the Project to Ulaanbaatar's existing district heating network

3. Additional railway lines/sidings and stabling area which will connect the CHP5 site from the southeast
4. Raw water supply pipeline for use as make-up water in the power plant, as well as for potable use
5. A sewage pipeline, connecting to the existing sewerage system.

A detailed project description and an overview of the site is provided in Chapter 2.

1.3 Financing of the Project

It is expected that the Project will seek finance from International Financial Institutions (IFIs), as well as a syndicate of commercial banks. To address the potential environmental and social requirements of a range of potential banks that may wish to finance this Project, this ESIA has been undertaken in line with the following international standards;

- Asian Development Bank Safeguard Policy Statement (ADB SPS) (2009)
- International Finance Corporation (IFC) Performance Standards (PS) (2012) and relevant Environmental Health and Safety(EHS) Guidelines
- European Bank of Reconstruction and Development (EBRD) Environmental and Social Policy (ESP) and related Performance Requirements (2014)
- The Equator Principles (EqPs) (2013)

1.4 Purpose of the ESIA report

The purpose of this ESIA, and the ESMMP which accompanies it, is to assess the Project's potential environmental and social impacts, in order to satisfy the principles of the international standards and guidelines identified in Section 1.3, and to define appropriate mitigation and management measures in accordance with international standards.

In accordance with international lending requirements identified above, the ESIA will present the findings of the environmental and social impact assessment of the project in compliance with all applicable regulations, legislation and guidance.

The objectives of this ESIA are to:

1. Identify and assess the potential environmental and social impacts that the Project may have on the environment and communities within its area of influence
2. To avoid, or where avoidance is not possible, minimise, mitigate or compensate for adverse impacts on the environment and communities
3. To ensure that the effected communities[1] are appropriately engaged on issues that could potentially affect them
4. To promote improved social and environmental performance through the effective use of management systems

[1] Reference to communities includes consideration of impacts on labourers

A scoping exercise has been conducted to define the terms of reference for this assessment and to identify the key environmental and social aspects and potential impacts relevant to the Project. Therefore the degree of appraisal required for each aspect will differ in accordance with potential significance of impact. While this ESIA aims to identify both positive and negative impacts associated with the development of the Project, it is inherently more focused on describing and mitigating potential negative impacts. However where possible, opportunities to enhance positive impacts have been identified. Further discussion relating to the ESIA methodology has been addressed in Chapter 5 of this ESIA.

1.5 Structure of the ESIA report

This ESIA is comprised of four volumes organised as presented in Table 1.1. This report comprises **Volume II** of the overall ESIA documentation.

Table 1.1: Structure of this ESIA

Volume No. (and contents)	Title
Volume I	**Non-Technical Summary**
Volume II	**Environmental & Social Impact Assessment**
Chapter 1	Introduction
Chapter 2	Project Description
Chapter 3	Project Need and Analysis of Alternatives
Chapter 4	Policy, Legislative and Institutional Context
Chapter 5	ESIA Methodology
Chapter 6	Information Disclosure, Consultation and Participation
Chapter 7	Air Quality
Chapter 8	Noise and Vibration
Chapter 9	Hydrology, Hydrogeology and Flood Risk
Chapter 10	Greenhouse Gases
Chapter 11	Biodiversity and Ecology
Chapter 12	Ground Conditions
Chapter 13	Traffic and Transport
Chapter 14	Landscape and Visual
Chapter 15	Archaeology and Cultural Heritage
Chapter 16	Waste and Materials Management
Chapter 17	Social Impact Assessment
Chapter 18	Assessment of Associated Facilities
Volume III	**Appendices and Supporting Documents**
Volume IV	**Environmental & Social Management and Monitoring Plan (ESMMP)**

Contact details for enquires on this ESIA are given below:

Project Proponent	Information
Name of Company	CHP5
Address	10F, Naiman Zovkhis Building 21 Seoul Street Ulaanbaatar 14251, Mongolia
Telephone	976-75555151
E-mail	contact@chp5.mn
Website	www.chp5.mn

2 Project Description

2.1 Overview

This chapter provides a description of the proposed Project and its associated facilities. The Project comprises a lignite fired CHP plant which can operate in two modes:

- Condensing mode (463.5MW of electricity through 3 x 154.5MW (gross) generation units)
- CHP mode (between 426MW_e gross and 587 MW_{th} depending on load)

The key components of the Project at the site include:

- Coal storage yard, coal conveyor and coal wagon defrosting facility
- Start-up boiler
- Three 154.5MW_e (minimum) generation units
- Emergency diesel generator
- One 170m stack
- Air cooled condenser (ACC) system
- Emissions abatement systems
- Waste water treatment facility
- On-site ash handling system
- Segregated waste management and chemical storage areas
- Temporary facilities during construction

The associated facilities for the Project will include:

- 220 kV GIS which will connect the Project and a 220kV transmission line to the CES network
- District heating pipeline which will connect the Project to Ulaanbaatar's existing district heating network
- Additional railway lines/sidings and stabling area which will connect to the Project site from the southeast
- Raw water supply pipeline for use as make-up water in the Project, as well as for potable use and a sewage pipeline, connecting to Ulaanbaatar's existing sewerage system.

Further detail on the associated facilities is included in Section 2.10.

2.2 Site Location

The Project site is located within the Khuliin Valley between the paved road that connects Ulaanbaatar with Nalaikh and the existing main railway from Ulaanbaatar to China. The Khuliin Valley River is a tributary of the Tuul River and the site is approximately 3km from the Tuul River's southern bank at the confluence with the Khuliin tributary. The Project site is located 50m from the limited zone, and 2km from the protected zone of the Bogd Khan National Park Special Protected Area.

The Project site is approximately 45 hectares (ha) in area and is located in a currently un-industrialised area with some existing residential developments. Land use in the vicinity of the Project site comprises:

- Bogd Khan National Park
- Low density residential developments
- Existing transmission lines

- Existing roads and railway line

The Project site is located within the tectonic fractured zone of valley between Bogd Khan and Bayanzurkh mountains. The ground surface is slightly inclined from southeast to the northwest. The ground surface elevation varies between 1,355m and 1,362m.

An overview of the Project site location in relation to Ulaanbaatar is illustrated in Figure 2.1, whilst Figure 2.2 shows the general layout of the Project in the context of proposed associated facilities and nearby residential areas.

Figure 2.1: Site Location

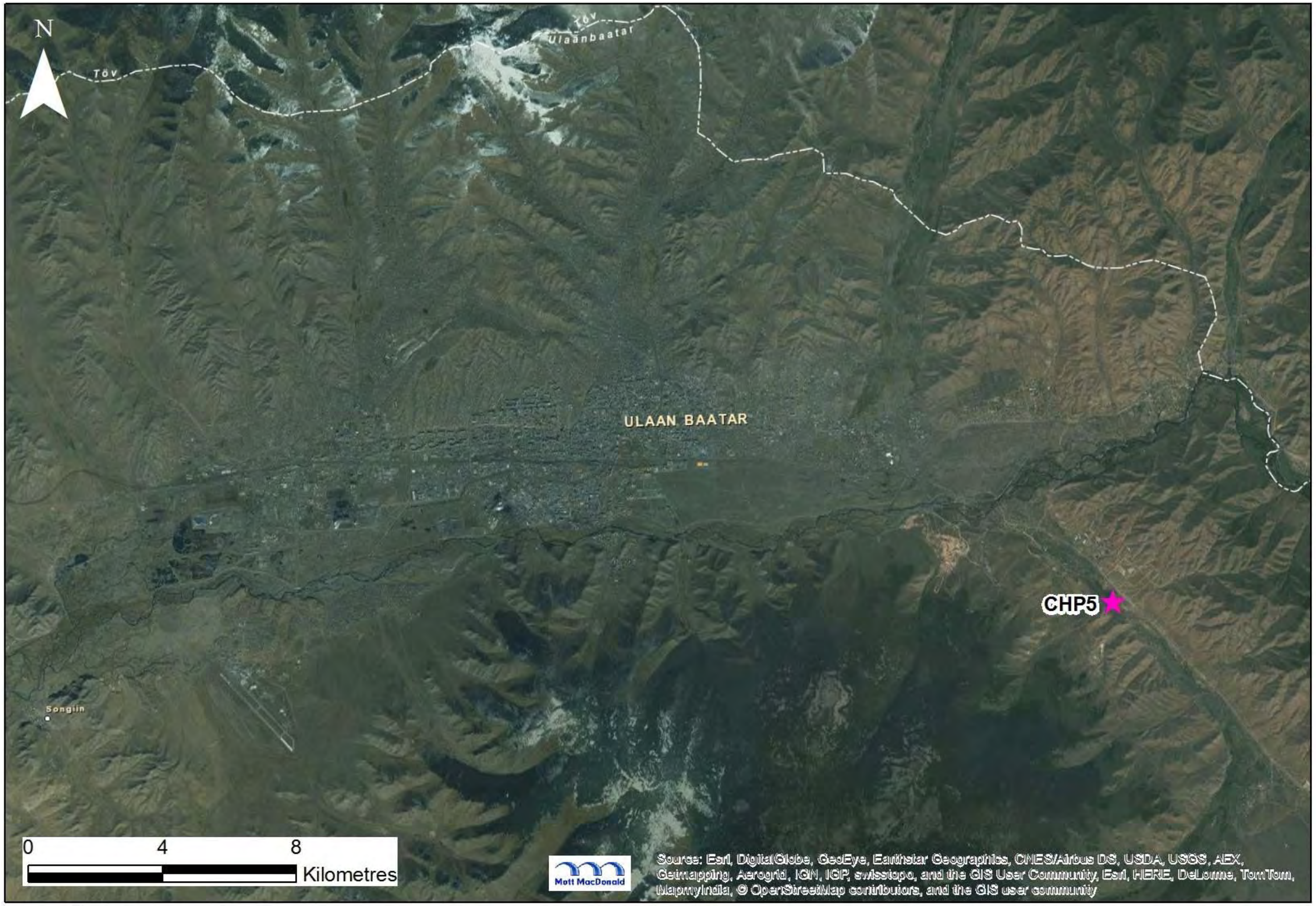
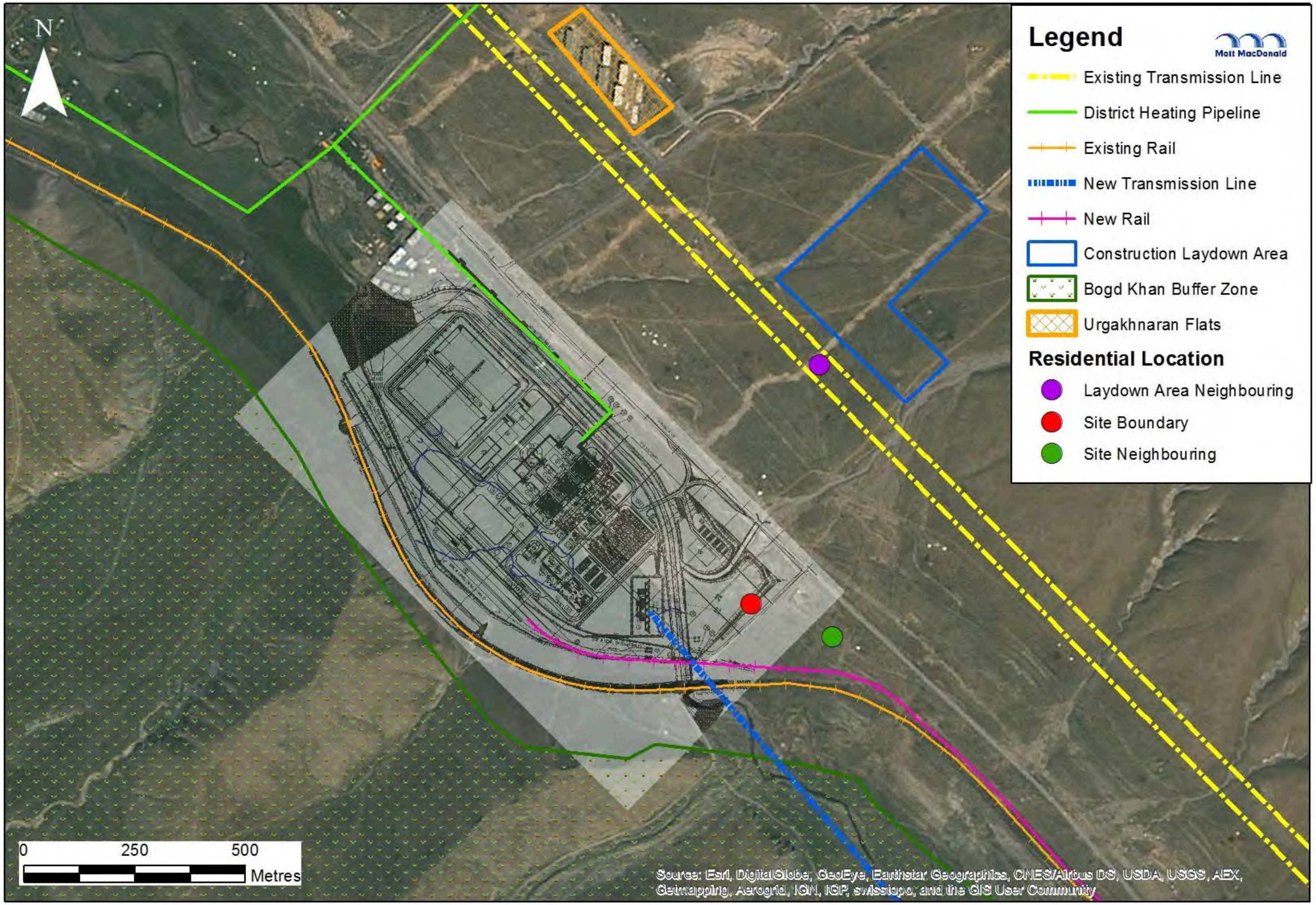


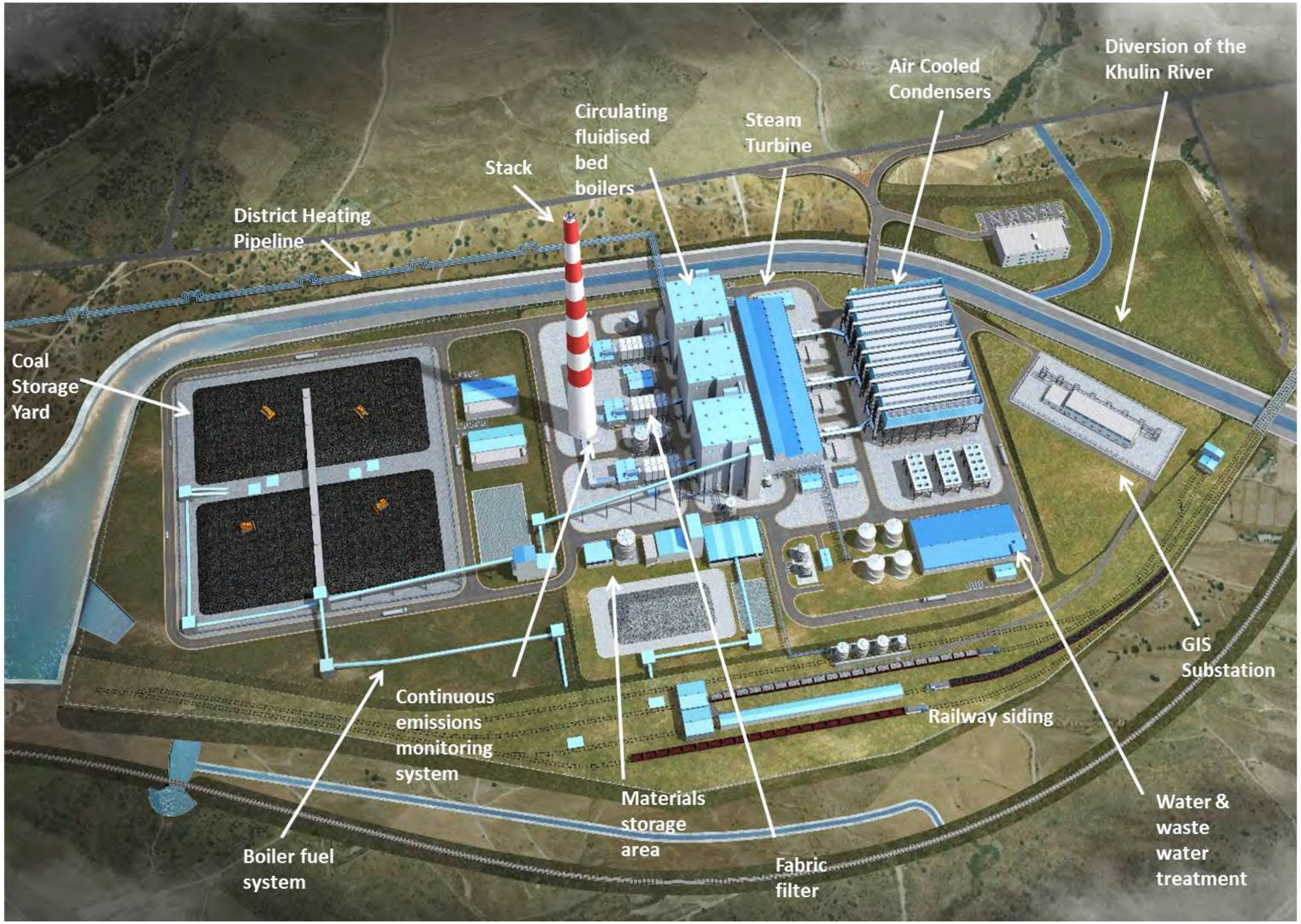
Figure 2.2: General Layout of the Project Site



2.3 Power plant components

Figure 2.3 shows the location of the main components of the Project which are discussed further in the sub-sections below.

Figure 2.3: Layout of main power plant components



Source: Consortium

2.3.1 Fuel

The Project will be fuelled by lignite coal with 30% of the required fuel expected to be sourced from the Baganuur coal mine and 70% expected from the Shivee-Ovoo coal mine (refer to Figure 2.4). It is estimated that the plant will have a coal consumption of 10,187 tonnes/day.

The following coal deliveries are anticipated during the operation of the Project:

- Three trains per day (two of 44 wagons and one of 23 wagons) from Shivee-Ovoo to CHP5 (maximum 6771 tonnes)
- Two trains per day (one of 34 wagons and one of 22 wagons each) from Baganuur (maximum 3416 tonnes)

A railway capacity study completed for the Project has shown that the existing Trans-Mongolian railway has the capacity to guarantee the transportation of coal to the Project site, even during peak loads. Coal will be transported from the aforementioned coal mines to the Project site with trains via the existing Trans-Mongolian railway line.

A new stabling area outside the Project site and railway spur will be constructed from the existing railway line that runs to the south of the site which is defined as an associated facility. The Project site will incorporate a locomotive shed and an unloading area for coal. Coal will be transferred via conveyors from the unloading area to the coal storage yard. From the storage yard, coal will be crushed and then transferred to the boiler house storage bunkers to be used in the CFB boilers.

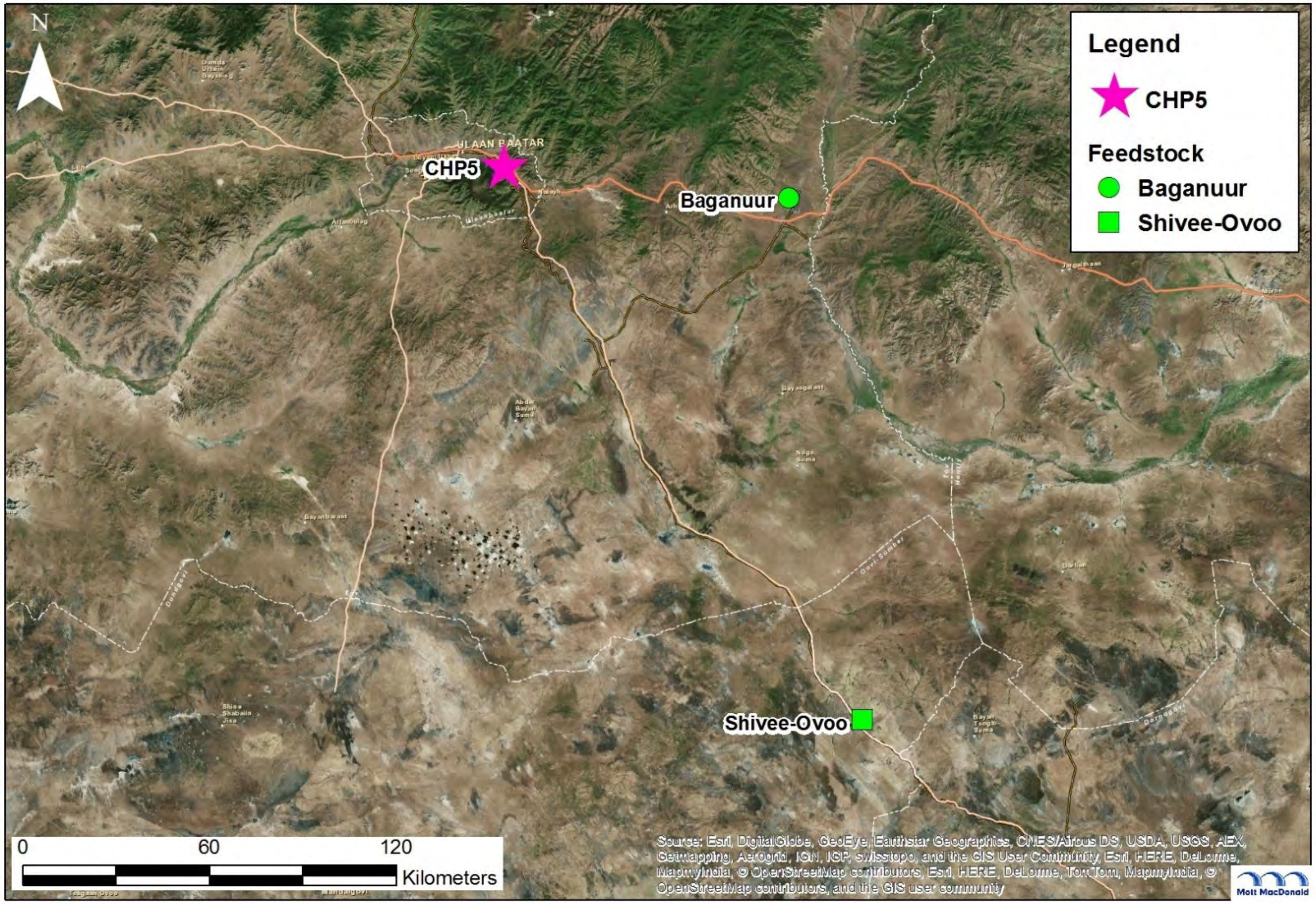
The Project will be designed to meet performance objectives (i.e. output) and all emissions limits applicable with the fuel specification design range, as identified in the coal composition analysis in Table 2.1.

Table 2.1: Coal composition

Analysis		Shivee Ovoo dried	Shivee Ovoo S2	Shivee Ovoo S3	Shivee Ovoo S4	Shivee Ovoo S5	Baganuur B1	Baganuur B2	Baganuur B3
Proximate analysis (as received)									
Total moisture	%wt	36.10	40.50	40.70	38.00	42.50	30.00	33.00	38.00
Volatile matter	%wt	24.87	23.41	23.17	24.13	24.87	25.65	36.62	22.88
Fixed carbon	%wt	29.58	27.59	27.63	24.37	24.13	25.55	30.88	21.12
Ash	%wt	9.45	8.50	8.50	13.50	8.50	14.80	9.50	18.00
Total	%wt	100	100	100	100	100	100	100	100
(dry ash free basis)									
Volatile	%wt	45.67	43.00	42.70	45.00	50.76	43.00	43.90	45.00

Analysis		Shivee Ovoo dried	Shivee Ovoo S2	Shivee Ovoo S3	Shivee Ovoo S4	Shivee Ovoo S5	Baganuur B1	Baganuur B2	Baganuur B3
matter									
Ultimate analysis (as received)									
Carbon	%wt	39.43	44.31	34.34	33.50	35.48	40.00	39.70	
Hydrogen	%wt	3.00	1.75	2.74	2.70	2.70	2.70	2.50	
Sulphur	%wt	0.67	0.53	0.90	0.30	0.60	0.40	0.36	0.50
Oxygen	%wt	10.86	3.96	12.24	11.70	9.77	11.50	14.44	
Nitrogen	%wt	0.50	0.45	0.58	0.30	0.45	0.60	0.50	
Ash	%wt	9.45	8.50	8.50	13.50	8.50	14.80	9.50	
Moisture	%wt	36.10	40.50	40.70	38.00	42.50	30.00	33.00	
Total	%wt	100.00	100.00	100.00	100.00	100.00	100.00	100.00	

Figure 2.4: Location of coal mines utilised for the Project



Source: The Consortium

2.3.2 Coal storage yard

The coal storage yard will be located at the northern point of the Project site. The storage yard will be 210m x 198m, an area of 41,580m^2. The net volume of coal storage is estimated at 460,760m^2 based on a stack height of 15m and an angle of 38 degrees. The coal yard has been sized to provide capacity for approximately 30 days of operation. The coal storage yard will be surrounded by a concrete wall and fabric pad which will shield the coal from wind and prevent the spread of dust. The storage yard will be lined with approximately 200mm of firmly compacted clay to prevent the infiltration of contaminated water into the soil.

2.3.3 Boiler fuel system

The boiler fuel system is comprised of coal storage bunkers, coal feeders and a fuel oil system which is used in system start-up and flame stabilisation at low loads. The coal is crushed before delivery to the coal storage bunkers from where it is transported by gravimetric coal feeders into the boilers. The fuel oil system stores the fuel oil in specific fuel oil tanks and supplies light fuel oil (LFO) with transfer pumps to the boilers during start-up or shut-down activities.

2.3.4 Other materials

Table 2.2 presents other key materials which will also be used at the Project site. The location of materials storage is shown in Figure 2.3.

Table 2.2: Raw materials used at the Plant

Material	Use	Quantities	Source	Transportation	Storage method
Limestone	Desulphurisation of flue gases	Estimated 100,000 ton/yr	Sourced from local mines	Rail Transferred from the wagon dumping facility to the limestone storage building.	Limestone storage building of 49.2 x 40 x 9.6m height.
Urea	Used in the removal of nitrogen from the flue gas using Selective Non-Catalytic Reduction (SNCR)	Estimated 8,500 ton/yr	Source to be identified during construction phase	Road	Tank (x3)
Fuel oil	Start up, stabilisation of combustion conditions, diesel generators.	Estimated 2,000 ton/yr	Purchased from a local distributor	Road	Tank (500m3)
Sand	Bed material for CFB boiler	Estimated 500 ton/yr	Purchased locally	Road	Silo (3 x 60 tons)

2.3.5 Circulating fluidized bed boilers

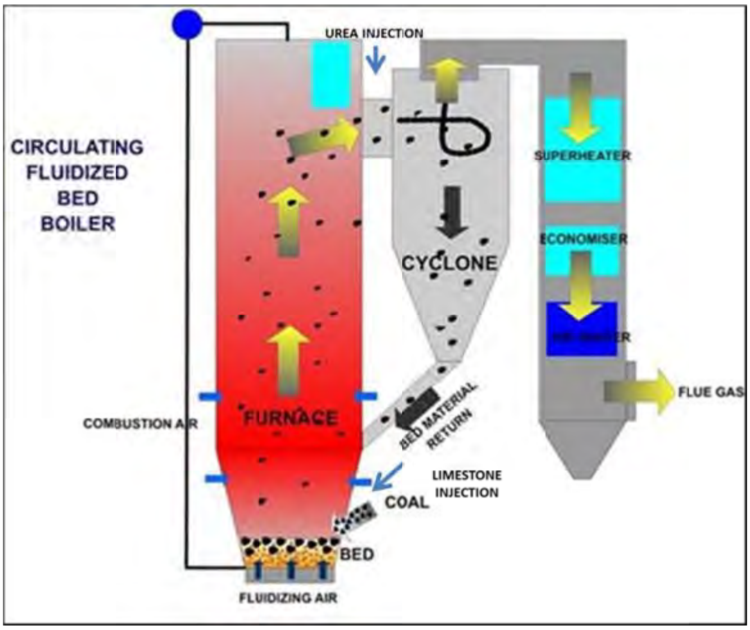
Three CFB boiler units (each producing 572 t/hr steam) will be installed at the Project site. Each boiler had has a footprint of 46.3m x 42.0m, and a height of 64m. Each boiler will provide steam for a steam extraction turbine/generator unit with a minimum electrical (gross) rating of 154.5MW_e. Hot water for distribution to the district heating network shall be produced from the steam extracted from the turbines.

As shown in Figure 2.5, the CFB technology proposed uses a cyclone unit in which hot flue gases and solid particles are separated. The larger solid particles that have not been fully combusted in the furnace will be returned to the furnace to undergo the combustion process again. This allows for a higher combustion efficiency of the fuel. Heat in the form of hot air, hot water and steam will be produced in the different sections of the furnace and backpass of the boiler sections called; vaporizer, economizer, super heater, re-heater and air heater.

Hot air is injected into the furnace which allows for combustion at relatively lower temperatures of 800 - 950ºC which greatly reduces the amount of nitrogen oxide emissions compared to other boiler technologies. The use of urea injection will further reduce the nitrogen oxide emissions to meet required emission limits.

The use of crushed limestone ($CaCO_3$) in the furnace bed causes a reaction with the SO_2 emitted from the fuel and forms calcium sulphate which is then removed from the system as a solid, with the fly ash.

Figure 2.5: CFB technology



2.3.6 Boiler air and gas system

Flue gas is transported through the boiler by the boiler air and gas system, which also supplies combustion air to the boiler. The flue gas leaving the furnace passes through large cyclones which recirculate larger particles transported with the flue gases back to the fluidized bed. Lighter fly ash and the remaining flue gas pass through the convective elements of the boiler i.e. the superheater, reheater and economiser, which transfer heat from the flue gases to the water and steam of the steam cycle. The feedwater is heated in the economiser, while the superheater and reheater heat the steam supplied to the turbine and then to the district heating system.

To remove the entrained fly ash, gypsum and un-reacted limestone from the desulphurisation process; cooled flue gas is passed through a fabric filter flue gas cleaning system. Induced draft fans will then discharge the cleaned flue gas into the atmosphere via the stack.

2.3.7 Steam turbines

The boiler steam system conveys superheated and reheated steam between the boiler and the turbine. The main steam system delivers superheated steam to the high-pressure turbine, while the reheat steam system returns exhaust steam from the high pressure turbine to the boiler, where it is again heated before being supplied to the intermediate pressure turbine. Steam from the boilers feed to the condensing and reheat turbine generators. Hot water for distribution to the district heating network is produced from the steam extracted from the turbines or reheat steam connection.

2.3.8 Air cooled condensers

Due to limited water resources in the area, ACCs will be used to cool the condensate from the steam turbines.

In an ACC, a series of cells containing finned tubes are mounted on a steel structure. Air is forced by an electric motored fan into the cells, where heat exchange between the air and the steam in the finned tubes occurs. This heat exchange condenses the steam, which results in steam being converted back into water which is then collected and re-used in the continuous water steam cycle.

2.3.9 Stack

A single multi-flue stack of 170m with a diameter of 7.8m and a velocity of 18.1m/s will be constructed for the Project to ensure effective dispersion of emissions to air.

This stack height was determined through the Atmospheric Dispersion Modelling System (ADMS), a computer based model of dispersion in the atmosphere of pollutants released from single or multiple sources which may be point, area or line sources.

2.3.10 Emissions to air and emissions abatement technology

Table 2.3 provides a summary of the abatement technologies that will be used to control emissions from the plant and the emissions levels that the Project will achieve:

Table 2.3: Emissions abatement technology implemented at CHP5

Emissions	Emissions Abatement	Achievable emissions level
Sulphur oxides (SO_x)	Direct injection of limestone into the CFB boilers	150 mg/Nm^3
Oxides of nitrogen (NO_x)	Relatively low combustion temperatures in the CFB boilers generally result in less generation of thermal NOx compared to other boiler technologies. Selective non-catalytic reaction (SNCR) utilising urea injection will be installed	150 mg/Nm^3
Particulates	Fabric filters will be installed to remove particulate matter from the flue gas prior to exiting the stack.	30mg/Nm^3, dry, at 6% O2

The limitation of carbon monoxide (CO) production is directly related to the quality of combustion. CFB boilers are recognised to have adequate combustion efficiency. As such, no further mitigation measures need to be implemented.

2.3.10.1 Monitoring

A Continuous Emission Monitoring System (CEMS) will be installed for each unit to monitor compliance of the emissions released via the stack. The following parameters will be measured:

- NO_x
- SO_2
- CO
- Total particulates
- Flue gas temperature and pressure.

2.3.11 Water Use

The Project will have an estimated average daily water demand of 10-11 Million Litres of Water (MLD) per day in winter and 2-3 MLD in summer. Water demand will be higher in the winter due to the need to provide make-up water for the district heating system. It is intended that a water supply agreement (WSA) is put in place with National Agency and Sewerage Authority of Ulaanbaatar City (USUG) for the Project to be supplied as an industrial customer via a piped water supply. Raw water will be demineralised and used as make-up water in the power plant and also for potable use.

2.3.12 Water treatment

Raw water piped to the plant will be treated via a demineralisation treatment plant for use in the power plant, make-up water supply to the district heating network as well as for potable use. The Demineralized Water Treatment System (DWTS) will remove oxygen, carbon dioxide and other dissolved gasses, along with various minerals from the water that could cause corrosion or scaling on metal surfaces, and produces high purity water required for use in the boilers. A separate water treatment system will be installed for the supply of district heating make up water.

A number of chemicals will be used in the water treatment process. The chemicals storage capacity will be seven days of maximal consumption and the tanks will be equipped with a bund wall for a volume equal to 110% of the tank.

2.4 Ash handling system, storage and disposal

Ash will be generated from the coal combustion process and will be comprised of bottom ash and fly ash. Quantities of each are provided in Table 2.4. Table 2.5 provides the ash analysis for the combustion of coal from both Baganuur and Shivee Ovoo.

Table 2.4: Ash Quantities produced by the Project.

Ash production	Fly ash	Bottom ash	Total
Maximal daily (boiler maximum continuous rating (BMCR), coal with highest ash cont.)	1,264 t/day	485 t/day	1,749 t/day

Table 2.5: Ash Analysis

Component	%	Baganuur	Shivee Ovoo
Silicon dioxide	SiO_2	41.25	43.2
Aluminium oxide	$Al2O_3$	15.7	11.65
Titanium dioxide	TiO_2	0.75	0.5
Iron Oxide	Fe_2O_3	16.3	10.15
Phosphorus pentoxide	P_2O_5	0.2	0.05
Sulphur trioxide	SO_3	6.55	13
Calcium oxide	CaO	13.75	16.55
Magnesium oxide	MgO	1.85	1.9
Sodium oxide	Na_2O	0.2	0.25
Potassium oxide	K_2O	1.4	1.05
Manganese dioxide	MnO_2	0.7	0.2
	Others	1.35	1.5
	Total	100	100

Source: SGS Mongolia LLC (November 2014)

Bottom ash is produced from the non-combustible material that settles to the bottom of the boiler. Bottom ash will be discharged from the boiler, cooled and then transferred by a pneumatic conveying system from the ash hoppers to a common bottom ash silo.

Fly ash is the result of the combustion of coal and is ash which has become entrained in the flue gases which emanate from the units. Additionally gypsum and un-reacted limestone originating from the desulphurisation process will be entrained in the flue gases. The Project will be installed with fabric filters which serve to remove fly ash particles and gypsum and un-reacted limestone from the flue gases thereby lowering the particulate concentration prior to emission to air via the exhaust stack. Fly ash will be collected by the fabric filters will be conveyed pneumatically by air compressor to one of three dry ash silos on-site for storage.

Fly ash will be collected and temporarily stored in dry silos on the site. There will be one fly ash silo for each of the generator units and the silos will have the capacity to store 72 hours of ash. The fly ash handling system will be designed to manage the worst case scenario that is, burning the lowest quality coal, with the highest ash and sulphur content. Bottom ash will be collected and temporarily stored in a dry silo. There will be one bottom ash silo for the Project and it will have the capacity to store 72 hours of bottom ash.

The three fly ash silos and the bottom ash silo shall be installed at the railway area of the site. The silos and associated infrastructure will be designed for discharging ash onto train wagons as well as trucks, to enable transport to the ash disposal area by train and to an emergency ash disposal area by truck.

An emergency ash disposal area with 30 days capacity for both fly ash and bottom ash will also be located at the site. Ash temporarily stored in this area will be stored in impermeable bags within the emergency ash disposal area. The area will be constructed on a compacted clay layer of one metre thickness. The exact design and required thickness will be determined during Project detailed design phase, with the minimum requirement that there shall be no possibility of infiltration in the groundwater. A collection pipe network will be constructed inside the drainage layer and connected to the waste water treatment plant.

In the long term, it is intended to develop a commercial market for the waste ash from the Project, and its use in cement production and road building has been highlighted. However, such markets do not presently exist in Mongolia and would be unable to utilise the ash waste produced.

2.5 Off-site Ash Disposal Facility

To address this and the uncertainty over the long term availability of ash disposal areas, the Consortium has identified a potential ash disposal site on the east side of the Baganuur mine located approximately 132km from the Project site, which will have sufficient capacity to store ash for 25 years. A conceptual study is currently in progress for the facilities, which will be designed, constructed and operated as required to manage the properties of the ash to be disposed of and subject to relevant environmental standards.

Ash generated by existing CHP plants in Ulaanbaatar using the same coal as this Project is not classified as hazardous waste.

A separate ESIA will be undertaken to assess the potential environmental and social impacts associated with the ash disposal facility.

Periodically throughout the life of the power plant, a review of potential off-takers for the use of the ash will be undertaken.

2.5.1 Wastewater treatment

All waste water from the site will be collected and treated prior to being discharged to the city sewage system. Approximately 1,523m^3/day of wastewater effluent from the plant will be discharged into the sewerage system controlled by USUG. Water authority has confirmed that the capacity to treat waste water from the Project is available. A feasibility study is being completed on behalf of international lenders which will be produced in November 2015. The study will contain the details of the treatment plant technology. Effluent limits specified by USUG are presented in Volume III, Appendix L.

Some water from the process will be recycled and stored in a water recycling pond on the site. This water will be used to control dust on site. The waste water treatment system will treat chemical wastewater, oily water and sewage and storm water. Each of these types of waste water will be treated by a separate process, each of which is outlined in the following sub-sections.

2.5.1.1 Chemical waste water treatment

Chemical waste water will be sourced from the boiler chemical dosing and sampling system, the demineralized water treatment system and the boiler blow down drain.

If needed this water will be treated with sodium hydroxide ($NaOH$) and hydrochloric acid (HCl) to neutralize the water and after meeting the necessary quality it will then be discharged to the water recycling pond or into the city sewerage system.

2.5.1.2 Oily waste water treatment

Oily water runoff from the oil handling area will be collected in a sump and pumped on demand to the oily water collection pond. This pond has an oil separator which skims the oil from the surface of the pond. The skimmed oil will be transferred to the oil sludge pond and the remaining water will then undergo secondary treatment.

2.5.1.3 Sewage treatment

Approximately 125m^3/day of sewage will be generated at the workshop, offices and temporary buildings at the site. Sewage will be collected in a collection sump and transferred on demand to the wastewater treatment facility before being discharged to the water recycling pond or discharged to the sewerage system.

2.5.1.4 Ash yard storm water treatment

Storm water from the ash yard will be collected in the ash yard storm water point and then discharged to a sand filter by a pump. Water that has been clarified through the sand filter will be transferred to a pH regulating tank where HCl and NaOH will be used as treatment chemicals. The treated water will be discharged to the site boundary or ash yard for use as a dust suppressant.

2.5.1.5 Coal yard storm water treatment

Storm water from the coal yard will be collected in the coal yard storm water pond. Gravity will be used to clarify the water, with the clarified water being discharged to the site boundary or provided for dust removal.

2.5.2 Auxiliary system and equipment

2.5.2.1 Fuel and chemical use

Diesel will be used for start-up boiler and start-up burners in the CFB boiler during start-up of the Plant and in the event of a plant shutdown. A diesel fuel oil system including a fuel oil storage tank and fuel oil unloading pumping and forwarding pumps will provide fuel for the start-up burners and will pump oil to the day tanks for the emergency diesel generators.

Fuel and chemicals will be stored in a suitably bunded areas and the chemical storage area will be covered and locked.

2.5.2.2 Waste management

Waste will be managed through the Project Environmental and Social Management System (ESMS) developed in accordance with the national requirements for waste management. A dedicated central waste collection and storage area will be identified with facilities for the segregation of wastes for off-site disposal. A covered and locked chemical storage area will also be provided with a suitable bunded hard standing area for the delivery and storage of chemicals.

2.5.2.3 Buildings and facilities

A number of buildings and facilities will be built within the footprint of the Project e.g. administration and canteen areas to support the operation of the power plant and operational staff. Parking for approximately 30 vehicles will be provided.

2.5.2.4 Security

All site and operational staff will be provided with security passes to allow access to and from the site and plant. A security policy will be in place which includes criteria for hiring security personnel including procedures for investigating allegations of reported unlawful action by contracted firms.

2.5.2.5 Site drainage

The drainage system on site will consist of storm water drainage, domestic sewage and operational wastewater drainage. All surface water from roads, hardstandings will be collected in drainage ditches and channels prior to being discharged into the new channel at the Project site.

Storm water from roads and other areas will be collected in catch basins or manholes and directed to the nearest storm drainage system.

2.5.2.6 Fire-fighting system

The fire-fighting system at the plant will be designed in accordance with local codes and the National Fire Protection Association (NFPA). Raw water will be used in the fire-fighting system.

2.6 Diversion of the Khuliin River

Extensive flood mitigation measures have been incorporated into the Project design in order to divert and channelize the watercourses that pass through the proposed site. The measures are shown in Figure 2.6 and include the following components:

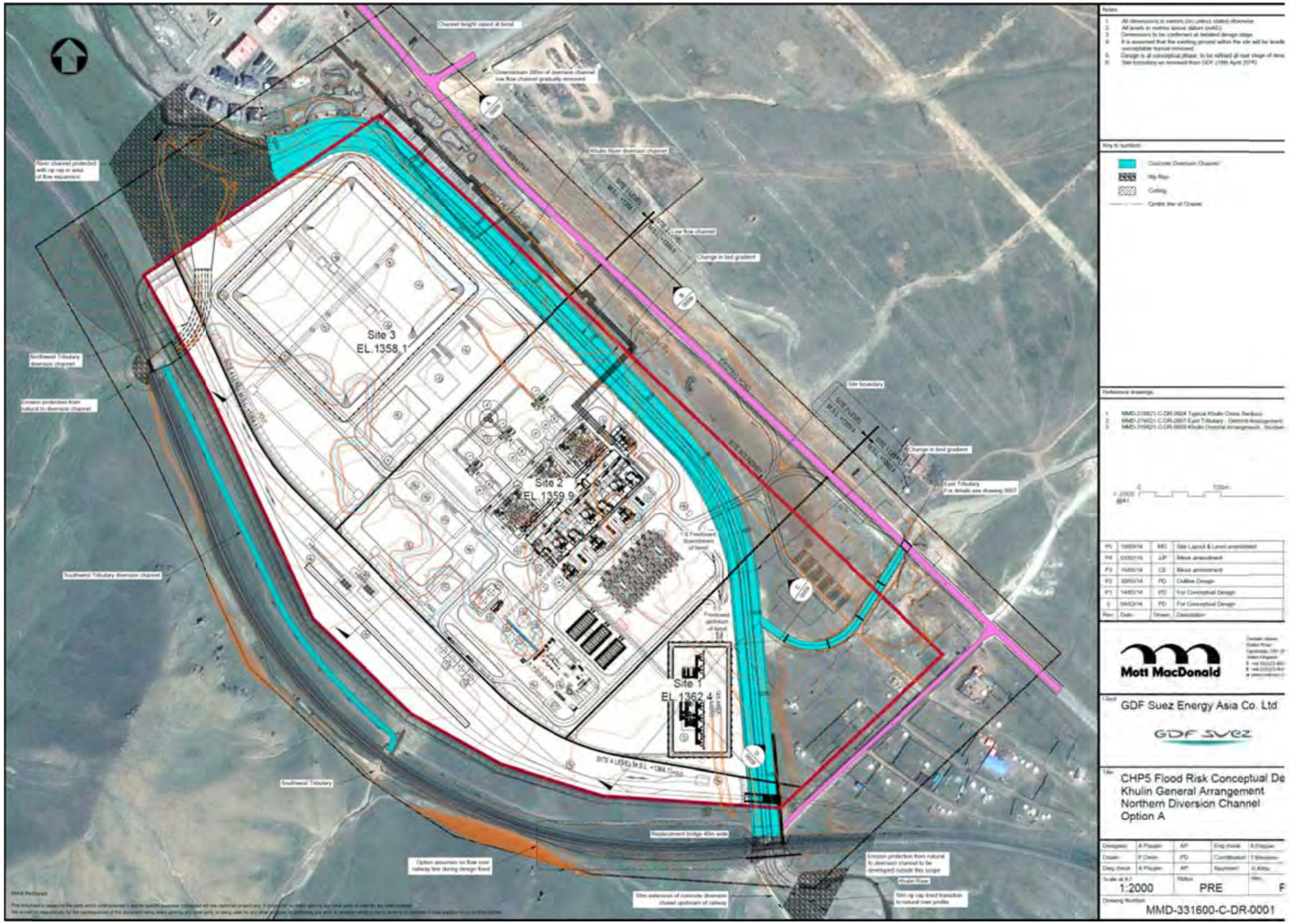
- Khuliin River
  - Rip rap lined transition area located approximately 50m upstream of the Ulaanbaatar Railway Bridge
  - Approximately 1250m long trapezoidal diversion channel, lined with closed concrete blocks. The channel top width varies depending on the modelled water levels and freeboard but ranges from approximately 39.6m[2] to 41.6m[2]
  - A combination of raised site levels and localised flood embankments to ensure that flood waters are contained within the diversion channel
  - A flow expansion area at the downstream end of the diversion channel.
- East Tributary
  - Replacement or restoration of box culvert under the road
  - Approximately 250m long stepped trapezoidal channel. Dimensions to be confirmed depending on the lining type
- Southwest Tributary

[2] Channel top widths were stated in the Flood Mitigation Outline Design Report (Mott MacDonald, 2014d) as ranging from 36.84m to 38.84m depending on whether 0.5 or 1m freeboard was selected. Subsequently an alternative channel design has been adopted resulting in an increase in modelled water levels by 0.7m, and consequently an increased channel top width of 2.8m.

  - Approximately 550m long trapezoidal channel. Dimensions to be confirmed depending on the lining type
- Northwest Tributary
  - Erosion protection measures upstream of the Ulaanbaatar railway bridge
  - Approximately 200m long section of rectangular channel and box culvert connecting to the downstream flow transition area.

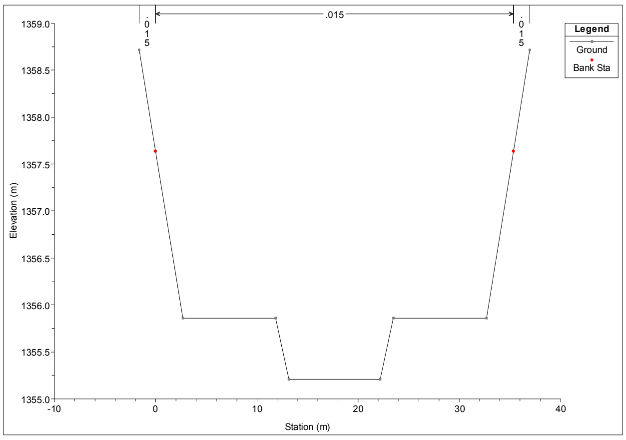
The dimensions of the trapezoidal diversion channel for the Khuliin River are shown in Figure 2.7 and an example of the closed concrete blocks lining that will be used is shown in Figure 2.8. The long profile of the Khuliin River diversion channel has three sections with subsequently reducing slope designed in order to aid the transition of supercritical flow conditions back to the natural channel.

Figure 2.6: Flood Mitigation Measures General Arrangement



Source: Flood Mitigation Measures Outline Design Report (Mott MacDonald, 2014d)

Figure 2.7: Khuliin River Diversion Channel



Source: Flood Mitigation Outline Design – Modelling of Channel Alternatives (Mott MacDonald, 2014e)

Figure 2.8: Closed Concrete Block Lining

Source: POSCO E&C

With modifications to the channel lining and an increased channel size the mitigation measures are likely to provide a standard of protection to the site of between 1 in 100 years and 1 in 200 years. However, due to the hydrological and hydraulic uncertainties associated with the analyses, refinement of the design of the indicated mitigation measures may be required during detailed design to meet the required standard of protection, without changing the overall nature of the mitigation measures proposed.

The ground level of the Project site will also be raised to avoid flooding from the channel. Due to the actual site morphology, the site will be levelled in three main zones. The level of each zone will be selected to eliminate any flood risk from the main diversion channel, based on the water level modelled for a 1-in-200 year return period event.

2.7 Construction phase

Construction and commissioning of the Project is expected to take approximately 57 months in total. The main construction stages and expected timeframes are set out in Table 2.6.

Table 2.6: Construction stages

Construction activity	Expected timeframe (months)
Site ground survey	0 – 1
Site preparation, including excavations, for the laydown area, site office, temporary facilities, temporary access road and drainage	2 – 10
Construction of temporary division channel	2 – 3
Site levelling	4 - 20
Construction of drainage channel for power block	4 – 16
Installation of foundations for boiler #1	15 – 18

Construction activity	Expected timeframe (months)
Installation of foundations for boiler #2	18 – 21
Installation of foundations for boiler #3	25 - 27
Erection of main steel structures for boiler #1	18 – 25
Erection of main steel structures for boiler #2 and boiler #3	21 – 28
Erection of main steel structures for boiler #3	27 - 31
Chimney erection	18 – 27
Turbine and generator installation for boiler #1	32 – 40
Turbine and generator installation for boiler #2	33 – 43
Turbine and generator installation for boiler #3	40 - 48
Commissioning unit #1	29 – 47
Commissioning unit #2	43 – 50
Commissioning unit #3	49 – 57

Note: Some construction activities will stop during the winter season when works will cease for four months

The Engineering, Procurement and Construction (EPC) contractor will follow national regulations for working hours.

At this stage, it is expected that the proposed daily working hours is ten hours per day, six days per week. Daily working hours will be from 6:00 AM to 6:00 PM, with a two hour lunch break (12:00 noon to 2:00 PM).

Working hours will be adjusted in summer and winter. Overtime work, if deemed necessary, will be performed.

2.7.1 Construction methods

The Project will be constructed under an EPC contract basis. The Project will be designed in accordance with good international industry practice (GIIP).

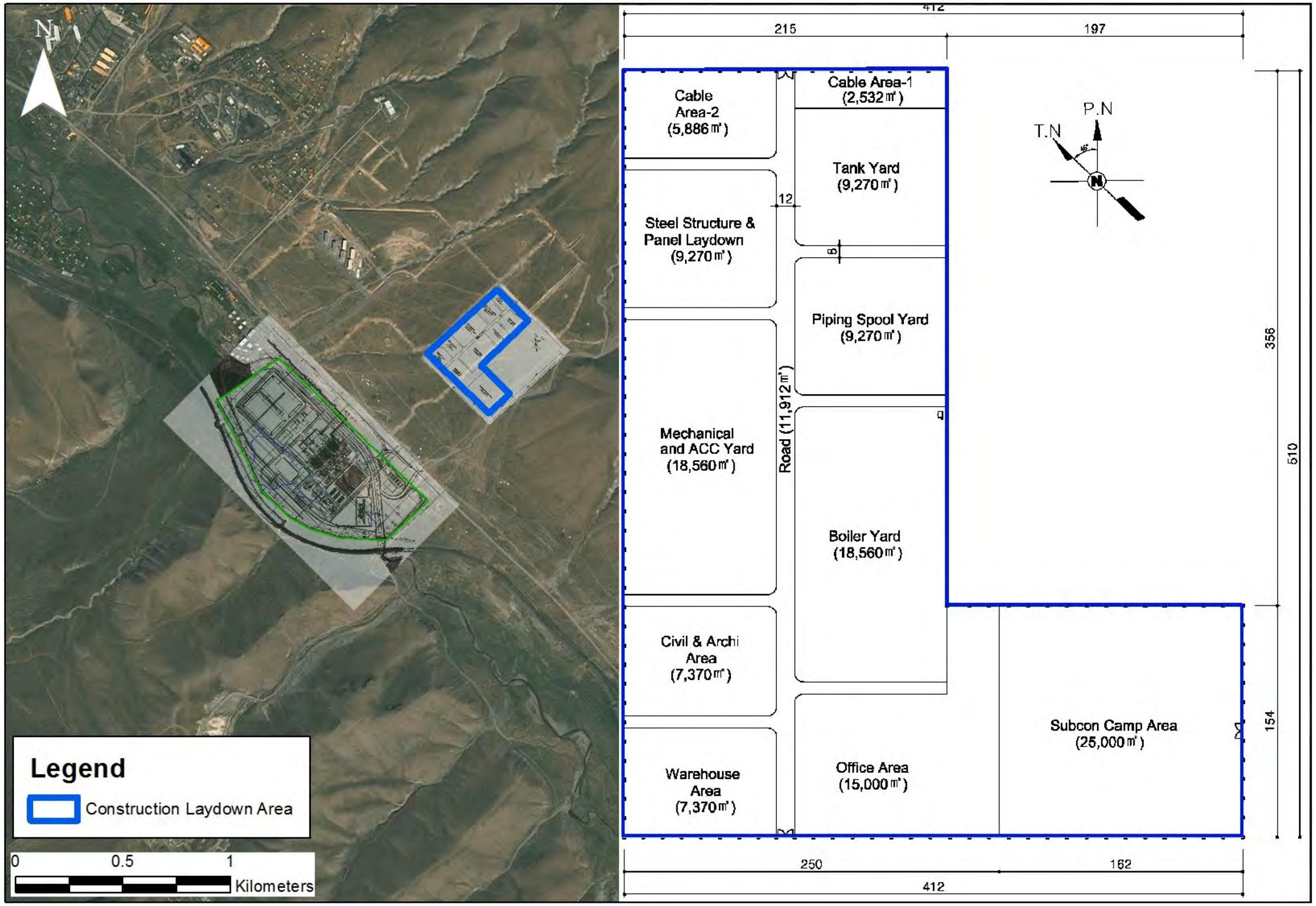
2.7.2 Construction employees

At this stage it is unknown the number of construction workers that will be required to work on the Project. However, it is expected that at the peak of construction, it is likely that approximately 2,700 - 3,200 workers will be on-site.

2.7.3 Construction laydown area

A temporary laydown area, identified in Figure 2.9, will be established to the east of the site across the Ulaanbaatar to Nalaikh road. This laydown area will be approximately 14 – 15ha in area.

Figure 2.9: Project Construction Laydown Area



Source: Consortium

2.7.4 Workers' accommodation

Temporary construction workers accommodation will be constructed adjacent to the construction laydown area. Some off-site accommodation will also be provided. All worker accommodation will be located outside of the protected areas and the final selected site of any accommodation will be agreed in accordance with local District and Khoroo leaders, and other relevant parties.

Construction workers accommodation will be designed to meet the requirements outlined within the joint EBRD/IFC guidance document on workers accommodation[3]. If, when finalising the plans for the workers accommodation, it is identified that land acquisition is required this will be undertaken in accordance with national regulations and international safeguard policies.

2.7.5 Borrow Pit

It has been calculated that 917,243m^3 of earthen material will be required to be brought onto the Project site during construction. At this stage, the location of the borrow pit has not been confirmed, and a number of potential sites are being reviewed by the Consortium and EPC contractor.

The selection of a suitable site for the borrow pit will be undertaken by the Consortium and EPC Contractor in accordance with international standards with particular attention being paid to the following:

- Suitability of materials
- Proximity to residential receptors
- Proximity to sensitive ecological receptors. The site shall not be located in any protected areas or buffer zones.
- Access and suitability of transportation routes.

Excavated soil from the site which is not reusable for construction will be transported to the borrow pit for disposal.

2.7.6 Labour standards

The Project will comply with local and international labour standards.

2.7.7 Security

The EPC contractor will provide security for the construction phase of the Project. The Project site perimeter will be wire fenced, with a separate security fence specific to the plant area. A central security building will be erected for entrance and exit controls and a camera system allowing 24 hours monitoring of the plant will be located at suitable points. The EPC contractor will prevent unauthorised access to the site

[3] IFC / EBRD (2009) Workers' accommodation: processes and standards. A guidance note by IFC and the EBRD

and laydown compound by fencing the perimeter of the site and providing lockable gates. All workers at the site will be registered to ensure only authorised workers enter the Project site.

2.7.8 Occupational Health and Safety

A comprehensive safety management plan will be developed and implemented during construction to protect the health and safety of all personnel and the property on or near the site. A site safety induction will be conducted for all personnel at the site.

A nurse and medical facilities will be provided to administer first aid at the site and an ambulance service will take emergency cases to hospital.

2.8 Operational phase

It is expected that the Project will employ a total of 300 - 350 people during the operational phase.

It is intended to maximise local labour utilisation, however if there are not a sufficient number of people with the required skills, other options will be considered such as using labour from nearby countries and temporary staff from other plants operated by one of the Consortium members. During the initial period skilled management personnel from the Consortium will be based at the Plant.

Under normal operating conditions, the Project will be operated at 100% of capacity with a design basis of 8,000 hours per year; however this will depend on the actual needs of the Mongolian Power grid and in the cold season on the required heat.

2.9 Decommissioning phase

The Project will be transferred to the GoM at end of the 25 year Power Purchase Agreement (PPA) in a condition which enables a further five years of operation by the Government, who will also be responsible for the eventual decommissioning of the plant.

However, upon end of life of the Project all hazardous wastes will be removed and sent for safe disposal, either within the industrial areas solid waste disposal area or under license by a third party contractor. A full ground investigation, including soil and groundwater monitoring, will be undertaken in and around all Project areas to identify any contamination. If contamination is identified, a remedial programme will be elaborated as part of decommissioning.

Remaining plant will be considered for re-use and recycling following dismantling. A dedicated decommissioning strategy (possibly including the preparation of an ESIA and ESMMP specifically relating to decommissioning) will be developed in advance of the end of Project life.

Given that there will be a large operational workforce; eighteen months prior to decommissioning, a retrenchment plan will need to be produced. Activities to support workers finding alternative work will need to be implemented in advance of the end of Project life.

2.10 Associated facilities

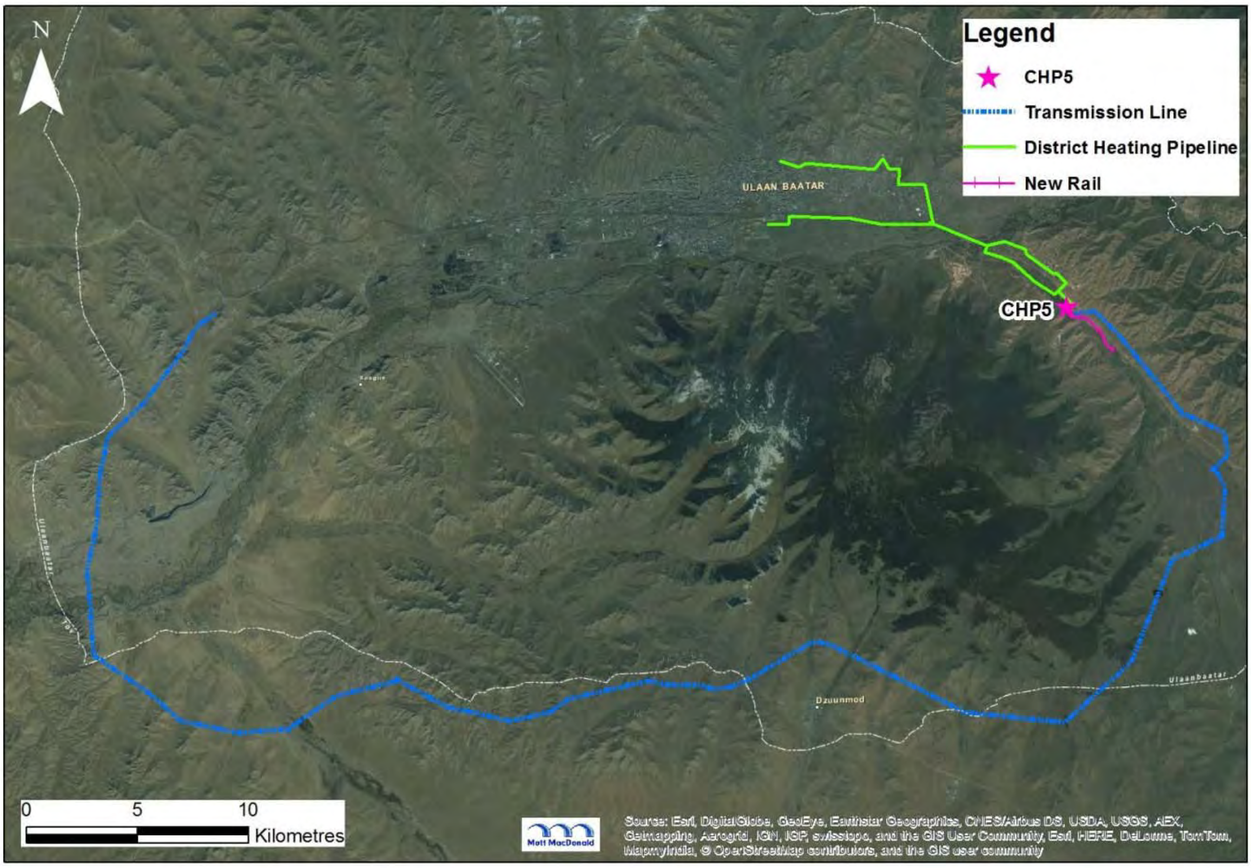
Associated facilities are items of infrastructure that are required to enable or support the Project but do not form part of the Project responsibilities of the Consortium, with other agencies responsible for their development. IFC PS and ADB SPS requires that where a project involves specifically identified physical elements, aspects, and facilities that are likely to generate impacts, environmental and social risks and impacts will be identified in the context of the project's area of influence. The associated facilities of the Project are identified in Table 2.7.

Table 2.7: Associated Facilities for the Project

Associated Components	Summary	Detail	Responsible Party
Transmission line	Power will need to be exported from the power plant to the national grid.	A new transmission line is proposed which will connect the power plant to the existing Songino substation. The transmission line will be approximately 85km in length and be routed around the southern side of Bogd Khan outside the boundary of the protected area. The transmission line will largely traverse rural areas and is depicted in Figure 2.10. A feasibility study for the transmission line is currently being completed on behalf of the Government of Mongolia.	Ministry of Energy
District heating pipeline	Heat will need to be exported for residential and commercial heating requirements. The Project is expected to supply heat to the central and eastern areas of Ulaanbaatar.	The Project will be connected to Ulaanbaatar's district heating network via two district heating return pipelines and two district heating supply pipelines with a diameter of 1,000 – 1,200mm. A high level plan showing the proposed routing of the district heating pipeline is shown in Figure 2.10. The district heating pipeline will be located outside of the Bogd Khan protected area. A study of the district heating pipeline is ongoing by the Government of Mongolia and ADB. Based on preliminary study, total flow of district heating water of CHP5 will be 7,800 tons per hour and the heat will be supplied in and around the districts of Khujirbulan, Uliastai, Bayanzurkh toll gate and 14th micro district.	Ministry of Energy
Railway spurs and stabling	To allow for the unloading and conveyance of coal and	A new stabling area and railway spur will be constructed from the existing	UB Railways

Associated Components	Summary	Detail	Responsible Party
	limestone and the loading and transport of ash waste.	railway line that runs to the south of the site. Coal will be transported from the mines to the site on trains via the Trans-Mongolian line. Coal will be transferred via conveyors from the unloading area to the coal storage yard. From the storage yard, coal will be crushed and then transferred to the boiler house to be used in the CFB boilers. Other raw materials including limestone, which will be used for emissions abatement, will be delivered to site by rail. Ash will be exported from the site via rail to the off-site ash disposal facility	
Raw water supply pipeline	USUG will be responsible for providing water to the site, which is likely to be from the Upper Source. An interconnection point for the supply of water to the Project will be located at the Project site boundary.	The detailed route of the water supply pipeline is yet to be determined.	USUG
Wastewater discharge pipeline	Any waste water which cannot be reused in the process will be discharged into the USUG sewerage piping system, which runs adjacent to the site. No untreated water will be discharged in to the diversion channel / Khuliin River.	The detailed route of the wastewater pipeline is yet to be determined.	USUG
GIS switchgear and substation	To export the electricity generated by the Project.	Electricity produced by the Project will be exported to the electrical transmission system from the 220kV GIS to be located within south-eastern corner of the site, occupying approximately 0.5ha (including a GIS building of 15 x 50m). It is intended that the substation at the Project site will have sufficient space for it to also become the interconnection between Ulaanbaatar, Baganuur and Songino substations. This will be operated by CES and is separate from the Project.	Ministry of Energy

Figure 2.10: Proposed location of Project associated facilities.



Source: Mott MacDonald

Chapter 18 provides a high level qualitative assessment of each of the associated facilities. Separate detailed assessments will be necessary for the development of these facilities under the Mongolian environmental assessment process and any separate requirements that the development of these facilities may have in terms of financing.

3 Project Need and Alternatives

3.1 Introduction

This chapter sets out the needs case for the Project in the context of economic, socio-economic and market factors in order to evaluate whether there are sufficient drivers to justify development of the Project. This section also provides analysis of the suitability of the site selection and potential alternatives.

The significant alternatives considered for the Project are broadly categorised as follows, and discussed in more detail below:
- Project need
- No project alternative
- Location of the Project
- Options and alternatives for key technical and process aspects of the Project.

3.2 Project need

3.2.1 Introduction

Following rapid urbanisation in the 1990s, Ulaanbaatar's population expanded significantly and now over 1.2 million people (around 40% of the total population of Mongolia) are understood to reside within the city's limits[4]. Although some of Ulaanbaatar's population live in the city centre, typically in old, energy-inefficient apartment blocks or small houses, approximately two-thirds of the population live on the outskirts of the city in traditional peri-urban ger areas[5,6]. Development in Ulaanbaatar is now seeing an increase in the construction of new apartment blocks.

Mongolia has an extremely harsh winter climate, with winter temperatures ranging from -10ºC to -30ºC in the daytime during mid-winter (December and January) and can drop to as low as -40ºC at night. Ulaanbaatar is the coldest capital city in the world and where almost half of the country's population resides. The long and harsh winter weather subsequently creates an unusually long heating season, which typically lasts from the middle of September to the middle of May.

Coal-fired power plants provide the majority of power generation for Mongolia. There are seven main coal-fired power plants in Mongolia with a total installed capacity of 836.3MW; however, the actual available power capacity is only 615MW. Due to the growing heating and electricity demands from Ulaanbaatar and aging existing heat and power generation facilities, there is an urgent need for the construction of new district heating and power supply infrastructure to address the growing vulnerability of heat and power supplies in the capital city.

[4] ADB 2011. Environmental and Social Impact Assessment. Ulaanbaatar Low Carbon Energy Supply Project Using Public-Private Partnership Model. ADB TA No. 7502-MON (ADB ESIA 2011)

[5] World Bank. (2012). Mongolia Quarterly Economic Update. World Bank's Poverty Reduction and Economic Management (PREM) Sector Unit. February 2012.

[6] UNEP (2007). Environmental Outlook of Ulaanbaatar City.

The extreme cold during winter months and rapid increase in population has resulted in significant demand for domestic heating. Around 80% of the city's apartment blocks are provided with heating and hot water from the three existing combined heat and power plants (CHP2, 3 and 4), 7% from heat-only boilers (HOBs) and 13% from individual stoves[(3)]. Population expansion and economic development have also led to an increased electricity demand, which is currently met by the existing coal-fired CHPs.

Ulaanbaatar's heating and electricity demands have increased every year by approximately 6% and 5%, respectively, as a result of economic development and an influx of population from rural areas. Both heating and electricity demands are expected to increase in the range of 4-5% annually between 2010 and 2020. Reliable supply heat and electricity is a prerequisite to sustain and increase economic development in Mongolia[7].

Air pollution is a major issue in Ulaanbaatar, particularly in the winter due to the pollution from outdated CHP plants, hundreds of coal fired heat only boilers (HOB) and stoves and in the spring from sandstorms. Table 3.1 in Section 3.2.6 provides a summary of the sources of air pollution in Ulaanbaatar.

3.2.2 Power Supply and Demand

Electricity is supplied through three centralized power grids and two isolated systems in Mongolia. The three centralized power grids are the CES; the Eastern Energy System (EES); and the Western Energy System (WES). The three large sized power plants (CHP2, CHP3, and CHP4) in Mongolia are located in Ulaanbaatar and account for 90% of the total installed capacity in the CES, which is the largest energy supply system in Mongolia. The two isolated systems are Dalanzadgad CHP plant and local grid, and the grid for Zavkhan and Gobi-Altai aimags.

The generation companies have 814MW of installed capacity, of which 580MW is generated by CHP4. The CES electricity grid reaches about 79% of the population and covers 60% of the country, including Ulaanbaatar and the surrounding fourteen aimags.[8]

Mongolia has also experienced a significant structural change in energy demand. Industrial energy demand has rapidly increased in the past five years due to the expansion of energy intensive industries and the industrialisation of the Mongolian economy.

In 2009, the system's peak electricity demand was 695MW. According to a studies conducted on behalf of ADB in 2011, the Municipal Governor's Office in Ulaanbaatar predicted that by 2020 power demand will mainly occur in the following areas:

- Construction of apartment buildings and related service constructions within existing apartment housing districts. Expected additional demand for these areas will be about 157MW by 2020 with about 5% of average annual growth of demand in these districts.

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[7] ADB 2011. Environmental and Social Impact Assessment. Ulaanbaatar Low Carbon Energy Supply Project Using Public-Private Partnership Model. ADB TA No. 7502-MON (ADB ESIA 2011)

[8] eGen 2013. Updating Energy Sector Development Plan. Prepared for the ADB and The Mongolian Ministry of Mineral Resources and Energy

- Ger areas. The power load density in these parts of Ulaanbaatar is relatively low, but these districts occupy a large area. Although it is anticipated that in the future a number of people living in the ger districts will move into new accommodation being constructed, it is expected that demand growth for these areas will be increased at an annual rate of 7%. In 2020, it is expected that 70.4MW of additional demand will arise from these areas.
- Ger areas to be replaced by new apartment building districts. By 2020, 166.8MW of new power will be needed for these residential developments.
- Apartment districts are in the process of being built in the city by 2020. There are five main free areas reserved for these new districts. According to planning of these constructions, it will cause an additional 188.7MW of demand in 2020.

It is also estimated that electrical energy needs will increase significantly when the Gobi mining area is connected to the CES.

3.2.3 Heating Supply and Demand

The main heat sources of the district heating system in Ulaanbaatar are power plants named, CHP2, CHP3, and CHP4. These power plants were constructed using Chinese and former Soviet Union equipment and technology, and have been operating for between 25 to 47 years. In 2012, the available thermal capacity for heating was 1,585 gigacalories per hour (Gcal/h). In addition to the CHPs, numerous small HOBs and water-heaters have been used in Ulaanbaatar for space heating and domestic hot water production.

The existing CHP plants in the CES cannot meet the peak power load, while the available heating capacity is almost fully utilized with little backup capacity. It is estimated that an additional heating demand of 970 Gcal/hr is needed for Ulaanbaatar by 2020.

The use of a CHP is highly advantageous in Ulaanbaatar due to the long heating season, as CHP can provide a stable heating load and domestic hot water demand. Installation of a CHP is therefore a logical choice to meet the heat and power demands of Ulaanbaatar.

3.2.4 Ageing Power Plants

The existing heat and power generation facilities in Ulaanbaatar are old and inefficient. CHP2 is over 40 years old, while CHP3 has been operating for nearly 40 years and it is considered that these two plants are nearing the end of their operational life. Initially the expected retirement periods of CHP2 and CHP3 were defined as 2005 and 2011, respectively; however, due to the lack of new replacement heating sources, these two plants are currently being kept in operation.

CHP4 is the largest coal-fired CHP plant in Mongolia, with a design capacity of 540MW which was later modified to 580MW. It covers 70% of total electricity demand of the CES and 64% of total heat energy demand of the district heating system of Ulaanbaatar. The plant was built over 30 years ago and many upgrades and repairs have been made in recent years.

3.2.5 CHP and HOB Pollution

The fuel efficiency of the existing CHP plants in Ulaanbaatar is very poor. In addition to the CHPs, many small coal-fired HOBs and domestic stoves are widely used in Ulaanbaatar for space heating and domestic hot water production. Due to the lack of efficient pollutant emission control measures, emissions of SO_2, NO_x, CO, and particulate matter (PM) from Ulaanbaatar energy generating facilities (including CHPs and HOBs) are major contributors to air pollution in Ulaanbaatar. The CHP4 plant is equipped with electrostatic precipitators (ESP), but emission control systems for SO_2, NO_x, and CO are not in place. Other heat and power generators, including CHP2, CHP3, HOBs, and domestic heating stoves, do not have any emission control devices.

3.2.6 Summary

Table 3.1 provides a summary of contribution to air pollution from different sources referred to in this section.

Table 3.1: Air Pollutant Contributions in Mongolia

Source	% air pollutant contribution
Existing CHP plants	10
House stoves	40
Vehicle emissions	30
HOBs (in urban buildings	20

Source: ADB ESIA (2011)

3.2.7 Environmental Benefits

The proposed CHP5 will have lower impacts on air quality given the advanced emission control equipment that consumes less coal and emits fewer pollutants than existing power plants.

3.2.8 Fuel Supply

Mongolia is one of the resource rich countries in the world and coal is one of the country's most important mineral resources. Mongolia has 162.3 billion tons of coal resources and preliminary explorations suggest there are over 20 billion tons in coal reserves.

Lignite is still the principal energy source in the power generation of the CES and EES. It is also the main energy source along with biomass and firewood in the residential sector. There are a number of lignite coal mines which surround Ulaanbaatar, in which the Baganuur and Shivee-Ovoo deposits are large enough reserves to supply existing power plants and also future proposed plants (including the CHP5 power plant) over the next 20-30 years. It has been proposed that the CHP5 power plant use 30% of its coal inputs from the Baganuur mine and 70% from Shivee-Ovoo mine.

Coal delivery by railway is a practical and viable option for shipping the mass volumes of coal from the identified mines to Ulaanbaatar, and given the quantities required, transport by road would not be practical. Coal is transported by the existing trans-Mongolian railway system from both mines to the existing CHP plants in Ulaanbaatar. The estimated total railway distance from Baganuur mine to the current CHP3 power plant site in Ulaanbaatar is approximately 191km. The railway distance between Shivee-Ovoo mine and the CHP3 power plant site is approximately 259km.

3.3 Analysis of Alternatives

3.3.1 'No Project' Alternative

The 'no Project' option considers the position if the proposed Project does not proceed. It assumes that no development would take place and the existing baseline situation would remain.

Without the CHP5 Project, the urban residents of Ulaanbaatar would have to rely on the outdated CHP plants and inefficient and high polluting HOBs and coal-fired water heaters. In addition to the existing CHP plants, due to lack of dust removal and flue gas cleaning equipment, the HOBs and water heaters contribute to the poor air quality baseline and subsequent health impacts. Without the Project, the city's environmental conditions would deteriorate further as a result of rapid urbanization, economic development and population growth.

The Project design has been developed in line with national and international environmental best practice standards. Where potentially significant environmental impacts have been identified a range of appropriate mitigation measures have been proposed. These measures will be written into the Project's construction and operation ESMMPs covering all phases of the project life. The CFB boiler technology utilised in the CHP5 Project is highly efficient technology[9] and contributes to significant lower NO_x emissions by operating at lower combustion temperatures. Therefore, the Project is anticipated to have a positive effect on existing ambient air concentrations within Ulaanbaatar.

Development of the proposed Project will have a significant economic benefit: it will be able to produce and provide both electricity and heating directly to Ulaanbaatar city, where demand has almost doubled in the last decade due to mining developments and urbanization. The CHP5 plant will be able to meet rising demand and encourage further economic development in Ulaanbaatar.

The Project will result in job opportunities during the construction and operational phase. It is expected that the Project will provide good quality direct employment and training opportunities for local people. The Project will also stimulate secondary economic activity in the form of suppliers and other local service providers that will be supported by the increased income of people working at the Project.

With a 'no project' alternative the current situation would remain and none of these benefits would be realised.

[9] Deteriorated equipment and outdated technology used in existing coal fired power plants is one of the primary factors causing severe pollution and depletion of scarce resources. CHP5 will be significantly more efficient than existing CHPs

3.3.2 Site Alternatives

When assessing the suitability and therefore selection of a project site the location is often driven by all or a selection of the following factors:

- Designation of site for the use of land
- Proximity to sensitive receptors
- Proximity to raw materials/fuels
- Proximity to connections for utilities
- Proximity to infrastructure to transport raw materials in and products out
- Proximity to areas of energy demand.

A number of potential site alternatives for the Project have been evaluated through various feasibility studies undertaken on behalf of the GoM during the conceptual study of the CHP5 project:

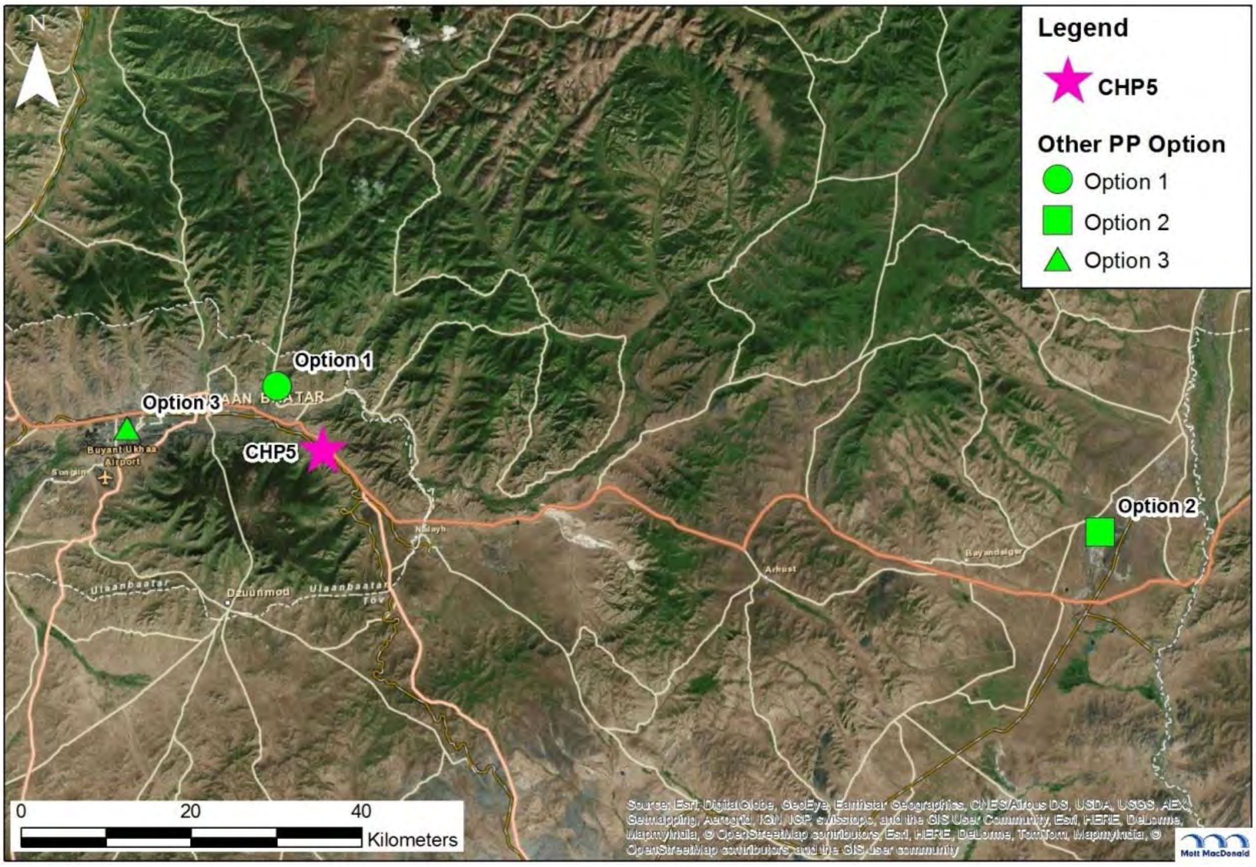
1. A new CHP plant to be built in Uliastai Valley on the eastern outskirts of Ulaanbaatar
2. A new condensing power plant to be constructed at the Baganuur coal mine to produce electricity only, while new HOBs are installed in Ulaanbaatar for heat supply
3. A new CHP plant built at the existing CHP3 site, utilising most of the existing infrastructure

Option three was initially the chosen option for the CHP5 project. However, the Ministry of Energy (MoE) determined that this site was not suitable and an alternative site was subsequently selected.

4. A new CHP plant to be built on a greenfield site approximately 20 kilometres south-east of Ulaanbaatar in the Khul Valley.

Figure 3.1 presents the site alternatives in relation to the selected CHP5 site.

Figure 3.1: Alternative site locations



Source: Mott MacDonald

Table 3.2 sets out the advantages and disadvantages of each site considered which is based on the information presented in the ESIA prepared by ADB in 2012[10] in terms of the environmental, social and technological issues associated with each site; it is considered that all sites will have a degree of similar environmental and social issues, which have not been presented below (i.e. air pollution, water discharge, and waste management).

Table 3.2: Site Analysis

Option	Benefit	Constraint
Option 1	• High level of fuel utilization efficiency • Connected to existing district heating supply • Located close to demand for electricity and heating • Relatively low electricity transmission losses	• Potential risks of flooding and permafrost • Geological conditions are not ideal • Significant earthwork and site levelling required • Poor transport connections

[10] ADB ESIA (Chapter V) 2012

Option	Benefit	Constraint
		• Close to residential receptors
Option 2	• The power plant is far from the Ulaanbaatar urban area and therefore the air pollution impact on Ulaanbaatar is minimized. • Close to feedstock supply • Fugitive dust emissions from transportation of ash from HOBs out of Ulaanbaatar	• Since the CHP5 Project site was selected, a separate project has been developed to construct a power plant at Baganuur coal mine. • Potential risks of flooding and permafrost • Poor transport connections • 130km from Ulaanbaatar – significant distance from main workforce base • Complex site selection process • Overall energy efficiency of plant set-up is low • Significant losses, transmitting electricity to end users • Significant process water consumption
Option 3	• Good use of existing land and supporting infrastructure • High level of fuel utilization efficiency • Existing water supply sources, railway, and roads infrastructure, etc. can be used • Existing heating pipelines and short term ash yard	• Additional land take required from land owners, which is not economically viable. • Complex to implement: heat output from the existing CHP3 plant needs to be maintained throughout the construction of the new CHP5 plant • Close to residential receptors
Option 4	• Site proposed by Ministry of Environment and Green Development (MEGD) to MoE. • Close to areas of demand for power and heat. • Located on the outskirts of the city close to local labour market. • Fewer nearby sensitive receptors than central Ulaanbaatar. • Close to transport links (road and rail). • Plant located outside of the Ulaanbaatar airshed. Will not contribute to existing poor air quality of Ulaanbaatar.	• Site has two areas of permafrost identified. Careful engineering to reduce permafrost and construct on these areas. Site layout chosen to avoid key components being located on permafrost areas. • Located on flood plain, and as such a flood diversion channel will need to be constructed to reduce the potential risk of flooding. • Significant earthwork and site levelling required • Adjacent to the limited zone of the Bogd Khan Special Protected Area

3.3.3 Technology Alternatives

The ESIA process requires an analysis of alternatives to determine that the proposed development represents the best practicable option, taking account of economic, technical, environmental and social issues.

A review of available technologies can essentially be considered under two generic headings; fossil-fuelled and renewables. Exploiting the benefits of renewable technology for Mongolia has some attractions in terms of improving the diversification of supply; however, the relative intermittence of renewable energy generation, the very critical need of constant heat supply to Ulaanbaatar during the winter, combined with size of plant required for equivalent supply, when compared to fossil fuel generation, is an important factor to be considered. Commentary on a number of technologies is shown in Table 3.3 and considered with headline advantages and disadvantages.

Table 3.3: Technology Alternatives- key advantages/disadvantages

	Energy Generation			
Technology	Electricity	Heat	Advantages	Disadvantages
Conventional CHP plant	✓	✓	• Well established and understood technology with several large plants operating in Mongolia (such as CHP2, CHP3 and CHP4). • Range of potential national providers for coal/lignite increasing security of supply • Cogeneration plant produces electricity, hot water for district heating and process steam for industry; heating is especially important for Mongolia because of the extremely cold winters and the heating demand. Produce heating which would otherwise had to have been produced by another heat generating device • Fuel flexibility (from CFB)	• Higher CO_2 emissions than gas • Additional emissions from auxiliary boilers • Lower plant efficiency than other thermal technologies • Produces significant volumes of waste (fly and bottom ash) compared to gas • Contributor to acidification (increased NO_x and SO_x) • More fugitive dust emissions from coal yard • Noise impacts from transportation and operation activities (including coal conveyor).
Conventional coal fired power plant (electricity only)	✓	×	• Well established and understood technology. • Range of potential national providers for coal/lignite increasing security of supply. Electrical cost per MW/hr would be lower than CHP plant.	• Higher CO_2 emissions than gas • Lower plant efficiency than other thermal technologies • Would not generate heat. • Produces significant volumes of waste (fly and bottom ash) compared to gas • Contributor to acidification and photochemical ozone creation • Noise impacts from

Technology	Energy Generation Electricity	Heat	Advantages	Disadvantages
				transportation and operation activities (including coal conveyor)
Heat only boiler (HOB)	×	✓	• Lower investment costs. • Typically smaller than a conventional CHP plant, resulting in less landtake. • Shorter construction period. • Fuel flexibility	• No electricity produced. • Efficiency of producing heat is lower than a CHP plant. • Higher emissions.
Biomass / firewood power plant	✓	✓	• Renewable source of energy. • Minimal SOx production compared to other thermal combustion processes • GHG savings compared to fossil fuel • Less atmospheric CO_2 in long term when compared to coal • Reduced ash loadings and fewer truck movements • Potential uses for ash (soil conditioner or fertiliser) • Options to support local producers.	• Large storage required – implications on selection of site, with sufficient land. • Limited availability of biomass in Mongolia. • The energy density of biomass / firewood relatively low (compared to coal) and the transport costs are high • Potential land use conflicts
Open/combined cycle gas turbine (O/CCGT)	✓	✓	• Lower emissions to air depending upon fuel used and pollution abatement techniques employed when compared to other thermal generating technologies • Combined cycle gas one of the most efficient generating technologies • No solid waste production compared to coal	• Fuel would need to be imported (from Russia or China) at high cost. • Potential environmental impacts of gas pipelines
Hydropower	✓	×	• Elimination of the cost of fuel • With an estimated 3,800 rivers and streams and a total length of 6,500km, Mongolia has significant hydropower potential • Renewable technology- free fuel- with CO_2 emissions only considered with lifecycle assessment of equipment manufacture - no CO_2 emissions from general operations • Energy storage possible with dam use • Run of river schemes typically	• Significant distance of the hydropower potential from Ulaanbaatar. Would require significant infrastructure for the energy transmission. • No opportunity for district heating • Can often significantly impact on communities upstream and downstream • Significant land take required for dam reservoir • Dam construction for large scale projects can be costly

Technology	Energy Generation Electricity	Heat	Advantages	Disadvantages
			minimise impacts to river users; 10 small hydropower schemes currently provide electricity to rural areas	• Can be significant impacts on the hydrological profile/ river ecology • Release of significant amounts of carbon dioxide at construction and flooding of the reservoir
Wind	✓	×	• Mongolia has potential to exploit wind resources with one wind farm already in operation • Renewable technology - free fuel - with CO_2 emissions only considered with lifecycle assessment of equipment manufacture - no CO_2 emissions from general operations • No water requirement	• No opportunity for district heating • Only suitable for areas with high wind intensity/regularity • Dependent on wind allowing little scope for increasing power generation if needed: generally not seen as suitable for baseload power given inconsistencies in generation • Typically needs large areas of land. Alternative site would need to be sought. • Wind turbines sometimes considered as visually detrimental to the surrounding landscape • No opportunity for district heating • Shadow flicker and noise impacts depending on proximity to sensitive receptors.
Solar	✓	×	• Mongolia has substantial solar potential • Renewable technology - free fuel - with CO_2 emissions only considered with lifecycle assessment of equipment manufacture - no CO_2 emissions from general operations • Typically low maintenance • Very little noise associated with operations • No water requirement (apart from maintenance and cleaning)	• No opportunity for district heating • Highest cost per MW • Power only possible during sunlight hours (or limited energy storage through use of molten salts for thermal solar power) • Relative inefficiency /square metre compared to thermal combustion options- large areas required • Generally not seen as suitable for baseload power given inconsistencies in generation • Typically lower employment opportunities during operations than combustion technologies • Panel efficiencies reduce over time (though typically manufacturers offer maximum degradation guarantees)

Technology	Energy Generation: Electricity	Energy Generation: Heat	Advantages	Disadvantages
				• Often significant land take required and panels can be considered detrimental to the surrounding landscape

3.3.4 Best Available Techniques (BAT)

The choice of system employed at a facility is based on economic, technical, environmental and local considerations such as the availability of fuels, the operational requirements, market conditions, network requirements. This section briefly appraises the options available for the Project following the principles of Best Available Techniques (BAT) and highlights which options have been chosen. The Project has been reviewed against the European Commission's BAT Reference (BREF) Notes for Large Combustion Plants (LCP) 2006 and Best Available Techniques (BAT) Reference Document for the Large Combustion Plants Draft 1 (June 2013) which set out what would constitute BAT in terms of a coal fired power plant.

A clear and comprehensive definition of BAT is provided within the European Union Directive 96/61/EC in article 2.11:

- "best available techniques" shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole:
- "techniques" shall include both the technology used and the way in which the plant is designed, built, maintained, operated and decommissioned;
- "available" techniques shall mean those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator,
- "best" shall mean most effective in achieving a high general level of protection of the environment as a whole.

The main issues relevant to this review of BAT were deemed to be the choice of combustion technology and the techniques proposed to control the key emissions generated by the Project. A summary of the Projects performance against the identified BAT criteria has been presented in Table 3.4.

Table 3.4: BAT Overview

System	BAT Options	Chosen Option
Combustion Technology	• Pulverised coal (PC) firing: – Dry bottom ash furnace – Wet bottom ash furnace • Fluidised bed combustion furnace: – Non-pressurised systems – Pressurised systems	CHP5 will utilise CFB boiler technology The benefits of using this technology are as follows: • A high level of combustion efficiency • Low levels of NO_x as a result of the low combustion temperatures. • Low SO_2 emissions – through the injection of limestone

System	BAT Options	Chosen Option
	• Grate firing • Techniques to increase coal-fired efficiency: – Unburnt carbon in ash – Air excess – Flue-gas temperature • Techniques to improve combustion efficiency – Supercritical – Combined heat and power	and low combustion temperatures. • Ability to combust a range of fuels as this technology is not highly sensitive to fuel specifications and as such, can lower grade coals can be combusted. • Fuel flexibility – a wide range of fuel characteristics can be used in a single boiler. • Whilst supercritical technology is being used more for CFB technology
Techniques to reduce particulate emissions	• Electrostatic precipitators (ESPs) • Fabric filters • Wet scrubbers	• Pulse-jet fabric filters will be installed to achieve the environmental performance by reducing the levels of particulate matter (PM) contained the flue gas to be released from the stack. • The following specified particulate emission limits will be guaranteed: 30 mg/Nm^3 at 6% O_2 dry
Techniques to reduce sulphur oxides emissions (in particular sulphur dioxide SO_2)	Primary measures: • Use of low sulphur fuel • Use of adsorbents in fluidised bed combustion systems Secondary measures: • Wet flue-gas desulfurization (FGD) - water + limestone as reagent • Semi-dry FGD - lime as reagent • Seawater FGD	• Limestone is fed into the CFB boiler to reduce the SO_2 content of flue gases. • Low levels of SO_2 can be achieved through the injection of limestone. • The following specified SO_x limit of 150 mg/Nm^3 will be guaranteed. • Given the achievable emissions levels from the CFB boiler, FGD is not considered necessary. •
Techniques to reduce nitrogen oxide emissions	Primary measures: • Combustion modifications: • Low excess air • Air staging • Air staging in the furnace (burner out of service, biased burner firing, over-fire air) • Low NO_x burners • Flue gas recirculation • In furnace • Reduced air preheat • Fuel staging • In furnace (re-burning) Secondary measures: • Selective catalytic reduction (SCR) • Selective non catalytic reduction (SNCR)	• SNCR with urea injection will be installed for NO_x control • The following specified NO_x limit of 150 mg/Nm^3 will be guaranteed. • Relatively low temperature combustion in the CFB boilers generally results in less generation of thermal NO_x compared to PC boilers.
Cooling system	• Open once-through systems • Open wet cooling tower • Open hybrid cooling tower • Natural draft cooling • Dry air-cooled condenser	The Water Resources Assessment (WRA) undertaken for the Project recommended that given water resources were not available for a water cooled plant an ACC would deliver the most water efficient solution, as a water cooled plant (natural draft cooling tower (NDCT) would require more than ten times the water requirement for the ACC option.

System	BAT Options	Chosen Option
		Given the water constraints in Mongolia, it was determined that ACC would be the most suitable cooling option for the Project.

3.4 Carbon Capture and Storage

Fossil fuel power plants can be built with the carbon capture technology integrated, or can be built "carbon capture ready," which allows the plant to have carbon capture capabilities in the future.

The Consortium completed a preliminary study to assess the economic feasibility of developing the Project to be carbon capture ready in the future.

A number of multilateral financial institutions such as EBRD, considered for the project financing, are engaged to fund projects which can demonstrate a minimum environmental impact which includes mitigation measures for CO_2 emissions. In terms of determining the suitability of a coal fired power generation project, typically three screening criteria can be applied:

1. The infrastructure being financed must be the least carbon-intensive of the realistically available options.
2. The infrastructure must use BAT, as defined in the EU Industrial Emissions Directive.
3. The plant must comply with the EU Industrial Emissions Directive (IED) requirements in relation to carbon capture and storage readiness (article 36 of IED).
   a. Suitable storage sites are available
   b. Transport facilities are technically and economically feasible
   c. It is technically and economically feasible to retrofit for carbon dioxide capture.

The study completed focussed on the third point relating to carbon capture and storage readiness. The findings are summarised in Table 3.5.

Table 3.5: Review of carbon capture and storage readiness for CHP5 Project

Criteria	Preliminary study findings
Suitable storage sites for carbon	• In consultation with a local geo-environmental consultancy, the Consortium reviewed options for available carbon capture storage sites • At the time of the study, no known sites were identified to meet the above requirements. It is considered that due to the Mongolian geological structure, potential for carbon storage may exist but that country policy would need to be supportive in order to further identify the potential storage sites.
Technical and economic feasibility of transporting carbon	• For large scale projects, options for transport via rail and pipeline were considered. • Potential impacts of pipelines would need to be assessed including the distance and routing of pipeline including environmental and resettlement effects. • Given no potential storage sites have been identified to date, no further assessment has been made with regard to transportation of the captured CO_2.
Technical and economic feasibility for the retrofit of CO_2	• The Project site does not have sufficient additional land necessary for the future installation of a carbon capture plant. For each of the 3 units, addition land of

Criteria	Preliminary study findings
capture at the plant	25x30m for the capture plant and 120x20m for additional cooling systems (such as fin fan coolers) would be required. If future Mongolian policy favours and incentivises carbon capture and storage (CCS), additional land could potentially be made available by the Government of Mongolia. • The study also identified that for a power plant with a gross output of 150MW_e and net output of 128MW_e, the implementation of carbon capture would lead to a reduction of gross output of 138MW_e and net output of 94MW_e. This would require a readjustment of the Power Purchase Agreement as the original net guaranteed net capacity and heat rates would not be achieved. The Consortium has identified that the investment necessary for CCS would require the PPA tariff to be increased by 60% to be economically viable.

Source: Abbreviated from ENGIE study (2015)

3.4.1 Summary conclusions

The study concluded that in order for CCS to become economically viable long term carbon policies will need to be implemented in Mongolia. Given the substantial increase in tariffs which would have been calculated, at this stage incorporation of carbon capture readiness (CCR) within the project design is not feasible.

3.5 Summary

The use of conventional CHP technology is considered to be the most appropriate technology for the Project as will provide a reliable supply of heat and electricity to Ulaanbaatar. The CFB boiler technology selected is highly efficient and significantly reduces NO_x emissions as a result of low temperature combustion. Coal/lignite is the most appropriate fuel for the Project because of its abundance in Mongolia. Coal consumption per unit for the Project will be less than existing CHPs due to higher boiler efficiency. Delivery by railway is a practical and viable option for shipping the mass volumes of coal from the identified mines to Ulaanbaatar. The Project site has also been strategically located on the outskirts of the city, to minimise the number of affected people in terms of potential environmental impacts, most notably outside of the Ulaanbaatar airshed, and as such the Project will not contribute to the existing poor air quality of Ulaanbaatar. However, the selected Project site does have a number of environmental constraints, most dominantly being its location adjacent to the limited zone of the Bogd Khan SPA and being located on a floodplain, which has required additional engineering design to overcome this constraint. However, the Project will be able to take advantage of the rail links which connect the site to the mines and to Ulaanbaatar.

4 Legal Standards and Requirements

4.1 Introduction

There are a number of national and regional requirements that the Project will have to comply with in addition to appropriate international standards. This section provides a brief overview of the applicable legislation, associated regulations and relevant standards that will be applied to the Project.

4.2 National regulatory framework

4.2.1 National Mongolian legislation

Article 16.1.2 of the Constitution of Mongolia (1992) states that everyone has the right to live in a healthy and safe environment and to be protected against environmental pollution and ecological imbalance. The transition to a market economy has required Mongolia to fundamentally transform its approach to environmental regulation. The creation of a legal basis for the protection and rehabilitation of the environment and natural resources are becoming more common.

The State Great Hural amended existing laws and also introduced new laws in 2012. The purpose of the review was to reduce duplication and improve the quality of regulation, ensuring responsible, environmentally-friendly and sustainable development, improving economic efficiency and introducing international standards in environmental auditing and the “polluter pays” principle. The new laws also, increase public participation in environmental decision-making, and security for environmental protection. A summary of these laws is presented in Table 4.1.

Table 4.1: Key Mongolian Environmental Laws

Current Laws	Latest Changes	Previous Repealed/Revised laws
Law on Environmental Protection	Revised, 2012	Law on Environmental Protection
Law on Environmental Impact Assessment	Revised, 2012	Law on Environmental Impact Assessment
Law on Atmosphere	Revised, 2012	Law on Atmosphere
	Consolidated and repealed, 2012	Law on Reducing Ulaanbaatar Air Pollution
Law on Fees for Air Pollution	Amended, 2012	
Law on Water	Revised, 2012	Law on Water
	Consolidated and repealed, 2012	Law on Spring Water
Law on Water Pollution Fees	Newly created, 2012	
Law on Fees for the Use of Natural Resources	Consolidated and repealed, 2012	Law on Fees for use of Water and Mineral Water
	Consolidated and repealed, 2012	Law on Reinvestment of Natural Resource Use Fees for Conservation
	Consolidated and repealed, 2012	Law on Hunting Reserve use Payments and on Hunting and Trapping Authorization Fees
	Consolidated and repealed, 2012	Law on Fees using Natural Plants
	Consolidated and repealed, 2012	Law on Fees for the Harvest of Timber and

Current Laws	Latest Changes	Previous Repealed/Revised laws
		Fuel Food
Law on Forests	Revised, 2012	Law on Forests
	Consolidated and repealed, 2012	Law on Prevention of Steppe and Forest Fires
Law on Waste	Consolidated and repealed, 2012	Law on Household and Industrial Waste
	Consolidated and repealed, 2012	Law on Prohibiting Export and Transportation of Hazardous Waste
	Consolidated and repealed, 2012	Law on Prohibition of plastic bags use
Law on Hazardous Substances and Chemicals	Revised, 2006	Law on Protection from Toxic Chemicals, 2005
Law on Land	Submitted as new packages of land laws in 2013 and amended as of February 2015	
Law on Land Fees	Amended 2012	
Civil Code of Mongolia	2002 and amended December 2014	
Law on Cadastre Mapping and Land Cadastre	Amended 2011	
Law on Subsoil	Amended, 1995	
Law on Soil Protection and Combating Desertification	Newly created, 2012	
Law on Special Protected area	Amended, 2014	
Law on Buffer Zones	Created 1997	
Law on Protection of Plants	Amended, 2011	
Law on Natural Plants	Amended, 2010	
Law on Animals	Consolidated and repealed, 2012	Law on Fauna
	Consolidated and repealed, 2012	Law on Hunting
Law on Minerals	Amended 2015	
Law on Fire Safety	Amended, 2015	
Law on Sanitation	Renewed, 2012	
Mongolian Protection of Cultural Heritage	Renewed 2014	
Law on Labour Safety and Hygiene	Amended, 2015	

4.2.2 Law on Environmental Protection

The Law on Environmental Protection (2012) is an overarching law for all environmental legislation. It is the principal law that regulates activities associated with the protection of the environment with special emphasis on ‘Natural Resource Reserve Assessment’ and ‘Environmental Impact Assessment’.

The Law sets out the provisions for natural resource use licensing and obligations for pollution prevention. It places an obligation on private entities to comply with relevant environmental standards and to ensure the protection, use, and restoration of natural resources. The latest amendment establishes the liability of polluters to pay compensation for damage caused to the environment and natural resources. The amount of compensation payable depends on the natural resources that have suffered the damage.

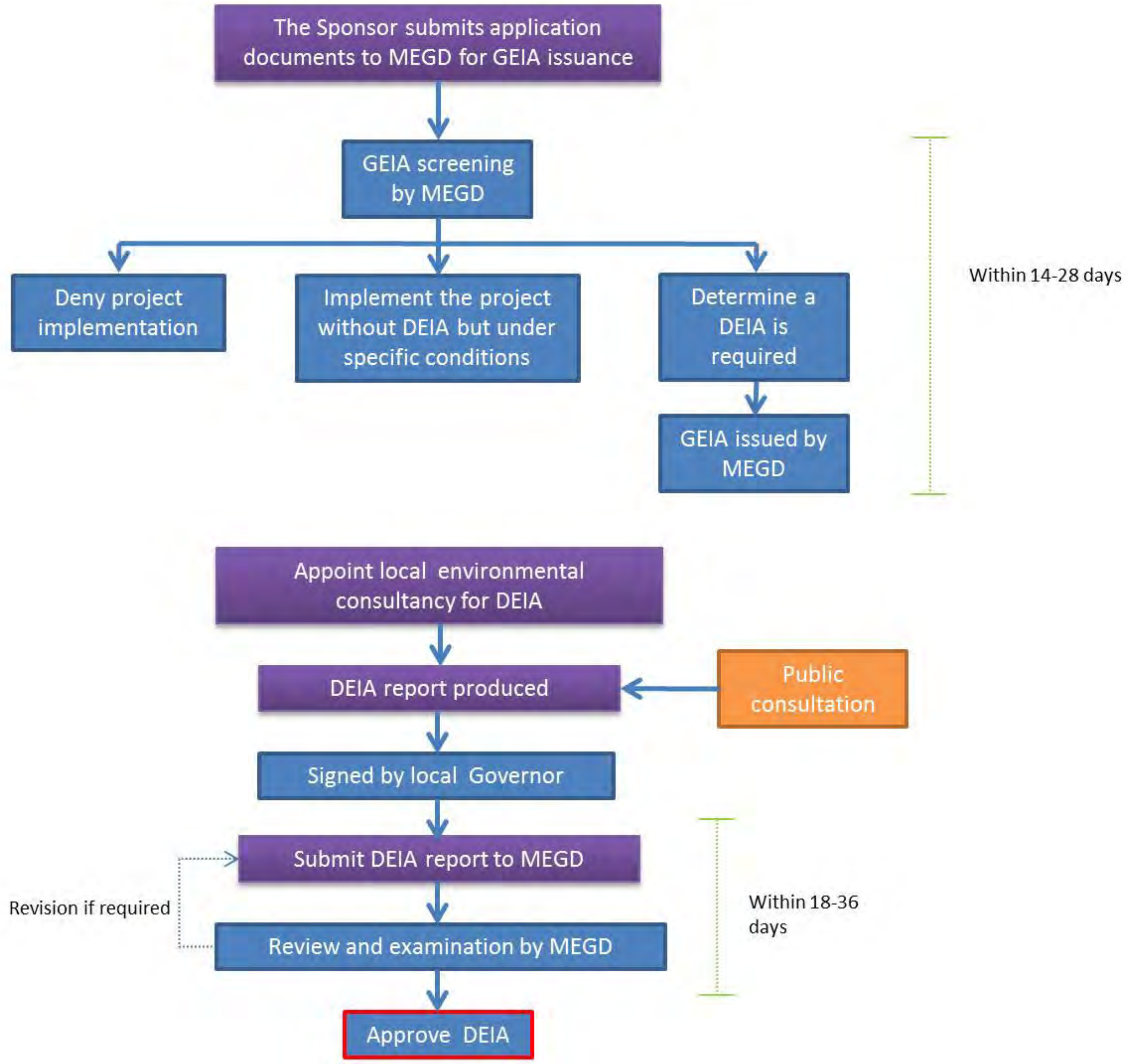
4.2.3 National environmental impact assessment process

The amended Law on Environmental Impact Assessment (EIA) was passed in May 2012. The Law defines the legal process required for development projects including all new projects as well as the renovation and expansion of existing industrial, service and construction activities and project which use natural resources. There are two types of EIA defined in the law: a General EIA (Screening) and a DEIA.

In Mongolia, the MEGD decides as to whether or not a project requires a DEIA. This is undertaken through a General Environmental Impact Assessment (GEIA) screening exercise carried out by the MEGD, based on a brief description of the project provided by the project developer including technical details and drawings. Depending on the screening process, a DEIA is required if the MEGD determine that further assessment is required.

Figure 4.1 provides an overview of the Mongolian EIA process.

Figure 4.1: DEIA Process



MEGD-Ministry of Environment and Green Development; GEIA-General Environmental Impact Assessment; DEIA-Detailed Environmental Impact Assessment.

Source: Nature Friendly

The DEIA is required to include and address the following key topics and issues:

- Environmental baseline conditions
- Project design and analysis of alternatives

- Recommendations for minimising and mitigating measures as well as eliminating potential and significant adverse impacts
- Analysis and calculation of the extent and distribution of adverse impacts and consequences
- An estimation of accidents and risks
- Environmental Protection Plan or Environmental Management Plan
- Environmental monitoring program
- Stakeholder consultation.

The MEGD has confirmed that a DEIA is required for the Project. Nature Friendly, a registered Mongolian Environmental Consultancy has been appointed to produce the DEIA on behalf of the Consortium.

4.2.4 International conventions

Mongolia has signed and is ratified on to a number of international conventions including the Kyoto Protocol and the International Labour Organisation (ILO) core labour standards. Those relevant to the Project are referenced in the applicable specialist assessments (Chapters 7-17).

4.3 International standards and guidelines

The following international guidelines, principles and guidelines apply to this Project.

4.3.1 Project categorisation

Under a number of the international funding mechanisms, international lending organisations are required to categorise projects based on the type of project, its location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. The typical approach to categorising projects is as follows:

Category A: Projects with potential significant adverse social or environmental impacts that are considered diverse, irreversible or unprecedented.

Category B: Projects with potential limited adverse social or environmental impacts that are considered few in number, generally site-specific, largely reversible and readily addressed through mitigation measures.

Category C: Projects with minimal or no social or environmental impacts.

It is considered that the Project has the potential to cause adverse impacts on the community and on sensitive receptors such as watercourses, fauna and in the case of noise, air quality and water quality, extend beyond the Project boundaries. Although the majority of environmental impacts are likely to be temporary and / or can be mitigated, in view of the need to adequately assess the impacts and strongly implement adequate mitigation measures, it is considered that the Project will likely be categorised as **Category A**. Each IFI will individually categorise the Project based on their own policies.

4.3.2 Asian Development Bank

ADB's Safeguard Policy Statement (2009) consists of three operational policies that aim to avoid, minimise, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalised by the development process.

4.3.3 International Finance Corporation (IFC)

The IFC is a member of the World Bank Group (WBG) and is recognised as an international leader in environmental and social sustainability policy. As a part of the 'positive development outcomes' outlined in the IFC's Policy on Environmental and Social Sustainability, the corporation applies a comprehensive set of social and environmental PSs in its project review process. The revised IFC Policy and PSs on Social and Environmental Sustainability came into force in January 2012.

Table 4.2: IFC Performance Standards – Relevance to the Project

Performance Standard	Scope and Triggers	Applicable to the Project
PS1 - Assessment and Management of Environmental and Social Risks and Impacts	PS1 establishes the importance of: (i) integrated assessment to identify the environmental and social impacts, risks and opportunities of projects (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of social and environmental performance throughout the life of the project.	Yes
PS2 - Labour and Working Conditions	PS2 recognises that economic development should be balanced with workers' rights. PS2 aims to: establish, maintain and improve the worker-management relationship; promote the equal opportunity of workers, and compliance with national labour and employment laws; protect the workforce by addressing child labour and forced labour; protect vulnerable workers and promote safe and healthy working conditions and the health of workers.	Yes
PS3 – Resource Efficiency and Pollution Prevention	PS3 recognises that economic activity and urbanisation often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. PS3 aims to: avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities; promote more sustainable use of resources including energy and water; and to reduce project-related emissions that contribute to climate change.	Yes
PS4 – Community Health, Safety and Security	PS4 recognises that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. PS4 aims to: anticipate and avoid adverse impacts on the health and safety of the affected community during the project life cycle; and ensure that the safeguarding of personnel and property avoids or minimises risks to the community's safety and security.	Yes
PS5 – Land Acquisition and Involuntary Resettlement	PS5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on	Yes

Performance Standard	Scope and Triggers	Applicable to the Project
	communities and persons that use this land. PS5 aims to: avoid or at least minimise involuntary resettlement wherever feasible by exploring alternative project designs; mitigate adverse social and economic impacts from land acquisition by (i) providing compensation for loss of assets and (ii) ensuring that resettlement activities are implemented with appropriate consultation and disclosure; and improve or at least restore the livelihoods, standards of living and living conditions of displaced persons.	
IPS6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources	PS6 encourages sustainable development while recognising that the protection and conservation of biodiversity and sustainably managing living natural resources are fundamental to sustainable development. PS6 aims to protect and conserve biodiversity; to maintain the benefits from ecosystem services; and promote the sustainable management and use of natural resources through practices that integrate conservation and development.	Yes
PS7 - Indigenous Peoples	PS7 aims to: ensure that the development process fosters full respect for Indigenous Peoples; anticipate and avoid, minimise or compensate adverse impacts of projects on Indigenous Peoples and provide opportunities for development benefits; establish and maintain an ongoing relationship with affected Indigenous Peoples throughout the life of the project; to ensure free, prior and informed consent of Indigenous Peoples; and respect and preserve their culture, knowledge and practices.	No
PS8 - Cultural Heritage	PS8 recognises the importance of cultural heritage for current and future generations. PS8 aims to protect cultural heritage from the adverse impacts of project activities and support its preservation as well as to promote equitable sharing of benefits from cultural heritage.	Yes

Some PSs require reference to be made to the relevant Environmental, Health and Safety (EHS) Guidelines; these are technical reference documents with general and industry-specific examples of GIIP. In addition to the General EHS Guidelines (April 2007), the EHS Guidelines for Thermal Power Plants (December 2008) are relevant for the purposes of assessing the Project.

Where host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever standards are more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is required as part of the site-specific environmental assessment.

The following WBG/IFC EHS guidelines are applicable in terms of the Projects ‘associated activities’:

- Electric Power Transmission and Distribution (April 2007)
- Waste Management Facilities (December 2007)
- Electric Power Transmission and Distribution (April 2007)
- Railways (April 2007)

4.3.4 European Bank for Reconstruction and Development (EBRD)

Under the EBRD ESP 2014, EBRD categorises projects as either based on environmental and social criteria to:

- Reflect the level of potential environmental and social impacts and issues associated with the proposed project
- Determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required for each project, taking into account the nature, location, sensitivity and scale of the Project and the nature and magnitude of its possible environmental and social impacts and issues.

The categorisation of each project depends on the nature and extent of any actual or potential adverse environmental or social impacts, as determined by the specifics of its design, operation and location. The EBRD ESP 2014 lists the criteria by which a Project is classified as being a Category A project. This includes projects which involve thermal power stations and other combustion installations with a heat output of 300 megawatts or higher and the construction of high-voltage overhead electrical power lines, both of which are features of this Project and consequently it is classified as **Category A.**

4.3.4.1 EBRD performance requirements

EBRD has adopted a comprehensive set of specific Performance Requirements ("PRs") that projects are expected to meet. Furthermore, EBRD is committed to promoting EU environmental standards. The following PRs are relevant to this Project:

- PR1 Environmental and Social Appraisal and Management
- PR2 Labour and Working Conditions
- PR3 Pollution Prevention and Abatement
- PR4 Community Health Safety and Security
- PR5 Land Acquisition, Involuntary Resettlement and Economic Displacement
- PR6 Biodiversity Conservation and Sustainable Management of Living Natural Resource
- PR7 Indigenous Peoples
- PR8 Cultural Heritage

EBRD requires financed projects to be aligned and comply with the standards typically proposed within the European Union legislation. Most relevant applicable legislation is summarized below:

- Council Directive 85/337/EEC (amended by 97/11/EC) on Environmental Impact Assessment (EIA)
- The Industrial Emissions Directive (Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (Natura, 2000) – The Habitats Directive
- Council Directive 79/409/EEC on Conservation of Wild Birds
- Council Directive 2008/98/EC on waste (Waste Framework Directive)
- Council Directive 1999/31/EC (as updated by 2003/33/EC) on the Landfill of Waste 91/689/EEC (amended by 94/31/EEC) controlled management of hazardous wastes

- Council Directive 75/439/EEC (amended by 91/692/EEC) waste oil disposal
- 96/62/EC Framework Directive on Ambient Air Quality Assessment and Management (and Daughter Directives 99/30/EC (NO_x, SO_2, Pb (lead) and PM_{10}), 00/69/EC (benzene, CO), 02/3/EC: Ozone, 2008/50/EC on ambient air quality and cleaner air for Europe

4.3.5 Japanese Bank for International Cooperation (JBIC) Requirements

The JBIC requires that proponents of projects seeking financing undertake appropriate actions to prevent or minimise impacts on the environment and local communities such that unacceptable effects are avoided. The primary document governing JBIC environmental and social lending requirements is '*Guidelines for Confirmation of Environment and Social Considerations*' (JBIC Environmental and Social Guidelines), which were revised in April 2012.

Part 1 (4) of the JBIC Environmental and Social Guidelines identifies the applicable environmental and social standards that are required to be achieved and which JBIC will undertake its environmental review against:

- Host country environmental laws, standards, policies and plans
- Relevant aspects of the World Bank Safeguard Policy regarding environmental and social considerations
- For private sector limited or non-recourse project finance cases or otherwise where appropriate, the relevant aspects of the IFC PSs.

JBIC also refers to standards established by other international financial institutions and other internationally recognised standards and/or good practices established by developed countries in its environmental review process for benchmarking and reference as required. Environmental checklists are provided for different industry types that detail the environmental and social issues that should be assessed. The environmental checklists of particular relevance to the proposed Project include:

- Environmental Checklist 11: Thermal Power

The following environmental checklists relate to associated facilities:

- Environmental Checklist 15: Power Transmission and Distribution Lines
- Environmental Checklist 21: Waste Management and Disposal

4.3.6 Equator Principles (EqPs)

The EqPs are a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing. EqPs signatories use the principles to ensure that the projects they finance are developed in a manner that is socially responsible and reflect sound environmental management practices. To date, these principles have been adopted by 79 financial organisations as a mandatory requirement for project financing.

Mongolia is designated a lower middle income country on the World Bank Development Indicators Database and it is not a designated country according to the definition provided within the EqPs III. As such, and as directed by the Equator Principles, for the purposes of project financing in Mongolia, project proponents are required to demonstrate not only compliance with host country laws but also compliance with all applicable IFC Performance Standards and supporting EHS World Bank Guidelines.

4.4 Summary

A national DEIA is required for the Project which is being produced by Nature Friendly, a registered Mongolian Environmental Consultancy, on behalf of the Consortium.

This ESIA is being undertaken in line with the requirements of IFC PS, which is recognised as international best practice. As such, the requirements of ADB, EBRD, JBIC and the EqPs should fundamentally be met when adhering to the IFC PS.

Whilst the Project will achieve a guaranteed emissions level of 30mg/Nm^3 for particulates compared to the EBRD requirement of 10mg/Nm^3, it will meet the emissions guidelines of other IFIs. However, it is estimated an emissions level typically between 15-21 mg/Nm^3 could be achieved for the majority of the Project's operation depending on the ash content and heating value of the coal provided. In the event of future tightening of emissions limits, small modifications could be made to the plant to achieve an emissions level of 10mg/Nm^3 for particulates. Consequently, this would reduce the efficiency of the plant and increase plant CO_2 emissions.

5 Assessment Scope and ESIA Process

5.1 Introduction

In accordance with international requirements for environmental and social assessment, the scope of works for the ESIA includes:

- Environmental, social, labour, gender, health, safety, risks and impacts
- The Project and associated facilities
- Risks and impacts that may arise for each key stage of the project cycle, including pre-construction, construction, operation and decommissioning or closure
- Role and capacity of the relevant parties including government, contractors and suppliers
- Potential third party impacts including supply chain considerations

The ESIA has identified negative and positive, direct and indirect, and cumulative impacts of the Project related to the bio-physical and the socio-economic environment.

The definition of the Project includes all infrastructure and facilities that are directly part of the proposed development or associated development that exists specifically for or as a result of the Project. Given the limited detail available regarding the associated facilities at the time of this ESIA, a high level qualitative assessment of this infrastructure has been completed, noting that further detailed assessment will be undertaken prior to their development.

This chapter presents the key findings of the scoping stage and the general methodology followed to produce undertake an ESIA to meet international standards.

5.2 Scoping stage

For the first step in the ESIA process, Mott MacDonald produced a Scoping Report (August 2014) that set out the potential environmental and social issues associated with the Project. The scoping report established the scope and methodology for assessing the potentially significant environmental and social impacts from the Project, based on the initial site visit and consultations with relevant environmental authorities in Ulaanbaatar. The scope and methodology set out in the scoping report are presented in Table 5.1. The scoping report was updated in August 2015 following introductory project consultation with community members and Non-Governmental Organisations (NGOs).

Detailed consideration of all potential impacts has been reported in the subsequent individual assessment chapter. It is considered that decommissioning impacts would be similar in nature to those identified within the construction phase.

Table 5.1: Identification of potential environmental and social impacts of the Project and proposed ESIA assessment methodology (taken from CHP5 Scoping Report)

Environmental / Social Aspect	Key Issues / Impacts and Potential Significant Effects	Indicative National Laws / Legislation and Standards / International Guidelines	Additional Baseline Data to be Collected	Impact Assessment Methodology
Environmental				
Air Quality	Construction activities associated with the proposed development could generate dust from excavation works, the loading/unloading of materials, stockpiling of materials and from increased traffic movements and associated vehicular emissions. A reduction in air quality will occur due to the introduction of additional emissions (including dispersion of the following pollutants: PM_{10}, NO_x and SO_2) during operation in proximity to human and ecological receptors.	• Law on Air Pollution Reduction of the Capital City MNS 5919: 2008 - Air emissions from the steam and hot water boilers or thermal plant • MNS 4585:2007 – Mongolian Standards for ambient air quality • WBG/IFC EHS Guidelines for Thermal Power Plants	• Existing pollutant concentrations obtained from available ambient air quality monitoring data in the area • Short term spot sampling undertaken.	Construction impacts will be assessed using a qualitative risk based approach to determine the effects of construction dust and construction emissions. This will identify the activities in the construction phase of the Project, which could lead to temporary effects on air quality. For each activity, the risk of potential emissions will be evaluated with consideration to any mitigation measures that are proposed. The assessment will also consider whether there will be any sensitive receptors (human or ecological) that might be impacted. The risk assessment will then determine whether additional mitigation measures are required to reduce the risk of any impacts. These mitigation measures can be implemented through the Construction Environmental and Social Management Plan (CESMP). Operation emissions will be assessed using an internationally approved dispersion model such as ADMS. The assessment will include determination of a stack height to identify the most appropriate release height for emission based on the building layout and the surrounding topography. Modelling will be undertaken to calculate pollutant concentrations at nearby sensitive receptors and will be compared against both national and international ambient air quality standards. The dispersion modelling will take account of the proposed fuel specifications, planned operation conditions and local meteorological conditions in order to calculate resultant pollutant concentrations. The assessment will determine the impacts of the Project on ambient air quality and asses these against national and international ambient air quality standards. The baseline information captures the existing pollution sources including existing power plants and vehicle emissions. With the exception of the Amgalan Heat Only Boiler (HOB) plant within the Ulaanbaatar airshed no further future point source developments are planned. Fugitive emissions arising from fuel handling and ash stockpiles during the operational phase will be considered qualitatively in the assessment, following the same risk assessment approach outlined for the construction phase. Emissions from traffic impacts will be

Environmental / Social Aspect	Key Issues / Impacts and Potential Significant Effects	Indicative National Laws / Legislation and Standards / International Guidelines	Additional Baseline Data to be Collected	Impact Assessment Methodology
				assessed qualitatively. In addition, a qualitative assessment of associated rail movements required for the Project will be undertaken.
Noise and Vibration	During the construction phase the main sources of noise and vibration are likely to be from site clearance, earthmoving, construction traffic, ground and foundation works including piling and construction of structures associated with all aspects of the project. During the operational phase, installed plant equipment will be the main source of noise, with noise also being generated by related rail, truck and other vehicle movements. Noise disturbance could potentially affect nearby residential receptors and receptors travelling through the Khuliin River Valley and / or ecological receptors within the adjacent Bogd Kahn National Park.	• Mongolian Noise Standards MNS 4585:2007 • WBG/IFC EHS Guidelines Environmental – Noise Management	• Collection of noise baseline data at sensitive receptor locations identified around the Project site and surrounding area.	For the construction phase noise assessment, calculations of predicted noise will be made based on the likely construction plant, the percentage of time that plant are likely to be in operation, and their operating position in relation to sensitive receptors. Operation noise arising from the Project will be assessed using internationally approved noise assessment methodologies and based on sound power levels for the type of equipment that will be installed. Noise levels will be calculated at nearby receptors and be compared to relevant national and international standards including WBG/IFC EHS General Guidelines: Environmental – Noise Management.
Hydrology, Hydrogeology and Flood Risk	The proposed site is located on a potential future drinking water reserve for Ulaanbaatar, upstream of the “Central Source” of drinking water supply for Ulaanbaatar and also upstream of informal private supplies. There is potential for pollution and contamination of drinking water resources from surface water drainage, potential leaks and spills of hazardous materials and waste during construction and operational phases. There are limited water resources in Ulaanbaatar. The Project will obtain its water demand from an existing groundwater source in the Tuul Valley, which need to be considered in the context of overall water demand.	• Law on Water • Law on Water Pollution Fees • Law on Fees for the Use of Natural Resources	• Consultation with the National Agency for Meteorology, Hydrology and Environmental Monitoring to obtain existing baseline data. • Review of geotechnical data. Available secondary data used for the Flood Risk Assessment (FRA) including meteorological, hydrological and topographical data.	Assessment of other groundwater users and what impact the water demands of the Project may have on existing users, which has been assessed in a separate Water Resources Assessment (WRA) completed for the Project. For both the construction and operational phases, the mitigation measures relating to surface water drainage and transport/ handling/ storage/ use of hazardous materials and waste for the main site and ash disposal site will be evaluated in order to assess impacts to groundwater contamination. For both construction and operational phases the flood mitigation measures will be evaluated using the Hydrologic Engineering Centers River Analysis System (HEC-RAS) model developed for the FRA to determine the likely impact on flood risk downstream of the site as a result of the development of these measures in terms of water levels, flows and flood velocities. The extent of river modifications and the possible alterations of the natural floodplain will also be considered. Flood mitigation measures to be incorporated

Environmental / Social Aspect	Key Issues / Impacts and Potential Significant Effects	Indicative National Laws / Legislation and Standards / International Guidelines	Additional Baseline Data to be Collected	Impact Assessment Methodology
	During the construction and operational phase there is likely to be an increase in the risk of groundwater contamination associated with works at the Project. The alteration and channelization of watercourses at the site will significantly affect the natural river channels by reducing floodplain storage. The flood mitigation measures required to be undertaken for the site to be used may exacerbate flood risk downstream of the site within the residential area of the Tuul confluence, having potentially significant effects on human and ecological receptors.			into plant design and operational measures have been developed as part of the Project's FRA.
Greenhouse Gases	Emissions of Greenhouse Gases (GHGs) will arise during the construction and operational phases of the Project. There will be embodied GHGs in construction materials (from their manufacture) and plant and vehicular emissions used for construction. Emissions of greenhouse gases will be generated from the operation of the Project.	• Law on Atmosphere • Law on Fees for Air Pollution • WBG/IFC EHS Guidelines for Thermal Power Plants	• Review of existing greenhouse emissions in Mongolia using data from the International Energy Agency and the Mongolian National Communication published as part of Mongolia's obligations to the United Nationals Framework on Climate Change.	Greenhouse gas impacts during the construction phase will be qualitatively assessed. The key activities which may lead to potential emissions will be identified and the assessment will consider whether there are suitable measures in place to minimise construction phase emissions and if additional measures should be included in the CESMP. Operational phase emissions (mostly combustion related emissions) within the Project boundary will be quantified. Emissions will be calculated based on the fuel properties, energy and mass balances and other operational data. The sources included in the assessment and calculations completed will be undertaken with reference to the methods and guidance provided in IFC PS3 and the EBRD GHG Calculation Methodology. In addition to quantifying the total emissions the emissions intensity (emissions per unit of power produced) will also be quantified. This will be compared to typical values for plants of this kind, and to the average grid electricity production values for Mongolia to provide an indication as to relative efficiency of the plant. Other sources of operational emissions will be qualitatively assessed.
Biodiversity and Ecology	The Project has the potential to result in a number of impacts on biodiversity, including: • Effects on protected species and	• Law on Protection of Plants • Law on Natural Plants	• Baseline flora and fauna surveys on site and surrounding area. • Review of available	Based on existing available information and flora and fauna surveys undertaken, the ecological and biodiversity impacts due to direct loss of natural habitat and indirect disturbance will be assessed qualitatively. The impact significance will be assessed with reference to the IFC PS6, which includes an assessment of the significance of

Environmental / Social Aspect	Key Issues / Impacts and Potential Significant Effects	Indicative National Laws / Legislation and Standards / International Guidelines	Additional Baseline Data to be Collected	Impact Assessment Methodology
	habitats including the Bogd Kahn National Park, located adjacent to the proposed site. • Loss or disturbance to flora and fauna on the main site and associated facilities. • Effects on the use of the site by fauna due to habitat loss and fragmentation	• Law on Animals • Law on Fees for the Use of Natural Resources	desktop literature. • Consultation with MEGD and relevant stakeholders.	Project impacts on all levels of biodiversity. The impact significance will take into account the following: • The habitat quality of the impact area. • The presence of species of conservation interest listed under the international conventions for conservation of wildlife. • The presence of sites of internationally recognition and the likelihood of impact. Mitigation measures will be proposed in the order of priority of avoidance, minimisation and the last resort of compensation with the aim of achieving no residual loss of biodiversity. A Biodiversity Management Plan will be proposed if necessary for implementation during the construction and operational phases. Of particular note, one of the potential impacts specified by the IFC PSs (particularly PS6) relates to the consideration of the Project's potential impact on the services provided by the surrounding environment ("ecosystem services"). Ecosystem services relate to the benefits that people, including businesses, derive from ecosystems. Ecosystem services are organised into four types: (i) Provisioning services - the products people obtain from ecosystems. (ii) Regulating services - the benefits people obtain from the regulation of ecosystem processes. (iii) Cultural services - the non-material benefits people obtain from ecosystems. (iv) Supporting services - which are the natural processes that maintain the other services. The evaluation of ecosystem services is a complex consideration of natural, social and economic values placed upon the system in question. As such, the ESIA will consider socio-economic indicators for the area which will be determined through the detailed studies to be undertaken as part of the ESIA. Other elements within the assessment such as air quality and waste generation will be considered.
Ground Conditions	The Project has the potential to result in a number of impacts on ground conditions, including:	• Law on Subsoil • Law on soil protection and	• Desktop baseline data collection of published information.	The assessment of impacts relating to contaminated land risks will be informed by a high level contamination assessment to broadly comply with the requirements of WBG/IFC EHS Contaminated Land guidance. The assessment will identify the potential contamination

Environmental / Social Aspect	Key Issues / Impacts and Potential Significant Effects	Indicative National Laws / Legislation and Standards / International Guidelines	Additional Baseline Data to be Collected	Impact Assessment Methodology
	• Change in land use and impacts on soil structure. • Potential for fuel or chemical spills that could result in contamination of land.	Combating desertification	• Soil and groundwater quality data obtained during the geotechnical study. • Collection of shallow level soil profile data at selected points in the study area to define soil type, erosion and disturbance.	'sources', transport 'pathways' and sensitive 'receptors' and the linkages between them. The potential risk associated with each pollution linkage will then be evaluated based on the probability and the likely consequence of the event occurring all phases of the Project.
Traffic and Transport	The Project will have impacts on the existing road network during the construction phase by generating significant traffic movements. During operation there will be a small increase in traffic generated as a result of routine deliveries, staff and personnel operating the site and equipment and parts during maintenance activities and outages. The import of coal and ash exports will be via rail. Effects arising from increased traffic from the Project are likely to include an increase in noise levels, disturbance to local communities, increased emissions from traffic and impacts on road safety.	• MNS 4585:2007 – Mongolian Standards for ambient air quality	• Use of existing traffic data (where available). • Short term traffic counts of vehicles passing through an observation point (traffic in both directions). • Information to be gathered from studies to be completed on the use of rail for transportation of coal, ash and other materials including a rail management study which has been commissioned for the Project.	The traffic assessment will be undertaken in line with Guidance on Transport Assessment 2007 to assess the likely changes in traffic movements (road and rail) predicted as a result of the development and the proposed routings of the anticipated traffic movements. The traffic assessment will take into account changes in rail movements for the movement of coal and ash. Consideration will also be given to abnormal load deliveries which will be required during the construction phase. Following the assessment, mitigation measures will be identified in line with international best practice.
Landscape and Visual	The Project site is adjacent to the Bogd Kahn National Park, regarded for its natural landscape value. Development during the construction and operational phases could potentially affect the landscape character of the area and the views experienced by some sensitive visual receptors. The Project will change the existing	• Law on Special Protected Areas • Law on Buffer Zones	• Review of available mapping and topographical data, aerial photographs, information from statutory agencies, and other relevant reports and data.	A review of baseline information will be undertaken to develop an understanding of the characteristics and features of the site and its surroundings. The landscape and visual assessment will make reference to the IFC guidelines and requirements which would then be refined in accordance with guidance contained within the publication Guidelines for Landscape and Visual Impact Assessment (2013), prepared by the UK Landscape Institute and the Institute of Environmental Management and Assessment (IEMA)which is

Environmental / Social Aspect	Key Issues / Impacts and Potential Significant Effects	Indicative National Laws / Legislation and Standards / International Guidelines	Additional Baseline Data to be Collected	Impact Assessment Methodology
	landscape setting through introduction of a power plant into a currently unindustrialised area located on the outskirts of Ulaanbaatar. This will affect the visual amenity of recreational users, residents etc.			deemed to represent best practice. The sensitivity of the receiving landscape and visual receptors will be identified as part of the assessment. Mitigation measures will be identified where feasible and considered through the iterative plant design process.
Waste and Materials Management	Hazardous and non-hazardous wastes will be generated in the construction and operational phases of the Project. The construction phase will generate quantities of spoil from earthmoving works and other wastes generated by the construction workforce. During operation, the largest waste stream will be ash generated by the combustion process. If not handled and stored appropriately, ash has the potential to impact air quality and result in the contamination of soils and the contamination of groundwater.	• Law on Waste • Law on Hazardous Substances and Chemicals	• Existing information on the following will be reviewed: • Existing waste management capacity in Ulaanbaatar. • Existing waste management facilities in Ulaanbaatar. • Project ash management study under preparation	An assessment of the types of waste to be generated by project activities and the proposed method of waste disposal will be undertaken. The assessment will consider the types and quantities of solid waste that would be generated during construction and operation, and the severity of the likely significant environmental impacts and effects that may arise from the quantity of waste requiring off-site disposal to landfill (this being a finite and least preferred waste management option). The assessment will consider waste arising from the Project and waste management infrastructure capacity at local and regional levels, alongside the route of the Project. The assessment will consider relevant waste management legislation, policies and guidance applicable to all buildings and infrastructure components of the Project. The criteria for the assessment will be derived from professional experience previously applied to large-scale infrastructure projects. Waste management resources and receptors will include waste receiving facilities, waste transportation providers and waste disposal facilities. The assessment will also consider the availability of existing waste disposal facilities in the locality of the Project and how they can be utilised, where such information is available. Mitigation and enhancement for waste and resources management during construction and operation will be considered in line with the waste hierarchy and good practice guidelines includes EHS Guidance. Residual environmental effects will then be identified.
Archaeology and Cultural Heritage	Potential impacts on cultural heritage assets could include: • Change in the setting due to the presence of Project structures in proximity to an asset • Damage to a property and/or the integrity of its foundations • Partial or full demolition	• Law on Special Protected Areas • Mongolian Protection of Cultural Heritage	• Consultation with Institute of Archaeology to determine potential presence of archaeological artefacts on site. • Site walkover to comprise the main	Initial consultation with the Mongolian Academy of Sciences Institute of Archaeology (MASIA) has indicated that no substantial earthworks associated with the site lie within the development. There is potential that previously unidentified cultural assets may lie within the footprint of the development. An appraisal of the existing cultural heritage and archaeological baseline will be performed using a desk based assessment to identify tangible and intangible assets within a 1km buffer from the proposed development footprint; existing landscape features will be

Environmental / Social Aspect	Key Issues / Impacts and Potential Significant Effects	Indicative National Laws / Legislation and Standards / International Guidelines	Additional Baseline Data to be Collected	Impact Assessment Methodology
	• Potential archaeological impacts may include • Unearthing and exposing remains to erosion or the elements • Damage to archaeological remains during excavations during the construction phase • Removal of archaeological remains		power plant site and locations for associated activities.	assessed for the likelihood of containing archaeological remains. Discussions with MASIA and consultation with the local community may be necessary to identify any potential remains within the development that represent previously unrecorded heritage assets. The nature, location, extent and importance of any cultural heritage assets and archaeological resources which have the potential to be impacted (either directly or indirectly) by the Project will be described. The assessment to be undertaken in accordance with IFC PS8 and EBRD PS8 will consider how the Project may impact on the known heritage assets. Where there is the potential for the Project to result in significant impacts to archaeological or cultural assets, appropriate mitigation will be identified.
Social				
Social - Job creation and labour issues	The Project will: • Generate employment during the construction and operational phases. • Develop skills of employed persons • Create a multiplier effect of increased incomes in local community	• Labour Law of Mongolia • Law on Labour Safety and Hygiene	• Baseline data on education, skills and employment in the local community.	The ESIA will assess the social and economic impacts associated with the construction and operational phases of the Project. The socio-economic assessment will propose mitigation measures and provide recommendations for social indicators to be included in the ESMMP. Information for the socio-economic assessment will utilise a combination of desktop studies, information gathered as part of the consultation with the local community and knowledge of the local area from Mongolian-based consultants, Nature Friendly. The public participation phase of the environmental assessment process is expected to identify the Interested and Affected Parties (IAPs), also referred to here as stakeholders), disseminate information to them, manage their dialogue with the project proponent, assimilate and take into account public comments received, and feedback the outcomes and inputs of the dialogue to demonstrate how these have been taken into account in the design of the activity. Dissemination of project information and engagement with stakeholders needs to continue throughout the Project's lifetime. The socio-economic impact assessment will be undertaken with reference to IFC PS 2, 4, 5, 6 and 7. A Resettlement Plan (RP) is being prepared for households who will be physically and / or economically displaced by the Project. This plan will summarise the national and international requirements for
Social - Community health safety, security and wellbeing	Transportation of materials, workers and waste may generate a risk of traffic accidents. The Project could also result in an influx of workers and people seeking work to the area.	• Law on Sanitation • The Constitution • Law on Land • Land Allocation Law • Land Procedure	N/A	
Social - Livelihoods and economic impacts	The development of the Project may have an impact on the enjoyment and amenity value of local leisure facilities. There may also be economic effects on existing businesses and developments.	N/A	• Information on types of businesses and leisure facilities in the nearby area	
Social - Land	The Project could potentially result in	• Constitution of	• All relevant data from	

Environmental / Social Aspect	Key Issues / Impacts and Potential Significant Effects	Indicative National Laws / Legislation and Standards / International Guidelines	Additional Baseline Data to be Collected	Impact Assessment Methodology
acquisition and resettlement	a loss of livelihoods or homes due to land acquisition. Currently there are households living within the Project site and seasonal herder households identified who use the site for summer grazing. However, this may change depending on the Project design and results of impact assessment studies.	Mongolia • Law on Land • Law on registration of immovable property • Civil Code of Mongolia • Law on Allocation of Land to Mongolian Citizens for Ownership, 'the Land Allocation Law'	the government body managing resettlement. • Baseline data on the use of the site for livelihood supporting activities.	land acquisition and involuntary resettlement, assess the households who will be affected including a census, inventory of assets and socio-economic conditions. It will also present the criteria for eligibility and entitlements for compensation, timeframes for resettlement activities and key organisations responsible for implementation of the resettlement plan.
Social - Ecosystem services	The Project could potentially result in a loss of natural resources used for subsistence and / or impacts on land required for plant and laydown area that may currently be used for grazing horses and cattle, use of water from river.	N/A	• Baseline information on use of the site for natural resources for food, fuel, grazing, building materials etc.	
Social - Indigenous Peoples	Potential impact on populations of Indigenous Peoples during construction and operation. At this stage, impacts on Indigenous Peoples are not expected but this will be investigated further and confirmed.	N/A	• Information on ethnicities of local communities from census or consultation.	
Social - Access to summer residences and camps	A route traversing the Project site leads to summer residences and camps. Access will be restricted due to the Project. An unknown number of people will be affected. Alternative access to the road will need to be provided.	N/A	• Details on who uses the summer residences and camps to be obtained through consultation with stakeholders.	

5.3 Impact assessment methodology

5.3.1 Overview

Following the review of the studies undertaken to date and the findings of the site visits, specialist assessments were carried out in order to predict potential impacts associated with the Project and propose measures to mitigate the impacts as appropriate. Each assessment chapter follows a systematic approach, with the principal steps being:

- Description of assessment methodology used
- Identification of the spatial and temporal scope of potential impacts (area of influence)
- Description of baseline conditions
- Impact assessment
- Identification of appropriate mitigation measures as required
- Assessment of residual impacts

5.3.2 Area of influence and temporal scope

The Area of Influence (AoI) indicates where proposed works, including related facilities and infrastructure, will have a direct or indirect impact on the physical and social environment. This can result from aspects such as physical land-take or as a result of the extent of the potential impact that extend beyond the developments physical boundary such as noise emissions or emissions to air. The AoI can also vary according to the stage of the Project being assessed such that construction impacts may have a greater area of impact than for operation.

For each impact assessment chapter the spatial and temporal zone of influence are defined. It is important to note that the area of influence has primarily been based on the impacts associated with the power plant itself. However, as far as reasonably practical and for the purposes of this ESIA consideration of the potential locations of the associated facilities has been taken into account in the defined spatial scope for each environmental and social aspect.

It should be noted that this approach has been adopted given that the detailed design and routing arrangements have not yet been finalised for the associated facilities. Further assessment will be undertaken for each of these components by the relevant developer / lending agency once feasibility studies have been completed. Further details can be found in chapter 18.

5.3.3 Baseline data

The primary sources of information for baseline assessment have been the site surveys carried out by Mott MacDonald Limited in August 2014, and by local environmental specialists from Nature Friendly LLC. In addition, secondary information obtained by the Project proponent has also been utilised. Where secondary information has been used, it is referenced in each assessment chapter that follows.

5.3.4 Assessment of effects

5.3.4.1 Overview

The assessment of the significance of impacts and identification of residual impacts has taken account of any inherent mitigation measures incorporated into the Project by the nature of its design. The significance of the resultant impact is largely dependent on the extent and duration of change, the number of people or size of the resource affected and their sensitivity to the change. The criteria for determining significance are specific for each environmental and social aspect but generally for each impact the magnitude is defined (quantitatively where possible) and the sensitivity of the receptor is identified. Generic criteria for the definition of magnitude and sensitivity are summarised below.

5.3.4.2 Magnitude

The assessment of impact magnitude is undertaken in two steps. First, the key impacts associated with the Project have been categorised as beneficial or adverse. Second, the magnitude of potential impacts have been categorised as major, moderate, minor or negligible based on consideration of the parameters such as:

- Duration of the impact – ranging from temporary with no detectable impact to beyond decommissioning
- Spatial extent of the impact – for instance, within the site boundary to regionally, nationally, and internationally
- Reversibility – ranging from no change to permanent requiring significant intervention to return to baseline
- Likelihood – ranging from unlikely to occur to occurring regularly under typical conditions
- Compliance with legal standards and established professional criteria - ranging from meets standards or international guidance to substantially exceeds national standards and limits/international guidance.

Table 5.2 outlines the generic criteria for determining magnitude.

Table 5.2: Generic criteria for determining magnitude

Magnitude (beneficial or adverse)	Description
Major	Fundamental change to the specific conditions assessed resulting in long term or permanent change, typically widespread in nature, and requiring significant intervention to return to baseline; exceeds national standards and limits.
Moderate	Detectable change to the specific conditions assessed resulting in non-fundamental temporary or permanent change.
Minor	Detectable but minor change to the specific condition assessed.
Negligible	No perceptible change to the specific condition assessed.

Source: Mott MacDonald

5.3.4.3 Sensitivity

Sensitivity is generally site specific and criteria have been developed from baseline information gathered and secondary information sources. The sensitivity of a receptor will be determined based on review of the population (including proximity/ numbers/vulnerability) and presence of features on the site or the surrounding area. Generic criteria for determining sensitivity of receptors are outlined in Table 5.3. Each detailed assessment defines sensitivity in relation to their topic if required.

Table 5.3: Criteria for determining sensitivity

Sensitivity	Definition
High	Vulnerable receptor (human or ecological) with little or no capacity to absorb proposed changes or minimal opportunities for mitigation.
Medium	Vulnerable receptor (human or ecological) with limited capacity to absorb proposed changes or limited opportunities for mitigation.
Low	Vulnerable receptor (human or ecological) with some capacity to absorb proposed changes or moderate opportunities for mitigation
Negligible	Vulnerable receptor (human or ecological) with good capacity to absorb proposed changes or and good opportunities for mitigation

Source: Mott MacDonald

5.3.4.4 Impact evaluation and determination of significance

The significance of an impact can be described by the interaction of magnitude and sensitivity as depicted in the significance matrix shown in Table 5.4.

Table 5.4: Significance matrix

		Magnitude						
		Adverse				*Beneficial*		
		Major	Moderate	Minor	Negligible	Minor	Moderate	Major
Sensitivity	High	Major	Major	Moderate	Negligible	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Negligible	Minor	Moderate	Major
	Low	Moderate	Minor	Negligible	Negligible	Negligible	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

Table 5.5 provides a guide to the terminology used to define significance of impacts, however it should be noted that each chapter of the ESIA develops topic specific criteria where applicable.

Table 5.5: Definition of significance

Significance of impact	Definition
Negligible	No detectable impact – i.e. effects are within the range of normal natural variations in the system.

Significance of impact	Definition
	No mitigation is required.
Minor	Short time scale of the activity or event. Area over which the activity or event may occur is <5 % of the area occupied by the resource of concern. Impacts a specific group of localised receptors/population only. Activity does not exceed statutory limits. No mitigation is required.
Moderate	Time scale of the activity or event is 5-10% of the regeneration time of the resource of concern or a critical sensitive period. Area over which the activity or event may occur is 5-10% of the area occupied by the resource of concern. Affects a portion of a population and impact may bring about a change in abundance and/or distribution over one or more generations, but does not threaten the integrity of that population or any population dependent on it. Affects users of natural resources, but only in the short term, or resources used by a minority of local people (<10%). Some mitigation will help minimise impacts.
Major	Time scale of the activity or event is >10% of the regeneration time of the resource of concern or a critical sensitive period. Area over which the activity or event may occur is >10% of the area occupied by the resource of concern. Causes a decline in abundance/distribution of an entire population or species, beyond which natural recruitment would not return that population or species, or any population or species dependent upon it, to its former level within several generations without mitigation. Users of natural subsistence or commercial resources (on which more than 10% of local people depend) are affected to the degree that their wellbeing is affected over a long term, if mitigation not applied. Activity occasionally exceeds statutory/regulatory limits, and mitigation is required.

For each aspect, the significance of impacts has been discussed before and after mitigation (i.e. residual impact). Impacts identified as having moderate to major significance based on the above approach are classified as significant impacts.

Where feasible the following hierarchy of mitigation measures will be applied to reduce, where possible, the significance of impacts to acceptable levels:

- Mitigation/elimination through design
- Site/technology choice
- Application of best practice.

5.3.4.5 Uncertainty

Any uncertainties associated with impact prediction or the sensitivity of receptors due to the absence of data or other limitation will be explicitly stated. Where applicable, the ESIA will make commitments concerning measures that should be put in place with monitoring and /or environmental or social management plans to deal with the uncertainty. This is summarised in the Project ESMMP that forms Volume IV of this ESIA.

5.4 Cumulative impacts and transboundary effects

Cumulative impacts are those impacts that may result from the combination of past, present or future actions of existing or planned activities in a project's area of influence. While a single activity may not itself result in a significant impact, it may, when combined with other impacts in the same geographical area and occurring at the same time, result in a cumulative impact that is significant.

Where and when relevant and applicable, an assessment of the cumulative impact of the Project is given in each impact assessment chapter. This takes into account the Project as a whole as well as with any other known present and planned developments in the area of influence.

The developments which have been identified as potentially resulting in a cumulative impact have been identified in Table 5.6

Table 5.6: Review of planned developments in Ulaanbaatar and the surrounding area

Development	Location	Estimated Schedule	Features
The New Ulaanbaatar International Airport (NUBIA)	Located in the Khushigiin Khundii valley, Sergelen sum, Tuv province, approximately 50km southwest of Ulaanbaatar	2012 - 2016	• The main components of construction include a three-storey passenger terminal building covering an area of 37,000m^2, an Air Traffic Control (ATC) tower, an operations building • The development will also include a 28MW heating plant, and a 3,600m long and 45m wide concrete based runway • The runway construction will involve the transfer of about three million cubic metres of earth
Amgalan HOB	Approximately 10km north of the CHP5 site	Operational late 2015	• Height of Chimney – 120 metres • Height of the boiler – About 40-41 metres • Number of boilers – 3 x 116MW
Associated Facilities			
Transmission line	From Songino substation to CHP5. The transmission line is 85km long, routed around the southern side of Bogd Khan National Park	2016 – 2020	• Steel lattice structures • 220kV high voltage transmission line
District heating pipeline	From CHP5 site to central and eastern areas of Ulaanbaatar		• Over ground pipeline with diameter of 1000 – 1200mm
Railway spurs and stabling:	From the existing railway line that runs to the south of the site		• New rail spur and stabling • Rerouting of the existing rail line
Raw water supply pipeline and wastewater discharge pipeline	Detailed routes of the pipelines are yet to be determined.		• Not yet known at this stage
GIS switchyard and substation located at project site	within south-eastern corner of the Project site		• 220kV gas insulated switchgear (GIS) • Approximately 0.5ha (including a GIS building of 15 x 50m)

Assessments have been undertaken at a high level in the context of broad development parameters sufficient to provide an understanding of the likely environmental and social impacts of future developments in combination with the development of this Project. Any additional future developments will be required to follow the national EIA process and be required to obtain the relevant approvals. In addition, if any future developments seek international funding, the project would be required to undertaken an ESIA in accordance with the applicable international guidelines.

The Convention of Transboundary Effects of Industrial Accidents (1992) states that “transboundary effects mean serious effects within the jurisdiction of a Party as a result of an industrial accident occurring within the jurisdiction of another Party”. The Project will not have any effect to other countries; its effects are on a local / regional scale. Transboundary effects have therefore not been considered as part of this ESIA.

6 Information Disclosure, Consultation and Participation

6.1 Overview

This chapter outlines the information disclosure, consultation and participation activities that have been undertaken as part of the ESIA process in accordance with the Stakeholder Engagement Plan (SEP) produced at the outset of the ESIA process and updated throughout. The key objective of this chapter is to present a summary of the outcomes of the ESIA consultation activities, as well as an overview of the consultation activities planned for construction and operational phases of the Project.

The chapter consists of the following sub-sections:

- 6.2 Principles of consultation
- 6.3 Consultation requirements
- 6.4 Stakeholder identification and analysis
- 6.5 ESIA consultation activities and outcomes
- 6.6 Resettlement planning consultation
- 6.7 Engagement planned throughout the lifetime of the Project
- 6.8 Project grievance redress mechanism

6.2 Principles of consultation

Early and ongoing consultation, disclosure and meaningful stakeholder engagement are key requirements for projects financed by international lenders. The consultation and disclosure activities used to inform affected communities about the Project and to inform the assessment in this ESIA have been underpinned by the principles that community engagement should be free from external manipulation, interference, coercion and intimidation and conducted on the basis of timely, relevant, understandable and accessible information. Furthermore, that consultation activities should always be well planned and based on principles of respectful and meaningful dialogue.

6.3 Consultation requirements

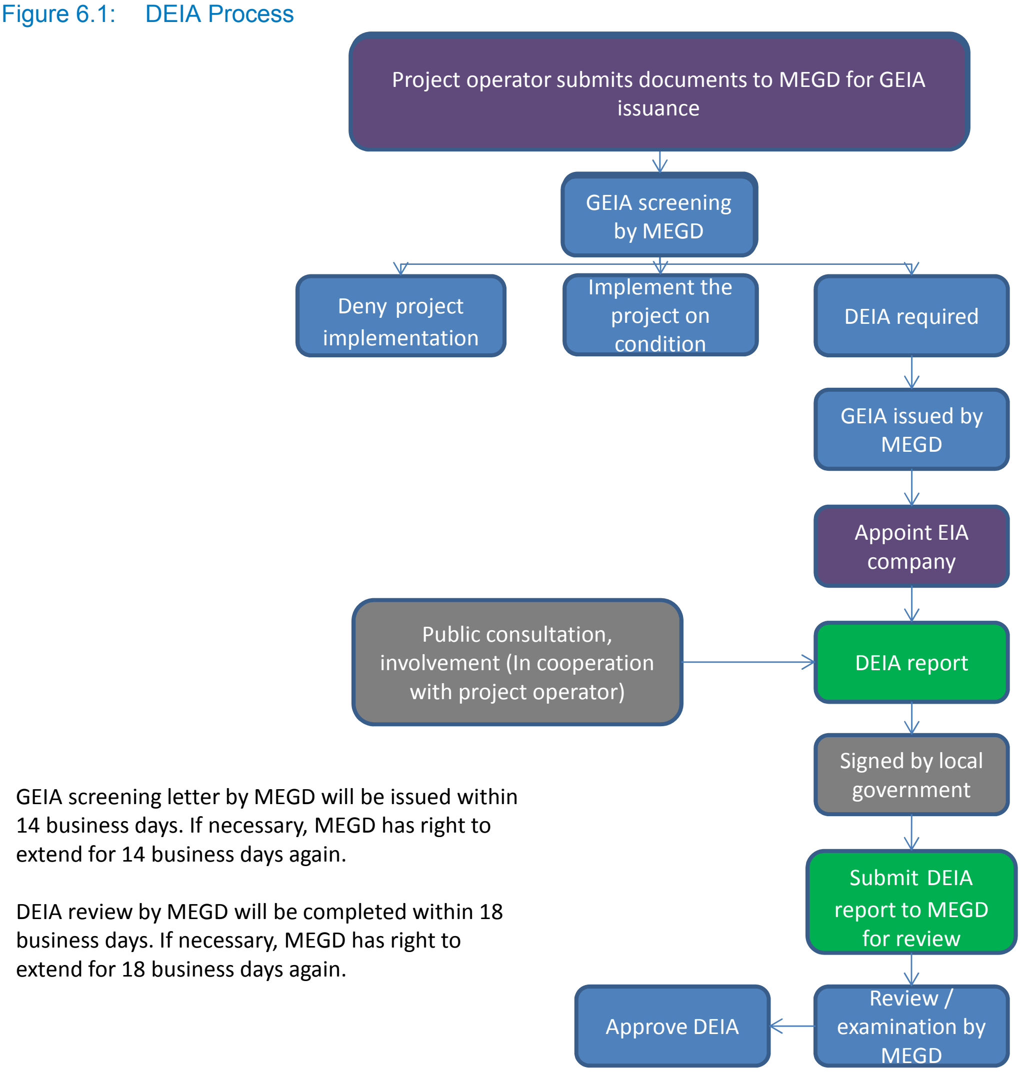
6.3.1 Overview

This sub-section provides an overview of the national requirements contained within the Mongolian EIA procedures, and the international disclosure, consultation and stakeholder engagement requirements of the ADB, the EqPs, IFC, and EBRD.

6.3.2 National requirements

The Law of Mongolia on Environmental Impact Assessment (revised May 2012) contains two chapters that relate to consultation and public involvement. Chapter 2: DEIA Structure, Framework, Regulation contains Article 8: which states that the DEIA should include meeting minutes, comments by local government, and community consultation that has been conducted with local communities in the area of influence. An overview of the DEIA process is illustrated in Figure 6.1.

Figure 6.1: DEIA Process



Source: Nature Friendly

MEGD-Ministry of Environment and Green Development
GEIA-General Environmental Impact Assessment
DEIA-Detailed Environmental Impact Assessment.

Chapter 4: ‘Public Involvement’ contains Article 18: ‘Public Involvement of DEIA’, which states that the development plans and programs that need to be assessed as part of the DEIA process will need to be publicly disclosed on the website of the State Administrative Central Organization in charge of nature and environment (Article 18.1). There will be a period of 30 working days in which complaints from the public in verbal or written form will be collected (Article 18.3). The entity that is developing the DEIA report should organize community consultations that include the comments and complaints of local government and local residents within the area of influence (Article 18.4).

Whilst the national requirements will be fulfilled by the DEIA, public consultation activities for both the DEIA and the international ESIA have been streamlined as far as possible to reduce stakeholder fatigue.

6.3.3 International consultation requirements

6.3.3.1 Overview

Project finance is being sought from the ADB and may be sought from EqPs signatory private lenders, the IFC, and the EBRD. This sub-section summarises relevant stakeholder engagement requirements of the potential lenders that the Project should meet in order to be considered for international financing.

6.3.3.2 Asian Development Bank consultation requirements

The ADB SPS (2009) explains that the ADB is committed to working with borrowers/clients to put meaningful consultation processes into practice. ADB requires borrowers/clients to engage with communities, groups, or people affected by proposed projects, and with civil society through information disclosure, consultation and informed participation in a manner commensurate with the risks to and impacts on affected communities. For projects with significant adverse environmental, involuntary resettlement, or Indigenous Peoples impacts, ADB project teams will participate in consultation activities to understand the concerns of affected people and ensure that such concerns are addressed in project design and safeguard plans.

ADB's SR 1: Environment specifies that projects must:
- Carry out meaningful consultation with affected people and facilitate their informed participation
- Ensure women's participation in consultation
- Involve stakeholders, including affected people and concerned nongovernmental organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account
- Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment
- Establish a grievance redress mechanism to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's environmental performance
- Disclose a draft environmental assessment (including the ESMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders
- Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders
- Implement the ESMMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports

6.3.3.3 Equator Principles III

The EqPs are a framework for managing credit risk in project finance transactions, which are often used to fund major infrastructure and industrial projects. The EqPs determine, assess and manage environmental and social risks. The EqPs are based on the IFC PSs (discussed in Section 6.3.3.4) on social and environmental sustainability and on the WB/IFC General EHS Guidelines. The most recent version of the EqPs (version III) has been effective from 4th June 2013.

For all projects that are classified as Category A, the government, borrower or third party expert should consult with project affected communities in a structured and culturally appropriate manner. Affected communities are communities of the local population within the project's area of influence who are likely to be adversely affected by the project.

Environmental and social assessment documentation, action plans or non-technical summaries, as appropriate, should be made available to the public by the borrower for a reasonable minimum period. These documents will be provided in a culturally appropriate manner in the local languages.

The process should be documented and the results of the consultation, including any actions agreed resulting from the consultation, should be taken up by the borrower. Disclosure of the relevant information, for projects with adverse social or environmental impacts, should be carried out as early in the project assessment process as possible and on an on-going basis thereafter and at least should occur before project construction commences.

6.3.3.4 IFC Consultation requirements

Public consultation, disclosure and stakeholder engagement are key requirements of IFC's Policy on Social and Environmental Sustainability embodied within the PS of 2007 (updated in January 2012).

The eight IFC PSs are applicable to private sector projects in emerging markets. Each PS has specific consultation requirements and these are embedded in the general requirements specified in PS1: Assessment and Management of Environmental and Social Risks and Impacts. These requirements specifically refer to the need for and means of achieving community engagement, disclosure of relevant project information, appropriate consultation processes and grievance mechanisms throughout the project lifecycle. The requirements for stakeholder engagement in projects are:

- Start as early as possible in the project cycle
- Continue throughout the life of the project
- Be free of external manipulation, interference, coercion, or intimidation
- Where applicable enable meaningful community participation
- Be conducted on the basis of timely, relevant, understandable, and accessible information in a culturally appropriate format.

IFC PSs seek to provide accurate and timely information regarding project investment and advisory activities. IFC's Access to Information Policy states that for Category A projects proposed for financing, a summary of review findings and recommendations must be disclosed and include as a minimum the following information:

- Reference to the PSs and any applicable grievance mechanisms, including the compliance advisor/ombudsman.
- The rational for IFC's categorisation of the project.

- A description of the main social and environmental risks and impacts of the project.
- Key measures identified to mitigate those risks and impacts, specifying any supplemental measures and actions that will need to be implemented to undertake the project in a manner consistent with the PSs.
- Electronic copies or web-links to any relevant environmental and social impact assessment prepared by the developer.
- Any additional documents such as Action Plans, SEPs and RPs.

6.3.3.5 EBRD

EBRD's Environmental and Social Policy (2014) and Public Information Policy (2014) documents outline the Bank's key policies regarding information disclosure and stakeholder engagement.

For Category A projects, EBRD requires the project developer to build disclosure and consultation into each stage of the ESIA process. The developer should also engage with interested parties and identified stakeholders at an early stage to ensure key issues are identified for consideration in the ESIA. During the scoping stage stakeholders should also be provided with an opportunity to comment on the draft SEP and ESIA scoping documents. Where an Environmental and Social Action Plan (ESAP) is agreed between EBRD and the developer, this must be disclosed to affected parties.

The 2014 EBRD policy requires project developers to engage with stakeholders from the earliest stages and throughout the life of the Project. Stakeholder engagement must be open, meaningful, and conducted in a culturally and linguistically appropriate manner to the potentially affected communities. The engagement program must actively address the needs of vulnerable populations who may be affected by the project. The ESIA documents must remain in the public domain for the life of the Project, and if changes to project plans are necessary, these must be made public as well. A key requirement of EBRD's Performance Requirement 10 on Information Disclosure and Stakeholder Engagement is the provision of a grievance mechanism to address concerns and complaints.

EBRD's Public Information Policy requires ESIA documents to be available through their Business Information Centre and resident offices as well as their website at least 60 days prior to consideration of the project by the Board of Directors for private sector projects.

6.4 Stakeholder identification and analysis

Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. Stakeholders for the Project include locally affected communities and their formal and informal representatives, national or local government authorities, civil society organisations and groups with special interests, the academic community, or businesses. A stakeholder identification and analysis exercise and identification of the most appropriate communication methods was undertaken at the outset of the ESIA process and has been updated as necessary throughout the ESIA. The affected communities and interested non-governmental stakeholders are identified in Table 6.1.

Table 6.1: Identification of community and non-governmental stakeholders and communication methods

Stakeholders	Community Population	Communication methods	Proposed Formats
Closest communities to the Project activities			
Vulnerable groups include families living in gers and near to the site either seasonally or permanently who will need to be resettled, especially • Female headed households • Families living below the poverty line • Other groups (if identified)	Less than 200 people	• Consultations, interviews and informal meetings with identified vulnerable groups • Disclosure of non-technical Project information. • Invitation to public consultation meetings	• Household and key informant interviews / focus group discussions • Brochures and leaflets distributed in locations frequented by people11 • Notice boards within the Khoroo • Khoroo Governor's office • Project website • Local newspapers
Residents of Bayanzurkh District, Khoroo-11 (sub-district 11) where the Project is located.	Approximately 7,000 permanent residents and 6-7,000 seasonal residents.	• Consultations and interviews with identified directly affected community • Disclosure of non-technical Project information. • Invitation to public consultation meetings	• Key informant interviews • Brochures and leaflets distributed in locations frequented by people12 • Notice boards within the Khoroo, • Khoroo Governor's office • Project website • Local newspapers
Other nearby communities			
Residents of East Bayanzurkh Khoroo-10	7,484 (1,899 households)	• Consultations, interviews with key informants • Disclosure of non-technical Project information • Invitation to public consultation meeting	• Brochures and leaflets distributed in locations frequented by people13 • Notice boards within the Khoroo • Khoroo Governor's office • Project website • Today Newspaper • Daily News
Residents of North West Bayanzurkh Khoroo-23	13,934 (3,801 households)		
Project employees and job seekers			
Employees, prospective employees (direct/indirect) and representatives of workers' unions	Varies depending on phase of Project.	• Provision of non-technical information about the Project • Disclosure of Project recruitment policy • Disclosure of job	• Meetings • Leaflets • Letters included in payslips • Newspaper adverts for jobs

[11] Locations will include markets, health clinics, community buildings, places of worship (mosques, temples), Khoroo government buildings and places of business frequented by women such as hair salons, health spas

[12] Same types of locations identified for vulnerable groups will also be used for Khoroo 11 residents

[13] Locations will include markets, health clinics, community buildings, places of worship (mosques, temples), Khoroo government buildings and places of business frequented by women such as hair salons, health spas

Stakeholders	Community Population	Communication methods	Proposed Formats
		advertisements • Meetings with staff and trade union representatives regarding key project changes that affect staff, for example end of construction phase. • Workers' grievance mechanism	• Notices at site and Khoroo office/noticeboards regarding recruitment • Project website
Non-Government Organisations (NGOs)			
Association for Support of Mongolian Environmental Protection Groups		• Consultations, interviews or informal meetings (commensurate with the NGO's level of interest/ or influence in the Project) • Disclosure of reports • Invitation to public consultation meetings	• One-to-one meetings and workshops / focus group discussions • Letters / personal invitations • Brochures and leaflets Annual Reports • Project website • Local newspapers • Regional radio stations
Mongolian Water Association			
Association for protecting water resources and river upstream			
Bogdkhan Mountain Natural complex centre			
National Center for Mongolian Air Pollution Reduction and Forest Reserve Protection			
Mongolian Environmental Civic Council			
National Environmental Cooperation Society			
Tuuliin Khar shugui			
Selbe-Tuul Movement.			
Tuul River Basin Committee.			
Open Society Foundation-Mongolia.			
Women`s association for sand movement(desertification) prevention			
The Nature Conservancy			
*Fathers Glory			
*State Child and Youth Organisation			
MONFEMNET – Women's Organisation			
Others			
International Lenders (ADB, IFC, EBRD)		• Private meetings • Invitation to participate in public consultations • Disclosure of ESIA report and associated plans and Project information • Project updates	• Progress reports • ESIA Report and related environmental and social management and mitigation plans.
Media		• Project staff member responsible for media communications identified • Disclosure of Project	• Press articles • Project website • Brochure and leaflets

Stakeholders	Community Population	Communication methods	Proposed Formats
		information	

Notes: * NGOs active within Khoroo 11[14]

The Project team recognises that marginalised and disadvantaged groups are likely to experience impacts differently from mainstream society. For instance, they may be less able to cope with change such as influx of workers into the area than a typical community household or may be less able to take advantage of benefits such as employment generation.

Vulnerable groups for this Project include families living in gers and near to the site either seasonally or permanently who will need to be resettled, especially female headed households, families living below the poverty line, and potentially other groups, if identified. These groups will be identified through household surveys and consulted through focus group discussions as part of the resettlement planning process that is being undertaken for the Project. Consultation and information disclosure activities will take into consideration logistical and cultural factors such as language, physical access, literacy levels, and time availability of these groups.

Table 6.2 identifies the government stakeholders and decisions makers at the national, regional and local levels.

Table 6.2: Identification of Government and Local Authority Stakeholders and Communication Methods

Stakeholders	Relevance to the Project (interest / influence)	Communication Methods	Proposed Formats
National Government			
MoE	Proponent of Project	• Private meetings • Invitation to participate in public consultations • Disclosure of reports	• On-going consultations and working relationships with the authority • Invitation to public consultations and meetings • Brochures and leaflets Project website
MEGD	Environmental approval of the Project		
Energy Regulatory Authority	Responsible for regulation of energy in Mongolia		
Ministry of Transport	Responsible for assisting in framework agreement of transporting coal, ash and associated facilities		
Mongol Invest	Responsible for negotiating on project documents on behalf of the GoM		
National air pollution reduction committee of Mongolia	Mandate to reduce air pollution	• Invitation to participate in public consultations • Disclosure of reports	• Letter • Brochures and leaflets Project website

[14] As communicated in a preliminary meeting with the Khoroo 11 Governor (15 August 2014)

Stakeholders	Relevance to the Project (interest / influence)	Communication Methods	Proposed Formats
Municipality Government level (Ulaanbaatar)			
Ulaanbaatar electricity distribution company	Responsible for electricity transmission to Ulaanbaatar and Tuv Aimags	• Private meetings • Invitation to participate in public consultations • Disclosure of reports	• On-going consultations and working relationships with the authority • Invitation to public consultations and meetings • Brochures and leaflets Project website
Land Department of the Municipality	Responsible for land acquisition / expropriation		
Environmental department of the Municipality	Undertakes environmental monitoring of the Project		
City Air Quality Department	Controls and regulates air quality in UB		
Water sewerage authority	Responsible for provision of water to CHP5 Project and displaced communities		
Ulaanbaatar Railways (UB Rail)	Responsible for coal and ash transportation for the CHP5 Project		
Ulaanbaatar District Heating Company	Responsible for district heating network in Ulaanbaatar		
Local Government and Local Authorities (District and Khoroo level)			
Bayanzurkh District	Responsible for the protection of its citizens and businesses	• Private meetings • Invitation to participate in public consultations • Disclosure of reports	• On-going consultations and working relationships with the authority • Invitation to public consultations and meetings • Brochures and leaflets Project website
Land Department of Bayanzurkh District	Responsible for implementing regulations on land issues.	• Private meetings • Invitation to participate in public consultations • Disclosure of reports	• On-going consultations and working relationships with the authority • Invitation to public consultations and meetings • Brochures and leaflets Project website
Khoroo 11 Sub-district Governor	Sub-district within which the Project is located	• Private meetings • Invitation to participate in public consultations • Disclosure of reports	• On-going consultations and working relationships with the authority • Invitation to public consultations and meetings • Brochures and leaflets Project website

Stakeholders	Relevance to the Project (interest / influence)	Communication Methods	Proposed Formats
			• Press releases
Khoroo 10 and 23 Sub-district Governors	Sub-districts located adjacent to Khoroo 11	• Private meetings • Invitation to participate in public consultations • Disclosure of reports	• Invitation to public consultations and meetings • Brochures and leaflets Project website • Press releases

The SEP and the above tables are considered to be live and will be updated on an on-going basis as new stakeholders are identified throughout Project implementation.

6.5 ESIA consultation activities and outcomes

6.5.1 Overview

This sub-section presents the activities undertaken during the ESIA in accordance with the SEP and the requirements outlined in Section 6.3. The issues raised are summarised and signposts are provided to where and how these issues have been addressed in the ESIA process and documentation. Previous consultation undertaken in relation to the Project prior to the international ESIA is summarised in the SEP. A chronological overview of the ESIA consultation activities undertaken is presented in Table 6.3.

Table 6.3: Chronological overview of ESIA consultation and disclosure activities

Date	Activity	Participant / Stakeholder details			
		Name	Males	Females	Total
ESIA Scoping Consultation Round 1					
17th August 2015	Scoping public consultation meeting 2.1	10th & 23rd Khoroo residents (interested)	24	32	57
25th August 2015	Scoping public consultation meeting 2.2	11th Khoroo residents (directly affected)	24	26	50
26th August 2015	Scoping public consultation meeting 2.3	11th Khoroo residents (directly affected)	18	20	38
27th August 2015	Scoping open key informant meeting 2.4	Non-Governmental Organisations (interested)	16	14	32
Expected October 2015	Public disclosure of SEP and ESIA Scoping report via Project website	Affected communities, NGOs and the public	Not applicable		
ESIA Disclosure and Consultation					
14th October 2015	Disclosure of national DEIA documentation	Affected communities, NGOs and the public	NA		
15th / 16th October	Draft ESIA disclosure (for 120 days) and public consultation meetings	Affected communities, NGOs and the public	TBD	TBD	TBD
February 2016	Disclose final ESIA		Not applicable		

The issues raised and how they were responded to during meetings and in this ESIA is summarised in the sub-sections below.

6.5.2 ESIA scoping consultation and disclosure activities

The ESIA scoping consultation officially commenced in August 2015 when three public consultation and disclosure meetings were held with residents of the directly affected sub-districts. The objectives of these activities were to:

- Disclose information the proposed development of the Project including a non-technical summary of the ESIA scoping report
- Engage key stakeholders by introducing the ESIA process
- Identify additional key stakeholders
- Identify concerns and opportunities to be addressed during the ESIA process

The first of these meetings was with the neighbouring affected sub-districts to the project of the 10th and 23rd Khoroos on the 17th August 2015. Invitation letters were distributed to the 11th, 23rd and 10th Khoroos and a poster was posted on local stores, hospitals, governor's house, bus stations and other public places within the affected communities.

Figure 6.2: Scoping public consultation meeting advertisement and transportation to venue

Source: Mott MacDonald

The location of the meeting was the 10th Khoroo Governor's building and was well attended with 57 participants. A leaflet was prepared detailing the key information about the Project that was given out at the meeting. A copy of the text of this leaflet is provided in Volume III, Appendix A.

The meeting commenced with an introduction by the chair, Mr Ghankhuyag, Director of Infrastructure and Energy of Newcom LLC (part of the Consortium) to disclose information about the Project, the ESIA and the consultation process. Introductions were then made to the other panel members that included ADB's environmental specialist.

There was then an opportunity for questions which, along with the responses provided by the panel during the meeting and the section of the ESIA where these issues have been addressed, is summarised in Table 6.4 below. The main points of discussion centred around resettlement and community impacts and mitigation, as well as employment opportunities, noise impacts, the Project schedule, approvals process and power plant capacity.

Table 6.4: ESIA scoping public consultation meeting 2.1 with 10th and 23rd Khoroo residents, 17th August, 2015

No.	Stakeholder question	Initial response provided by the Consortium at the scoping consultation meeting	Chapter within this ESIA where this issue and relevant mitigation (where applicable) is discussed further (October 2015)
1	Will land and noise impacts be similar to Amgalan HOB Will there be impacts on houses that are close?	• We are not sure if the noise and community assessment for Amgalan was as extensive as for CHP5 • There are lots of housing developments and CHP5 will benefit these through providing heat and power	The noise assessment (Chapter 8) has identified that there will be some impacts on residential receptors close to the Project site. Where significant impacts are predicted, mitigation measures will be applied.
2	Will you hire residents from 11, 10 and 23rd Khoroo? Or will there be only foreign workers?	• At peak construction periods, there will be up to 3,200 construction workers and local people will be hired as much as possible • We will be calculating the percentage of Mongolians employed and out of that the percentage of local people • Training will be provided for local students in schools	Chapter 17 Socioeconomics and Communities assessed the opportunities for local employment as a result of the Project, which will include employment opportunities during construction (peak of 3,200 jobs) and operation (300-350). There will also be indirect employment opportunities as a result of the Project such as provision of equipment required for the Project.
3	Doesn't the site have permafrost? What about the protected area?	• 6% of the site has permafrost but the team has experience of building in this environment • The Bogd Mountain is a protected area but the site is outside this and the project will be developed in line with international environmental standards	Areas of permafrost have been taken account of during the project design and site layout. Specialists have been employed to identify appropriate techniques for the treatment of permafrost and construction on areas of permafrost.
4	You will be meeting with affected residents to resettle them. Who will be affected?	• The site is almost empty, there are a few residents at the corner and some seasonal herders with some livestock • These will all be resettled according to Mongolian law and strict international standards • The district heating pipeline route is not yet confirmed and efforts are being made to avoid resettlement	Residents on the site and those neighbouring the site boundary residents may also be physically displaced and required to permanently relocate. Consultation has already been held with a number of these residents and further socio-economic surveys were/will be undertaken in October – November 2015. Further detail is provided in section 17.5.2.1. Chapter 18: Assessment of Associated Facilities has identified that there will be limited resettlement required for the development of the associated facilities. However, this will be confirmed during the separate feasibility studies currently underway.

No.	Stakeholder question	Initial response provided by the Consortium at the scoping consultation meeting	Chapter within this ESIA where this issue and relevant mitigation (where applicable) is discussed further (October 2015)
5	When will the Project start, what if CHP5 fails due to election? Will you divert the Nalaikh road? Would there be another road?	• The project is the number one priority of the government and will not be affected by the upcoming elections • Most of the transport will be via rail and efforts are being made to not divert the road – we have experience in doing this for Salkhit wind farm where impacts on transport were limited.	Chapter 13 Traffic and Transport provides a review of the potential traffic and transport impacts and mitigation required. Given the amount of earthen material required during construction there will be significant traffic movements. Additional construction traffic on the road network will result in significant disruption/ delays to existing users. Further studies are being completed to identify options to reduce the impact and identify mitigation measures. During operation, coal and a majority of other materials will be transported via rail and therefore limit impacts to road traffic.
6	What is the capacity of CHP 5?	• Total capacity is 450MW with 3 units. It is about 4-5 times bigger than CHP3. • Even though with the expansion, CHP 4 is considered to have the highest capacity, but it cannot operate at its fullest capacity.	Chapter 2 Project Description provides further detail regarding the technical components of CHP5
7	There were talks that the plant was to be built next to Baganuur mine, has the decision been reversed to build it here?	• A site next to Baganuur mine was identified as a potential option for the siting of the Project. • Separately from this Project, a power plant is likely to be built at Baganuur. A Power Purchase Agreement for the Project was signed earlier this year.	Please refer to Chapter 3 Project Need and Alternatives.

Source: Newcom LLC, Mott MacDonald

The second scoping public meeting was with residents of the directly affected sub-districts Khoroo 11, where the project site is located. The meeting was held at the 11th Khoroo Children-Development centre on 25th August 2015. This meeting was also well attended with 50 participants (see Figure 6.3).

Figure 6.3: ESIA scoping public consultation meeting 2.2 with 11th Khoroo residents, 25th August, 2015

Source: Mott MacDonald

The meeting was advertised in the same manner and followed the same format as the first meeting. The proceedings are summarised in Table 6.7 below. Similar to the first meeting, the main points of discussion centred around resettlement and community impacts and mitigation, as well as the benefits of district heating and impacts on specific locations such as Urgakh Naran town.

Table 6.5: ESIA scoping public consultation meeting 2.2 with 11th Khoroo residents, 25th August, 2015

No.	Stakeholder question	Initial response provided by the Consortium at the scoping consultation meeting	Chapter within this ESIA where this issue and relevant mitigation (where applicable) is discussed further (October 2015)
1	I am really appreciative of this project; however will it not mean that there is not enough pasture that 5 families use for livestock? What job opportunities will there be for young people?	• The Resettlement Plan will consider impacts on herders and compensate them so that they are not adversely affected, the same is the case for permanent residents who will be most affected. • The Project will try to hire as many Mongolian and local workers as possible.	Chapter 17 Socioeconomics and Communities identified that there will be beneficial impacts through the creation of employment during construction and operation.
2	I am really pleased about this Project, but I am worried it will fail like other recent projects of the GoM such as Amgalan power plant. Also, what will be the impacts on Urgakh Naran town?	• Amgalan power plant is 100% financed by the GoM and is temporary project until CHP5 is finished, CHP5 is a long term project that is financed internationally and therefore it will last. • The land that has been cordoned off for use near	The Air Quality chapter (chapter 7) identifies that the Urgakh Naran apartments lie outside of the 500m buffer zone used for qualitatively assessing dust impacts from construction and operation. With the implementation of dust mitigation measures including covering dust sources, dust suppression techniques and implementation of a dust management plan, it is expected that there will be limited dust impacts. During operation, coal storage and transportation will be carefully managed to mitigate potential dust impacts. Mitigation measures

No.	Stakeholder question	Initial response provided by the Consortium at the scoping consultation meeting	Chapter within this ESIA where this issue and relevant mitigation (where applicable) is discussed further (October 2015)
		Urgakh Naran town is land that will only be temporarily used for construction. Potential impacts including noise on this receptor have been assessed.	will be in accordance with WB/IFC EHS guidelines and include the covered transportation of coal, sprinkler systems and construction of a wall around the coal storage yard to mitigate dust impacts. The noise assessment (chapter 8) has identified that there will not be any significant noise impacts at this location.
3	In the meeting in September will it be possible to get more information about resettlement affected areas and residents?	• There are only a few households on the site but they will be fully resettled according to GoM laws and very strict international standards.	Chapter 17: Socioeconomics and Communities (section 17.5.2 assesses resettlement impacts arising from the Project. Those living on the Project site have been identified as needing to be resettled. Based on the ESIA and consideration of the project activities and also those relating to the associated facilities, other households requiring to be resettled will be identified. Resettlement consultation and socioeconomic surveys of those to be resettled are ongoing in October and November 2015.
4	Do similar projects operate in Korea? Will the heating line connect to schools and other buildings in Khonkor?	• Most countries use this technology other than Mongolia – we will use the best and most advanced technology on this project. • The heating line will cater for the eastern side of Ulaanbaatar as well as some small cities around UB.	Chapter 2: Project Description provides an overview of the route for the district heating pipeline. The route of the pipeline has been selected as part of the wider project.
5	My son lives in the Khuliin valley and he couldn't get his land certificate because of uncertainty with this Project, what will happen next with the resettlement process?	• We are working with the resettlement department of the Bayanzurkh district to facilitate the resettlement. • In accordance with strict international standards, anyone who is to be resettled will maintain the same standard of living.	A Resettlement Plan is being developed for the Project in accordance with national and international standards. All those to be resettled will be consulted on the resettlement process.
6	I think that residents of Nogoon Zoori and Urgakh Naran town did not attend this meeting as it is too far from their home – the next meeting should be closer.	• This is an integrate meeting to cater for people from a number of different areas, however we will take this into consideration when planning the future meetings.	The draft ESIA disclosure meeting was held at a different venue and transportation provided to increase the number of people that could attend the meetings.

Source: Newcom LLC, Mott MacDonald

On the following day (26th August 2015), the third and final scoping public meeting was held, also with residents Khoroo 11 and in the same location. This meeting had 38 participants (see Figure 6.4) and was advertised in the same manner and followed the same format as the first two meetings.

Figure 6.4: ESIA scoping public consultation meeting 2.3 with 11th Khoroo residents, 26th August, 2015

Source: Mott MacDonald

The proceedings of the third meeting are summarised in Table 6.6 below. A wide range of topics were discussed at the meeting, including noise, construction schedules, resettlement and agricultural impacts, employment benefits and dust.

Table 6.6: ESIA scoping public consultation meeting 2.3 with 11th Khoroo residents, 26th August, 2015

No.	Stakeholder question	Initial response provided by the Consortium at the scoping consultation meeting	Chapter within this ESIA where this issue and relevant mitigation (where applicable) is discussed further (October 2015)
1	How much noise will be produced?	• During construction, large construction machinery will produce noise similar to other types of projects (e.g. residential construction) • After commissioning, noise levels will meet international standards and expected to be minimal	Night time noise impacts have been assessed in Chapter 8 (Noise and Vibration) Unmitigated noise impacts during construction are likely to be significant especially for receptors close to the project boundary and require mitigation such as noise barriers. Other mitigation may include the resettlement of some residential receptors. During operation, noise levels will meet international standards and expected to be minimal.
2	How many units and turbines are there?	• Total electrical capacity is approximately 450MW with 3 Units – 3 boilers and 2 turbines	See Chapter 2: Project Description for further project information.
3	Will construction occur in the day time? Has there been agreement with the officials of the district?	• Today, no decision has been made on the time when there will be construction and drive machinery.	A majority of construction activities will occur during the daytime, although there may be a need for some night-time activities. Noisy construction activities will be limited to daytime

No.	Stakeholder question	Initial response provided by the Consortium at the scoping consultation meeting	Chapter within this ESIA where this issue and relevant mitigation (where applicable) is discussed further (October 2015)
		• Decision expected by the end of this year or early next year	periods only.
4	I am a resident of the Khuliin Valley. How will the Project affect the pasture area for livestock in the Khuliin Valley area? What will happen to the blue fences just next to the CHP5 site?	• The living conditions of resettled households should not be lower than previous condition, including current livelihoods • For the permanent households living at the CHP5 site, affected fences and houses will be compensated through the resettlement plan that is being developed	This will be managed under the resettlement process. All those affected will be consulted and alternative pasture land will be identified.
5	When will Nalaikh-Ulaanbaatar road construction be start? What are the sewage facilities for workers? How will access to the Bogd Khan mountain be affected and are you going to use the road to access the Bogd Khan Mountain? Does the resettlement plan include the Khonkor area?	• The Nalaikh-Ulaanbaatar paved road will not start this year • The site will use advanced sewage technology and reproduce the waste water; the waste water line will connect to the central sewage line • Access to the mountain will not close; the southern side of the bridge for the train will be developed and to be used as previously • The Khonkhor area is not included in the resettlement plan	Please refer to the following chapters for further information: 9 Hydrology, Hydrogeology and Flood Risk 13 Traffic & Transport 14 Landscape and Visual 16 Waste and Materials Management 17 Socioeconomics and Communities
6	How many people work at CHP5? What percentage will be Mongolians?	• There will be thousands of jobs during construction and a lot of the workers will be Mongolian, the exact number is to be confirmed. The remainder will be expat specialists • During the operational period, there will be fewer staff	Temporary employment generation will result from the construction of the project components and associated facilities. Construction phase employment is expected to peak at approximately 3,100 workers. The EPC contractor estimates that approximately 550 jobs (approximately 20%) will be provided for unskilled workers at peak construction and the intention is that majority of these will go to local workers. Unskilled jobs will include labourers and the provision of services for workers such as food and refreshments, cleaning of accommodation, sanitation and hygiene. The operational phase is expected to generate fewer direct employment opportunities than the construction phase with the number of skilled jobs to perform maintenance and operation of the power station estimated at approximately 340. These will be mainly permanent jobs and approximately 330 of the roles are expected to be filled by Mongolians with only 10 expatriates
7	How do you protect against coal blowing in the wind?	• The coal storage technology prevents coal from blowing	A qualitative assessment of potential impacts arising from coal dust was undertaken as part of

No.	Stakeholder question	Initial response provided by the Consortium at the scoping consultation meeting	Chapter within this ESIA where this issue and relevant mitigation (where applicable) is discussed further (October 2015)
		away	the Air Quality assessment (Chapter 7). It was identified that there is potential for coal dust generated from the coal storage yard and coal handling facilities and conveyors. However, mitigation measures will be incorporated into the project to minimise impacts to local receptors. Mitigation to be implemented includes: • All transfer of coal at the power plant will be via an enclosed conveyor system. • Use of wall around the coal storage yard to reduce wind-blown dust • Use of a sensor based dust suppression system • Use of telescopic chute at coal yard • Air quality monitoring at sensitive receptors to ensure effectiveness of mitigation measures Also refer to the Air Quality Management Plan prepared for the Project in Volume IV ESMMP.
9	Ash will be transported. Is there a possibility to use the ash in construction material instead?	• This will be discussed with companies once the technology is in place	Opportunities to use ash generated by the combustion process at the power plant will be researched and regularly reviewed.
10	What kind of employment opportunities will be available for the local residents?	• Jobs during the construction period will be offered to those with the education and qualifications • Job selection will focus on permanent residents of the 11th sub-district • Meat, milk and working clothes are expected to be purchased from local businesses	Refer to comment 6 above.

Source: Newcom LLC, Mott MacDonald

On the 27th August 2015 a final scoping meeting was held with NGOs. 30 people participated at the Ulaanbaatar Corporate Hotel (see Figure 6.5). The panel consisted of the same people and the meeting was organised in the same manner as the previous meetings. The outcomes of the meeting are presented in Table 6.7 and the discussion included queries ion the technology, approvals process, water usage, disaster mitigation and impacts on the Khuliin river channel.

Figure 6.5: ESIA scoping key informant meeting 2.4 with NGOs, 27th August, 2015

Source: CHP5 Consortium

Table 6.7: ESIA scoping key informant meeting 2.4 with NGOs, 27th August, 2015

No.	Stakeholder question	Initial response provided by the Consortium at the scoping consultation meeting	Chapter within this ESIA where this issue and relevant mitigation (where applicable) is discussed further (October 2015)
1	What is the capacity of CHP5? Have you talked with Mongolian University of Science and Technology (MUST) about their work on manufacturing building blocks using waterless coal? Have you considering shielding the coal yard from wind?	• The current total capacity is 1000MW • We are in contact with MUST and conducting studies • Shielding fences are provided to prevent coal dust being blown by the wind	Refer to Table 6.6, comment 7.
2	Will you be using underground water? What impact will this plant have on road and other accidents? Why is it being built in the city?	• Water is supplied from upper source water wells; there is one current water treatment facility with the plan to build another • Safety measures will be implemented once construction starts • The site was chosen to be protected from wind and storm in Baganuur	Refer to comment 5 in Table 6.4. The site was selected by the MoE and recommended by the MEGD. A review of the benefits and constraints of the Project site is presented in Chapter 3: Need and Alternatives. Section 3.3.2.
3	What is the impact on the environment and water resource?	• CHP5 will use less water than existing power plants in UB • CHP5 will have a	Refer to comment 2 above.

No.	Stakeholder question	Initial response provided by the Consortium at the scoping consultation meeting	Chapter within this ESIA where this issue and relevant mitigation (where applicable) is discussed further (October 2015)
		water treatment facility unlike other existing CHPs	
4	I would like to see more hydropower stations. You mentioned that you will divert the Khuliin river channel.	• Khuliin River is almost dried up and only flows during the rainy season • CHP5 will have a flood mitigation system	Chapter 3 Project Need and Analysis of Alternatives reviews the benefits and constraints of alternative technologies. The Site is located on an active floodplain at risk of flooding, meaning that the Project will not increase the risk to people living in the floodplain downstream the Plant. Due to the layout of the site, the Khuliin river channel will need to be diverted. A quantitative flood risk assessment was undertaken to determine flood mitigation measures required for the site. Refer to Chapter 2 (2.6) and Figure 2.3 which shows the proposed site layout.

Source: Newcom LLC, Mott MacDonald

6.5.3 Disclosure of SEP and Scoping Report

The SEP and the Scoping report was disclosed in Mongolian in October 2015 on the Project website and in local affected communities of Khoroo 11, 10 and 23. The SEP will remain available online for the lifetime of the Project, subject to updates as necessary.

6.5.4 Disclosure of Draft ESIA

On 15 and 16 October 2015 the CHP5 Consortium hosted a consultation event in the project affected communities to present the draft ESIA at the Bayanzurkh District Citizens Hall. Over the two days, 67 community members attended the meetings. The event was advertised in advance and transportation was provided to assist community members to attend the meetings. At the event, the draft ESIA was presented and verbally summarised with the assistance of a PowerPoint presentation.

The meeting commenced with an introduction by the chair, Mr Ghankhuyag, Director of Infrastructure and Energy of Newcom LLC (part of the Consortium) to disclose information about the Project, the ESIA and the consultation process. Introductions were then made to the other panel members that included Mott MacDonald's ESIA project manager, ADB's environmental specialist and the Chief Executive Officer for ENGIE Mongolia. The presentation paid particular focus to the key issues raised during the scoping consultation meetings held in August 2015, which included impacts of coal dust arising during construction, air quality impacts, noise generated during construction and operation and flood risk. Responses to the questions initially raised during the initial scoping consultation are provided in Table 6.4 to Table 6.7 which sets out the key findings of the ESIA and an overview of mitigation. This information was presented during the draft ESIA consultation meetings.

The feedback received on the presentation from local stakeholders was broadly positive and feedback from community members following the presentation was that their questions at the scoping stage had been addressed.

There was then an opportunity for questions which, along with the responses provided by the panel during the meeting is summarised in Table 6.8 below.

Table 6.8: Environmental questions raised at the draft ESIA disclosure public consultation meeting, 15th and 16th October, 2015

No.	Stakeholder question	Response given by the Panel at the consultation meeting
1.	In Mongolia, the dominant wind direction is from North-West. I live in the Urgakh Naran and interested in wind impact. Where would be blown coal dust and how much?	The wind direction from CHP5 will be away from Ulaanbaatar. The qualitative dust assessment shows that with mitigation there will be limited impacts on Urgakh Naran. Mitigation to be applied includes a wall to be constructed around the coal storage yard. Dust sensor suppression system, with sprinkler activation. After being unloaded from the rail wagons, the coal will be handled in enclosed systems within the Plant boundary.
2.	What is the height of the CHP4 stack?	The height of the CHP4 power plant stack is 220m. For this Project, we undertook a stack height determination exercise to calculate the height necessary to ensure that emissions from a stack do not result in excessive ground level concentrations of air pollutants using meteorological, terrain and building information. This exercise determined that based on the estimated emissions from the plant, a stack height of 170m is appropriate.
3.	How long will construction be?	The construction period for the power plant will be four years. However, there will be construction seasons due to the seasonal weather constraints.
4.	There are uncompleted houses. Are they stopping work due to the power project?	Land issues are all the decision of the GoM. The Happy Valley development located adjacent to the Project site stopped construction before the CHP5 project commenced.
5.	The area is supposed to have permafrost under it. What is its influence?	Geotechnical surveys were completed at the site to determine the presence and location of permafrost. There are two small areas of permafrost on the Project site. Surface permafrost will be melted as part of the construction and piling will be undertaken to drill through deeper levels of permafrost. All technical surveys were made in conjunction with Mongolian companies, who suggested the approach for constructing the power plant on permafrost.
6.	How is the stack cleaned?	The Project will use a technology which will filter the particles in the gas before they are dispersed the stack. Whilst the other CHPs located in Ulaanbaatar use a similar method, the technology they use is now considered outdated. A particulates emissions level of 30mg/Nm^3 will be achieved. Currently CHP3 and CHP4 emissions are between 200-2,000mg/Nm^3. A fabric filter will be used. Limestone will be injected to the boiler and SOx will react with it and neutralize within the boiler. Circulating fluidized bed boiler is the new technology in Mongolia. By using this newer technology, NOx burning process will be held at lower temperature. NOx emissions from the Project will be relatively low.
7.	What kind of emissions measurement and abatement technology will be used?	Emissions from the stack will be continuously monitored. Should there be any exceedances, these will be identified immediately.
8.	How much lower is the dust level in comparison with CHP4?	CHP4 produces around 200mg/Nm^3. CHP5 discharges 10-20mg/Nm^3 in average and 30mg/Nm^3 is the maximum. Therefore emissions are estimated to be approximately 10 times lower than those of CHP4.

No.	Stakeholder question	Response given by the Panel at the consultation meeting
9.	Do you mean new technology for Mongolia only? Do you use it in other countries?	The technology proposed for this Project has been used in power plants worldwide. ENGIE operate 10 similar boilers in several foreign countries in USA, Finland and in some Asian countries as Thailand etc. ENGIE has the experience in this field and operates over 200-300 plants in 70 countries all over the world, including in countries where the conditions are similar to those in Mongolia, such as Canada. An emissions level of 150mg/Nm3 will be achieved for SO_2. This is significantly lower than emissions from CHP4 of approximately 1000mg/Nm3. It is fully acknowledged that emissions of particulates are a significant issue in Ulaanbaatar due to the very poor air quality. Low emissions of particulates will also be achieved by the Plant. All the existing CHPs are located in the west side of Ulaanbaatar. As a result of the dominant wind direction and low predicted emissions contributions, emissions from the Project will not contribute to the air pollution in Ulaanbaatar.
10.	I am from 11th khoroo. I run the financial cooperation Zurkh Naran and I appreciate this project. One of the options to support the local residents is the collaboration. The small business owners are joined in our community. Is there any possibility to supply our products to CHP5 during the construction and operation?	A project like this has the opportunity to get goods from local communities, not importing from abroad. Many products, including equipment such as gloves are needed during constructions and operation. Of course the Project will support the small manufacturers and local communities and it is in plan. There will work at least 2000 people during construction and 300-500 people will work during the project operation. Therefore we need a lot of products and supplies here and we are negotiating all the possibilities with the government.
11.0	I live in the project site. Thank you for the cooperation of Newcom representative Batsaikhan and Land authority specialist Tsogtoo. Our new land license is almost issued and we will moved to there before 15 May 2016. The important thing is the land work and pole holes. And the problem of moving to the Emiin Urgamal is the electricity. Here we lived 4 years without light and connected to the line only 3 years ago. And what about the households of east side of the road? I would like to say that there are a lot of arrangements and preparations needed. So, please support us having the electricity there. And in addition, I would like to say that 11th khoroo is located far from the city center and not developed factories, and has enough labor force. Therefore, I am kindly asking you to hire more people from this region and train them. Also, you may hire employees during the construction work. I wish good luck to the Consortium.	Thank you very much and I would like to answer to last questions. I think it is also very important to give an opportunity to local people. First, as mentioned previous gentlemen, we will support the small factories how much we can. And trainings will be held. Regarding the electricity issue on new land, the Consortium is preparing the resettlement plan. We will make more meetings with people under resettlement and will be undertaken in accordance with national and international standards.

No.	Stakeholder question	Response given by the Panel at the consultation meeting
13.	I am the welder and interested in work. What are the requirements to the job? And how do you choose the staff?	Currently the consortium is signing 5-6 contracts with the government. If the contracts succeed in near 2-3 months, we will apply for the financing in next 3-4 months. When the financing issues are completed, the project company will start registration and collect applications. Our employees will be trained for two years before the operation. And we will organize the meetings before the construction to announce the open positions. Please contact the CLO for further details.
14.	What about the impact on the households, who lives in the south of the small road?	People who will need to be resettled are still under discussion at this point. If required, there will be planned the resettlement, which will ensure that people are either as well off as they currently are or better.
15.	You are talking about modern plant with lower emissions of pollutants. What is the height of the stack? Wind direction is going along the Khuliin gol valley. What kind of mitigation measures you are taking? How do you solve the small particles issue, however planned the tall partition? Will you build noise reducing walls?	This Project will not influence the air quality of Ulaanbaatar. Coal dust spread covers 500m radius and impacts on 200m around. Therefore, we planned several mitigation measures as building the wall around the coal storage yard for coal storage, using the closed type conveyer transportation, applying of water spraying technology to reduce the coal dust. There is the modern technology to measure the pollutants in flue gas. CHP4 uses the technology of dry cyclone, or the gas goes out from the stack in cyclone type. CHP3 sprays the water to the gas from the high pressure boiler. This allows the particles go out from the stack directly, however catches 70-80% pollutions. CHP4 uses electrostatic method, which catches 80-90% of the particles. But CHP5 uses different technology, named fabric filter. The gas is blown through the fabric filters and those filters catch the particles inside. This technology allows for a particulate removal rate of up to 99.5-99.9% to be achieved.
16.	How do you validate the numbers of 30 and 100?	All these numbers are practical and have been confirmed with the contractors. There is a permissible level is 30mg/Nm^3, however, the technology to be used may allow for emissions as low as 10-20 mg/Nm^3. Emissions will be monitored continuously and in the event of an exceedance operations will be stopped to rectify the problem.

6.6 Disclosure of draft ESIA by ADB

The Draft ESIA was disclosed on the Project and ADB website for a period of 120 days (as is required by lenders for category A projects) in October 2015.

The evidence of disclosure and feedback from consultation activities will be reflected in the final ESIA which will be disclosed on the Project and ADB websites here: www.chp5.mn and http://www.adb.org/projects.

6.7 Resettlement planning consultation

Additional consultation will be undertaken with vulnerable resettlement affected people, once identified, through the resettlement planning household surveys that are being undertaken for the Project, as detailed in Section 6.4. This will be done through focus group discussions that will be targeted to exploring displacement impacts, livelihood restoration opportunities and gender issues with project affected women. The outcomes of these activities will be described in the RP.

6.8 Consultation planned throughout the lifetime of the Project

The SEP outlines ongoing stakeholder engagement and implementation of the grievance mechanism throughout the construction, operation and decommissioning stages. Activities include communications as necessary with settlement representatives, community consultation events at key project milestones such as the beginning and end of construction, regular updating of the Project website and social media, updating the SEP and annual sustainability reporting.

6.9 Project grievance redress mechanism

6.9.1 Overview

A grievance can be defined as an actual or perceived problem that might give grounds for complaint. As a general policy, the Project will work proactively towards preventing grievances through the implementation of impact mitigation measures and community liaison.

Anyone can submit a grievance to the Project if they believe a practice is having a detrimental impact on the community, the environment, or on their quality of life. They may also submit comments and suggestions. The sections below consider confidentiality and anonymity and the project's grievance resolution process.

6.9.2 Confidentiality and anonymity

The Project will aim to protect a person's confidentiality when requested and will guarantee anonymity in annual reporting. Individuals will be asked permission to disclose their identity. Investigations will be undertaken in a manner that is respectful of the aggrieved party and the principle of confidentiality. The aggrieved party will need to recognise that there may be situations when disclosure of identity is required and the Project will identify these situations to see whether the aggrieved party wishes to continue with the investigation and resolution activities.

6.9.3 Grievance reporting and resolution

People may register grievances using a grievance form or by contacting the project community liaison officer (CLO) or reporting to their Khoroo Leader. Contact details for the CLO will be included in appropriate project communication materials such as the non-technical summaries and if the CLO needs to be replaced, the new CLO's contact details will be shared with affected communities.

The CLO will acknowledge grievances within seven working days. Grievances will be logged in a formal logging system for which the CLO will be responsible, and grievances will be classified according to the risk criteria presented in Table 6.9.

Table 6.9: Grievance classification criteria and Response process and timeframes

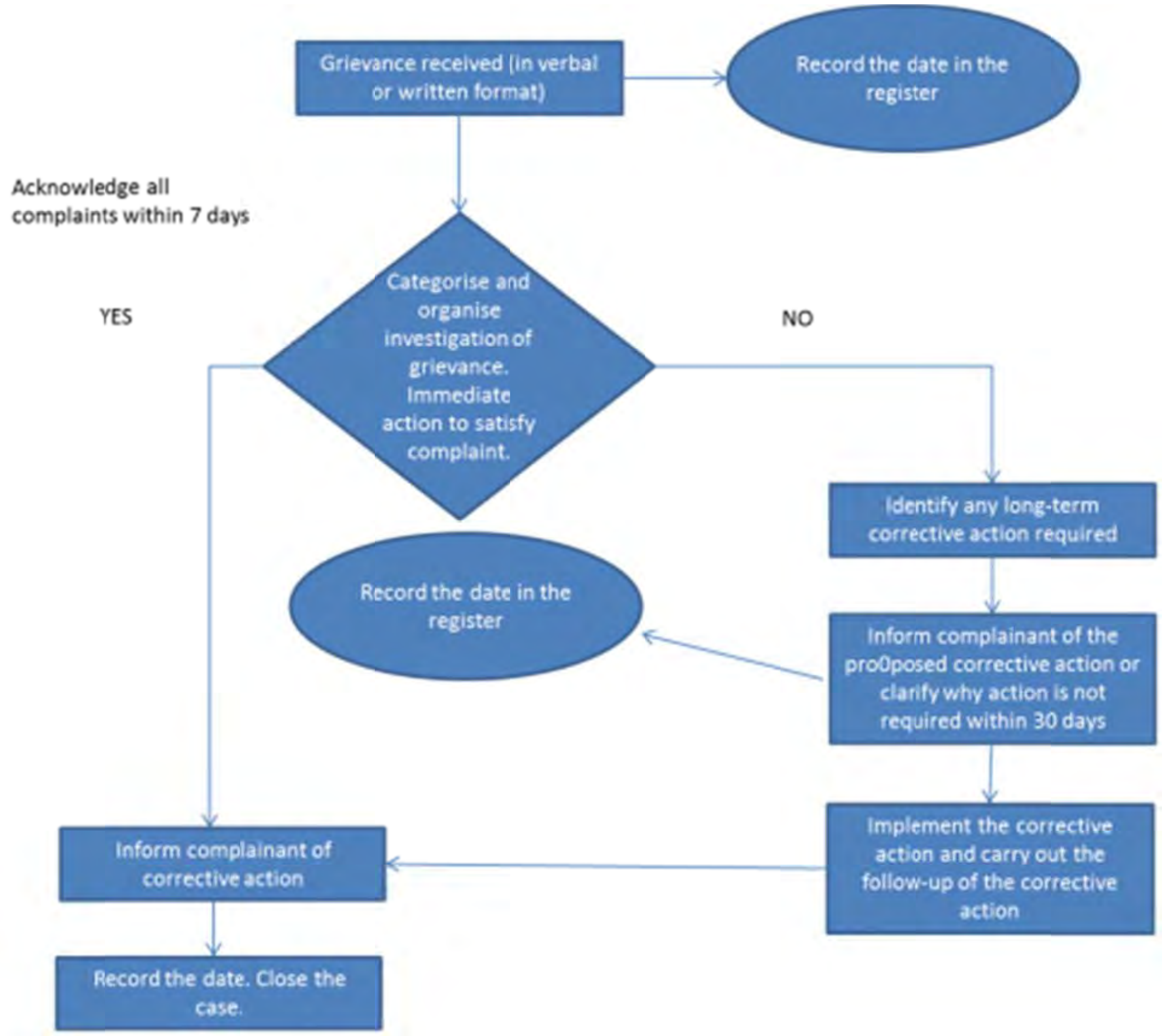
Classification	Risk Level (to health, safety or environment)	Response process and timeframes
Low	No or low	CLO will conduct investigation, document findings and provide a response immediately or within 30 days
Medium	Possible risk and likely a one off event	CLO and an appropriate Project investigation team will conduct an investigation. The Site Manager or Occupational Health and Safety Manager may decide to stop work during the investigation to allow the corrective preventive actions to be determined. The CLO will communicate the outcomes of the investigation to the complainant within 14 days
High	Probable risk and could reoccur	CLO will organise the Grievance Redress Committee (GRM – as discussed below) that will conduct a prompt investigation and resolution. Work may be stopped in the affected area. The CLO will communicate the outcomes of the investigation to the complainant within 14 days

Where investigations are required into high risk grievances, a Grievance Redress Committee (GRC) will be formed consisting of project personnel including the CLO, project management and project staff with the necessary specialist skills to address the issues raised. The GRC will also include local government leaders and local affected community representatives. The GRC will verify the CLOs preliminary grievance classification including determining the extent to which the incident leading to the grievance is likely to reoccur. Identifying and implementing activities, procedures, equipment and training to address and prevent reoccurrence will be part of the investigation activities.

The CLO will explain in writing to the complainant (or where literacy is an issue, orally) the review process, the results, and any changes to activities that will be undertaken to address the grievance and how the issue is being managed to meet appropriate environmental and social management systems. In some cases it will be appropriate for the CLO to follow up at a later date to see if the person or organisation is satisfied with the resolution or remedial actions.

The CLO will summarise grievances weekly during construction and bi-annually during operations removing identification information to protect the confidentiality of the complainant and guaranteeing anonymity. The procedure will be at no cost and without retribution to project affected persons and stakeholders. The procedure for processing grievances is depicted in Figure 6.6.

Figure 6.6: Flowchart for Processing Grievances



Source: Mott MacDonald

During the planning phase of the Project, the Consortium has nominated Ms Uyanga Munkhkhuyag as the CLO and point of contact for grievances and comments. Grievances and comments should be sent to the contacts below. Grievance and all communications will be logged by the Project to maintain a detailed record of all engagement and follow up actions.

Name	Address	Telephone	Email	Website
Ms Uyanga Munkhkhuyag	10F, Naiman Zovkhis Building, 21 Seoul Street, Ulaanbaatar 14251, Mongolia	976-75555151	contact@chp5.mn	http://www.chp5.mn

7 Air Quality

7.1 Introduction

7.1.1 Overview

This chapter provides an assessment of the potential impacts of the Project on local air quality. This assessment has been carried out in accordance with international guidelines and addresses the potential construction and operational phase impacts resulting from emissions to air.

7.1.2 Key Pollutants

7.1.2.1 Overview

The combustion of fossil fuel gives rise to a number of pollutants with the potential to negatively affect local air quality. With respect to coal (the proposed fuel for this Project), the primary pollutants of concern are:
- Oxides of nitrogen (NO_x)
- Sulphur dioxide (SO_2)
- Particulate matter (PM)
- Carbon monoxide (CO)
- Hydrogen fluoride (HF)
- Hydrogen chloride (HCl).

7.1.2.2 Oxides of Nitrogen

Oxides of nitrogen is a term commonly used to describe a mixture of nitric oxide (NO) and nitrogen dioxide (NO_2), referred to collectively as NO_x. These are primarily formed from atmospheric and fuel nitrogen as a result of high temperature combustion. The major sources in most countries are road traffic and power generation.

During the process of combustion, atmospheric and fuel nitrogen is partially oxidised via a series of complex reactions to NO. The process is dependent on the temperature, pressure, oxygen concentration and residence time of the combustion gases in the combustion zone.

Most NO_x exhausting from a combustion process is in the form of NO, which is a colourless and tasteless gas. It is readily oxidised to NO_2, a more harmful form of NO_x, by chemical reaction with ozone and other chemicals in the atmosphere.

7.1.2.3 Sulphur Dioxide

SO_2 is a colourless, non-flammable gas that can irritate the eyes and air passages. It reacts on the surface of a variety of airborne solid particles, is soluble in water and can be oxidised within airborne water droplets. The most common sources of SO_2 include fossil fuel combustion, smelting, manufacture of sulphuric acid, conversion of wood pulp to paper, incineration of waste and production of elemental sulphur. Coal burning is the single largest man-made source of SO_2, accounting for about 50% of annual global emissions, with oil burning accounting for a further 25-30%. The most common natural source of SO_2 is volcanoes.

7.1.2.4 Particulates

PM is a complex mixture of organic and inorganic substances present in the atmosphere and sources are numerous. Coarse particulates arise mainly from mechanical suspension of soil, dust, sea salt and diffuse industrial / traffic related sources and are predominantly of natural or indirect anthropogenic origin. Particulates are described in term of their size; for example the term $PM_{2.5}$ describes particulate matter that is less than 2.5 microns (10^{-6} metres) in aerodynamic diameter. Fine particulates ($PM_{2.5}$ – $PM_{0.1}$) are derived mainly from gas-to-particle reactions in combustion exhausts or between ammonia and sulphate and nitrate, and are predominantly of direct anthropogenic origin.

7.1.2.5 Carbon Monoxide

CO is a colourless, odourless gas produced by the incomplete combustion of carbon-based fuels and by biological and industrial processes. The major source of carbon monoxide is traffic, particularly in urban areas. CO is produced under conditions of inefficient combustion, is rapidly dispersed away from the source and is relatively inert over the timescales relevant for its dispersion. CO has always been present as a minor constituent of the atmosphere, chiefly as a product of volcanic activity but also from natural and man-made fires and the burning of fossil fuels.

7.1.2.6 Hydrogen Fluoride

HF is a colourless gas with a pungent smell. HF can cause irritation to the eyes, nose and throat, and high levels of exposure can cause muscle spasms and may damage internal organs. The main releases of hydrogen fluoride are from high temperature industrial processes, for example from coal-fired power stations.

7.1.2.7 Hydrogen Chloride

HCl is a colourless or slightly yellow corrosive gas at room temperature, which has a strong smell and is heavier than air. It is highly soluble in water, forming hydrochloric acid. HCl is formed by industrial activities such as from coal-burning power stations and incinerators. Fossil fuels contain small amounts of naturally-occurring chlorides and HCl is produced when they are burnt.

7.2 Applicable Legislation

7.2.1 Overview

This section outlines the Mongolian national legislation and standards relevant to emissions and ambient air quality. International financing is being sought for the Project, therefore, demonstration of compliance with the following international requirements has also been considered:

- The ADB's SPS (2009)
- IFC PSs (2012)
- WB/IFC Sector Specific EHS Guidelines
  - EHS Guidelines for Thermal Power Plants
  - General EHS Guidelines
- EU Requirements –met through the EBRD's 2008 ESP and related PRs.
- The EqPs (2013).

7.2.2 Limits on Emissions to Air

7.2.2.1 Mongolian Emission Limits

Mongolia's emission limits are set out in MNS 6298:2011 which specifies maximum permissible emissions for new thermal power stations. Relevant national limits are presented and compared to international standards in Table 7.1.

7.2.2.2 International Emission Limits

The ADB SPS

The ADB environmental safeguard policy has the principle to "apply pollution prevention and control technologies consistent with international good practices as reflected in internationally recognised standards such as the WB/IFC's EHS Guidelines". The policy statement requires that if host countries standards differ from values set out within such documents a project is expected to achieve the most stringent. The policy statement requires that "when the project has the potential to constitute a significant source of emissions in an already degraded airshed, strategies that help improve ambient conditions, such as evaluating alternative project locations and considering emissions offsets, will be introduced".

IFC PSs

The IFC PS3: Resource Efficiency and Pollution Prevention aims: *"to avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities".* To achieve this, the IFC provides both industry-specific and general guidance on Good International Industry Practice with respect to emissions to air.

Relevant IFC standards for emissions to air applicable for the project are presented in the WB/IFC Guidelines for Thermal Power Plants. These Guidelines advise that, with respect to emission limits, when host country regulations differ from the levels presented in the Guidelines, projects are expected to achieve whichever is more stringent.

EBRD Requirements

EU requirements have been assessed against the guidance provided by the EBRD Environmental and Social Policy PR3: Pollution Prevention and Abatement, the objectives of which are: *"to avoid or, or where avoidance is not possible, minimise and mitigate adverse impacts".*

The EU Industrial Emissions Directive (IED) (2010/75/EU) provides standards for emissions to air for plant with a thermal input greater than 50 MW. Relevant emissions limits from the IED are presented in Table 7.1.

Summary

Table 7.1 provides a summary of the relevant international emission limits potentially applicable to the Project.

Table 7.1: Summary of Applicable Emission Limit Values (mg/Nm³)

Pollutant	Mongolian Standards[a]	WB/IFC Guidelines[b] Non-degraded airshed (NDA)	WB/IFC Guidelines[b] Degraded airshed (DA)[f]	EU Limits[g]
NO_x	1100	510 or up to 1100 if volatile matter of fuel <10%	200	150
	650[c]			
	450[d]			
SO_2	400[e]	900-1500[h]	400	200 for CFB combustion
Particulate Matter	50	50	30	10
CO	180	-	-	-

Source: [a] Reference conditions not stated
[b] WB/IFC EHS Guidelines for Thermal Power Plants. Nm³ is at 0°C, dry, 6% O_2, 1 atmospheric pressure
[b] if Vdaf <10%
[c] if 10% <Vdaf <20%
[d] if Vdaf > 20%
Vdaf – Volatile compound concentration in coal ash and flammable objects
[e] Airsheds should be considered degraded if nationally legislated air quality standards are exceeded or, in their absence if WHO Air Quality Guidelines are exceeded significantly.
[f] An airshed is considered to be degraded if nationally legislated air quality standards.

[g] EU IED. All values at 372.15 K, 101.3 kPa pressure, dry, 6% O_2 and apply to plant >300 MWth input.

[h] Targeting the lower guideline values and recognising issues related to quality of available fuel, cost effectiveness of controls on smaller units, and the potential for higher energy conversion efficiencies (FGD may consume between 0.5% and 1.6% of electricity generated by the plant).

7.2.3 Ambient Air Quality Standards

7.2.3.1 Mongolian Air Quality Standards

The legal framework for air quality regulation in Mongolia consists of the “Constitution of Mongolia”, “Law on Environmental Protection”, “Law on Air” and other relevant laws and regulations issued in conformity with them. The purpose of the Mongolian Law on Air is to regulate the actions related to the protection of ambient air, prevention from pollution, and reduction and monitoring of emissions of air pollutants. The Mongolian ambient air quality standards are stated in MNS 4585:2007[15] and the relevant standards for this Project are presented in Table 7.2.

7.2.3.2 International Standards

IFC Guidelines

Relevant IFC standards for ambient air quality are presented in the WB/IFC General EHS Guidelines for Air Emissions and Ambient Air Quality.

The WB/IFC General EHS Guidelines advise that ‘relevant standards’ with respect to ambient air quality are national legislated standards or, in their absence, the current World Health Organisation (WHO) Air Quality Guidelines or other internationally recognised sources such as the EU.

Where a host country’s legislated standards are less stringent than either the WHO or other internationally recognised sources, the IFC acknowledge that it is acceptable to use the national legislated standards as the principal standards that the Project is assessed against. Mongolia’s ambient air quality standards are broadly based on the WHOs guideline values and in some cases more stringent than the WHO guidelines.

The current WHO Guidelines for NO_2, SO_2 and particulate matter are provided in the Air Quality Guidelines Global Update 2005. These guidelines are intended to support actions for air quality at the optimal achievable level for public health protection in different contexts. The WHO does not formally prescribe how guidelines should be used in air quality management. However, the Air Quality Guidelines Global Update does provide ‘Interim Targets’ to aid the progression of policy development to bring air quality in line with the proposed guideline values.

The WB/IFC General EHS Guidelines suggest that, as a general rule, emissions should not contribute more than 25 percent of the relevant air quality standards to allow additional, future sustainable development in the same airshed. It also states that projects located within poor quality airsheds (if the nationally legislated standards are exceeded significantly), should ensure that any increase in pollution is as small as feasible, and amounts to a fraction of the applicable short term and annual average air quality guidelines established in the project-specific environmental assessment. It is considered that this is a general rule and needs to be considered for individual projects on a case by case basis and should take

[15] Mongolian Air Quality Standard MNS 4585-2007. Accessed on http://www.ub-air.info/ub-air/en/about/air-quality-standard.html

account of the location and the size of the area that predicted impacts are above 25% of the relevant ambient air quality standards.

The significance of the impacts of the Project has been discussed in the context of this approach.

EBRD Requirements

EBRD applies EU environmental regulations as the basis for its environmental assessments. Directive 2008/50/EC on ambient air quality and cleaner air for Europe was adopted in May 2008. This latest Directive merges the first three existing Daughter Directives and one Council Decision into a single Directive on air quality (it is anticipated that the fourth Daughter Directive will be brought within the new Directive at a later date). It also sets new standards and target dates for reducing concentrations of fine particles. Relevant EU ambient air quality objectives are presented in Table 7.2.

It should be noted that EBRD's PR3 states that "*when host country regulations differ from the levels and measures presented in EU environmental requirements or requirements agreed pursuant to paragraph 7, projects will be expected to meet whichever is more stringent*".

The EU ambient air quality limit values are based on the WHO Guidelines. The WHO Guidelines acknowledge that when States use the guidelines for setting legally binding standards (such as limit values) considerations such as prevailing exposure levels, technical feasibility, source control measures, abatement strategies, and social, economic and cultural conditions should be taken into account.

In many jurisdictions, such as the United States and Europe, these considerations have led to the introduction of a threshold of tolerance to account for exceptional, worst case episodes. In practice this means defining a number of allowable occurrences greater than the prescribed value to account for potential abnormal or infrequent pollutions episodes - these are often referred to the guideline values being applied as percentiles. For example, the standard for the one hour NO_2 allows for 18 exceedances within a calendar year and therefore the objective level is expressed as the 99.79^{th} percentile. It should also be noted that there are specific locations where EU Limit Values apply. They do not apply in areas defined as workplaces and areas where members of the public do not have access and there is no fixed habitation.

7.2.3.3 Summary

Table 7.2 provides a summary of the ambient air quality standards that have been applied to the proposed Project. Following a review of the Mongolian standards and comparing them to standards from other countries around the world they are not considered to be appropriate for use by themselves. This is based on a number of reasons which include the following:

- Mongolian standards for NO_2 and SO_2 in particular are very stringent when compared to international standards such as those specified by the EU and other countries in the region with more developed environmental regulatory frameworks. For example, the Mongolian ambient air quality standard for SO_2 (24 hour) of 20µg/m³ is over six times more stringent than the equivalent EU standard. A comparison of Mongolian standards to other countries in the region is presented in Volume III Appendix M, which further demonstrates this point.

- Mongolian standards are based on maximum values. This does not allow an allowance for infrequent worst case conditions (as is the case for the EU and US, for example). Therefore comparing a maximum predicted modelled concentration from a project against such a standard should only be done alongside additional consideration of the likelihood of the impact and its location.
- Existing baseline conditions within Ulaanbaatar and the surrounding area where the Project is located currently exceed the national standards which demonstrates that these are currently not be enforced and used appropriately. The elevated baseline conditions (particularly in Ulaanbaatar) are an indicator that Mongolia is in the early stages of implementing regulatory interventions to meet these standards.
- A phased approach to meeting such standards is common, and promoted within the WHO Guidelines through the use of 'Interim Targets' for some pollutants. Currently there are no interim targets set out to provide a phased approach for achieving the Mongolian standards. The EU's 24 hour standard for SO_2 has the same numerical values as the WHO Interim Target 1 and therefore provides an appropriate standard for this assessment.

The Project impacts have therefore been assessed against the EU ambient air quality standards. To meet the requirements of the IFC EHS Guidelines, and for completeness, impacts are also compared with the Mongolian standards and these are presented in Volume III, Appendix D.

The proposed Project is part of a long term step aimed at improving air quality in Ulaanbaatar. It would provide significant amounts of heat and electricity to Ulaanbaatar whilst having no negative effect on air quality within the city and therefore its impacts on air quality should be reviewed in this context.

In the case of HF and HCl, applicable standards have been derived from appropriate UK guidance in the absence of national or EU legislated standards.

Table 7.2: Summary of Relevant Ambient Air Quality Standards and Guidelines (µg/m³)

Pollutant	Averaging Period	Mongolian Standards[(a)]	EU Standards[(b)]	Other[(h)]
Nitrogen Dioxide (NO_2)	20 Minute	85	-	-
	1 hour	-	**200**[(c)]	-
	24 hour	40	-	-
	Annual	30	**40**	-
Sulphur Dioxide (SO_2)	10 Minute	500	-	-
	15 Minute	-	**266**[(d)]	-
	20 Minute	450	-	-
	1 Hour	-	**350**[(e)]	-
	24 hour	20	**125**[(f)]	-
				-
				-
	Annual	10	-	-
Particulate Matter (PM_{10})	24 hour	100	**50**[(g)]	-
				-

Pollutant	Averaging Period	Mongolian Standards[a]	EU Standards[b]	Other[h]
				-
				-
	Annual	50	**40**	-
				-
				-
				-
Particulate Matter ($PM_{2.5}$)	24 hour	50	-	-
				-
				-
				-
	Annual	25	**25**	-
				-
				-
				-
Carbon Monoxide (CO)	30 Minute	60,000	-	-
	1 hour	30,000	-	-
	Running 8 Hour Mean	10,000	**10,000**	-
Hydrogen Fluoride (HF)	1 hour	-	-	**160**
	Annual	-	-	**16**
Hydrogen Chloride (HCl)	1 hour	-	-	**750**

Notes: Bold text indicates the primary standards that the Project has been assessed against
[a] Source (Mongolian Law on Air).
[b] EU Directive 2008/50/EC on ambient air quality and cleaner air for Europe.
[c] 99.79th percentile
[d] 99.9th percentile
[e] 99.73rd percentile
[f] 99.18th percentile
[g] 90.41st percentile
[h] UK Expert Panel on Air Quality Standards Guidelines for halogens and hydrogen halides in ambient air for protecting human health against acute irritancy effects

7.3 Methodology and Assessment Criteria

7.3.1 Overview

This section provides an overview of the assessment approach taken and the inputs used within the dispersion modelling.

7.3.2 Baseline Conditions Methodology

The baseline assessment includes a review of currently available air quality monitoring data for the study area including data from a continuous analyser located close to the proposed Project site and data from within Ulaanbaatar. Although the Ulaanbaatar data is not from within the Project's airshed it provides useful additional insight to the current ambient conditions within the city.

The existing pollutant concentrations derived from the baseline monitoring have been used within the impact assessment to represent ambient conditions. When assessing the impacts from the Project on short term averaging periods (including 10 minute, 15 minute, 20 minute and one hour) the background concentration used to represent ambient conditions has been assumed to be twice that of the long term (annual) concentrations used within the assessment. This approach is consistent with international best practice and specified by the UK Environment Agency.[16]

7.3.3 Scope of Assessment

7.3.3.1 Temporal Scope

It is anticipated that the construction period of the site will be a maximum of 57 months and the operational lifetime of the proposed Project will be for a minimum of 30 years.

7.3.3.2 Spatial Scope

The baseline included a review of available air quality data for Ulaanbaatar.

Construction impacts will be located close to the site and will not extend beyond 500m from construction or decommissioning activity.

In accordance with best practice, potential impacts of emissions from operation of the plant on ambient air quality have been assessed within 15km of the stack. Due to the location of the Project and the predicted impacts being limited to within 15km of the stack, transboundary impacts have not been considered.

7.3.4 Construction Phase Impact Assessment Methodology

Construction activities can result in temporary effects from dust. 'Dust' is a generic term which usually refers to particulate matter in the size range 1-75 microns. Emissions of construction dust are predominantly associated with the movement and handling of minerals and therefore composed of the larger fractions of this range, which do not penetrate far into the respiratory system. Therefore the primary air quality issue associated with construction phase dust emissions is normally loss of amenity and/or nuisance caused by, for example, soiling of buildings, vegetation and washing and reduced visibility.

[16] Environment Agency, Horizontal Guidance (H1) Annex F – Air Emissions

Dust deposition can be expressed in terms of mass per unit area per unit time, e.g. $mg/m^2/month$. No relevant Mongolian or IFC standards exist for dust deposition, however, a range of criteria from 133 to $350mg/m^2/month$ is found around the world as representative of thresholds for significant nuisance.

It is considered that a quantitative approach is inappropriate and unnecessary for assessing particulate emissions associated with the construction and decommissioning phases of the Project, given their relatively short duration and limited number of sensitive receptors. The potential for construction and decommissioning activities to raise dust, and the likely consequences of dust emissions have therefore been assessed qualitatively.

The first stage of the assessment involved the identification of construction activities which have the potential to cause dust emissions, along with the degree of dust potential. Table 7.3 provides a generic list of potential activities at each stage of construction. Selected information for this table has been used within this assessment to determine the impact of the Project with respect to construction dust.

Table 7.3: Relevant Generic Dust Emitting Activities

Potential Dust Emitting Activities	Description	Dust Emission Potential
Soil handling	Potential to be high in dust nuisance, depends on soil dryness	High
Loading Activities	Potential to be high in dust nuisance, depends on material characteristics	High
Storage of materials onsite	Potential to be high in dust nuisance, depends on material characteristics	High
Transport of materials within site	Can be high depends on type of transport and nature of road surface	Medium
Drilling and digging activities (Including soil excavation)	Can be high depending on type of drilling and digging activities and material characteristics	High
Transport of material offsite	Generally low as transport occurs by surfaced roads	Low
Construction of new buildings	Generally low although some activities with high dust raising such as material cutting can occur	Medium-Low
Assembly of plant	Generally low as involves assembling prefabricated pieces	Low

Source: Table adapted from UK Department for Environment and Rural Affairs and Buildings Research Establishment guidance

In the second stage of the assessment, all sensitive receptors with the potential to be significantly affected by construction dust emissions have been identified. The distances from source at which construction dust effects are felt are dependent on the extent and nature of mitigation measures, prevailing wind conditions, rainfall and the presence of natural screening by, for example, vegetation or existing physical screening such as boundary walls on a site. However, research indicates that effects from construction activities that generate dust are generally limited to the areas within 150-200m of the construction site boundary. To ensure a conservative assessment, any receptors within 500m of the construction site boundary have been identified, and their classification determined in accordance with Table 7.4.

Table 7.4: Receptor Classification

Classification		
High	**Medium**	**Low**
Hospitals and clinics	Gers	Farmland
-	Residential house including gers	Other Industry
-	Residential flats	-
-	Road users	-

It should be noted that the same approach used for the construction phase has been used for assessing operational impacts from the coal storage and handling facilities.

At this stage exact numbers of construction vehicles is not known and the routes that they will take are not defined. However, during peak construction periods the total number of vehicle movements is expected to be above 200 per day. Therefore appropriate mitigation measures have been included to avoid significant effects on local air quality.

7.3.5 Operational Phase Impact Assessment Methodology

7.3.5.1 Stack Height Determination

The purpose of a stack height determination is to calculate the height necessary to ensure that emissions from a stack do not result in excessive ground level concentrations of air pollutants as a result of atmospheric downwash, eddies or wakes which may be created by nearby structures or terrain.

Nearby structures are normally the dominant cause of any atmospheric downwash, eddies or wake effects. For proper dispersion to occur it is necessary for the emissions to be released well above the top of nearby structures. Dispersion of emissions from a stack is also determined by the emission characteristics of the source, particularly their temperature and speed when they exit the stack.

A number of methods are available to determine an appropriate stack height, including simple equations and dispersion modelling. In this case the stack height has been determined by dispersion modelling as detailed below.

The results of the stack height determination are presented in Volume III, Appendix C and concluded that a stack height of 170m was appropriate even though terrain in the study area was still having an influence on dispersion. Modelled results presented in Section 7.5 have been based on a stack height of 170m and additional modelled results based on a stack height of 200m presented in Volume III, Appendix C.

7.3.5.2 Dispersion Model

The ADMS is a PC-based model of dispersion in the atmosphere of pollutants released from single or multiple sources which may be point, area or line sources, produced and validated by Cambridge Environmental Research Consultants (CERC). It is designed to allow for consideration of dispersion problems ranging from simple single isolated point sources to modelling the impact of existing and proposed industrial installations.

ADMS is a 'new generation' dispersion model and applies up-to-date understanding of physics of the atmospheric boundary layer structure based on the Monin-Obukhov length and the boundary layer height. ADMS accurately represents vertical variation in boundary layer parameters, such as wind speed. It includes parameters such as variable meteorological and complex terrain conditions, effect of plume rise, effect of buildings and the surface roughness of the surrounding terrain.

7.3.5.3 Emissions Data

Emissions data have been based on information provided by ENGIE and additional calculations carried out by Mott MacDonald. The emissions data used within the stack height determination are presented in Table 7.5. It should be noted that the stack height determination presented in Volume III, Appendix C has been carried out using a mass emission of 1g/s.

The Project could operate in a number of different modes depending on varying electricity and heat demands across the year. Therefore, following a review of these operating scenarios two operational scenarios have been assessed in order to identify the potential impacts of the Project:

- Scenario 1: The proposed Project at 100% boiler load
- Scenario 2: The proposed Project at 40% boiler load

Scenario 1 has been selected as it reflects the operating scenario that would result in the greatest amount of fuel being combusted and therefore the highest mass emissions of pollutants emitted and represents the worst high load case. Scenario 2 has been selected as it represents the lowest operating profile that the boilers could continuously operate for. This scenario is considered to represent the least favourable emission parameters such as exit velocity and exhaust gas temperature exiting the stack and represents the worst load case.

Both Scenarios assume operation at the respective loads for the whole year. The Project will not operate for the whole year due to planned and un-planned shutdowns. In addition, it is considered unlikely that the plant will operate at 40% load for extended periods. Both Scenarios can be considered conservative, particularly Scenario 2. Nevertheless, both are considered appropriate to identify potential worst case impacts. Results from Scenario 2 are presented in Volume III, Appendix E.

Emissions of CO are related to poor combustion and therefore will be militated against through the efficient operation of the proposed Project. Estimated emissions of CO have not been assessed further as they are not a key pollutant with respect to this assessment given the predicted emission rates and because relevant ambient standards are significantly higher than those for NO_2, SO_2 and PM_{10}.

As noted in Table 7.1, the Project is expected to meet the IFC emission limits for particulates and achieve better than the limits for NO_x and SO_2 applicable to degraded airshed (refer to Section 7.4.2.2). It will also meet EU emission limits, with the exception of the EU emission limit for PM (of 10mg/Nm^3).

Although the proposed abatement for the Project will not specifically reduce emissions of HCl and HF from the proposed Project, they are nevertheless expected to be relatively small at source compared to the pollutants presented below. On this basis no further assessment of HCl and HF has been undertaken. In addition, emissions of metals will also be small as they will be removed via the fabric filters which form part of the Project's abatement technology and therefore have not been assessed further.

Table 7.5: Emissions Data

Parameter	Scenario 1		Scenario 2	
	Per Unit	Multiflue Stack (3 flues)	Per Unit	Multiflue Stack (3 flues)
Actual Volumetric Flow Am^3/s	288.6	865.7	126.5	379.4
Normalised Volumetric Flow Nm^3/s	179.3	537.9	68.2	204.5
Efflux Temperature °C	161	161	139	139
Efflux Velocity m/s	18.1	18.1	8.0	8.0
Stack Diameter m	4.5	7.8	4.5	7.8
Stack coordinates[(d] m	657900, 5303645			
NO_x (mg/Nm^3)	150			
NO_x (g/s)	26.9	80.7	10.2	30.7
SO_2 (mg/Nm^3)	150			
SO_2 (g/s)	26.9	80.7	10.2	30.7
PM (mg/Nm^3)[(a)]	30			
PM (g/s) [(a)]	5.4	16.1	2.0	6.1

Notes (a) Emission of PM are assumed to consist of only the PM_{10} fraction and below. The Project's fabric filters will be designed to remove a range of all particles although a higher proportion of smaller ones will remain in the exhaust gas and therefore this can be considered to be a conservative assumption.

7.3.5.4 Meteorological Data

The most important meteorological parameters governing atmospheric dispersion of pollutants are wind direction, wind speed and atmospheric stability as described below:

- Wind direction determines the sector of the compass into which the plume is dispersed
- Wind speed affects the distance which the plume travels over time and can affect plume dispersion by increasing the initial dilution of pollutants and inhibiting plume rise
- Atmospheric stability is a measure of the turbulence of the air, and particularly of its vertical motion. It therefore affects the spread of the plume as it travels away from the source. New generation dispersion models, such as ADMS, use a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters are measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature.

A meteorological station at Ulaanbaatar airport is approximately 25km to the west of the Project site. Although located relatively close to the proposed Project site, there is a mountainous area which lies in between, as well as mountainous ground to the east of the proposed project site. Because of this, meteorological data from the prognostic gridded meteorological model 'MM5' was used to generate a pseudo-station in the study area which is considered more representative than the data from Ulaanbaatar airport. Data was generated for five years (2009-2013) and used within the dispersion modelling assessment.

Data from the airport and a nearby air quality monitoring station (UB-08) that also contains a meteorological mast has also been used for a sensitivity analyses. Volume III, Appendix F presents windroses from the airport and air quality monitoring station sites. The data collected at this location illustrates that the wind originates from a number of different directions and is not totally consistent with the MM5 data. Although it should be noted that the data capture for meteorological data from this site is only 80% for 2012 and 88% for 2013 and no information is available regarding the anemometer height. The modelled results using this data are presented in Volume III, Appendix I.

Figure 7.1 presents the locations of the meteorological data in relation to the Project site. Figure 7.2 present wind roses of the MM5 meteorological data used within the main assessment. The data used within the assessment has 100% data capture and therefore the use of this data as the primary data source is considered robust. The windroses illustrate that the dominant wind direction is from the north west and funnels through the valley where the Project site is located. The predominant wind direction indicates that the Project emissions will be dispersed to the south east and therefore will have a minimal impact on Ulaanbaatar, the centre of which is located approximately 15 km to the north west. Volume III, Appendix F presents windroses from the airport meteorological station and the meteorological station located at UB-08.

Figure 7.1: Location of Meteorological stations in relation to Project site

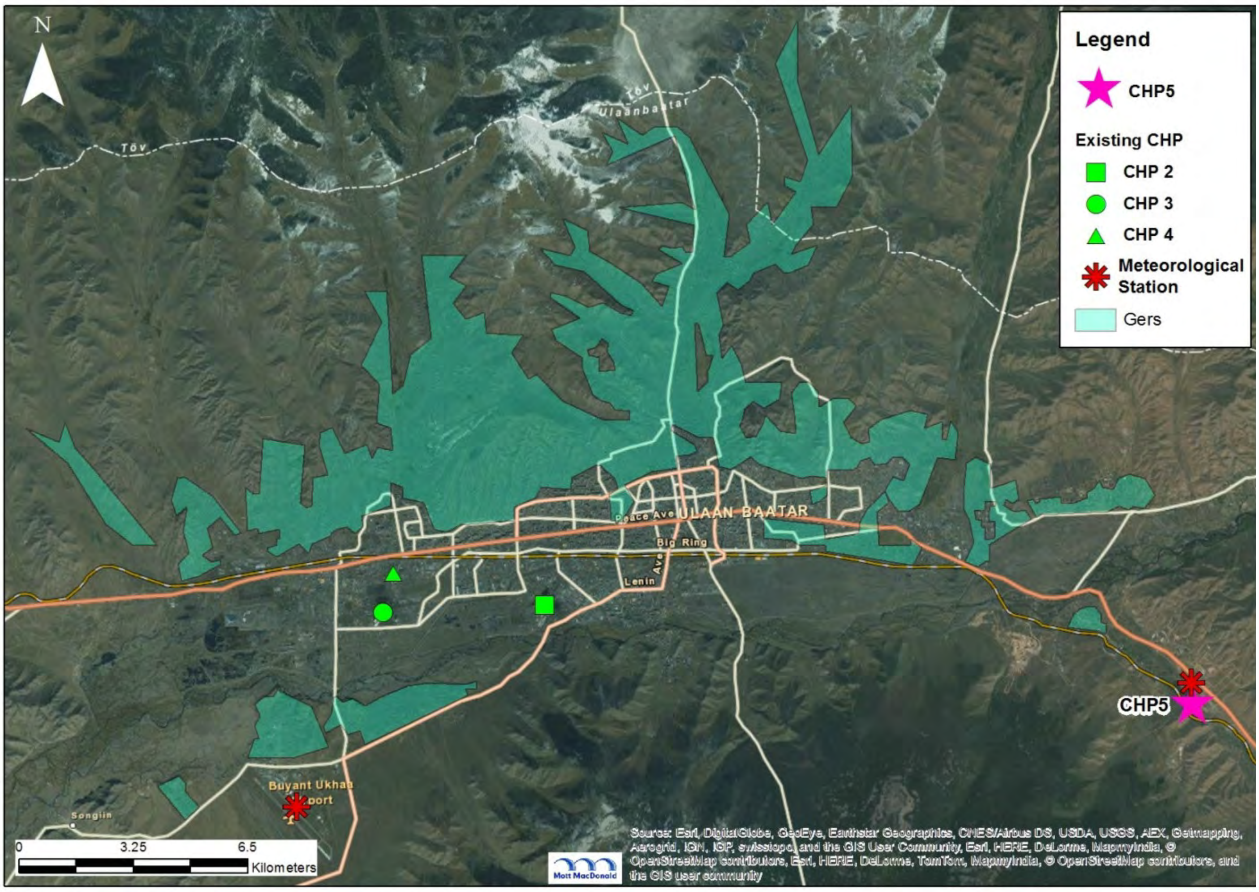
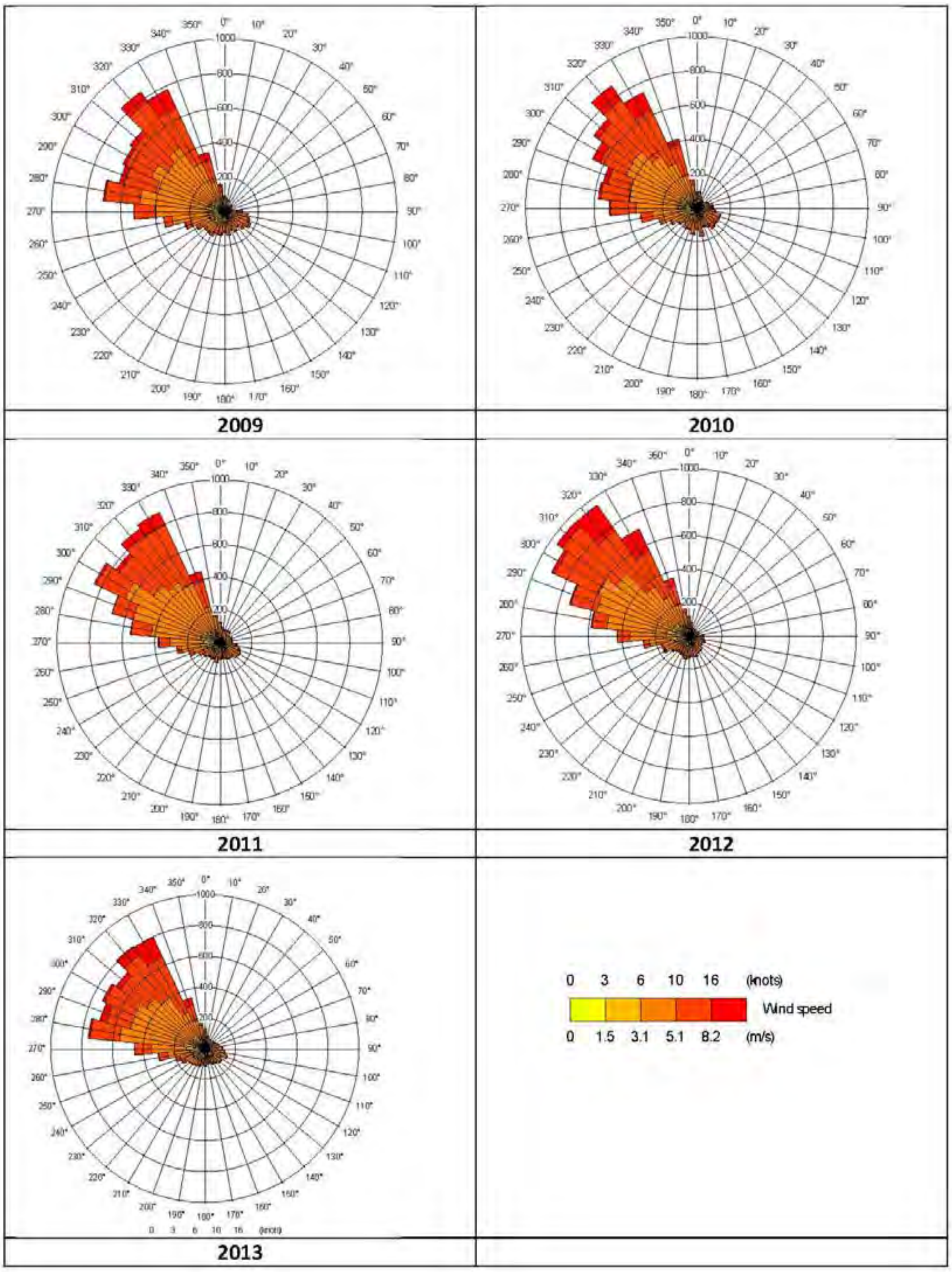


Figure 7.2: Meteorological Data used within the Assessment



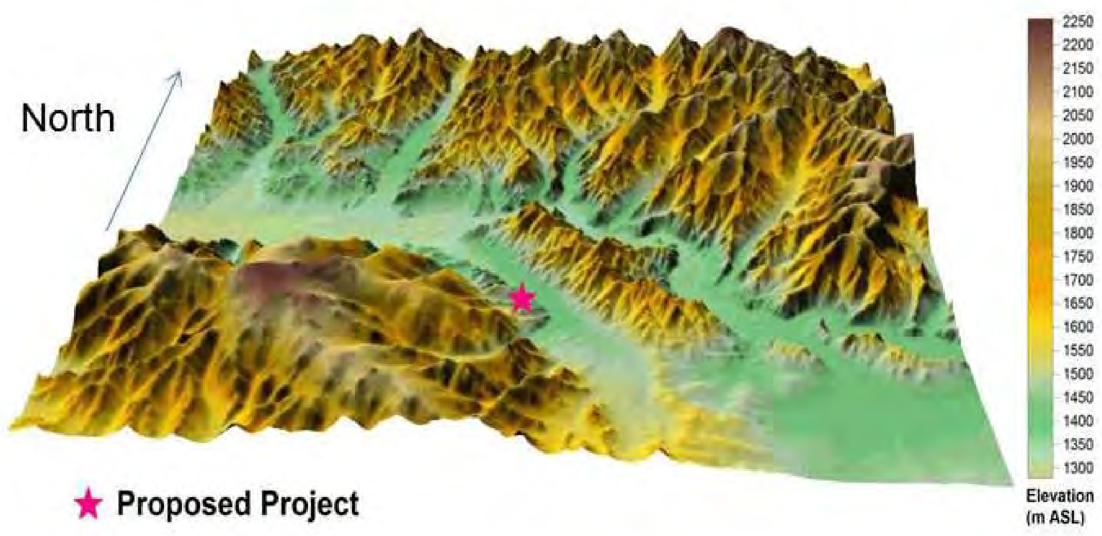
7.3.5.5 Terrain

The presence of elevated terrain can significantly affect (usually increase) ground level concentrations of pollutants emitted from elevated sources such as stacks by reducing the distance between the plume centre line and ground level. Terrain can also increase turbulence and, hence, plume mixing which can also reduce ground level concentrations.

Terrain data has been included in the dispersion model to take account of changes in elevation surrounding the project location. Figure 7.3 presents the terrain in relation the project. (It should be noted that the vertical scale is exaggerated for presentational purposes). The meteorological data used for the assessment matches well with the terrain and illustrates that the predominant wind from the north west funnels through the valley where the proposed Project will be located.

Roughness of terrain over which a plume passes can have a significant effect on dispersion by altering the velocity profile with height, and the degree of atmospheric turbulence. Surface parameters within 1 kilometre of the proposed project site can be characterised as having a low surface roughness and have been assigned a surface roughness length of 0.3m.

Figure 7.3: Three Dimensional Representation of Terrain



7.3.5.6 NO_x to NO_2 Relationship

NO_x emissions associated with combustion sources such as boilers will typically comprise approximately 90-95% NO and 5-10% NO_2 at source. The NO oxidises in the atmosphere in the presence of sunlight, ozone and volatile organic compounds to form NO_2, which is the principal pollutant of concern with respect to environmental health effects.

There are various techniques available for estimating the proportion of the NO_x that is converted to NO_2. A 50% conversion of NO_x to NO_2 has been assumed for short term averaging periods (20 minute and 1 hour), and 70% conversion for long term averages (24 hour and annual). This approach is considered appropriate based on guidance from the United Kingdom's Environment Agency (EA) and United States Environmental Protection Agency (USEPA).

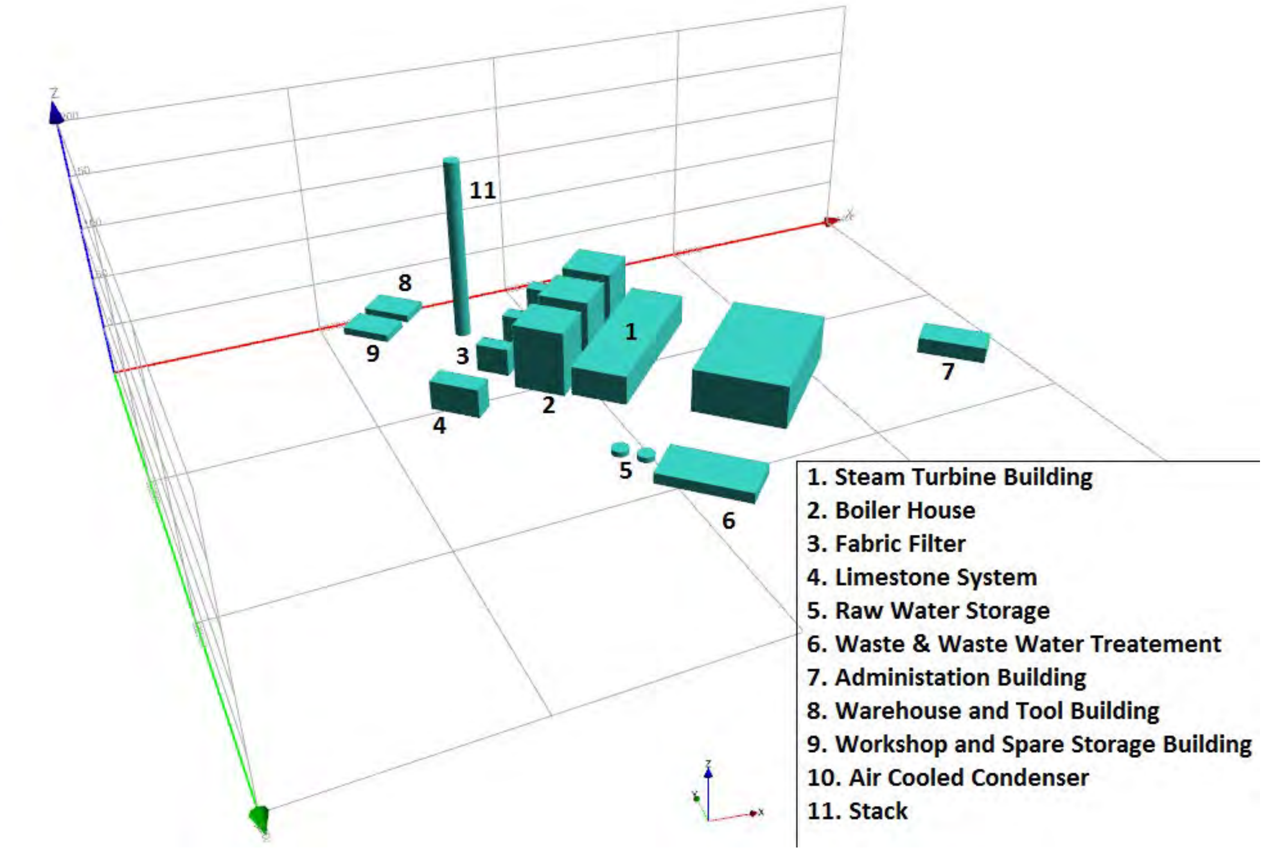
7.3.5.7 Buildings and Plant Layout

The movement of air over and around buildings generates areas of flow circulation, which can lead to increased ground level concentrations in the building wakes. The buildings likely to have the dominant effect (i.e. with the greatest dimensions likely to promote turbulence) are the boiler houses and are listed in Table 7.6 and illustrated in Figure 7.4.

Table 7.6: Buildings included within Dispersion Modelling

Building	X	Y	Height (m)	Length (m)	Width (m)	Angle
Steam Turbine Building	657981	5303461	31	155	50	-45
Boiler Building 1	658018	5303578	64	42	46	-45
Boiler Building 2	657979	5303537	64	42	46	-45
Boiler Building 3	657938	5303497	64	42	46	-45
Fabric Filter1	657988	5303630	30	15	30	-45
Fabric Filter 2	657948	5303590	30	15	30	-45
Fabric Filter 3	657907	5303550	30	15	30	-45
Warehouse and Tool Building	657858	5303681	10	30	45	-45
Mechanical Workshop and Spare Storage Building	657830	5303653	10	30	45	-45
Administration Building	658298	5303388	18	30	60	-45
Water & Waste Water Treatment	657950	5303349	13	82	43	45
Limestone System Building	657829	5303526	30	45	20	45
ACC	658099	5303445	44	127	83	45

Figure 7.4: Buildings Included within Dispersion Modelling



7.3.6 Impact Assessment Criteria

7.3.6.1 Construction Phase

A combination of dust emission potential from on-site activities (Table 7.7) and their expected duration has been used to determine the impact magnitude of construction and decommissioning phases (Table 7.8).

Table 7.7: Determination of Impact Magnitude – Construction Phase

Dust Raising Potential (a)	Duration	Magnitude
High	Any	Major
Medium	> 3 Months	Moderate
Medium	< 3 Months	Minor
Low	Any	Negligible

Notes (a) Dust raising potential defined in accordance with the approach described in Section 7.3.4

In addition, receptor sensitivity has been based on the type of receptor and the distance from the construction or decommission activity boundary. Table 7.8 presents the criteria on which receptor sensitivity has been based.

Table 7.8: Determination of Receptor Sensitivity – Construction Phase

		Distance to Activities			
		0-50m	50-100m	100-200m	200-500m
Receptor Classification (a)	High	High	High	Medium	Low
	Medium	Medium	Medium	Low	Low
	Low	Medium	Low	Low	Negligible
	No Receptors	Negligible	Negligible	Negligible	Negligible

Notes: (a) Receptors classified based on method described in Table 7.4 above.

7.3.6.2 Operational Phase

Guidance has been issued in the UK to assist in determining the significance of operational phase impacts in air quality assessments. This guidance recommends that significance should be determined by a combination of two aspects:

- Change in concentrations (Process Contribution) caused by the Project at sensitive receptors
- Resulting total concentrations (Predicted Environmental Concentrations) at sensitive receptors as a percentage of the relevant ambient air quality standard(s).

This approach is considered to represent best practice for assessments of this kind and has therefore been adapted in determining the significance of impacts on local air quality from the proposed Project.

Changes in ambient concentrations over 25% of the relevant standards are considered to represent an impact of ‘Major’ magnitude as the General EHS Guidelines note that Projects should:

“…prevent or minimize impacts by ensuring that …emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this guideline suggests 25 percent of the applicable air quality standards to allow additional future sustainable development in the same airshed.” (WBG/IFC EHS Guidelines).

The General EHS Guidelines classify ‘poor quality airsheds’ as those where relevant standards are exceeded significantly. Therefore, receptors experiencing existing ambient pollutant concentrations above the relevant standards are concluded to be of ‘High’ sensitivity.

For each of the key pollutants and averaging periods assessed, a number of ambient air quality standards are applicable.

Impact magnitude and receptor sensitivity criteria are presented in Table 7.9 and Table 7.10.

Table 7.9: Determination of Impact Magnitude– Operational Phase

Change in Concentrations as % of Standard	Magnitude
Increase >25%	Major
Increase 15-25%	Moderate
Increase 5-15%	Minor
Increase <5%	Negligible

Table 7.10: Determination of Receptor Sensitivity – Operational Phase

Ground Level Pollutant Concentrations in Relation to Standard	Receptor Sensitivity
Above Standard	High
75 to 100% of the Standard	Medium
50 to 75% of the Standard	Low
Below 50% of the Standard	Negligible

7.3.6.3 Significance

Based on the methods defined above for determining the magnitude of impact and sensitivity of receptors, the significance matrix specified in Chapter 5 has been applied to determine overall significance.

Notwithstanding the above, any non-negligible increases causing a new exceedance of the relevant standards are afforded ‘Major’ adverse significance. All impact descriptors described as ‘moderate’ or ‘major’ are considered to be significant.

7.4 Baseline Description

7.4.1 Overview

This section provides a summary of ambient monitoring data that is undertaken within Ulaanbaatar and the Project’s airshed. Data from Ulaanbaatar has been included as it demonstrates the existing high ambient pollutant concentrations that are currently monitored and that these have an influence on concentrations within the Projects airshed. In addition it presents the results of the site specific monitoring that has been undertaken as part of the Project.

7.4.2 Existing Monitoring Data

7.4.2.1 Overview

Monitoring data within Ulaanbaatar is available from a number of sources and includes the National agency of Meteorology and Environmental monitoring (NAMEM). A summary of these sources and the data collected has been presented within the following sub-sections.

7.4.2.2 Summary of Existing Data

Figure 7.5 presents the location of a number of permanent monitoring stations located across Ulaanbaatar. Table 7.11 presents a summary of the annual mean data from these sites for 2012, 2013 and 2014.

Analysis of the three sets of meteorological data used within the assessment indicates that the prevailing wind in the study area is from the north west and demonstrates that the main area of potential impact is located to the south east. Considering the prevailing wind direction and the distance between Ulaanbaatar and the proposed Project location it can be considered that the airshed affected by the Project does not include Ulaanbaatar and this is demonstrated by the results presented in section 7.5.2. The airshed that the Project affects is considered to be located within 15 km of the Project.

Although the Project is not predicted to have a negative impact on Ulaanbaatar, data from all the existing monitoring stations has been summarised. The existing monitoring indicates that in general annual mean concentrations are elevated across the whole of Ulaanbaatar. As described in Volume III, Appendix J the main contributors to these high concentrations are the existing CHPs, ger districts and road traffic emissions and therefore ambient air quality monitoring located close to these locations will be heavily influenced by these sources. It also demonstrates that the Mongolian air quality standards are exceeded at most of the monitoring locations.

The closest monitoring station in relation to the proposed Project and the airshed is UB-08 which is located approximately 500m to the north east and is considered to be broadly representative of background ambient air quality conditions. However, concentrations monitored at UB-08 may be affected by traffic emissions from a road which is located approximately 40m away from this monitoring station.

Data for UB-08 illustrates that the annual average over the last three years for NO_2, SO_2 and PM_{10} are all above the Mongolian standards. The data also illustrates that the NO_2 annual mean concentrations are above the EU standards. There are no EU standards for annual mean SO_2. On the basis of the monitoring data available the airshed should be considered as degraded for NO_2, SO_2, PM_{10} and $PM_{2.5}$. Although data for $PM_{2.5}$ is not available it is likely that the airshed can be described as degraded for this pollutant also.

Figure 7.5: Location of Existing Monitoring Stations in Ulaanbaatar

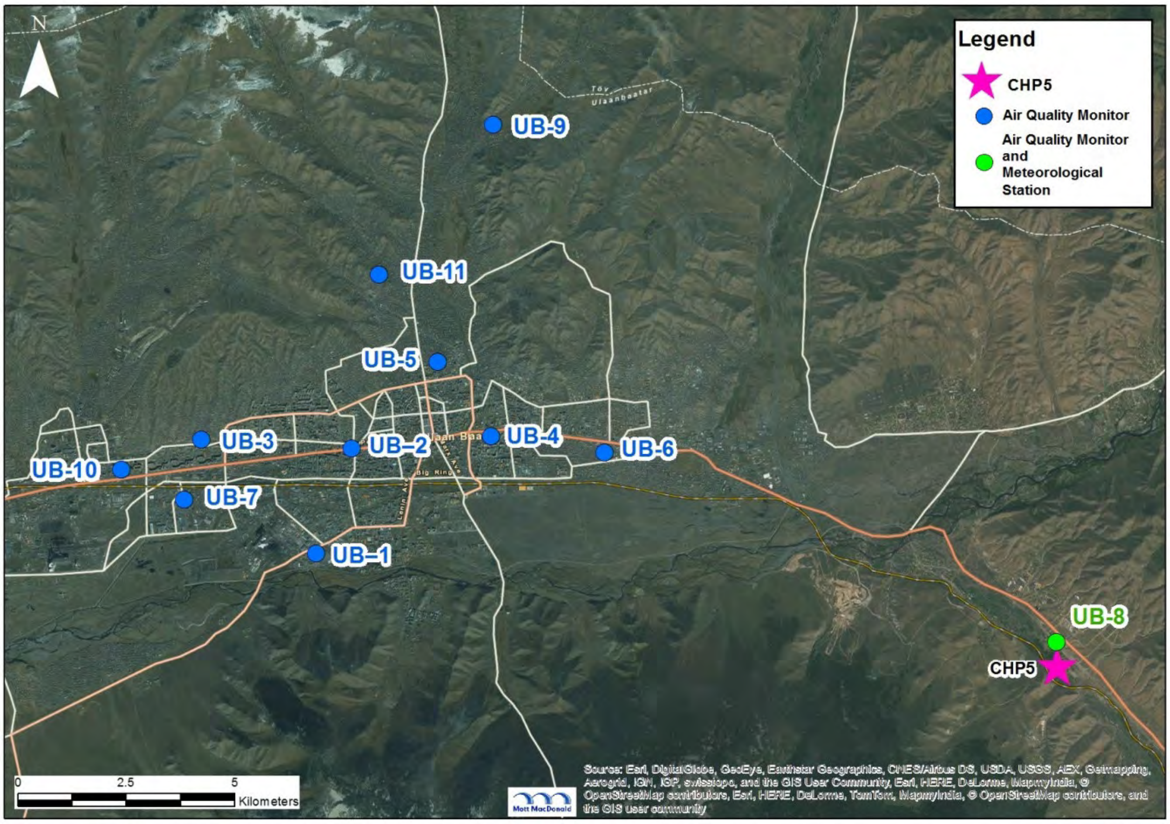


Table 7.11: Summary of Annual Mean Pollutant Concentrations at Monitoring Stations across Ulaanbaatar (µg/m^3)

Monitoring Station	NO_2			SO_2			PM_{10}			$PM_{2.5}$		
	2012	2013	2014	2012	2013	2014	2012	2013	2014	2012	2013	2014
UB-02	**135.9**	**165.2**	-	**24.1**	**17.5**	-	**190.4**	**188.7**	-	**97.2**	**88.9**	-
UB-03	**31**	30	-	**34**	**29**	-	-	-	-	-	-	-
UB-04	**68.8**	**88.3**	-	**33.5**	**20.4**	-	**187.6**	**171.1**	-	-	**56.6**	-
UB-05	**41.8**	**48.9**	-	**55.1**	**36.1**	-	**519.6**	**391.0**	-	-	-	-
UB-06	29	**43**	-	**32**	**74**	-	-	-	-	-	-	-
UB-07	**42.1**	**39.5**	-	**20.1**	**13.7**	-	**298.3**	**178.0**	-	-	-	-
UB-08	**81.3**	**46.5**	**38**	7.7	**9.5**	**20**	**76.9**	**72.3**	**105**	-	-	-
UB-09	25	25	-	**27**	**23**	-	-	-	-	-	-	-
UB-11	25	26	-	**30**	**20**	-	-	-	-	-	-	-

Notes: Bold text indicates exceedance of Mongolian standards, Data capture for 2014 UB08 is poor (48% for NO_2, 62% for SO_2 and 57% for PM_{10}) compared to 2013 data where data capture rates are (86% for NO_2, 92% for SO_2 and 82% for $PM_{10)}$ and therefore 2013 data have been used to inform the existing baseline within the study area.

Although the of the data has indicated that the Project airshed should be categorised as degraded, analysis has demonstrated that emission sources within Ulaanbaatar are likely to have an effect on air quality within the Projects airshed. However, it should be noted that because the Projects airshed extends over a large area, the effect of poor air quality contributions from Ulaanbaatar will vary across it. For example, the area to the north of the Project will have its air quality more heavily influenced by contributions from Ulaanbaatar compared to the areas to the south of the Project. On this basis, it can be considered that air quality is likely to be influenced less by Ulaanbaatar with increased distance. The pollutant concentrations monitored at UB-08 are therefore likely to be higher than those experienced to the south east of the proposed Project. Using monitored data from UB-08 to represent background concentrations across the whole project airshed is considered to be conservative.

This section has demonstrated that there is some uncertainty over the baseline data which has been used to determine the airshed categorisation as air quality downwind of the proposed Project in the affected airshed has the potential to be better compared to the monitored data at UB-08. Further data collected at UB-08 could be influenced by the nearby road. Therefore a precautionary approach has been undertaken and at this time the whole airshed has conservatively been considered to be degraded. As a result the proposed Project is committed to meeting emission limits specified for degraded airsheds within the WB/IFC EHS Thermal Power Guidelines, or better in order to minimise its impacts on ambient air quality.

In order to fully determine the existing baseline concentrations to the south east of the Project where the maximum predicted impacts are expected, further additional baseline monitoring will be undertaken prior to operation. Full details of this are summarised in Volume IV but this will as a minimum this will include for two continuous air quality monitors. The results of the baseline and operational monitoring of the Project will be linked to future offset measures which are described further in section 7.6.2.

7.5 Impact Identification and Assessment

7.5.1 Construction Phase

Although no detailed construction methodology is available at present, the construction period is expected to last for a maximum of 57 months before commissioning begins which will consist of initial operations and smaller construction works. Therefore the construction assessment has been based on generic activities. Table 7.12 presents the dust raising potential of activities associated with construction of the proposed Project.

Table 7.12: Construction Activities and Dust Emitting Activities during Construction

Section	Description of works	Key activities	Dust raising potential	Duration at Any One Point	Impact Magnitude
Site preparation, clearance and groundworks	Excavation and moving material	• Earthmoving • Excavation • Wind	High (assumes undertaken in summer months)	>3 months	Major

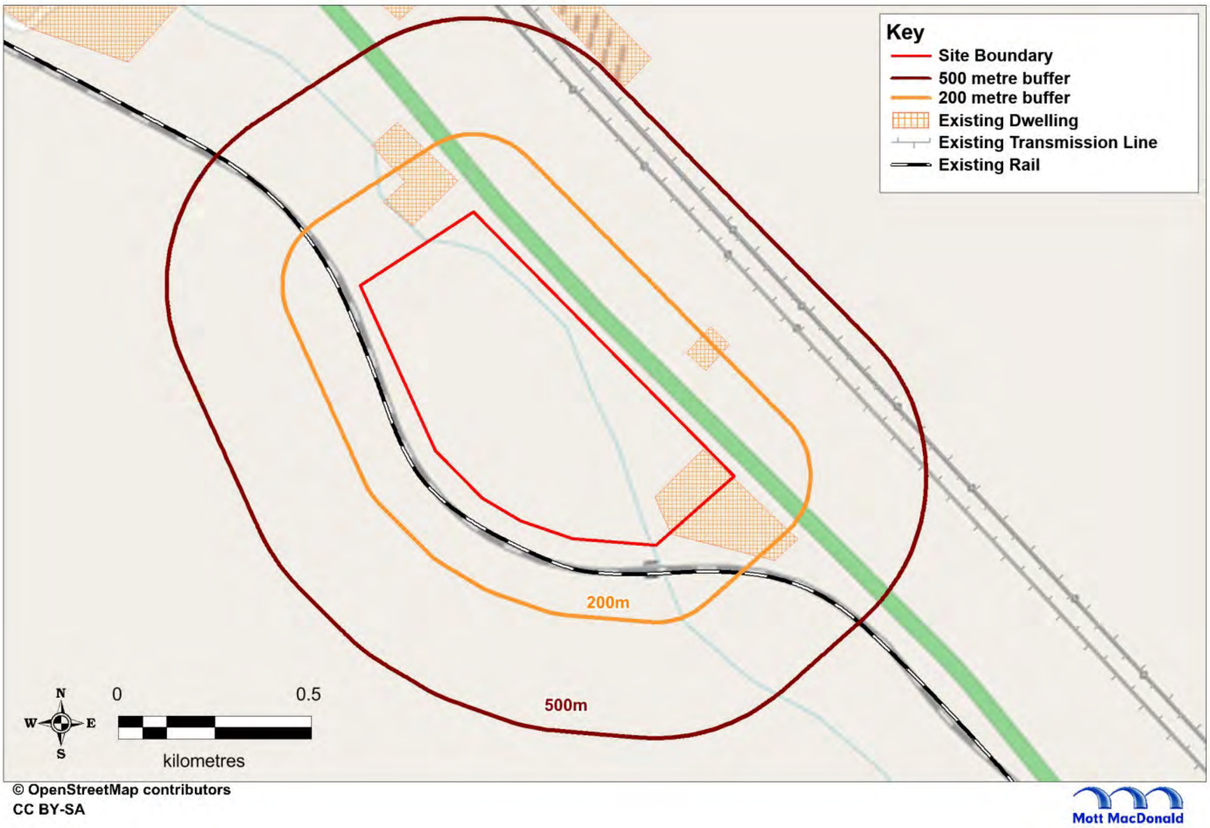
Section	Description of works	Key activities	Dust raising potential	Duration at Any One Point	Impact Magnitude
Roads and infrastructure	Ancillary works and delivery of materials to site, removal of wastes from site	• Minor excavation works. • Transport of materials. • Resuspension of dust on unsurfaced roads.	Medium	< 3 months	Minor
Construction of plant	Assembly of the main components of the plant	• Storage of materials • Preparation of materials (cutting etc.) • Resuspension of dust on unsurfaced roads	Medium	> 3 months	Moderate
Landscaping	Landscaping requirements	• Earthmoving • Excavation • Transport of materials • Wind • Resuspension of dust on unsurfaced roads	High (assumes undertaken in summer months)	< 3 months	Major

The impact magnitude of construction activities is conservatively described as 'major' for the whole construction period in accordance with Table 7.12. However, not all construction activities have a high dust-raising potential which implies that dust episodes may only occur over short periods, and not throughout the whole construction phase.

Figure 7.6 presents the Project site boundary and potentially affected sensitive receptors. There are a number of gers currently located within and adjacent to the Project site south east boundary. However, due to the likely impacts of the Project, along with impacts from the construction of the rail sidings to the Project, these will be resettled as part of the Project and therefore have not been considered further within the construction assessment.

To the north east of the site boundary there are number of residential dwellings known as Happy Valley. Although these are not currently inhabited they have been included within the assessment in case they are used in the future. The Urgakhnaran flats which are located to the north east are located approximately 500m from the site boundary.

Figure 7.6: Potentially Affected Sensitive Receptors



Source: Mott MacDonald

The receptors identified within the study area are classified as 'medium' as they are considered to be residential. When combined with distance from the dust raising activities the receptors located to the south east are described as having a 'medium' sensitivity as they are located within 50m of the site boundary. The receptors located close to the site boundary at Happy Valley which are also located within 50m are also described as having a 'medium' sensitivity.

The receptors located to the east which are approximately 150m from the site boundary and the Urgakhnaran flats approximately 500m to the north east are described as having a 'low' sensitivity. In order to undertake a conservative assessment all receptors have been assumed to have 'medium' sensitivity to dust effects.

Based on an impact magnitude of 'major' and a receptor sensitivity of 'medium' the significance of impacts resulting from the construction phase dust emissions is therefore considered **moderate adverse** in accordance with the significance criteria adopted for this assessment. In the event of decommissioning of the proposed Project, it is likely that any potential air quality impacts would be similar to those in the construction phase, as broadly similar activities would be required. Similar to the construction phase these are considered to be of **moderate adverse** significance.

There is some uncertainty in the potential presence of receptors, which depending on the time of decommissioning may have been introduced or removed from the study area. Therefore, at the time of decommissioning, the management plan should take due care to ensure that all receptors at that time are accounted for and that the management plan adequately minimises potential issues for receptors that could be affected.

In addition to construction activities identified above there will be an offsite borrow pit that will be used to supply fill material for the Project site. At present the location of the borrow pit has not been defined and therefore it has not been possible to undertake a full assessment of potential impacts at this stage. The final location will be determined based on a number of considerations including the number of sensitive receptors located nearby. In addition the same mitigation measures identified for construction activities at the proposed Project location will also be implemented at the borrow pit.

7.5.2 Operational Phase

7.5.2.1 Emissions from Coal Storage and Handling

The proposed storage and handling of the coal would be potential sources of particulate emissions during operation:

- Unloading of coal at the rail unloading facility
  - Large drop height between the coal wagons and conveyor
- Conveyor system feeding the coal yard and the boilers
  - Releases at the loading and delivery ends of the conveyor
  - Releases along the length of the conveyor if not enclosed (exacerbated by higher conveyor speeds)
- Storage of coal at the stockpile
  - Wind erosion of pile (particularly during hot, dry conditions)
  - Plant activity around the stockpile during maintenance

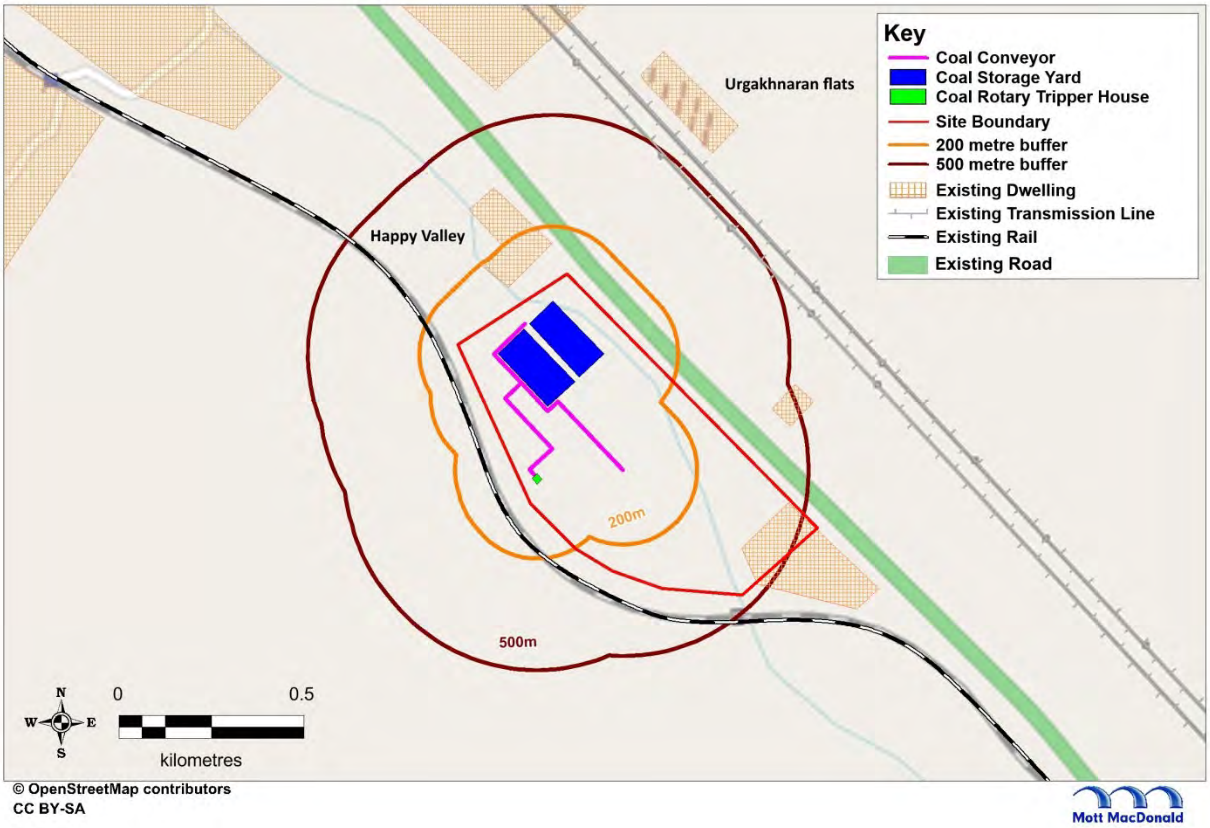
Particulate emissions from coal storage and handling comprise of small particles (PM_{10}) which can have negative health effects and larger particles (referred to as 'dust') which can cause nuisance or a loss of amenity.

The potential for emissions of fugitive dust and PM_{10} from the coal storage and handling facilities is high due to wind erosion of the stockpile during hot, dry conditions and plant activity around the stockpile during maintenance and therefore is described as 'major'.

Figure 7.7 presents the location of the coal yard and its associated equipment such as the coal conveyor. Based on the proposed plot plan there will be sensitive receptors within 500m of these locations. These will include the currently uninhabited the residential receptors to the south east of the site boundary, the Happy

Valley houses, road users on the adjacent main road and residential receptors to the east. In accordance with the construction dust assessment these receptors are described as being 'medium' in sensitivity.

Figure 7.7: Location of Coal Storage and Handling Facilities



Source: Mott MacDonald

Activities will be controlled by best practice mitigation techniques to reduce any potential impacts at these locations. In addition to the mitigation measures described within Section 7.6, the ESMMP will provide further assessment and monitoring required to ensure that the impacts from coal storage and handling are kept at an acceptable level. Based on an impact magnitude of 'major' and a receptor sensitivity of 'medium' the significance of impacts resulting from the operation of the coal yard and its associated facilities is described as **moderate adverse.**

7.5.2.2 Emissions from the Stack

Stack Height Determination

The Stack Height Determination results are presented in Volume III, Appendix C. In accordance with the results, modelling for Scenario 1 and Scenario 2 has been undertaken assuming a stack height of 170m.

Scenario 1 – 100% Load

Model results from Scenario 1 are presented in Table 7.13 and compared against the EU air quality standards. Volume III Appendix D presents a comparison of the results against Mongolian standards.

NO_2

The results indicate that for annual mean concentrations of NO_2, process contributions from the Project are small relative to EU standards (3.2%). However the annual mean predicted environmental concentrations are above the EU air quality standards as a result of the high background concentrations assumed within the study area. The significance of these impacts is described as '**negligible**' when comparing the results to the EU standards when applying the significance criteria adopted for this assessment and therefore not significant.

The contour plot presented in Figure 7.8 illustrates that the maximum annual mean NO_2 process contributions for the proposed Project will be experienced approximately 11km to the south east and located over an area of elevated ground. The contour plot demonstrates that the Project will have minimal contributions to air quality concentrations within the National Park.

Predicted process contributions for comparison with the EU standards for one hour NO_2 concentrations are described as 'minor'. Predicted impacts are described as '**negligible'** and therefore not significant. Figure 7.9 illustrates that the maximum one hour NO_2 process contribution is predicted to occur in a similar location to the annual mean impact.

SO_2

A comparison of the modelled process contributions against the EU standards (which incorporates percentiles for 15 minute, one hour and 24 hour averaging periods) indicates that the predicted results are all below 25% of the standards. The SO_2 15 minute process contribution is 21.5% of the standard, the one hour process contribution is 8.6% of the standard and the 24 hour process contribution is 10.6% of the standard. On this basis the impacts are described as '**negligible'** for all SO_2 averaging periods and therefore are not considered significant. Figure 7.10 shows that the predicted 15 minute SO_2 concentrations are predicted to occur in an area approximately 2km to the east of the Project site. Figure 7.11 and Figure 7.12 present the one hour and 24 hour process contributions from the Project. They indicate that the majority of the impacts will occur to the south east of the Project site.

PM_{10} and $PM_{2.5}$

Annual mean and 24 hour mean PM_{10} process contributions are below 25% of the EU air quality standards. Although the annual mean 24 hour mean standards are exceeded as a result of the high background concentrations the impacts are described as **negligible** and therefore are not considered significant because of the very small process contributions. Maximum annual mean process contributions would be located in the same area as presented in Figure 7.8.

Annual mean and 24 hour mean $PM_{2.5}$ process contributions are also below 25% of the EU air quality standards even when conservatively assuming all dust emissions are as $PM_{2.5}$. As a result of the low process contributions the impacts are described as **negligible** and therefore not significant.

Summary

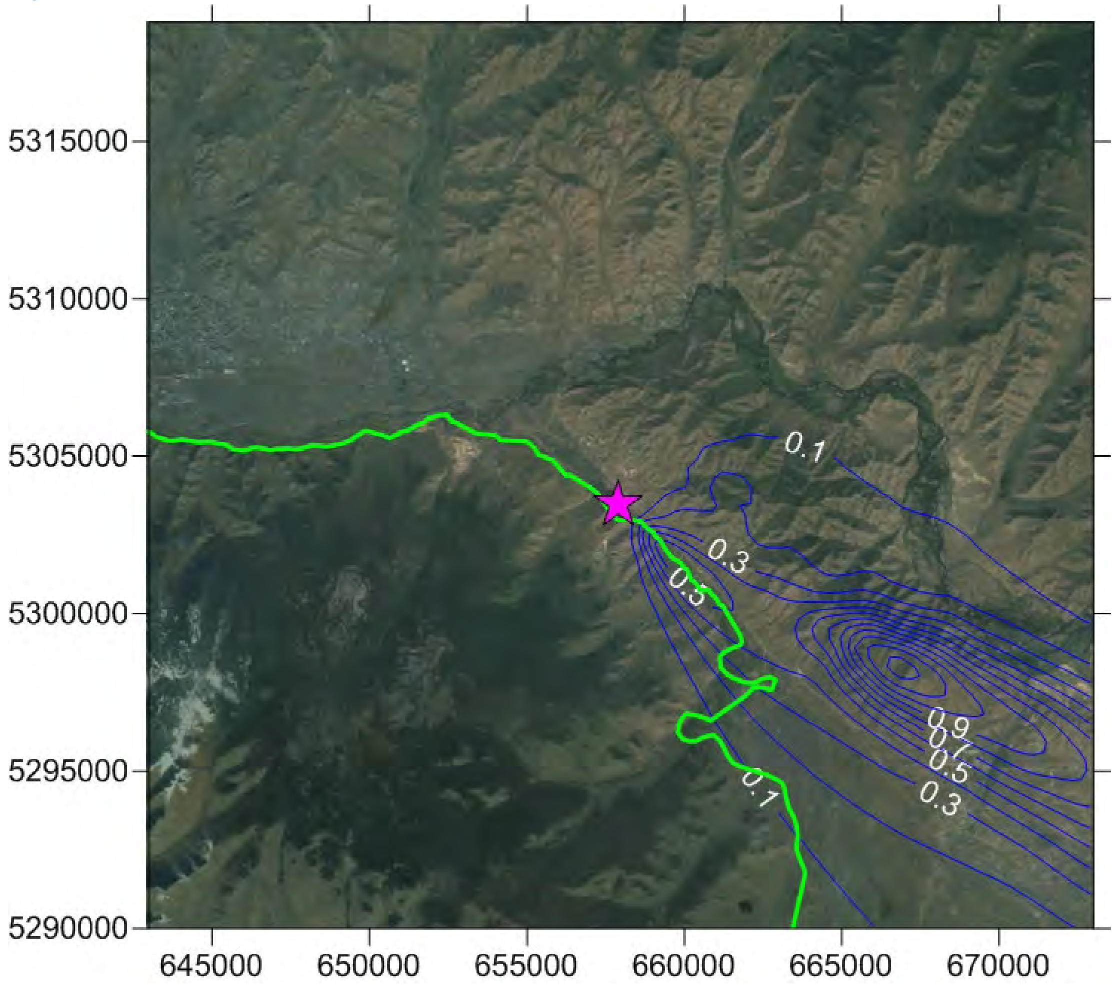
When applying the significance criteria adopted for this assessment using the EU standards, all impacts are concluded to be **‘negligible’** and therefore not significant.

Table 7.13: Scenario 1 – 100% Load – Comparison with Relevant International Standards (μg/m^3)

Pollutant	Averaging Period	Max PC	% of EU Standards	Impact Magnitude	AC	PEC	% of EU Standards	EU Standards	Receptor Sensitivity	Impact Descriptor
NO_2	1hr 99.79	15.8	7.9	Minor	110.7	126.5	63.3	200	Low	Negligible
	Annual	1.3	3.2	Negligible	55.4	56.6	141.6	40	High	Negligible
SO_2	15 Minute 99.9	57.1	21.5	Moderate	24.8	81.9	30.8	266	Negligible	Negligible
	1 Hour 99.73	30.2	8.6	Minor	24.8	55.0	15.7	350	Negligible	Negligible
	24hr 99.18	13.2	10.6	Minor	12.4	25.6	20.5	125	Negligible	Negligible
PM_{10}	24 hour 90.41	1.0	1.9	Negligible	84.9	85.9	171.7	50	High	Negligible
	Annual	0.4	0.9	Negligible	84.9	85.3	213.1	40	High	Negligible
$PM_{2.5}$	Annual	0.4	1.6	Negligible	84.9	85.3	341.2	25	High	Negligible

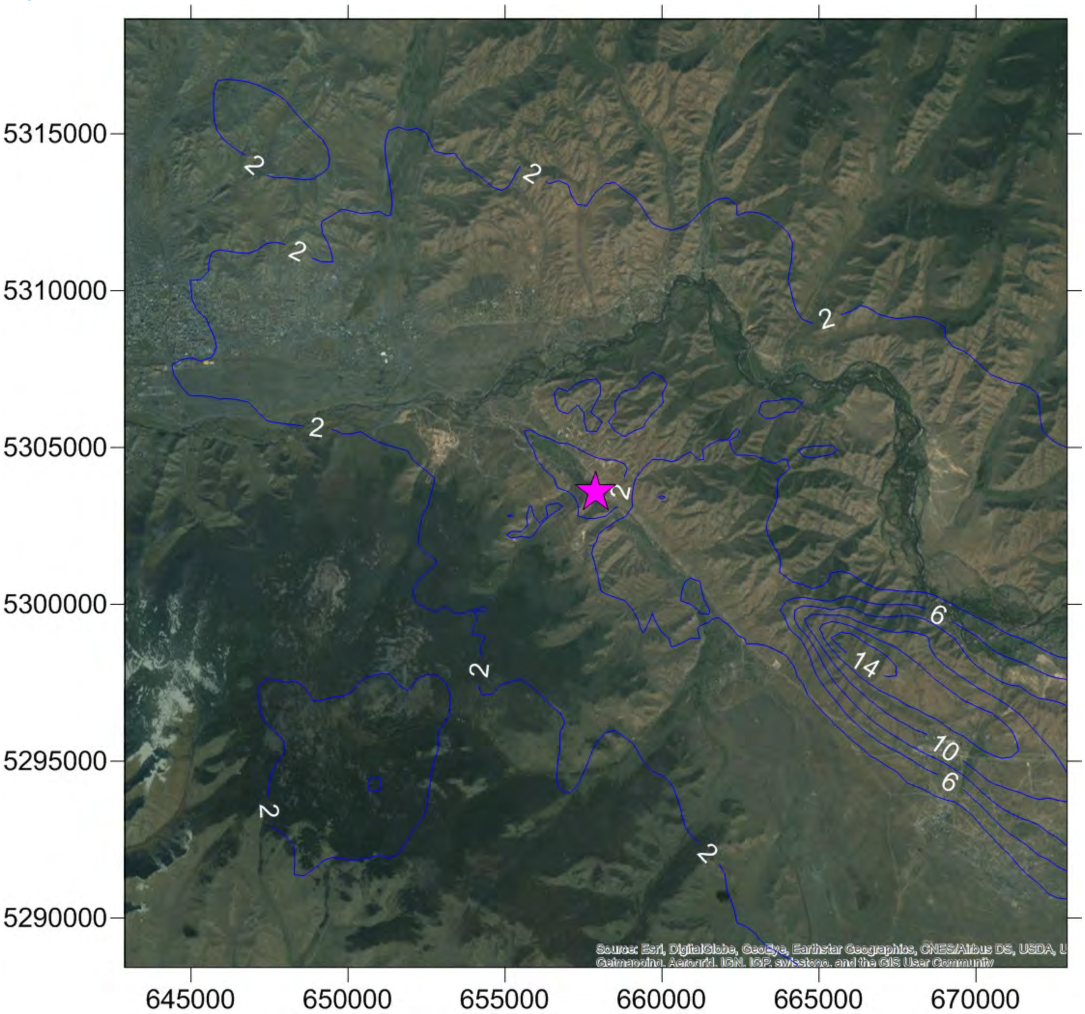
Notes: PC = Process Contribution, AC Ambient Concentration, PEC Predicted Environmental Concentration
Results and percentages are rounded to 1 decimal place

Figure 7.8: Scenario 1 Annual mean NO_2 Process Contributions



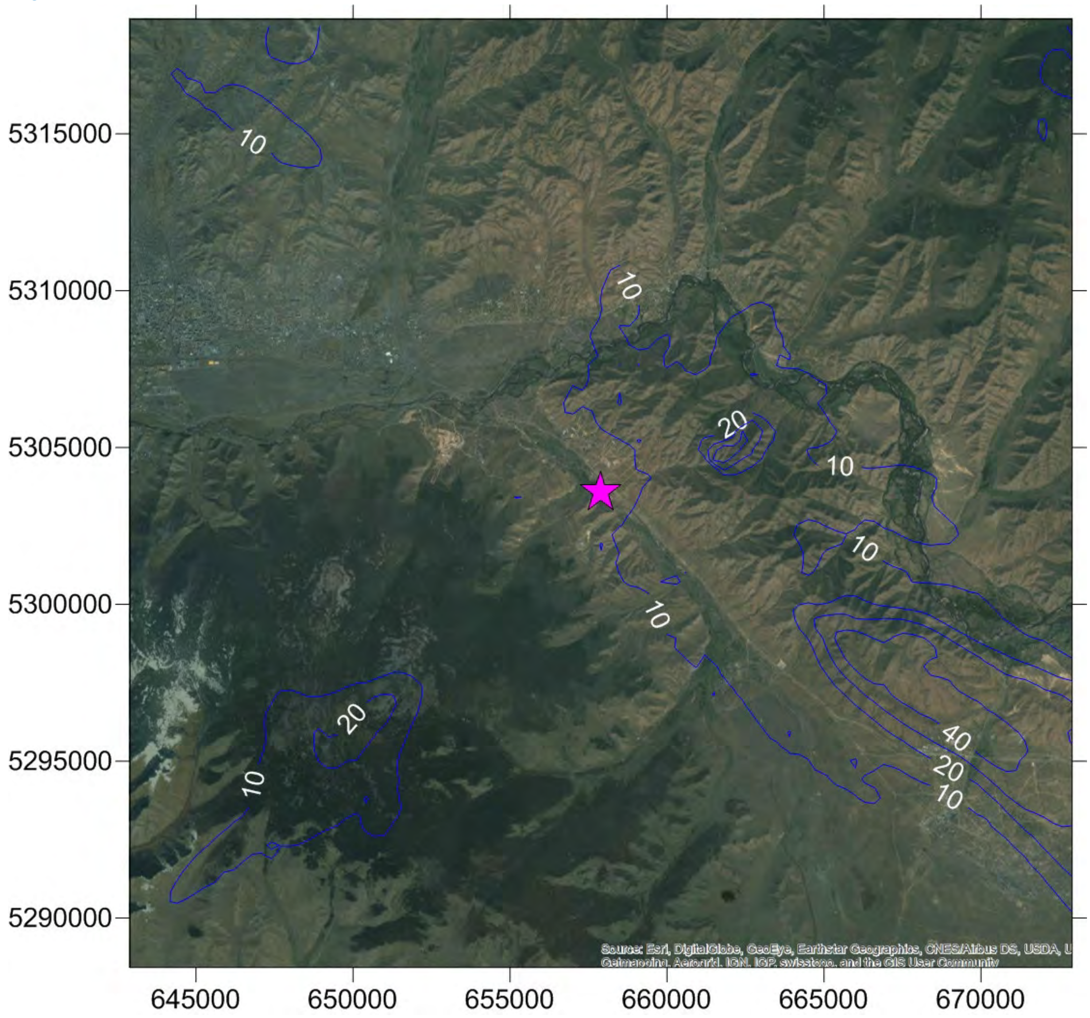
Notes: 2011 worst meteorological year, contour increments 0.2µg/m³, highest contour is 1.3µg/m³. Green line indicates buffer boundary of Bogd Khan National Park

Figure 7.9: Scenario 1 1hr 99.79th percentile NO_2 Process Contributions



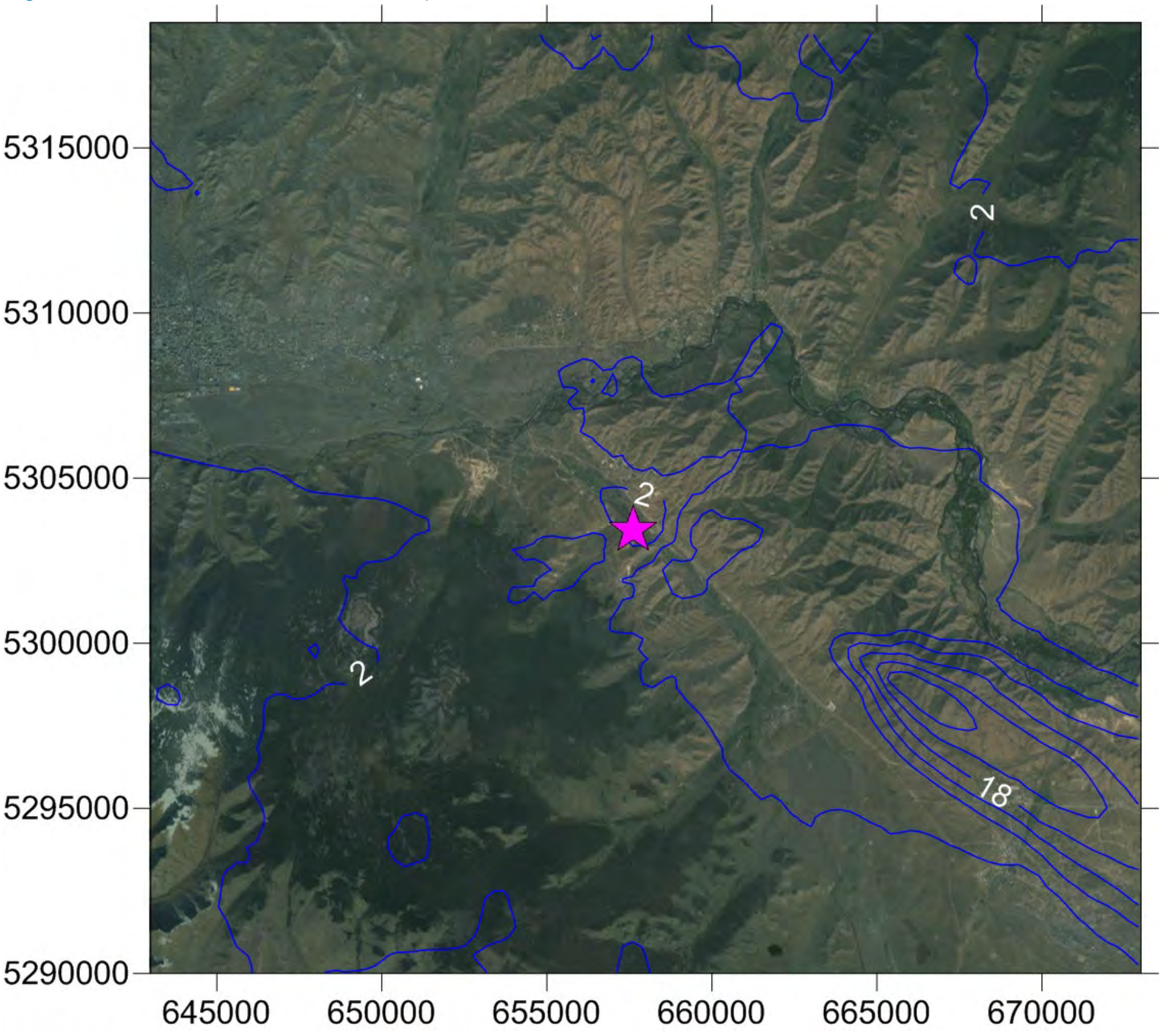
Notes: 2011 worst meteorological year, contour increments 2µg/m^3, highest contour is 14µg/m^3

Figure 7.10: Scenario 1 15 minute 99.9th percentile SO_2 Process Contributions



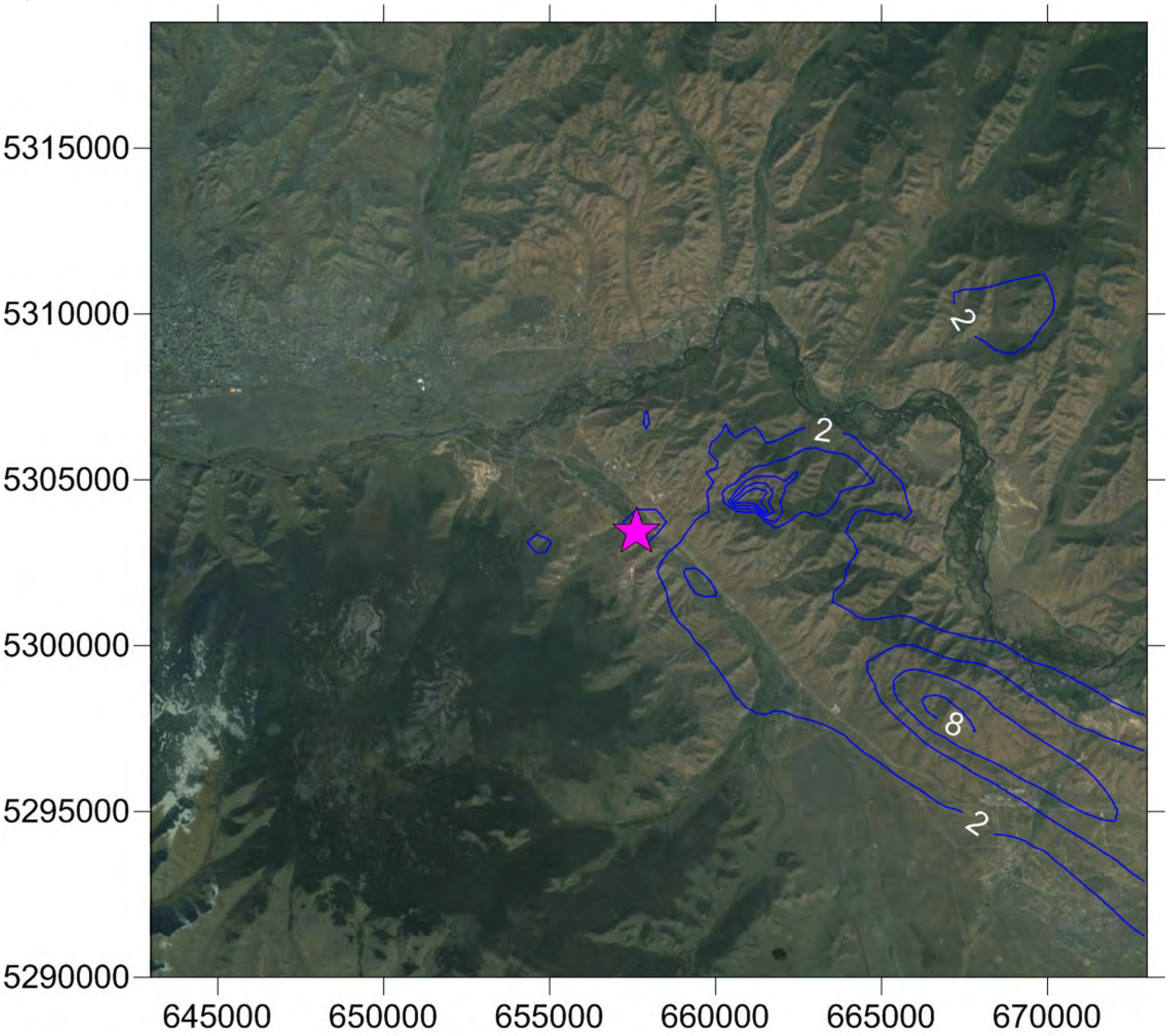
Notes: 2012 worst meteorological year, contour increments 10µg/m^3 highest contour is 40µg/m^3

Figure 7.11: Scenario 1 1 hour 99.73rd percentile SO2 Process Contributions



Niotes: 2011 worst meteorological year, contour increments 4µg/m3 highest contour is 26µg/m^3

Figure 7.12: Scenario 1 24 hour 99.18th percentile SO2 Process Contributions



Notes:: 2012 worst meteorological year, contour increments 2µg/m³ highest contour is 10µg/m³

Sensitivity Analyses

Additional sensitivity analysis presented in Volume III, Appendix I presents modelling results for the 170m stack using three years of meteorological data from Ulaanbaatar airport (2009,2010,2011) and two years of meteorological data collected at the UB-08 ambient air quality monitoring station (2012, 2013).

Although the meteorological data collected at the airport is not fully representative of the proposed Project location, and at the UB-08 site the data capture is relatively poor, the data allows for useful additional analyses.

Table 7.14 presents a comparison of the modelled process contributions for all modelled pollutants and averaging periods for the three sets of meteorological data used within the assessment. The results indicate that the process contributions for the proposed Project using meteorological data from UB-08 are lower than those when using the MM5 data but higher when using the airport meteorological data. This indicates that the results presented within this assessment are robust.

Table 7.14: Comparison of Modelled Results from Sensitivity Analysis (µg/m^3)

Pollutant	Averaging Period	MM5 Met Data	UB-08 Met Data	Airport Met Data
NO_2	1hr 99.79	15.8	14.3	48.0
	Annual	1.3	0.6	0.7
SO_2	15 Minute 99.9	57.1	50.9	229.9
	1 Hour 99.73	30.2	28.0	61.2
	24hr 99.18	13.2	6.4	24.6
PM_{10}	24 hour 90.41	1.0	0.5	0.6
	Annual	0.4	0.2	0.2
$PM_{2.5}$	Annual	0.4	0.2	0.2

Notes: Results and percentages are rounded to 1 decimal place

7.6 Mitigation and Enhancement Measures

7.6.1 Construction Phase

The following mitigation measures (which are in accordance with the WBG/IFC EHS Guidelines) for controlling air quality impacts will be incorporated into the construction phase:

- Minimizing dust from material handling sources, such as conveyors and bins, by using covers and/or control equipment (water suppression)
- Minimizing dust from open sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content
- Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimise dust from vehicle movements
- Manage emissions from mobile sources as per the EHS Guidelines for Air Emissions and Ambient Air Quality
- No open burning of solid waste
- Development of a dust management plan for the construction and operational phases
- Location of borrow pit to be positioned away from sensitive receptors where possible.

Emissions from on-road and off-road vehicles should comply with national or regional programs. In the absence of these, the following should be considered:

- Regardless of the size or type of vehicle, owners / operators should implement the manufacturer recommended engine maintenance programmes
- Drivers should be instructed on the benefits of driving practices that reduced both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits
- Old construction vehicles should be replaced with newer more fuel efficient alternatives;
- Convert high use vehicles to cleaner fuels where possible
- Install and maintain emission control devices such as catalytic convertors
- Implement a regular vehicle maintenance and repair program.

7.6.2 Operational Phase

In order to minimise dust and particulate matter from the handling and storage of coal the following measures should be applied:

- Use of cleaning devices for conveyor belts to minimise the generation of fugitive dust
- Use of enclosed conveyors with well designed, robust extraction and filtration equipment on conveyor transfer points to prevent emission of dust
- Use of wind fences in open storage of coal or profiling
- Use of machinery to compact coal in the coal yard
- Frequent utilization of (treated) waste water to suppress coal dust on coal yard

It is recommended that a Dust Monitoring and Action Plan (DMAP) is developed and undertaken prior to the operation of the proposed Project. The purpose of the DMAP is to establish a monitoring protocol for deposited dust (which can cause loss of amenity and/or nuisance) and atmospheric concentrations for PM_{10} and $PM_{2.5}$ (which can cause health effects) at the identified sensitive receptors located to the north west and south east of the proposed Project site.

It would be expected that the DMAP should identify the locations, type of equipment and duration to undertake dust, PM_{10} and $PM_{2.5}$ monitoring and a set of trigger levels which, if exceeded will result in a review of existing mitigation measures followed by additional mitigation measures, or modification. A framework DMAP including appropriate trigger levels is provided within the ESMMP.

No combustion mitigation measures in addition to those already accounted for within the dispersion modelling are proposed. The following key design features have been accounted for:

- An exhaust stack height of 170m to ensure effective dispersion of emissions
- State of the art Low NO_x technology. Limestone injection and fabric filters to achieve the emissions limits specified within this document.

In addition to the monitoring required to assess the operation of the coal storage and handling above, WBG Guidelines require that if impacts are greater than 25% of relevant short term ambient standards typically a minimum of two continuous ambient air quality monitoring stations are required to be installed in the vicinity of the plant. Although the modelling has demonstrated that impacts are below 25% of the EU standards (which have been used as the primary standards for the assessment) the predicted impacts are above 25% of the national Mongolian standards as presented in Volume III Appendix D. The details of the monitoring station requirements can be confirmed at a later stage, however, it is recommended that, as a minimum, the station should:

- Continuously monitor ambient concentrations of NO_x and NO_2 in accordance with internationally recognised approach
- Continuously monitor ambient concentrations of SO_2
- Continuously monitor ambient concentrations of PM_{10}
- Include a dispersion model ready meteorological station in accordance with US EPA guidance which can monitor wind speed, direction and temperature
- Be subject to regular calibration procedures and audits to ensure proper function
- Be located offsite, at the point of maximum impacts predicted by the dispersion modelling where there is suitable population exposure.

The ESMMP provides a framework monitoring plan that should be adopted prior to the operation of the proposed Project.

The baseline data illustrates that emission from Ulaanbaatar effect air quality within the proposed Project's air shed although the assessment has demonstrated that CHP5 will not have a significant effect on pollutant concentrations within the city as impacts are predicted to occur to the south east of the Project site.

It is expected that the Project will enhance air quality within Ulaanbaatar. This is because the Project will provide additional heat and electricity to the city which will help facilitate the relocation of large ger districts to new apartment blocks. As described in Volume III Appendix J, gers are a large contributor to poor air quality and therefore the aim of moving 30% of these areas to apartment blocks will have reduce air emissions from this source in the city significantly and improve air quality in these areas.

In addition, the introduction of the Project will allow the future closure of CHP2 which is oldest of the current power plants in the city, along with older less efficient HOBs. It is also hoped that through the introduction of this Project to provide power and heat, CHP3 will be able to undergo a significant maintenance programme which will extend its operating life whilst improving its operational performance which will have a positive benefit on air quality. There is also potential that Project, along with additional wind energy and potential other new efficient power plants would allow the shutdown of the less efficient CHP's during the summer months.

Overall it can be assumed that the Project will enhance air quality with Ulaanbaatar.

As discussed in the baseline section and detailed in Volume IV, additional ambient monitoring will be collected from 2016 onwards. This will be undertaken to fully categorise the Projects airshed and to determine if any additional offset measures are required to minimise impacts, in the event that the ambient monitoring confirms that the airshed to the south east of the Project where the maximum impacts are predicted to be is degraded. In addition, if the monitoring confirms that the Project causes an exceedance of the ambient air quality standards at this location or any other location, offset measures will be implemented. Based on the predicted annual mean impacts any offsets required would likely need to be small. Suitable measures include provision of cleaner fuels in the affected communities and supplying more efficient burning devices for ger households and would be covered by the CHP5 Corporate Social Responsibility (CSR) plan and/or process. It would be expected that all offset measures would be in line with the Ulaanbaatar clean air initiative programme.

7.7 Residual Impacts

Effects from the construction phase of the proposed Project are temporary and therefore residual impacts are not considered to be significant.

The operation of the proposed Project will lead to emissions of dust and particulate matter from the handling and storage of coal. Following the implementation of appropriate mitigation measures and a dust monitoring and action plan the residual impacts are not considered to be significant.

The effects from the proposed Project are not considered significant when assessed against relevant international standards. Overall the impacts from the proposed Project and considered to be not significant.

Table 7.15: Summary of air quality impacts and mitigation

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Description	Mitigation or Enhancement	Residual Impacts
Construction						
General construction activities, including excavation works, the loading/unloading of materials, stockpiling of materials	Increase in dust deposition at receptors located outside the proposed Projects site boundary as a result of construction activities	Medium	Major	Moderate adverse	Mitigation measures in line with IFC guidelines, dust management plan	Minor adverse
Operation						
Emissions from coal handling and storage	Increase in dust deposition and particulate matter concentrations at receptors located outside the propose Project boundary	Medium	Major	Moderate adverse	Mitigation measures in line with IFC guidelines a dust monitoring and action plan,	Minor adverse
Emissions from the stack when compared to national standards	Increase in ambient pollutant concentrations of NO_2, SO_2, PM_{10} and $PM_{2.5}$ in the proposed Projects airshed	Negligible to high	Negligible to major	Negligible to Major adverse	Monitoring and future offset plans	Negligible to major adverse
Emissions from the stack when compared to international standards	Increase in ambient pollutant concentrations of NO_2, SO_2, PM_{10} and $PM_{2.5}$ in the proposed Projects airshed	Negligible to high	Negligible to minor	Negligible	Monitoring and future offset plans	Negligible

8 Noise and Vibration

8.1 Introduction

This chapter presents an assessment of potential noise and vibration impacts that are anticipated to arise during the construction, operation and decommissioning of the Project. The purpose of this is to identify the significance of any adverse effects and to consider the scope of mitigation that is likely to be required.

Temporary noise and vibration impacts may arise during construction due to:
- Site clearance and ground works mainly related to excavation, temporary construction laydown area, raising of the site level and piling
- Delivery and movement of materials and equipment
- Construction of infrastructure and installation of equipment

Permanent operational noise impacts are expected to arise due to the Project elements including:
- Coal conveying belts
- Coal breaking/crushing plant
- Boilers
- Steam turbines
- Generators
- Steam exhaust and stack
- ACC units

Temporary noise impacts are expected to arise during decommissioning due to:
- Demolition of infrastructure and removal of materials
- Reinstatement

The key sensitive receptors in the Project area are existing residential dwellings including:
- The ger communities mainly to the south-east and south-west of the site
- The Urgakh Naran apartment blocks to the north/north-east of the site
- Bogd Khan National Park warden's accommodation to the west of the site

For the purpose of this assessment, it is assumed that the Happy Valley development to the north of the Project site will cease and not be occupied.

8.2 Applicable legislation

8.2.1 National requirements

8.2.1.1 Mongolian national standard MNS 4285:2007

Mongolian noise standards are set out in the national standard MNS 4585:2007 Air Quality – Technical general requirements. The noise limits established by this standard are summarised below in Table 8.1.

Table 8.1: MNS 4585:2007 guideline noise limit values

	Noise Level dB(A)	
	Daytime 07:00 – 23:00	Night 23:00 – 07:00
Maximum Environmental Noise Exposure for the Public	60	45

8.2.2 International requirements

8.2.2.1 World Bank Group and International Finance Corporation Guidelines

The WBG and IFC have developed a thorough programme of pollution prevention and management techniques in order to ensure that projects funded by the organisation are environmentally and socially responsible. These guidelines are adopted by many international funding agencies and banks.

The guideline noise levels as set out in the IFC General EHS Guidelines are presented in Table 8.2. The Guidelines state that noise impacts should not exceed the levels presented or result in a maximum increase in baseline levels of 3 dB at the nearest receptor location off-site.

Table 8.2: WBG/IFC EHS guideline noise limit values

	Noise Level dB $L_{Aeq,1\ hour,}$ free field	
Specific environment	Daytime 07:00 – 22:00	Night 22:00 – 07:00
Residential, educational or institutional	55	45
Industrial or commercial	70	70

8.2.2.2 World Health Organization (WHO)

The WHO ‘Guidelines for Community Noise’ includes a table of guideline values for community noise in specific environments corresponding with critical health effects. These values are widely recognised and form the basis of noise criteria used worldwide. The main criteria relevant to dwellings are given Table 8.3.

Table 8.3: WHO Guideline values for community noise

		Noise Level dB $L_{Aeq,T}$ free field	
Specific environment		Daytime and evening T = 16 hours	Night-time T = 8 hours
Outdoor living area	Serious annoyance during daytime and evening	55	–
	Moderate annoyance during daytime and evening	50	
Outside bedrooms (outdoor value)	Sleep disturbance with window open		45

The 55 dB L_{Aeq} daytime and 45 dB L_{Aeq} night-time WHO criteria correspond with the IFC Guidelines but are less onerous because these are averaged over 16 and 8 hours respectively. The IFC Guidelines are more stringent as the criteria are based on hourly L_{Aeq} values.

8.2.3 Other guidelines and policies

8.2.3.1 British Standard 5228 Code of Practice for Noise and Vibration Control on Construction and Open Sites

The British Standard 5228 'Code of Practice for Noise and Vibration Control on Construction and Open Sites' (2009+A1:2014) provides comprehensive guidance on construction noise and vibration including details of typical noise levels associated with various items of plant or activities, prediction methods and measures and procedures that have been found to be most effective in reducing impacts. The guidance forms the basis for the majority of construction noise assessments in the United Kingdom and has been applied in the noise and vibration assessments of ESIAs prepared for many international development projects. The BS 5228 methodology has been adopted for the assessment of construction noise.

8.3 EPC Contractor Requirements

The Project Technical Description[17] produced by the EPC contractor includes project-specific requirements on noise which will be adhered to throughout the duration of the Project. These requirements are set out in Table 8.4

Table 8.4: EPC contractor project specific noise requirements

Location	Threshold value dB(A)	Comments
At the Site boundary	Shall not exceed 60	During day-time and night-time, except in case of abnormal operation (e.g. by-pass operation and opening of safety valves)
At a distance of 1m	Shall not exceed 85	From the equipment surface or associated enclosure, under all operation conditions (exception: sound pressure level for steam turbine by-pass valves and safety valves < 120 dB(A))
In any permanent working place	Shall not exceed 55	For example, the control room, offices and meeting rooms

8.4 Methodology and assessment criteria

The methodologies and criteria adopted for the assessment of noise impacts anticipated to arise during the construction and operation of the proposed development are described below with reference to appropriate standards and guidelines. The criteria are defined within the context of this multi-disciplinary ESIA.

[17] CHP5 Project Technical Description 2014 (doc ref: CHP5ULA/4/0333167)

8.4.1 Sensitivity

Sensitivity criteria for the assessment of noise impacts are assigned in Table 8.5 below.

Table 8.5: Sensitivity criteria for noise-sensitive receptors

Sensitivity	Type of receptor
High	Residential areas, hospitals, schools, colleges or universities, places of worship and designated environmental areas.
Medium	Offices, recreational areas and public open spaces.
Low	Agricultural land and industrial areas.
Negligible	Derelict land.

8.4.2 Magnitude of impact

8.4.2.1 Noise impacts during the construction phase

WHO and IFC guidelines are not specific but generally apply to permanent operational noise impacts. Therefore, the assessment methodology described in British Standard 5228 Code of Practice for Noise and Vibration Control on Construction and Open Sites (2009+A1:2014) has been adopted for this assessment.

BS 5228 states that sensitive receptors typically tolerate a greater change in noise level as a result of construction activity as compared to an industrial noise source. This is considered to be partly due to the awareness that construction noise is not a permanent source of disturbance.

Annex E of BS 5228 presents example methods for the assessing the significance of construction noise levels and the 5 dB(A) change method has been applied for this assessment. Noise levels generated by site activities are deemed to be potentially significant if the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to the threshold values for construction noise alone given in Table 8.6 and a duration of one month or more, unless works of a shorter duration are likely to result in a significant impact.

Table 8.6: Threshold values for construction noise levels

Period	Threshold values for construction noise level only dB $L_{Aeq,T}$
Daytime (T= 07:00-19:00 Monday to Friday or 07:00 to 13:00 Saturdays)	65
Evenings and weekends	55
Night-time (T= 23:00-07:00)	45

* T=19:00-23:00 weekdays, 13:00-23:00 Saturdays or 07:00-23:00 Sundays

It has been assumed that construction work may be undertaken at any time of the day due to the seasonal constraints in Mongolia.

Table 8.7 summarises the criteria used in assessing the magnitude of temporary noise impacts during the construction phase.

Table 8.7: Criteria for magnitude of impact due to temporary noise impacts during construction

Magnitude	
Negligible	Noise level from construction activities alone is below the BS 5228 lower limit values of 65 and 45 dB(A) for day and night times respectively
Minor	Lower limit values from construction activities alone exceeded but change in ambient noise level is less than 5 dB
Moderate	Lower limit values from construction noise activities exceeded with the change in ambient noise level between 5 and 10 dB
Major	Lower limit values from construction activities alone exceeded with the change in ambient noise level of 10 dB or over

8.4.2.2 Noise impacts during the operational phase

Criteria for the magnitude of impact for operational noise impacts presented in Table 8.8 have been developed based on the Mongolian national standards and WHO and IFC guidelines. The IFC Performance Standards state:

"*When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent*."

Therefore, the criteria for operational noise impacts of the project are based on the limit values and averaging times of IFC Guidelines. Furthermore, reference is made to the baseline data to determine the magnitude of any increases in ambient noise levels as a result of the Project rather than assessment against absolute noise levels.

Table 8.8: Criteria for the magnitude of impact due to operational noise

Magnitude	Description
Negligible	Noise level from operational activities is below the IFC/World Bank Group Guidelines of 55 and 45 dB $L_{Aeq,1h}$ for day and night times respectively
Minor	Noise level from operational activities exceeds the IFC/World Bank Group Guidelines of 55 and 45 dB $L_{Aeq,1h}$ but change in ambient noise level is less than 3 dB
Moderate	Noise level from operational activities exceeds the IFC/World Bank Group Guidelines of 55 and 45 dB $L_{Aeq,\ 1h}$ with the change in ambient noise level between 3 and 6 dB
Major	Noise level from operational activities exceeds the IFC/World Bank Group Guidelines of 55 and 45 dB $L_{Aeq,\ 1h}$ with the change in ambient noise level over 6 dB

The significance of effect is determined using the matrix presented in Chapter 5 of this ESIA.

8.4.3 Baseline conditions methodology

The noise measurements made by Mott MacDonald used a Rion NL – 32 type sound level meter (serial number 903344) designed to be in compliance with the Class 1 standard for accuracy described within the

IEC 61672 (2002). The meter was supported on a tripod so that the microphone was 1.2 to 1.5m above the local ground level. The microphone was fitted with a windshield suitable for outdoor use. Figure 8.1 shows the noise measurement equipment in place on site.

Figure 8.1: Photograph of the Location 2 noise measurement position

The sound level meter was calibrated within two years of the measurement under laboratory conditions traceable to national and international standards. The sensitivity of the measurement system was measured before and after the measurement session using a field calibrator. No significant drift in sensitivity was noted (less than 0.5 dB).

The sound level meter was configured to record noise levels in contiguous 10-minute intervals and, as a minimum, the following parameters were recorded over each measurement interval:
- A-weighted equivalent continuous noise levels in decibels – $L_{Aeq,}$ dB
- Maximum A-weighted sound pressure level in decibels with the fast time-weighting – $L_{A(max)Fast}$ dB
- Statistical descriptors of noise level including L_{A90} dB defined as the A-weighted sound pressure level exceeded for 90% of the measurement interval (lowest part of the time varying sound within the measurement interval used to describe background noise level) and L_{A10} dB defined as the A-weighted sound pressure level exceeded for 10% of the measurement interval (highest part of time varying sound within the measurement interval often used to describe traffic noise).

At least three contiguous measurements were made at all measurement positions except Location 7 where one 10-minute interval was recorded.

8.4.4 Scope of assessment

8.4.4.1 Temporal scope

The assessment considers three phases:

- Baseline: Conditions assumed to be represented by those observed and measured during baseline noise surveys conducted on behalf of Nature Friendly in November 2013 and by Mott MacDonald in August 2014
- Construction: Conditions likely to occur during the 57-month construction phase
- Operational: Conditions immediately after full operation of the proposed Project has commenced

Specific details on decommissioning are not available at this stage of the Project. Furthermore, it is expected that the proximity of sensitive receptors will change over the lifetime of the Project. However, impacts during decommissioning are expected to be of a similar magnitude to those during construction but of shorter duration. Therefore, at this stage, it is not meaningful to undertake a detailed quantitative assessment of noise and vibration impacts that are expected to during decommissioning. It is recommended that this is undertaken once plans for decommissioning are developed so that specific requirements for mitigation can be considered as appropriate.

8.4.4.2 Spatial scope

The assessment considers effects on key sensitive receptors which are representative of all those within 1km of the Project site boundary.

8.4.5 Assumptions and limitations

8.4.5.1 Mapping and topography

The site is surrounded by mountainous terrain, which has been accounted for within the three-dimensional acoustic model of the Project and surrounding area.

8.4.5.2 Borrow Pit

The proposed location of the borrow pit has not been finalised and therefore the associated noise impacts have not be considered within this assessment. In order to avoid significant adverse effects the borrow pit and any access roads should be located as far as possible from sensitive receptors and developed to comply with international standards.

1.1.1.1 Road and rail traffic data

Table 8.9 summarises the frequency of truck movements during the construction phase.

Table 8.9: Summary of expected truck movements

	Site levelling		Foundations		Peak flows
	No. of trucks per 9-hour working day	Average no. of trucks per hour	No. of trucks per day per 9-hour working day	Average no. of trucks per hour	No. of trucks per hour
Earth movement	90	10	45	5	15
Concrete	–	–	45	5	5

	Site levelling		Foundations		Peak flows
movement					
Total deliveries	90	10	90	10	20
Total vehicle movements	180	20	180	20	40

Source: The Consortium

It is assumed that during the operational phase, there would be five scheduled freight trains in and out of the Project site on a daily basis (a total number of 10 movements per day) and that all movements would occur during the daytime period. A maximum on-site speed of 20 km/h has been assumed. Each train is assumed to comprise one diesel locomotive and 40no. 4-axle coal wagons.

8.4.5.3 Operational plant

Noise emission data for operational equipment has been provided by ENGIE[18] and is summarised in Table 8.10.

Table 8.10: Summary of sound power levels used in the acoustic model

Item	Sound Power Level dB(A)
ACC	100.7
Circulating water pump	95.1
Primary air fan	99.0
Boiler feed pump	100.9
Circulating electric pump	95.1
Transformer	85.1
Air compressor	97.2
Steam Turbine building	92.1
Coal conveyor belt	92.9
Boiler	98.1
High pressure blower	91.3
Stack	94.6
Coal crusher house	93.0

Source: The Consortium

8.4.5.4 Night-time baseline data

The baseline noise measurements conducted by Mott MacDonald (2014) and Nature Friendly (2013) were undertaken during daytime periods only. For the purpose of night-time noise impact assessment and based upon our professional judgement, a -5 dB correction has been applied to the measured daytime ambient noise level to give an estimated night-time ambient noise level at the receptors.

[18] Email dated 12 August 2015

8.5 Baseline description

8.5.1 Overview

The site is situated in a rural area. The main existing source of noise in this area is local road traffic on the eastern site boundary, with intermittent noise arising from the railway line located to the west of the site.

The key sensitive receptors within 1km of the site boundary are:

- The ger communities mainly to the south-east and to the south-west of the site
- Urgakh Naran apartments which are situated approximately 460m north/north-east of the eastern site boundary
- Bogd Khan National Park Warden accommodation which is situated at approximately 860m west of the western site boundary

These sensitive receptors are residential and the sensitivity is assessed as high.

8.5.2 Baseline surveys

Figure 8.2 indicates the measurement positions used for the baseline noise surveys undertaken by Mott MacDonald (Locations 1 to 7) and the monitoring undertaken on behalf of Nature Friendly (NF1 to NF5). The measurement positions are summarised in Table 8.11.

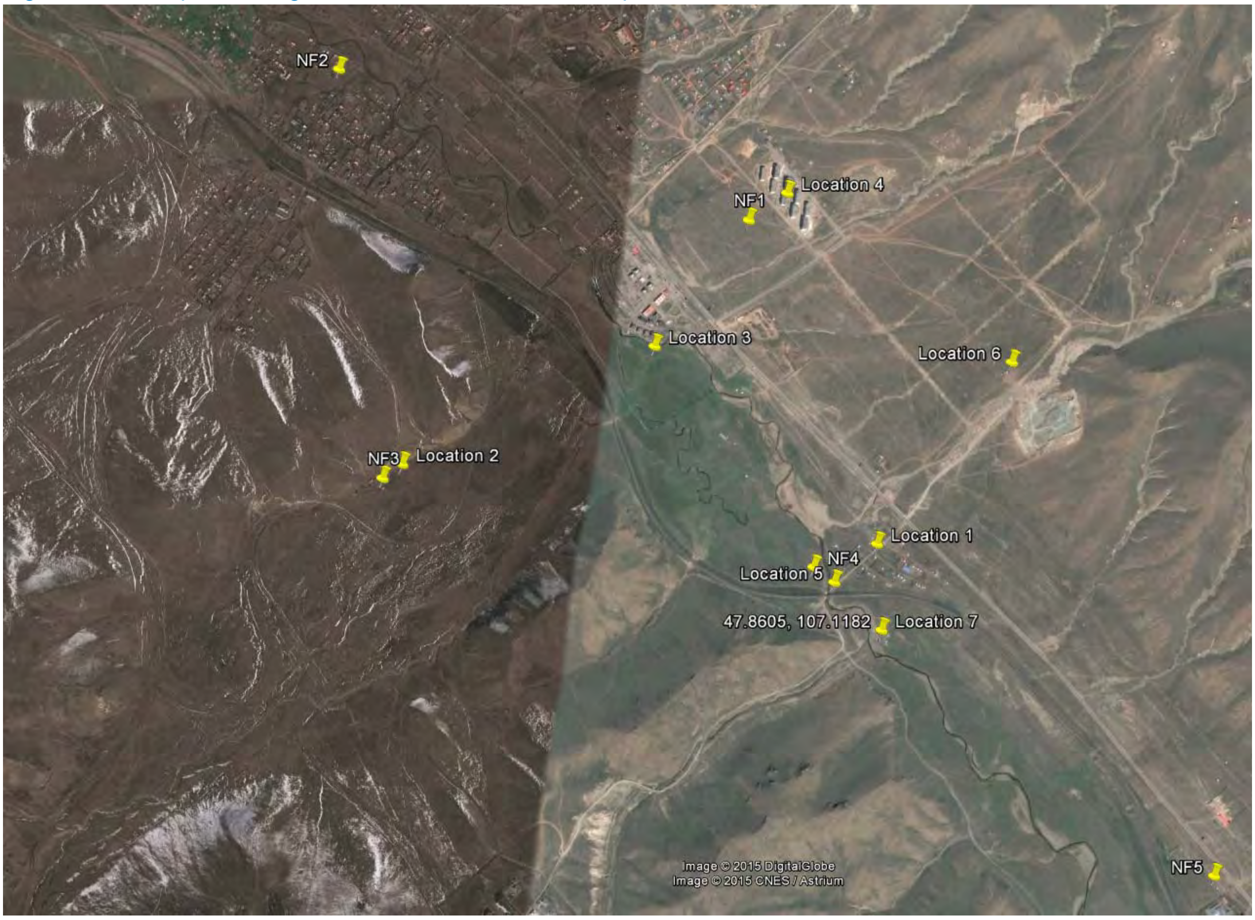
Table 8.11: Summary of baseline measurement positions

Position	Grid reference	Representative receptor
NF1	47° 52' 24.07" N, 107° 06' 43.22" E	Urgakh Naran apartments
NF2	47° 52' 41.11" N, 107° 05' 34.25" E	Residences in the area of Tuul junction
NF3	47° 51' 54.94" N, 107° 05' 41.57" E	Protected area / Bogd Khan National Park Warden accommodation
NF4	47° 51' 44.91" N, 107° 06' 54.11" E	South-west of ger settlement close to underpass
NF5	47° 51' 10.06" N, 107° 08' 01.50" E	Village to the south-east / ger settlement
Location 1	47° 51' 47.5" N, 107° 07' 04.8" E	Ger settlement on the south-east side of the site
Location 2	47° 51' 56.5" N, 107° 05' 44.9" E	Bogd Khan National Park Warden accommodation
Location 3	47° 52' 09.9" N, 107° 06' 27.4" E	Happy Valley Luxury Development (to be demolished)
Location 4	47° 52' 27.1" N, 107° 06' 49.7" E	Urgakh Naran apartments
Location 5	47° 51' 43.2" N, 107° 06' 57.6" E	South-west of ger settlement close to the railway bridge over the River Tuul
Location 6	47° 52' 08.1" N, 107° 07' 27.5" E	Ger settlement east of the site/proposed construction lay down area
Location 7	47° 51' 27.8" N, 107° 07' 05.5" E	Isolated ger settlement south-east of the site close to a borehole

The surveys conducted by Nature Friendly were carried out in November 2013 over a three-day period. The measurements at each position were made over 20-minute intervals and during the daytime period only.

The surveys undertaken by Mott MacDonald were carried out over two days in August 2014. At each position, measurements were made over three contiguous 10-minute intervals, except where stated, and during the daytime.

Figure 8.2: Map indicating baseline noise measurement positions



Source: Google Earth – annotated and used under professional license

8.5.3 Survey Results: Nature Friendly Survey 2013

The results of the survey by Nature Friendly have been summarised in Table 8.12. The measurement parameter is not explicitly stated but it is assumed to be L_{Aeq} for comparison with the criteria of Mongolian national standard. The time of day that the measurements were made were not stated but are noted to be daytime. This is defined in the Mongolian national standard as 7am to 11pm. The sound level meter used is given as a JIEC type 1015. However, details of the type or class with regards to the standards for accuracy were not stated.

Table 8.12: Summary of the results of the 2013 survey conducted by Nature Friendly

	Noise dB(A) assumed to be $L_{Aeq,20min}$ dB		
Position	**05/11/2013**	**06/11/2013**	**07/11/2013**
NF1 – Urgakh Naran apartments	64	63	53
NF2 – Residences in the area of Tuul junction	57	54	42
NF3 – Protected area / Bogd Khan National Park Warden accommodation	54	53	45
NF4 – South-west of ger settlement close to underpass	66	62	48
NF5 – Village to the south-east / ger settlement	68	74*	46

* Noted to have been affected by train noise

A noticeable feature of the results is that baseline noise levels were significantly lower on the final day of the survey.

8.5.4 Survey Results: Mott MacDonald Survey 2014

8.5.4.1 Overview

The measured noise levels were acquired over at least three contiguous ten-minute intervals (except at Location 7). Representative noise levels to be used in the assessment have been derived from the measurement results as follows:

- L_{Aeq} – This is the logarithmic average of all the $L_{Aeq,10minute}$ dB values (equivalent to $L_{Aeq,30\ min}$ dB in most cases)
- $L_{A(max)F}$ – This is the highest value of all the measured $L_{A(max)F,10minute}$ dB values (equivalent to $L_{A(max)F,30\ min}$ dB in most cases)
- L_{A10} and L_{A90} – The arithmetic average of the measured values of either $L_{A10,10minute}$ dB or $L_{A90,10minute}$ dB

8.5.4.2 Location 1 – Ger site to the south-east

The measurement position at Location 1 was selected to represent the ger settlement which is adjacent to the south-east boundary of the Project site.

Table 8.13 presents a summary of the results of the noise measurements made at Location 1.

Table 8.13: Summary of results of the noise measurement at Location 1

Date	Start Time	dB $L_{Aeq,10min}$	dB $L_{Amax,10min}$	dB $L_{A10,10min}$	dB $L_{A90,10min}$
11/08/2014	14:44:00	57	83	56	44

Date	Start Time	dB $L_{Aeq,10min}$	dB $L_{Amax,10min}$	dB $L_{A10,10min}$	dB $L_{A90,10min}$
11/08/2014	14:54:00	51	69	55	42
11/08/2014	15:04:00	49	60	52	44
Representative noise levels		54	83	54	44

8.5.4.3 Location 2

The measurement position at Location 2 was selected to represent the Bogd Khan National Park Warden accommodation. It is close to position NF3 that was used for the survey by Nature Friendly.

Table 8.14 presents a summary of the results of the noise readings made at Location 2. It was observed that the noise climate was mainly affected by noise from wind in the foliage and road traffic. The L_{Aeq} noise levels measured by Nature Friendly at position NF3 were significantly higher on the first two days of the survey but there is a closer agreement with the results obtained by Nature Friendly on the third day of the survey.

Table 8.14: Summary of the results of the noise measurement at Location 2

Date	Start Time	dB $L_{Aeq,10min}$	dB $L_{Amax,10min}$	dB $L_{A10,10min}$	dB $L_{A90,10min}$
11/08/2014	15:46:00	42	55	45	38
11/08/2014	15:56:00	45	67	43	38
11/08/2014	16:06:00	41	62	42	37
Representative noise levels		43	67	43	38

8.5.4.4 Location 3

Location 3 was selected to represent the closest part of the Happy Valley development to the Project site.

Table 8.15 presents a summary of the results of the noise readings made at Location 3. The main sources of environmental noise during the measurements were noted as rail and road traffic.

Table 8.15: Summary of the results of the noise measurement at Location 3

Date	Start Time	dB $L_{Aeq,10min}$	dB $L_{Amax,10min}$	dB $L_{A10,10min}$	dB $L_{A90,10min}$
11/08/2014	16:45:00	56	70	60	37
11/08/2014	16:55:00	42	54	45	36
11/08/2014	17:05:00	42	52	45	37
Representative noise levels		51	70	50	37

8.5.4.5 Location 4

The measurement position at Location 4 was selected to represent the Urgakh Naran apartments that are situated to the north-east of the Project site. The position is close to the NF4 position used for the Nature Friendly survey.

Table 8.16 presents a summary of the results of the noise readings made at Location 4. The main source of environmental noise was noted to be road traffic. The L_{Aeq} noise levels measured by Nature Friendly at position NF4 were significantly higher than those measured values on 2 of the 3 days but correlated with the measurement made on one day.

Table 8.16: Summary of the results of the noise measurement at Location 4

Date	Start Time	dB $L_{Aeq,10min}$	dB $L_{Amax,10min}$	dB $L_{A10,10min}$	dB $L_{A90,10min}$
11/08/2014	17:52:00	49	71	51	42
11/08/2014	18:02:00	56	74	54	42
11/08/2014	18:12:00	51	71	52	41
Representative noise levels		53	74	52	42

8.5.4.6 Location 5

Location 5 was selected to be representative of the settlement to the south-east of the Project site. It is close to position NF4 used by Nature Friendly.

Table 8.17 presents a summary of the results of the noise readings made at Location 5. Noise sources observed during the measurements included noise from the passing trains, adjacent river (steady lower level noise) and people talking by the water. The results are similar to those measured by Nature Friendly.

Table 8.17: Summary of the results of the noise measurement at Location 5

Date	Start Time	dB $L_{Aeq,10min}$	dB $L_{Amax,10min}$	dB $L_{A10,10min}$	dB $L_{A90,10min}$
12/08/2014	11:17:00	49	63	52	47
12/08/2014	11:27:00	74	96	78	47
12/08/2014	11:37:00	54	80	53	47
12/08/2014	11:47:00	72	86	56	47
12/08/2014	11:57:00	69	88	55	47
12/08/2014	12:07:00	53	73	54	47
12/08/2014	12:17:00	50	67	51	47
Representative noise levels		69	96	57	47

8.5.4.7 Location 6

Location 6 was selected to be representative of the noise climate affecting the ger adjacent to the proposed construction laydown area, to the east of the Project site. Table 8.18 presents a summary of the results of the noise readings made at Location 6. The dominant sources of noise were observed to be road traffic and heavy vehicles accessing a nearby borrow pit.

Table 8.18: Summary of the results of the noise measurement at Location 6

Date	Start Time	dB $L_{Aeq,10min}$	dB $L_{Amax,10min}$	dB $L_{A10,10min}$	dB $L_{A90,10min}$
12/08/2014	16:37:00	44	71	45	34
12/08/2014	16:47:00	50	66	55	37
12/08/2014	16:57:00	47	68	50	42
12/08/2014	17:07:00	43	57	47	36
Representative noise levels		47	71	49	37

8.5.4.8 Location 7

Location 7 was selected to represent an isolated ger settlement to the south-east of the project site.

The results of the noise measurement at Location 7 are summarised in Table 8.19. The main sources affecting the noise climate were noted as road traffic, wind in the foliage and light construction work being carried out nearby.

Table 8.19: Summary of the results of the noise measurement at Location 7

Date	Start Time	dB $L_{Aeq,10min}$	dB $L_{Amax,10min}$	dB $L_{A10,10min}$	dB $L_{A90,10min}$
12/08/2014	17:33:00	44	63	46	40

8.6 Impact identification and assessment

8.6.1 Construction Phase

8.6.1.1 Temporary impacts from construction noise

Construction is expected to take around 57 months to complete. The details of the construction programme, working methods and the utilisation of construction plant are not certain at this stage. However, the main phases of activities are expected to be as follows:

- Site preparation
- Excavation and foundation works including piling
- Erection of steel structures and duct work
- Construction of buildings
- Delivery and installation of equipment and components
- Laydown area.

Construction noise impacts will mainly be associated with operation of static and mobile items of plant. An assumed inventory of plant expected to be required within each of the phases of activity above is outlined in Table 8.20 as a reference for the assessment of potential noise impacts. Reference noise levels emitted by the items of construction plant have been taken from BS 5228-1:2009+A1:2014.

Table 8.20: Main items of noise-emitting plant expected to be used during construction and reference noise levels for the prediction of impacts

Activity	Main items of noise emitting plant	Reference noise level of a single item operating continuously $L_{Aeq,10\ metres}$ dB	BS 5228 – 1:2009+A1:2014 reference
Site preparation	Tracked excavator	78	C.2 #3
	Dozer	81	C.2 #12
	Dozer towing roller	81	C.2 #36
	Water pump	65	C.2 #45
	Dump truck	74	C.2 #32
Excavation and foundation works	Vibratory piling rig	88	C.3 #8
	Craneage for piling	67	C.3 #28
	Concrete mixer truck	80	C.4 #20
	Tracked excavator	78	C.2 #3
Erection of steel structures and duct work	Tower crane	77	C.4 #49
	Generator for welder	57	C.3 #33
	Hand held welder	73	C.3 #31
	Angle grinder	80	C.4 #93
	Tracked mobile crane	71	C.4 #50
Construction of buildings	Tower crane	77	C.4 #49
	Tracked mobile crane	71	C.4 #50
	Diesel scissor lift	78	C.4 #59
Delivery and installation of equipment and components	Lorry pulling up	70	D.7 #121
	Wheeled mobile crane	70	C.4 #43
	Telescopic handler	79	C.4 #54
	Lorry pulling up	70	D.7 #121
Laydown areas	Dumper truck	85	C.9 #24
	Lorry loading from a silo	82	C.9 #25
	Wheeled mobile crane	70	C.4 #43

It is assumed that activities within the temporary construction laydown areas will occur simultaneously with each phase of construction on the main site. The methodology for the calculation of noise impacts presented in Annex F of BS 5228 – 1:2009+A1:2014 has been used to predict the level of noise during each of the five main activities within the construction programme.

Table 8.21 presents a summary of the predicted noise impacts during each phase of construction activity at each of the seven locations used for the Mott MacDonald 2014 baseline noise survey, as well as the magnitude of impact according to Table 8.7. It is assumed that baseline levels during the night time are 5 dB lower than the representative levels measured during the daytime. The noise impacts have been predicted during each stage of works assuming the proximity to sensitive receptors can be described in two ways:

- General works where the majority of substantial activities are undertaken within the central area of the Project site.
- Worst case scenario where works are undertaken at the closest part of the Project site to the sensitive receptor.

Table 8.21: Summary of calculated noise impacts at Locations 1 to 7 predicted to arise and their magnitude of impact during the five main construction phases: general works and worst case

		Predicted L_{Aeq} dB due to construction alone (free field)													
		General (from the closest point of substantial works)							Worst-case (from the site boundary)						
Location		**1 Ger site south east**	**2 Bogd Khan Warden**	**3 Happy Valley**	**4 Urgakh Naran flats**	**5 Ger site railway bridge**	**6 Ger site near laydown area**	**7 Ger site borehole**	**1 Ger site south east**	**2 Bogd Khan Warden**	**3 Happy Valley**	**4 Urgakh Naran flats**	**5 Ger site railway bridge**	**6 Ger site near laydown area**	**7 Ger site borehole**
Indicative distances from the main site		150m	1200m	150m	500m	200m	750m	500m	25m	860m	25m	450m	25m	650m	350m
Indicative distances from the laydown area (off site)		500m	1700m	800m	550m	690m	130m	760m	500m	1700m	800m	550m	690m	130m	760m
Indicative distances from the temporary laydown area (on site)		800m	710m	90m	570m	770m	1130m	1010m	800m	710m	90m	570m	770m	1130m	1010m
Baseline – daytime		54	43	51	53	69	47	44	54	43	51	53	69	47	44
Baseline – night-time		49	38	46	48	64	42	39	49	38	46	48	64	42	39
1. Site preparation	Construction only	**56**	**43**	**64**	**48**	**53**	**59**	**46**	**74**	**44**	**75**	**49**	**74**	**59**	**48**
	Change in ambient & magnitude of impact (day)	+4 Negligible	+3 Negligible	+13 Negligible	+1 Negligible	0 Negligible	+12 Negligible	+4 Negligible	+20 Major	+4 Negligible	+24 Major	+1 Negligible	+6 Moderate	+12 Negligible	+6 Negligible
	Change in ambient & magnitude of impact (night)	+8 Moderate	+6 Negligible	+18 Major	+3 Minor	0 Minor	+17 Major	+8 Moderate	+25 Major	+7 Negligible	+29 Major	+3 Minor	+11 Major	+17 Major	+10 Major
2. Excavation and foundation works	Construction only	**60**	**43**	**64**	**50**	**57**	**59**	**48**	**78**	**46**	**78**	**51**	**78**	**59**	**51**
	Change in ambient & magnitude of impact (day)	+7 Negligible	+3 Negligible	+14 Negligible	+2 Negligible	0 Negligible	+12 Negligible	+6 Negligible	+24 Major	+5 Negligible	+27 Major	+2 Negligible	+10 Major	+12 Negligible	+8 Moderate
	Change in ambient & magnitude of impact (night)	+11 Major	+7 Negligible	+18 Major	+4 Minor	+1 Minor	+17 Major	+10 Major	+29 Major	+9 Negligible	+32 Major	+5 Moderate	+14 Major	+17 Major	+13 Major
3. Erection of steel structures and duct work	Construction only	**54**	**42**	**63**	**48**	**51**	**59**	**45**	**72**	**43**	**72**	**48**	**72**	**59**	**47**
	Change in ambient & magnitude of impact (day)	+3 Negligible	+3 Negligible	+12 Negligible	+1 Negligible	0 Negligible	+12 Negligible	+3 Negligible	+18 Major	+3 Negligible	+21 Major	+1 Negligible	+5 Moderate	+12 Negligible	+4 Negligible
	Change in ambient & magnitude of impact (night)	+6 Moderate	+6 Negligible	+17 Major	+3 Minor	0 Minor	+17 Major	+7 Moderate	+23 Major	+6 Negligible	+26 Major	+3 Minor	+8 Moderate	+17 Major	+8 Moderate
4. Construction of buildings	Construction only	**53**	**42**	**63**	**48**	**50**	**59**	**44**	**70**	**43**	**71**	**48**	**70**	**59**	**46**
	Change in ambient & magnitude of impact (day)	+2 Negligible	+3 Negligible	+12 Negligible	+1 Negligible	0 Negligible	+12 Negligible	+3 Negligible	+16 Major	+3 Negligible	+20 Major	+1 Negligible	+4 Minor	+12 Negligible	+4 Negligible
	Change in ambient & magnitude of impact (night)	+5 Moderate	+6 Negligible	+17 Major	+3 Minor	0 Minor	+17 Major	+6 Negligible	+21 Major	+6 Negligible	+25 Major	+3 Minor	+7 Moderate	+17 Major	+8 Moderate
5. Delivery and installation of equipment and components	Construction only	**52**	**42**	**63**	**47**	**49**	**59**	**44**	**69**	**43**	**70**	**48**	**69**	**59**	**45**
	Change in ambient & magnitude of impact (day)	+2 Negligible	+3 Negligible	+12 Negligible	+1 Negligible	0 Negligible	+12 Negligible	+3 Negligible	+16 Major	+3 Negligible	+19 Major	+1 Negligible	+3 Minor	+12 Negligible	+4 Negligible
	Change in ambient & magnitude of impact (night)	+5 Moderate	+6 Negligible	+17 Major	+3 Minor	0 Minor	+17 Major	+6 Negligible	+20 Major	+6 Negligible	+24 Major	+3 Minor	+7 Moderate	+17 Major	+7 Moderate

For general daytime works, the impacts are negligible at all receptors. If general works are undertaken at night then major adverse impacts are predicted at Locations 3 and 6 during all phases, and at Locations 1 and 7 during excavation and foundation works. Location 1 would also be exposed to moderate impacts during all other phases of general works if undertaken at night. At Locations 4 and 5 minor adverse impacts are expected during all stages if undertaken at night.

For worst case works at the site boundary, major adverse impacts are expected to arise at Locations 1 and 3 during all phases if undertaken at any time of day. At Location 5, worst case impacts are expected to be minor/moderate adverse if undertaken in the daytime and moderate/major if undertaken at night. At Locations 6, the worst case impacts are negligible if undertaken during the daytime and major adverse at night.

The assessment has identified the potential significant adverse effects in the case of:

- General works undertaken at night at Locations 1, 3 and 6 in all phases, and Location in the first 3 phases
- Worst case works near the site boundary if undertaken day or night at Locations 1 and 3 in all phases, at Location 5 in some phases, and mainly at night only at Locations 6 and 7.

8.6.1.2 Temporary noise impacts due to construction traffic

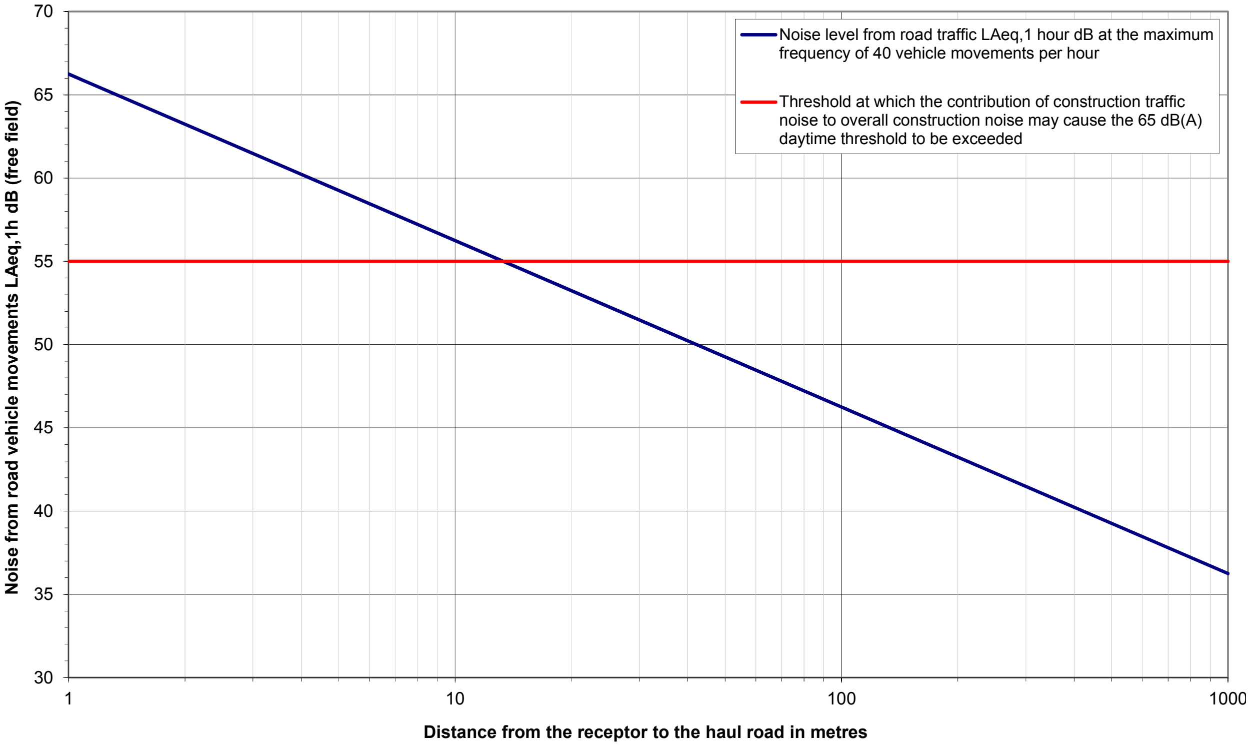
The maximum frequency of road movements during the construction phase of the Project site has been assumed to be 40 movements per hour as shown in Table 8.9. All movements are assumed to be during the daytime period only.

Annex F of BS 5228 2009+A1:2014 provides a methodology for predicting the noise levels due to the movement of mobile construction plant using a well-defined route (e.g. haul route). This has been used to predict the level of noise from heavy vehicle movements assuming:

- Sound Power Level (L_{WA}) for a heavy vehicle of 98 dB(A)
- An average speed of 30 km/h

The calculated noise levels are presented as a function of distance from the haul route in Figure 8.3. The layout of haul routes is not certain at this stage, however, if the noise impact of construction traffic at a given receptor is more than 10 dB below the daytime limit value of 65 dB(A) then the contribution of noise from construction traffic to overall noise impacts during construction is not expected to result in this threshold being exceeded. This analysis shows that the daytime limit would only be exceeded at receptors very close to the road or haul route i.e. at up to 15 metres from the road under worst case conditions of a maximum frequency of 40 vehicle movements per hour.

Figure 8.3: Calculated noise level ($L_{Aeq,1\ hour}$ dB) during the daytime from 40 heavy vehicle movements per hour as a function of distance from the road



In practice, the flow of construction traffic is expected to be variable and intermittent rather than all movements occurring within one hour. However, it is conceivable that the community response to noise from construction traffic could be adversely affected from a small number of movements or even the passage of a single heavy vehicle in close proximity to receptors if undertaken during a sensitive time of the day.

8.6.2 Operational Phase

A three-dimensional acoustic model of the Project site was developed using DataKustik CadnaA software (version 4.5.152) which implements the procedures set out in ISO 9613 Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation (1996).

The acoustic model has been used to predict steady-state noise levels from the Project during operation at the key receptors:

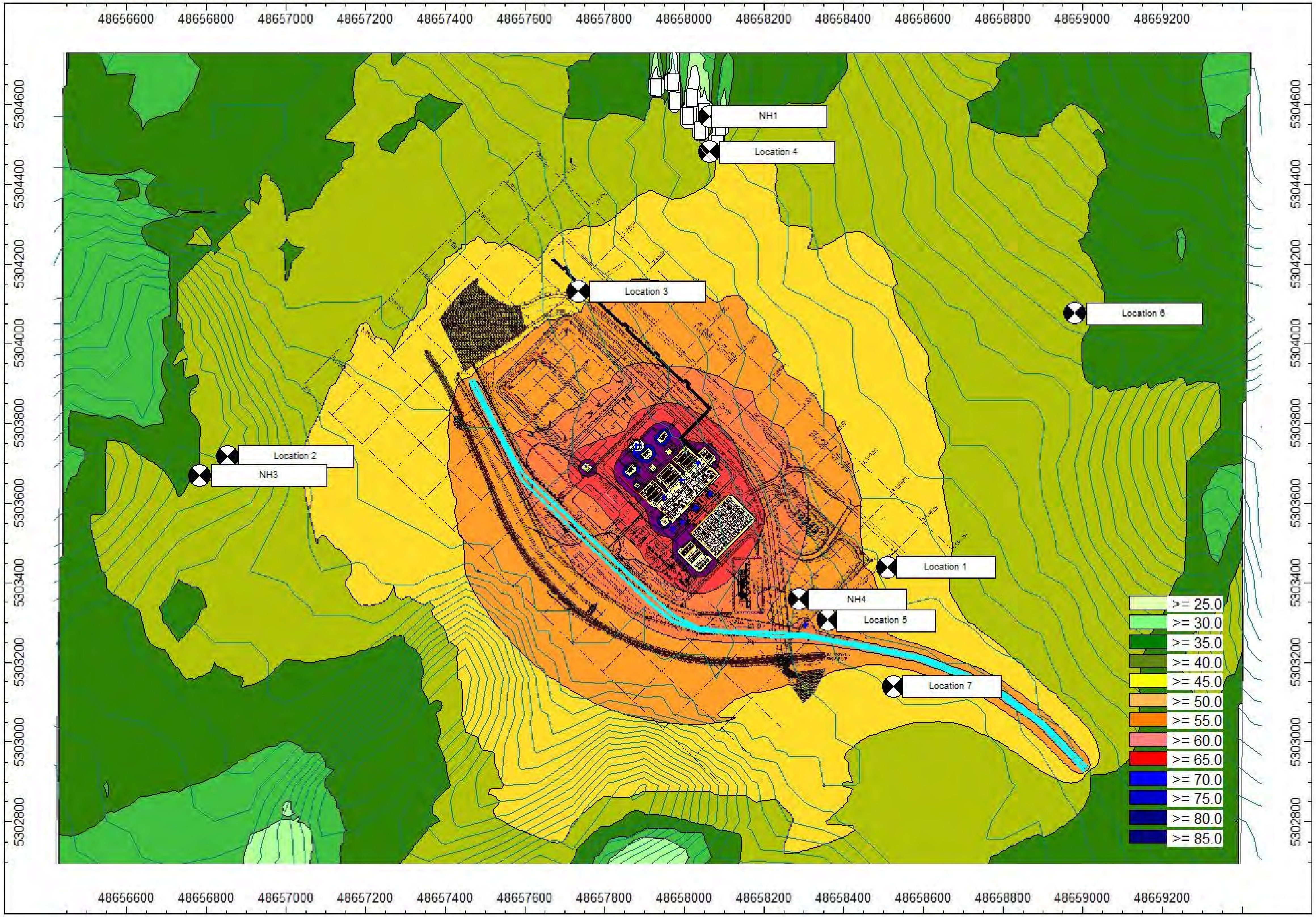
- Location 1 – Ger settlement on the south-east side of the site
- Location 2 – Bogd Khan National Park Warden accommodation
- Location 3 – Happy Valley Luxury Development (assumed to be demolished)
- Location 4 – Urgakh Naran apartments

- Location 5 – South-west of ger settlement close to the railway bridge over the Khuliin River
- Location 6 – Ger settlement east of the site/proposed construction lay down area
- Location 7 – Isolated ger settlement south-east of the site close to a borehole

The site is surrounded by mountainous terrain, which has been accounted for within the three-dimensional acoustic model of the Project and surrounding area, shown in Figure 8.4. Noise from the ten daily daytime train movements is combined with operational noise from fixed plant on the Project site.

The results of the predicted operational noise impacts are presented as a noise contour map in Figure 8.4.

Figure 8.4: Noise contour map of predicted operational noise levels



Source: Mott MacDonald

Table 8.22 summarises the results of the predictions of operational noise and assessed in terms of the daytime noise impacts. The predicted change in effect of ambient noise levels at the key receptors has been included in order to estimate the ambient noise levels during operation.

Table 8.22: Summary of the assessment of operational noise impacts without mitigation – daytime

Receptor position	Distance to nearest site boundary	Calculated operational noise level L_{Aeq} dB (free field)	Measured daytime baseline L_{Aeq} dB	Overall ambient L_{Aeq} dB with operating plant	Change over baseline dB	Significance of effects
Location 1 – Ger settlement on the south-east side of the site	50m	47	54	55	+1	Negligible
Location 2 – Bogd Khan National Park Warden accommodation	640m	41	43	45	+2	Negligible
Location 3 – Happy Valley Luxury Development (to be demolished)	0m	47	51	52	+1	Negligible
Location 4 – Urgakh Naran apartments (ground floor)	700m	41	53	53	+0	Negligible
Location 4 – Urgakh Naran apartments (top floor)	700m	45	53	54	+1	Negligible
Location 5 – South-west of ger settlement close to the railway bridge over the Khuliin River	40m	51	69	69	+0	Negligible
Location 6 – Ger settlement east of the site/proposed construction lay down area	800m	39	47	48	+1	Negligible
Location 7 – Isolated ger settlement south-east of the site close to a borehole	270m	46	44	48	+4	Negligible

The results show that the predicted daytime operational noise levels at the eight receptor positions are not expected to exceed the noise limit value of the Mongolian national noise standard of 60 dB(A) for the daytime, or the 55 dB(A) noise limit value of the IFC/World Bank Group for daytime. The significance of effects are assessed as negligible in all cases using the assessment criteria set out in Table 8.8 and assuming the key sensitive receptors are assessed as having high sensitivity.

Table 8.23 presents a summary of the operational noise impacts during the night time. The baseline noise level is assumed to be 5 dB lower than the daytime and the operational noise impacts do not include the contribution of noise from rail movements.

Table 8.23: Summary of the assessment of operational noise impacts without mitigation – night-time

Receptor position	Distance to nearest site boundary	Calculated operational noise level L_{Aeq} dB (free field)	Estimated night-time baseline L_{Aeq} dB	Overall ambient L_{Aeq} dB with operating plant	Change over baseline dB	Significance of effects
Location 1 – Ger settlement on the south-east side of the site	50m	47	49	51	+2	Minor
Location 2 – Bogd Khan National Park Warden accommodation	640m	41	38	43	+5	Negligible
Location 3 – Happy Valley Luxury Development (to be demolished)	0m	47	46	50	+4	Moderate
Location 4 – Urgakh Naran apartments (ground floor)	700m	41	48	49	+1	Negligible
Location 4 – Urgakh Naran apartments (top floor)	700m	45	48	50	+2	Minor
Location 5 – South-west of ger settlement close to the railway bridge over the Khuliin River	40m	51	64	64	0	Minor
Location 6 – Ger settlement east of the site/proposed construction lay down area	800m	39	42	44	+2	Negligible
Location 7 – Isolated ger settlement south-east of the site close to a borehole	270m	46	39	47	+8	Major

The results show that the predicted night-time operational noise levels from the Project exceed the noise limit values of the Mongolian national noise standard and the IFC/WBG noise limit value of 45 dB(A) for the night-time at four receptor positions with the exception of locations 2, 4 at ground floor level, and 6. At Location 5, the estimated baseline night-time noise level exceeds this due to the influence of existing railway noise. The significance of effects are assessed as major adverse at location 7 only using the assessment criteria set out in Table 8.8 and assuming the key sensitive receptors are assessed as having high sensitivity. Significant adverse effects are also expected at the Happy Valley receptor although this is to be demolished.

The Government of Mongolia requires that the sound pressure level at the site boundary should not exceed 60 dB(A) at any point. The predictive model shows that it does not exceed 59 dB(A).

8.6.3 Abnormal / Emergency Conditions

Abnormal and emergency noise impacts are expected to include venting through safety valves, the sounding of audible alarms during emergency drill tests and noise arising from activities during planned or unplanned maintenance work.

Noise emission levels associated with these events have not been obtained and therefore the magnitude of impact cannot be reliably assessed at this stage. It is expected that best practice in the design of the equipment used should be adopted to ensure any adverse effects are minimised.

8.6.4 Cumulative Impacts

The NUBIA is currently under construction. Cumulative impacts during construction are not expected due to the separation distance between the sites (the 1 km study areas would not overlap). Operational noise impacts due to aircraft movements may increase ambient noise levels within the study area of the CHP5 noise impact assessment. This is dependent on operational factors such as flight paths and the frequency of flights. There are no details available to assess cumulative impacts quantitatively; however, it is not anticipated that the resulting changes to ambient noise levels in combination with those of the project will alter the currently reported effects.

8.7 Mitigation and enhancement measures

8.7.1 Construction Phase

8.7.1.1 Construction Noise

Part 4 of the WBG General EHS Guidelines for Construction and Decommissioning includes recommendations for noise reduction and control strategies to be considered for works close to community areas including:

- Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance
- Using noise control devices, such as temporary noise barriers and deflectors for impact and blasting activities, and exhaust muffling devices for combustion engines
- Avoiding or minimising project transportation through community areas

General guidance on the mitigation of noise during construction is given in BS 5228:2009+A1:2014 to minimise of the adverse effects due to construction. The assessment of construction phase noise impacts has identified that the phase of activity with the potential to generate the greatest noise impacts is site excavation and foundation works. Specific measures that are relevant to this type of activity include:

- Layout of the temporary construction laydown area to ensure that noisy activities are located furthest away from sensitive receptors.
- Unnecessary revving of engines will be avoided and equipment will be switched off when not in use
- Internal haul routes will be kept well maintained
- Plant and vehicles will be sequentially started up rather than all together
- Use of effective exhaust silence systems or acoustic engine covers as appropriate
- Plant will always be used in accordance with manufacturers' instructions. Care will be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading will also be carried out away from such areas
- Regular and effective maintenance by trained personnel will be undertaken to keep plant and equipment working to manufacturers specifications
- Screening e.g. noise barriers and bunds will be used as appropriate

It is expected that the magnitude of worst case noise impacts can be reduced to negligible in all cases. This would be achieved using the application of the measures described above, particularly:

- Carrying out noisy works in the daytime only
- The use of temporary screening at sensitive parts of the site perimeter to reduce the noise from works close to the site boundary

It is recommended that additional noise monitoring is undertaken prior to construction to establish baseline noise levels during the night time at the key receptors.

Working hours on the site will be agreed with the Local Mongolia Government. Construction noise and vibration will be managed through implementation of the mitigation measures documented within the ESMMP.

8.7.1.2 Noise from Construction Traffic

It is considered that the effects due to construction traffic can be managed and adequately mitigated with measures such as:

- Maintenance of vehicles to ensure silencers are fitted and vehicles comply with emission standards
- Avoid queuing vehicles on the access road or at the site access points
- Restrict movements to avoid sensitive times of the day
- Adherence to speed limits
- Avoid unnecessary revving of engines and use of horns
- Minimise discontinuities in the profile of the haul routes to avoid body slap and rattle noise

It is considered that the magnitude of impacts can be sufficiently mitigated to ensure that effects will be negligible.

8.7.1.3 Operational Noise

No significant adverse effects are expected on the assumption that the Happy Valley development will be demolished and that receptors in the area of Location 7 will be relocated.

8.8 Residual impacts

8.8.1 Construction Phase

It is expected that significant adverse effects due to noise during the construction phase can be avoided by the careful application of the measures set out in Section 8.7.1. This will be of particular importance in mitigating effects at the sensitive receptors represented by the assessment locations 1, 3 and 5.

8.8.2 Operational Phase

The baseline noise climate is mostly rural in nature with very few man-made sources of industrial noise. The project will introduce continuous sources of noise (e.g. boiler, air-cooled condenser and coal conveyors) which would be audible over a wide area that is different in nature to the existing natural sources (wind, birdsong and animals) and to road traffic and passing trains which is intermittent. This is expected to change the character of the noise climate even if noise from the development can be reduced to levels that are in compliance with the Mongolian national standards, WBG/IFC and WHO guidelines.

Table 8.24: Summary of residual noise and vibration impacts and mitigation

Activity	Potential impacts	Sensitivity	Impact significance	Mitigation or enhancement	Residual impact
Construction					
General construction activities	Construction noise arising from general construction activities to the nearest sensitive receptor (NSRs): • Site preparation • Excavation, site raising and foundation • Erection of steel structures and duct work • Construction of buildings • Delivery and installation of equipment components • Temporary Construction Laydown area	High	Up to major adverse at the closest receptors to the site boundary under worst case conditions and if works are undertaken at night	• Best practicable means for the control of noise from construction • Contractor to develop ESMMP prior to works commencing that outline approach in accordance with this ESIA • Programming of noisy works to daytime periods only • Use of acoustic screening (e.g. earth bund or hoarding type barriers) along sensitive parts of the site boundary. • Configuration of haul routes to be no less than 10m from sensitive receptors • Implement Noise and Vibration Control Plan (NVCP) during construction to control noise and vibration caused by construction, traffic, operations, and other activities	Negligible
Operation					
Operational noise from the power plant	Operational noise impacts from boiler, air-cooled condenser and coal conveyors	High	Major in at one location at night, otherwise negligible or minor throughout.	None required at this stage.	Negligible

9 Hydrology, Hydrogeology and Flood Risk

9.1 Introduction

This chapter presents the baseline conditions and the assessment of Project impacts on hydrology, hydrogeology and flood risk. It identifies the relevant framework of the legislation and other requirements, and identifies and assesses potential significant adverse impacts, before defining appropriate mitigation measures that will be implemented as part of the Project. The baseline assessment builds on previous studies undertaken in relation to water resources and flood risk, which have used information from primary and secondary sources and involved hydrological and hydraulic analyses.

9.2 Applicable legislation

9.2.1 National requirements

The prevailing legislation in Mongolia is the Law on Water, passed on the 17 May 2012. In addition to this there are various Mongolian standards that are applicable to water as follows:

- Law on Water Pollution Fees (2012)
- MNS 4586: Indicator of water environment quality. General requirements (1998)
- MNS 3342: General requirements for protection of groundwater (1982)
- MNS (ISO) 4867: Water quality. Sampling third part. Recommendation for storage and protection (1999)
- MNS 4943: Water quality. Effluent standard (2011)
- USUG standard on maximum acceptable composition level of industrial wastewater is released to the sewage system.

A summary of national legislation is provided in Volume III, Appendix L.

9.2.2 International requirements

This Plant has been designed to meet the following international Lenders' standards:

1. ADB Safeguards
2. IFC PSs
3. WB/IFC's EHS Guidelines
4. EBRD PRs
5. JBIC Guidelines
6. Equator Principles

9.2.2.1 IFC PSs

The Project is required to meet the international standards of the IFC, which is part of the WBG. The IFC does not have established numerical standards for ambient surface water quality, but states: *Discharges of process wastewater, sanitary wastewater, wastewater from utility operations or stormwater should not result in contaminant concentrations in excess of local ambient water quality criteria*.

In addition, IFC PS3 states that:

- Water Consumption: When the project is a potentially significant consumer of water, in addition to applying the resource efficiency requirements of this PS, the client shall adopt measures that avoid or reduce water usage so that the project's water consumption does not have significant adverse impacts on others.
- Pollution prevention: the client will avoid the release of pollutants or, when avoidance is not feasible, minimize and/or control the intensity and mass flow of their release.

Whilst there is no specific guidance in relation to flood risk, IFC PS4 states that:

- Ecosystem Services: The project's direct impacts on priority ecosystem services may result in adverse health and safety risks and impacts to Affected Communities. With respect to this Performance Standard, ecosystem services are limited to provisioning and regulating services as defined in paragraph 2 of PS6. For example, land use changes or the loss of natural buffer areas such as wetlands, mangroves, and upland forests that mitigate the effects of natural hazards such as flooding, landslides, and fire, may result in increased vulnerability and community safety-related risks and impacts.

9.2.2.2 WB/IFC's EHS Guidelines

The WB/IFC EHS Guidelines for Wastewater and Ambient Water Quality state that: projects with the potential to generate process wastewater sanitary (domestic) sewage or stormwater should incorporate the necessary precautions to avoid, minimise and control adverse impacts to human health, safety or the environment.

Discharges should not result in contaminant concentrations in excess of local (or other applicable) ambient water quality criteria. Wastewater treatment measures should take into consideration: national and local standards, the assimilative capacity and intended use of the receiving water, the presence of sensitive receptors and GIIP.

The WB/IFC EHS Guidelines for Thermal Power Plants provide additional specific guidelines in relation to water conservation and effluent discharges for projects of this type. Specifically in areas of limited water resources it recommends use of air cooled systems for the conservation of water resources. The guidelines also recommend various measures to prevent, minimise and control wastewater effluents from thermal power plants.

Stated effluent guidelines which should be achieved without dilution, at least 95% of the time that the plant or unit is operating are summarised in Table 9.1.

Table 9.1: EHS Thermal Power Plants Effluent Guidelines

Parameter	Unit	Limit
pH	-	6 - 9
TSS	mg/l	50
Oil and grease	mg/l	10

Parameter	Unit	Limit
Total residual chlorine	mg/l	0.2
Chromium – Total (Cr)	mg/l	0.5
Copper (Cu)	mg/l	0.5
Iron (Fe)	mg/l	1.0
Zinc (Zn)	mg/l	1.0
Lead (Pb)	mg/l	0.5
Cadmium (Cd)	mg/l	0.1
Mercury (Hg)	mg/l	0.005
Arsenic (As)	mg/l	0.5

Source: EHS Guidelines – Thermal Power Plants, 19 December 2008.

The WB/IFC EHS Guidelines for Water Conservation state that water conservation programs should be implemented commensurate with the magnitude and cost of water use.

These programs should promote the continuous reduction in water consumption and achieve savings in the water pumping, treatment and disposal costs. Water conservation measures may include water monitoring/management techniques; process and cooling/heating water recycling, reuse, and other techniques; and sanitary water conservation techniques.

The WB/IFC EHS Guidelines for Community Health and Safety state that drinking water sources, whether public or private, should at all times be protected so that they meet or exceed applicable national acceptability standards or in their absence the current edition of WHO Guidelines for Drinking Water Quality (2008).

Whilst there is no specific guidance in relation to flood risk, the WB/IFC EHS for Occupational Health and Safety (OHS) states in relation to severe weather and facility shutdown:

- Work place structures should be designed and constructed to withstand the expected elements for the region and have an area designated for safe refuge, if appropriate.
- Standard Operating Procedures (SOPs) should be developed for project or process shut-down, including an evacuation plan. Drills to practice the procedure and plan should also be undertaken annually.

9.2.2.3 EBRD Performance Requirements

EBRD is committed to promoting EU environmental standards as well as the European Principles for the Environment (EPE), which are reflected in the PRs that projects are expected to meet. The EBRD PR's cover similar issues to the IFC PSs and include the following that are relevant to the water issues:

PR3 – Resource Efficiency and Pollution Prevention Control

- Identify project-related opportunities for energy, water and resource efficiency improvements and waste minimisation.

- Adopt the mitigation hierarchy approach to addressing adverse impacts on human health and the environment arising from the resource use and pollution released from the Project.

PR4 – Health and Safety
- Anticipate, assess, and prevent or minimise adverse impacts on the health and safety of project-affected communities and consumers during the project life cycle from both routine and non-routine circumstances.

Particular mention is given to natural hazards and the requirements state that:
- The client will identify and assess the potential impacts and risks caused by natural hazards, such as earthquakes, landslides or floods as these relate to the Project.
- The client will avoid and/or minimise the exacerbation of impacts caused by natural hazards or land use changes to which the Project activities may contribute.

9.2.2.4 ADB Safeguards

Requirements for assessing and addressing water pollution effects of projects are set out within ADB Safeguard Requirements 1: Environment, Section D9 'Pollution Prevention and Abatement'. In addition requirements for community health and safety in relation to natural hazards are set out in Section D10 'Health and Safety'.

ADB SPS 1, Environment requires:
- Pollution prevention and abatement: during the design, construction, and operation of the project the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the WBG/IFC EHS Guidelines.
- Community health and safety: the borrower/client will identify and assess the risks to, and potential impacts on, the safety of affected communities during the design, construction, operation, and decommissioning of the project, and will establish preventive measures and plans to address them in a manner commensurate with the identified risks and impacts. These measures will favour the prevention or avoidance of risks and impacts over their minimization and reduction. Consideration will be given to potential exposure to both accidental and natural hazards, especially where the structural elements of the project are accessible to members of the affected community or where their failure could result in injury to the community. The borrower/client will avoid or minimize the exacerbation of impacts caused by natural hazards, such as landslides or floods that could result from land use changes due to project activities.

9.2.2.5 JBIC

The JBIC requires that proponents of projects seeking financing undertake appropriate actions to prevent or minimise impacts on the environment and local communities such that unacceptable effects are avoided. A brief presentation of the JBIC's 'Guidelines for Confirmation of Environment and Social Considerations' (JBIC Environmental and Social Guidelines) relevant to this assessment is included in Section 4.3.5 of this document. More specific information is provided in the following paragraphs.

Environmental checklists are provided by JBIC for different industry types that detail the environmental and social impacts that should be assessed by proponents of projects. The environmental checklists of particular relevance to the proposed Project include Environmental Checklist 11: Thermal Power, Environmental Checklist 15: Power Transmission and Distribution Lines, Environmental Checklist 16: Roads, Railways and Bridges and Environmental Checklist 22: River and Channel Projects. Within these documents, requirements to assess and address the specific impacts are considered under Category 3: Natural Environment, which covers (1) water quality and (2) hydrology and Category 4: Social Environment which covers (2) Living and Livelihood.

The following guidelines are specific to the mentioned checklists:

Environmental Checklist 11: Thermal Power

- Effluents including thermal effluents from the power plant should comply with the country's effluent standards
- In the case of coal-fired power plants, leachates from coal piles and coal ash disposal sites should comply with the country's effluent standards
- Adequate measures should be taken to prevent contamination of surface water, soil, groundwater, and seawater by the effluents
- The amount of water used (e.g., surface water, groundwater) and discharge of thermal effluents by the project should not adversely affect existing water uses and uses of water areas (especially fishing).

Environmental Checklist 15: Power Transmission and Distribution Lines

- Adequate measures should be considered if there is a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas.

Environmental Checklist 16: Roads, Railways and Bridges

- Alteration of topographic features and installation of structures, such as tunnels should not adversely affect surface water and groundwater flows.

Environmental Checklist 22: River and Channel

- Hydrologic changes due to the project should not adversely affect surface water and groundwater flows.

9.3 Methodology and assessment criteria

9.3.1 Baseline conditions methodology

9.3.1.1 Previous Studies and Desktop Review

The baseline conditions methodology for the water aspects to a large extent builds on previous studies undertaken by Mott MacDonald prior to the commencement of the ESIA. The reports that are referred to in this section include:

- Mott MacDonald, 2014a, WRA for CHP5, Mongolia. Final Report Rev. B, 24 February 2014
- Mott MacDonald, 2014b, CHP5 FRA. Final Report Rev. B, 13 March 2014
- Mott MacDonald, 2014c, Flood Mitigation Conceptual Design Report, Rev B, 14 March 2014
- Mott MacDonald, 2014d, Flood Mitigation Outline Design, Final Report, Rev C, 19 September 2014
- Mott MacDonald, 2015e, CHP5 Flood Mitigation Outline Design – Modelling of Chanel Alternatives, 29 December 2014

The majority of the baseline information used to information the water aspects of this ESIA was collected as part of the FRA and WRA undertaken between October 2013 and March 2014.

As part of this work, the following baseline information was collected from the NAMEM and USUG:
- Daily precipitation data was supplied by the NAMEM for stations in the vicinity of Ulaanbaatar
- Monthly temperature data was supplied by NAMEM for the Ulaanbaatar station
- Flow data was supplied by NAMEM for stations in the vicinity of Ulaanbaatar

Other organisations were approached including MEGD, (Department of Policy Implementation), Mongolian Water Committee, Environmental and Green Development Agency of Ulaanbaatar City and the Geo-ecological Institute but none had or were able to provide additional relevant information as part of these investigations.

Various background literature covering the hydrology and hydrogeology has been utilised to inform the assessment. Key background documents that have been referred to include:
- Tuul River: Ecology change and water management issues, Geoecological centre of Mongolia Academy of Sciences (MAS)
- The Economic Value of the Upper Tuul Ecosystem, Washington (The World Bank, 2009)
- The Study on Water Supply System in Ulaanbaatar and Surroundings (Japan International Cooperation Agency (JICA), 1995)
- Tuul River Basin Integrated Water Resources Management Assessment Report, Ulaanbaatar MEGD, 2012a)
- Integrated Water Management National Assessment Report, Ulaanbaatar (MEGD), 2012b)
- The Study on City Masterplan and Urban Development Program of Ulaanbaatar City in Mongolia – Flood Prone Areas JICA, undated).

9.3.1.2 Field Surveys

The following investigations and surveys commissioned by the Consortium have been considered as part of consideration of the water aspects:
- Report on Geotechnical Investigation of Proposed CHP Plant of the CHP5 Project, Ulaanbaatar (Soil Trade LLC, 2014) (used in the consideration of the hydrogeological condition).
- Topographic Survey of the site and river channel cross sections in the Khuliin Valley undertaken by Geomasters in November 2013 (used in the FRA analysis).
- Sediment sampling undertaken by Nature Friendly in May 2014 and analysed by Engineering Geodesy LLC (used in the consideration of the sediment transport in each watercourses).

- Water quality sampling was undertaken by Nature Friendly in November 2013 and analysed by the Central Geological Laboratory for chemical and physical parameters at five locations in the Khuliin Valley and analysed by the Department of Nuclear Physics and Technology at the National University of Mongolia for Radiological Quality for four locations in the Khuliin Valley.

9.3.2 Scope of assessment

9.3.2.1 Temporal scope

The hydrology, hydrogeology and flood risk baseline conditions for the Project were assessed using field survey information collected in 2013 and 2014 as well as historic data from literature and online sources. Long term hydrological conditions were incorporated and considered as part of the WRA (Mott MacDonald 2014a) and FRA (Mott MacDonald 2014b).

9.3.2.2 Spatial scope

As part of the hydrology, hydrogeology and flood risk assessment, the AoI includes not just the Project site itself but the areas upstream and downstream or downgradient of the site. As such the AoI includes:

- Areas directly within the land take for the Project.
- Valley areas subject to flood mitigation measures immediately outside of the Project land take, from 100m upstream of the Ulaanbaatar railway bridge to the Happy Valley development.
- Downstream areas in the Khuliin Valley to the confluence with the River Tuul.
- Downgradient areas in the aquifers which includes the Khuliin Valley and the majority of USUG's Central Source well-field in the Tuul Valley.
- Areas which will be temporarily affected during construction, including access routes, site laydown area.

9.3.3 Assumptions and limitations

9.3.3.1 Hydrology

A good understanding of the surface water hydrology was established during the site visit in November 2013 when weather conditions allowed for the examination of all the watercourses. Any minor changes to the watercourses since then are unknown but are considered to be small.

9.3.3.2 Hydrogeology

Though there is comprehensive understanding of the aquifers in the Tuul Valley, in part due to extensive studies such as that undertaken by JICA in the 1990s, there remains uncertainty associated with the groundwater flows and interactions between the surface water and groundwater in the Khuliin Valley. Assumptions based on review and professional judgement of the Geotechnical Investigations (Soil Trade LLC, 2014) and local topography have been made in order to draw conclusions regarding the groundwater flow pathways and surface water – groundwater interactions. Water quality measurements reflect a snapshot of conditions on one day. Though these are considered to be representative there is likely to be some variability in these measurements over time.

9.3.3.3 Flood Risk

In the work undertaken as part of the FRA (Mott MacDonald 2014b) and the Flood Mitigation Outline Design (Mott MacDonald, 2014d) there were some significant limitations in terms of the flood hydrology data. A lack of flood data in the Khuliin Valley and rainfall data in the catchment meant that the US Soil Conservation Service (SCS) approach applied to derive the flood hydrology could not be calibrated. Sensitivity testing was undertaken on the approach and determined that adjustments to rainfall and runoff values used in the assessment do result in changes to the flood hydrology estimates. In deciding on the most appropriate values to adopt for the purposes of design, reference to other studies in the vicinity of Ulaanbaatar has been made. Details regarding the assumptions relating to the hydrological approach are contained in Appendix B of the Flood Mitigation Outline Design (Mott MacDonald, 2014d).

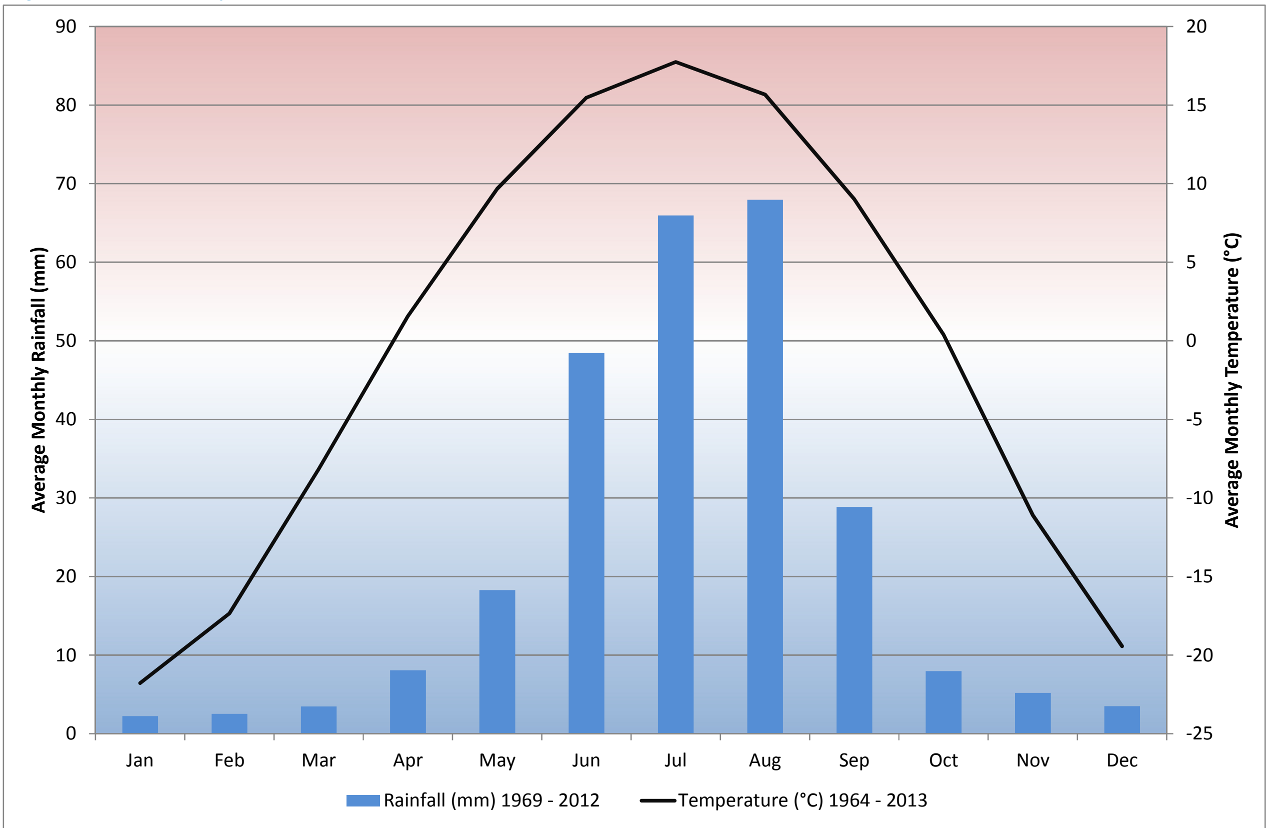
There are also other hydraulic assumptions and limitations associated with the modelling that are detailed in the same report in Section 3.4. However, these are considered secondary to the uncertainties associated with the hydrological aspects discussed above.

9.4 Baseline description

9.4.1 Climatic Background

The climate in Mongolia is semi-arid, with hot summers and cold winters. On the whole, Mongolia receives very little precipitation, with an annual mean value ranging from 55mm in the southern parts of Mongolia, to 400mm in the northern parts of Mongolia (Janchivdorj, 2007). Precipitation comes in two forms in Mongolia, snow from the end of October to the end of March, and rain during the rest of the year. The relationship between monthly temperature and precipitation for Ulaanbaatar is shown in Figure 9.1.

Figure 9.1: Monthly Precipitation and Temperature for Ulaanbaatar



Source: NAMEM data

Most of the long term annual precipitation of 275mm occurs through summer storms in the four months of June to September, the rainfall and snow falling over longer transition and winter months from October to May accounting for only 20% of the annual precipitation.

The river flows of the main Tuul River flowing past Ulaanbaatar and smaller tributaries draining the surrounding mountains emphasise this climatic pattern with early floods discharging due to the snow and ice melts followed by more important floods due to the summer storm activity. Only the Tuul River has a continuous base flow through the summer season until freezing conditions take over. None of the local rivers draining into the Tuul River are perennial including the Khuliin River.

9.4.2 Hydrology

As shown in Figure 9.2 the site is located in an active floodplain. In addition to the Khuliin River which runs through the site, there are three additional watercourses draining into the site, which are referred to as the East Tributary, Northwest Tributary and Southwest Tributary. These are all discussed in the following sections.

9.4.2.1 Khuliin River

The Khuliin River is the main watercourse in the Valley and enters the site at the southern corner close to the railway bridge and runs broadly parallel, yet still meandering, to the eastern edge and leaves the site at the northern corner (Figure 9.2). Photo 9.1 and Photo 9.2 show the Khuliin River at the railway bridge and Photo 9.3 and Photo 9.4 show the Khuliin River further down the Valley as it passes through the Project site.

Lighter areas on the satellite imagery show areas of river deposits (at the confluence with the East Tributary) that are regularly inundated. There is a secondary channel that runs parallel to the main channel through the site and is likely to only carry flow in times of flood, as shown in Photo 9.5 and Photo 9.6.

Photo 9.1: Khuliin River Immediately Upstream of Railway Bridge

Source: MM 1 November 2013

Photo 9.2: Khuliin River Immediately Downstream of Railway Bridge

Source: MM 1 November 2013

Legend

- Hydrology Inflows
- Watercourses
- Dry watercourses (during site visit in Nov 2013)
- CHP5 Site Boundary

Note: Only dry channels in close proximity to the site have been marked

Data Sources
Site Watercourses - Digitised from satellite imagery and observations from site visit
Satellite Imagery - Pleiades 0.5m resolution, dated 24 August 2013

0 200 400 800 M

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Project Title
CHP5 ESIA

Drawing Title
Figure 9.2 Watercourses in Vicinity of the Site

Scale	1:18,000	MM Project No.	330177	Status	INF

GIS File: Figure 9.2 Watercourses in Vicinity of the Site.mxd

Rev P1

Photo 9.3: Khuliin River in Centre of Site – Looking Downstream

Source: MM 1 November 2013

Photo 9.4: Khuliin River at Northern End of Site – Looking Downstream Towards Housing Development (Happy Valley)

Source: MM 1 November 2013

Photo 9.5: Secondary Flood Channel near Centre of Site – Looking Downstream

Source: MM 1 November 2013

Photo 9.6: Secondary Flood Channel near Centre of Site – Looking Upstream

Source: MM 1 November 2013

9.4.2.2 East Tributary

The East Tributary drains part of the eastern side of the Valley and enters the site through the road bridge in the east corner of the site. Remnants of a grouted rock channel exist but it has suffered extensive and severe erosion to the point of destroying the channel and undermining the existing road bridge. Significant material has been deposited within the site boundary. Photo 9.7 and Photo 9.8 show this tributary downstream and upstream of the road bridge.

It is also reported that during times of flooding, water spills over the road (immediately to the south of the road bridge) to form a secondary channel.

Photo 9.7: East Tributary Immediately Downstream of Road Bridge

Source: MM 1 November 2013

Photo 9.8: East Tributary Immediately Upstream of Road Bridge

Source: MM 1 November 2013

9.4.2.3 Northwest Tributary

This tributary drains part of the western slopes of the Khuliin Valley and enters the site through a railway bridge near the northwest corner of the site. As such it impacts only a relatively small area of the site. Photo 9.9 and Photo 9.10 show this tributary upstream and downstream of the railway bridge.

Photo 9.9: Northwest Tributary Immediately Downstream of Railway Bridge

Source: MM 1 November 2013

Photo 9.10: Northwest Tributary Immediately Upstream of Railway Bridge

Source: MM 1 November 2013

9.4.2.4 Southwest Tributary

This tributary also drains part of the western slopes of the Khuliin Valley and enters the site through a box culvert underneath the railway near the southwest corner of the site. Examination of the channel and topography indicated that it drains a steep catchment and requires regular clearing of deposited material. There are indications that at times flows may pass outside of the site along the railway line and drain to the Northwest Tributary. As such this tributary impacts a relatively small area of the site. Photo 9.11 and Photo 9.12 show this tributary upstream and downstream of the railway box culvert.

Photo 9.11: Southwest Tributary Immediately Upstream of Railway Box Culvert

Source: MM 1 November 2013

Photo 9.12: Southwest Tributary Immediately Downstream of Railway Box Culvert

Source: MM 1 November 2013

The site visit and subsequent sediment sampling undertaken in May 2014 identified that although there may be limited occasions throughout the year when sediment transport occurs (due to the generally dry conditions), when there is flow in the channels sediment transport is a significant issue. Whilst the Khuliin River has a relatively constant gradient through the site the East Tributary is much steeper and flattens out at its confluence with the Khuliin River. There are signs of deposition of eroded material at the confluence location. The Southwest Tributary exhibits a similar feature, though there the area of deposition around the railway box culvert is located just outside of the site boundary. Sediment transport is less significant for the Northwest Tributary due to the flatter grassed upstream Valley draining to the railway bridge.

9.4.3 Surface Water Quality

Five surface water quality samples were collected on 11 November 2013 in the Khuliin Valley. The locations of these samples are shown in Figure 9.3 and the results are summarised in Table 9.2 and Table 9.3. Samples have been taken both upstream, downstream and within the site itself along the Khuliin Valley. Samples were not taken from the smaller tributaries as these do not contain flow except in times of flood.

Legend
Radioactivity Monitoring Locations
Water Quality Monitoring Locations
Watercourses
Dry watercourses (during site visit in Nov 2013)
CHP5 Site Boundary

Note: Only dry channels in close proximity to the site have been marked

Data Sources
Site Watercourses - Digitised from satellite imagery and observations from site visit
Satellite Imagery - Pleiades 0.5m resolution, dated 24 August 2013

0 250 500 1,000 M

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Project Title
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Drawing Title
Figure 9.3 Watercourses and Surface Water Quality Monitoring Locations

Scale	MM Project No.	Status
1:24,000	330177	INF

GIS File
Figure 9.3 Watercourses and Surface Water Quality Monitoring Locations.mxd

Rev P1

Table 9.2: Surface Water Quality Results

Sample №	Unit	1	2	3	4	5	Drinking Water Standard	Effluent Discharge Standard
Location		Khuliin River (in site)	Khuliin River (upstream of site)	Spring	Khuliin River (downstream of site)	Khuliin River (near River Tuul confluence)	-	-
Coordinate		47° 52' 05.8"N 107° 06' 39"E	47° 51' 22"N 107° 07' 23.5"E	47° 52' 05.7"N 107° 06' 05.8"E	47° 52' 45.5"N 107° 05' 36.1"E	47° 53' 39.9"N 107° 04' 27.8"E	-	-
Sample taken		05/11/2013 12:32	05/11/2013 13:04	05/11/2013 13:33	05/11/2013 14:59	05/11/2013 11:29	-	-
Lab Sample №		16348	16349	16350	16351	16352	-	-
pH		7.45	7.53	6.9	7.76	7.24	6.5 – 8.5	6 - 9
Potassium (K^+)	mg/L	0.17	0.13	<0.05	<0.05	<0.05	-	-
Sodium (Na^+)	mg/L	8.87	8.97	13.1	8.49	0.05	200	-
Ammoniacal Nitrogen (NH_4^+)	mg/L	0.1	0.1	0.1	0.1	0.3	1.5	6
Calcium (Ca^{2+})	mg/L	31.06	28.06	17.03	30.06	19.04	100	-
Magnesium (Mg^{2+})	mg/L	7.29	6.68	5.47	7.29	4.86	30	-
Chloride (Cl^-)	mg/L	6.74	6.74	6.03	7.44	4.96	350	-
Sulphate (SO_4^{2-})	mg/L	19.75	20.75	23.87	17.28	19.75	500	-
Nitrite (NO_2^-)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	1	
Nitrate (NO_3^-)	mg/L	0.1	0.52	0.92	1.2	0.96	50	-
Carbonate (CO_3^{2-})	mg/L	<1.5	<1.5	<1.5	<1.5	<1.5	-	-
Bicarbonate (HCO_3^-)	mg/L	122.03	106.78	73.22	119	51.86	-	-
Metasilicic Acid (H_2SiO_3)	mg/L	14.17	13.6	23.04	14.59	10.02	-	-
Total Dissolved Solids (practice)	mg/L	152	142	128	152	90	1,000	1,000
Total Dissolved	mg/L	149.3	138.9	126.2	145.9	85.9	1,000	1,000

Sample №	Unit	1	2	3	4	5	Drinking Water Standard	Effluent Discharge Standard
Soilds (calculation)								
Permanganate oxidizing capacity ($KMnO_4$)	mg/L	4	1.2	3.04	3.52	2.4	-	20
Hardness	mg-eq/L	2.15	1.95	1.3	2.1	1.35		7
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01
Cadmium (Cd)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.03	0.03
Total Chromium (Cr)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	-	0.3
Copper (Cu)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	-	0.3
Total Iron (Fe)	mg/L	<0.02	<0.02	0.07	<0.02	<0.02	0.3	1
Nickel (Ni)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.2
Lead (Pb)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.1
Zinc (Zn)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	5	1
Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	-	0.001

Table 9.3: Radioactivity Results

Sample №	Unit	1	2	3	4	Detection Minimum Limit (1L volume per 1 Hour)	Drinking Water Upper Limit (MNS 0900:2005)
Sample Date	-	11/11/2013	11/11/2013	11/11/2013	11/11/2013	-	-
Coordinates	-	47° 52' 05.8"N 107° 06' 39"E	47° 51' 22"N 107° 07' 23.5"E	47° 52' 05.7"N 107° 06' 05.8"E	47° 52' 45.5"N 107° 05' 36.1"E	-	-
Lab Sample №	-	1	2	3	4	-	-
^{214}Pb	Bq/kg	17.2	13.2	11	48.3	0.3	-
^{214}Bi	Bq/kg	25.7	16.5	18.7	54.7	0.5	-
^{222}Rn	Bq/kg	21.4	14.8	14.9	51.5	0.4	100
^{226}Ra	Bq/kg	<0.4	<0.4	<0.4	<0.4	0.4	0.5
^{238}U	Bq/kg	<0.4	<0.4	<0.4	<0.4	0.4	0.185 (0.015mg/L)

However, based on the physical and chemical parameters presented, none of these exceed the drinking water standards. The river water quality was visibly clear suggesting that although some parameters are missing from the analysis it is likely that the natural river water quality is good. It is recommended that additional monitoring is undertaken for the following parameters to determine baseline water quality prior to commencement of site works; biological oxygen demand, chemical oxygen demand, total suspended solids, oil and grease, fat and bacteriological.

The radioactivity results indicate no exceedance of the drinking water standards. However, it is noted that in relation to ^{238}U the minimum level of detection is above the drinking water standard so it is not known if the standard is met in relation to this parameter.

9.4.4 Hydrogeology

9.4.4.1 Regional Hydrogeology

The Tuul River rises in the Khentii mountains to the north east of Ulaanbaatar at an elevation of approximately 2,300m above sea level and is joined by the Terelj River to form a large river basin in the Ulaanbaatar region. This important alluvial Valley separates the massifs surrounding Ulaanbaatar to the north and south. The Project is located within the Khuliin Valley which runs parallel to the Tuul Valley and opens out into the steppe of the Nailaikh depression formed of tertiary (Neogene, Paleogene) and underlying Cretaceous deposits. The hydrogeology of the upper Tuul region is shown in Figure 9.4.

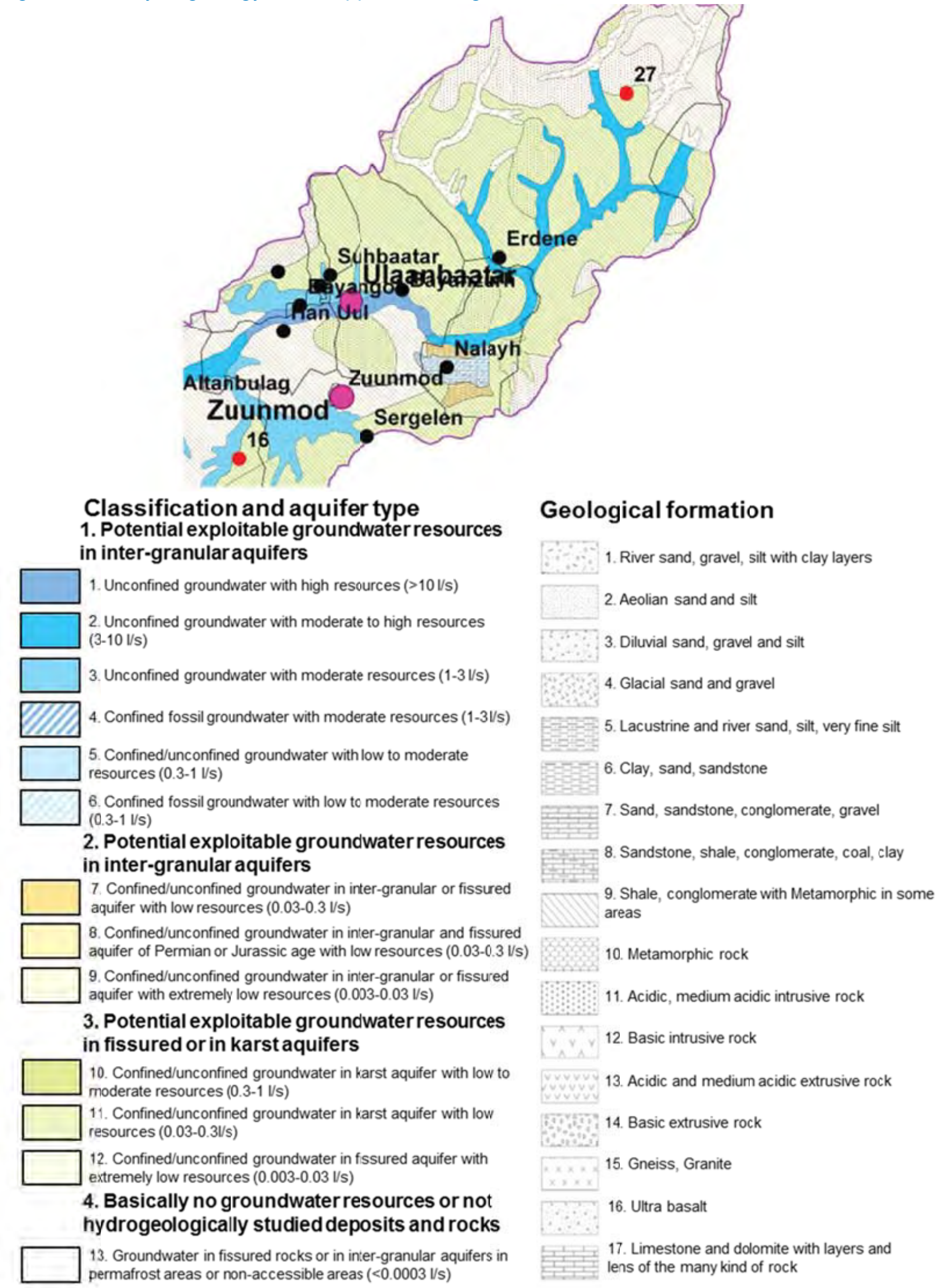
The regional hydrogeology is dominated by the extensive largely unconfined aquifers within the alluvial deposits of the Tuul River valley. There is some relatively limited potential in the alluvial fans of the tributaries and further potential in the fissured and fractured deeper (consolidated) formations, but these are insignificant compared with the aquifers of the Tuul River valley. Recharge to the alluvial aquifers occurs through infiltration from snowmelt, runoff and flooding.

The extensive unconfined alluvial aquifers of the Tuul River Valley sustain more or less all the water supplies of the Ulaanbaatar economy supplying about 80 million m^3 of annual abstraction (equivalent to 220MLD). The exploitation of these continuous Valley wide unconfined aquifers commences some 50km upstream at what is known as the upper source reserve and continues with extensive exploitation through to the confluence of the Boheg River some 20km downstream of the city. The extent of this exploitation by well fields for public water supply is shown in Figure 9.5.

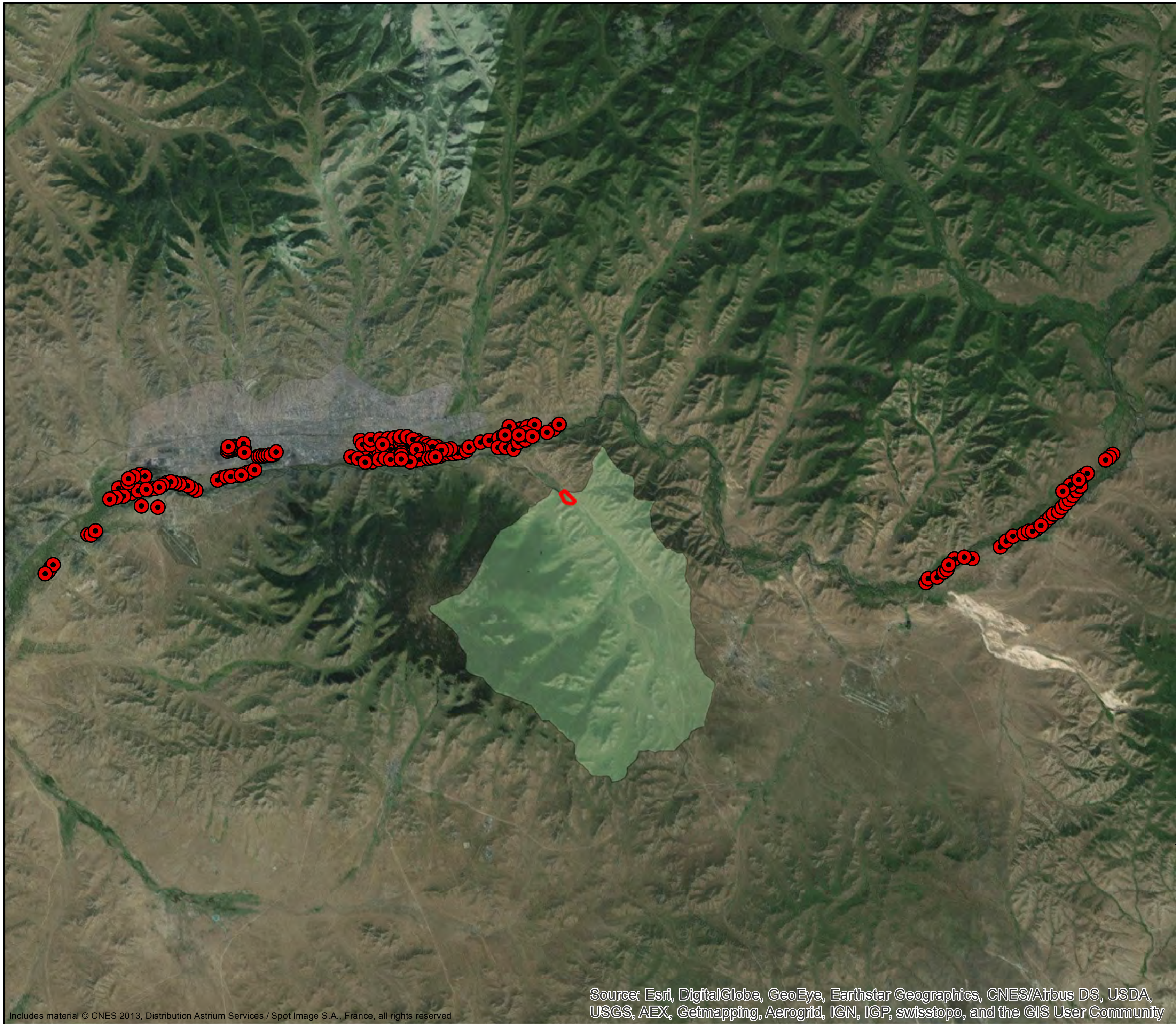
The exhaustive JICA study in the mid-1990's (JICA, 1995) provides a comprehensive understanding of the aquifers which are typically divided into an upper layer of Quaternary and recent sandy gravel deposits, overlying Middle to Late Quaternary deposits which are also sand and gravel, typically the upper layer is more permeable. The thickness of the alluvium ranges between 20m and 70m across the region, with the Valley width varying between 1km and 5km throughout.

The intensive use of the aquifers with the numerous wells, installed and pumping, is understood to have fully captured the exploitable resources, and establishing new wells in the region simply means that the allocation of the water to different end users will take place, not that more water is available.

Figure 9.4: Hydrogeology of the Upper Tuul Region



Source: Adapted from Tuul River Basin Integrated Water Management Plan Pg.41 (MEGD, 2012a)



Legend

- Public water wells
- Ulaanbaatar
- CHP5 Site Boundary
- CHP5 Site Catchment

Data Sources
Public water wells - Nature Friendly

0 3,000 6,000 12,000 M

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Project Title
CHP5 ESIA

Drawing Title
Figure 9.5 Public Water Wells within the Tuul River Alluvium

Scale 1:350,000	MM Project No. 330177	Status INF

GIS File
Figure 9.5 Public Water Wells within the Tuul River Alluvium.mxd

Rev P2

9.4.4.2 Local Hydrogeology

The Khuliin Valley within which the Project is situated is dominated by the Neogene deposits which are not productive aquifers, with only relatively limited alluvial stretches acting as unconfined aquifers.

Similarly to the vast Tuul Valley groundwater resource, the recharge of the alluvial aquifer in the Khuliin Valley occurs through infiltration from snowmelt, runoff and flooding.

A map and cross section following the Khuliin River just southeast of Ulaanbaatar is shown in Figure 9.7 and Figure 9.8 respectively.

Various private groundwater wells are located in the Khuliin Valley. The extent to which they are used for extraction of groundwater is not known, but it is considered likely that some may be used for extraction of water. Given that many of these are unregistered, the locations of these wells are not certain. Whilst one well was identified 600m downstream of the site there may be more located in the Khuliin Valley between 500m and 4km downstream of the site within the ger communities.

As confirmed by the Tuul River Basin Authority on 14 April 2015 a buffer zone of between 200 and 500m of the Khuliin river channel has been designated a SPZ, as specified under the Water Law, with associated restrictions on development, though it should be noted that power plants are exempt from these restrictions as per Clause 2.4 of the legislation. A map showing the locations of the SPZ is shown in Figure 9.6 and it has been confirmed that the site is wholly inside of the exterior area of the SPZ and partially (88.3% of the site) inside the interior area of the SPZ. Whilst the origin of the designation for this area as an SPZ is not known, it is likely to be because there is the potential for limited groundwater resource within the valley.

Figure 9.6: Location of Source Protection Zone in the Khuliin Valley

9.4.4.3 Groundwater Flow and Surface Water Interaction

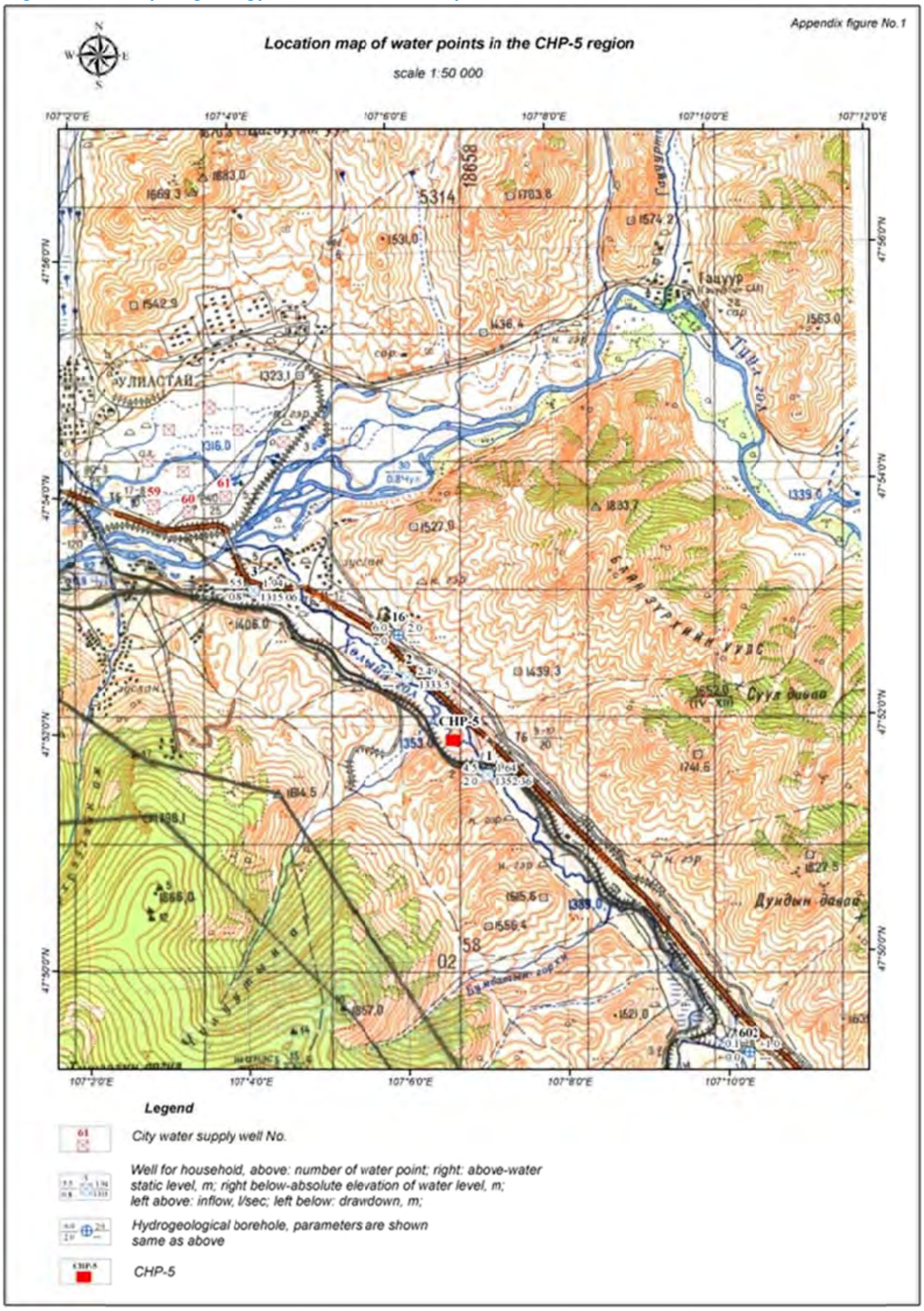
A study is currently in preparation to fully understand the precise interaction between groundwater and surface water and will be available in Q4 of 2015. At this stage the following is known:

- Groundwater within the alluvial deposits flows down gradient in the direction of the river flow
- During periods of snowmelt, runoff from rainfall and flooding, the river recharges groundwater.

In general, when groundwater in unconfined aquifers is lower than river levels, water is lost from the river to the aquifer. Conversely, when groundwater levels are higher than river levels, groundwater will feed the river as baseflow. It is assumed that both situations exist along the Tuul and Khuliin Rivers, depending on location and time of year. Baseflow is likely to exist near the confluence of the Khuliin River into the Tuul River, where the topography flattens.

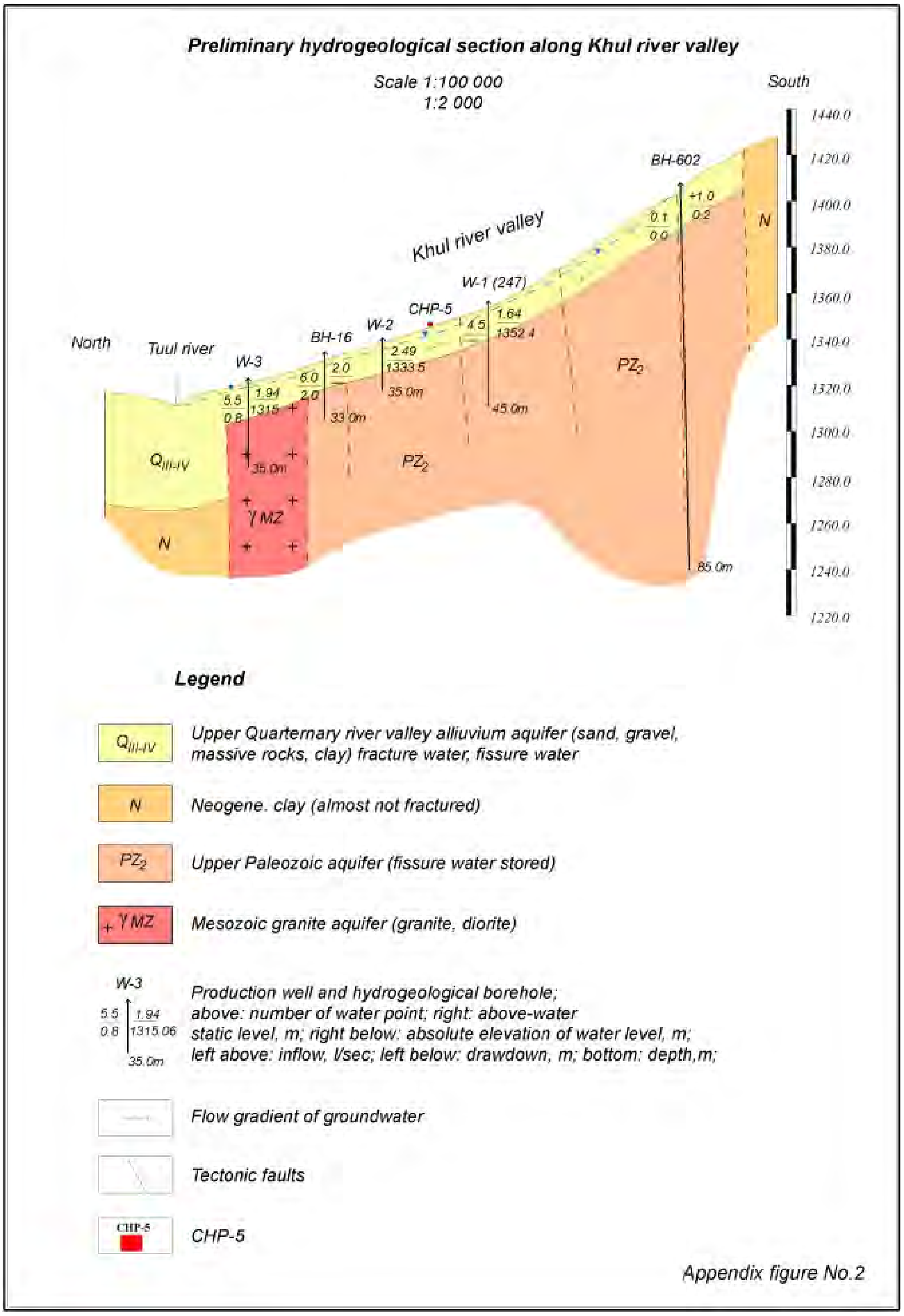
Groundwater present under the Project site is likely to flow down gradient through the alluvial aquifer towards the alluvial aquifers of the Tuul Valley at Ulaanbaatar, where it either continues as groundwater flow or becomes baseflow.

Figure 9.7: Hydrogeology of the Khuliin Valley



Source: Nature Friendly, December 2013

Figure 9.8: Hydrogeological cross section of the Khuliin Valley



Source: Nature Friendly, December 2013

9.4.5 Flood Risk

The Project site encompasses the majority of the width of an active floodplain between the road and railway line, both of which are on either high or raised ground. It is also surrounded by four structures which convey flood waters into the centre of the site: two bridges and one box culvert under the railway line and one box culvert under the road.

A separate FRA was undertaken between 2013 and 2014 (Mott MacDonald, 2014). As part of this flood estimates were derived using the SCS Method and a hydraulic model was developed to route flood flows and assess the risk of flooding in the site. The FRA contains details of the methodologies, analyses and modelling undertaken to assess the flood risk to the site. The following sub-section contains a summary of the results of this flood risk assessment. The flood estimates are summarised in Table 9.4.

Table 9.4: Peak Flow Discharge Estimates for Catchments

	Peak Discharge (m^3/s)				
Catchment	1-in-2 year	1-in-10 year	1-in-100 year	1-in-200 year	1-in-500 year
Upstream Khuliin	23.8	130.5	395.2	504.4	668.7
East Tributary	2.4	13.6	40.7	51.6	67.9
Northwest Tributary	1.8	16.0	61.7	81.3	112.3
Southwest Tributary	0.2	1.4	4.0	5.0	6.5

These flows were routed through the HEC-RAS hydraulic model and water levels were derived. These were compared against the site topographic data using GIS software to derive flood extent maps. The flood extents for the 1 in 10 year and 1 in 200 year return periods are shown in Figure 9.9 and Figure 9.10 as examples. All water level results and flood extents are included as part of the FRA (Mott MacDonald 2014b)[19]. Table 9.5 summarises the extents of flooding and average water depths under the different return periods.

Table 9.5: Extent of Flooding and Water Depth within Project Site for 1 in 10 to 1 in 500 Year Return Periods

Return Period	Inundated Area (km^2)	Percentage of site inundated (km^2)	Average Water Depth (m)
1 in 10 years	0.18	41%	0.50
1 in 100 years	0.32	74%	0.64
1 in 200 years	0.34	80%	0.72
1 in 500 years	0.36	84%	0.84

This shows that during the more frequent 1 in 10 year flood 41% of the site is flooded to an average depth of 0.50m. In the design return period of 1 in 200 years 80% of the site is flooded to an average depth of

[19] The hydraulic model was further developed and improved as part of the development of the flood mitigation measures for the site which cumulated in the Flood Mitigation Outline Design Report (Mott MacDonald, 2014d). As such the water levels stated in the FRA and used in the flood maps were revised. However, the flood maps were not updated due to the relatively small changes in water levels and fact this had a negligible impact on the conclusions drawn.

0.72m. There is not a significant difference in the area of the site flooded between the 1-in-100 year and 1-in-500 year flood events. The principal difference relates to the average depth of water. This is a reflection of the fact that in all these three flood events the majority of the floodplain, and site, is inundated. Only small areas close to the road are not flooded in the 1 in 200 year event (and lower return period events).

These results confirm the conclusions reached following the site visit that the current site is a poor location in terms of flood risk due to the extent of flooding across the site. The water courses tend to be mobile, eroding their banks and subject to flash flooding. As seen from the flood flow estimates, the main flood risk posed to the site is from the Khuliin River.

The modelling also identified that there was a flood risk posed to the existing structures in the vicinity of the site. All of these structures are likely to have been designed to lower standards of protection, suitable for road and rail infrastructure, than for critical infrastructure such as a power plant. As such in more extreme events (e.g. 1 in 200 year return period) there is a risk of overtopping and or failure of the East Tributary road bridge and the Ulaanbaatar Railways bridge over the Khuliin River. This could increase the impact of floods at the site if water impounded behind these structures is suddenly released when these structures fail. Risks associated with the Ulaanbaatar Railways bridge will be addressed in the feasibility study to be undertaken for the rail connection to the Project.

Legend

- Site Watercourses
- CHP5 Site Boundary
- Flood Mapping Boundary
- Flood Extent M1-10

Data Sources
Site Watercourses - Digitised from satellite imagery and observations from site visit
Satellite Imagery - Pleiades 0.5m resolution, dated 24 August 2013

0 50 100 200 M

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Project Title
CHP5 ESIA

Drawing Title
Figure 9.9 1 in 10 Year Flood Extent

Scale	MM Project No.	Status
1:5,500	330177	INF

GIS File
Figure 9.9 1 in 10 Year Flood Extent.mxd

Rev P2

Legend

- Site Watercourses
- CHP5 Site Boundary
- Flood Mapping Boundary
- Flood Extent M1-200

Data Sources
Site Watercourses - Digitised from satellite imagery and observations from site visit
Satellite Imagery - Pleiades 0.5m resolution, dated 24 August 2013

0 50 100 200 M

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Project Title
CHP5 ESIA

Drawing Title
Figure 9.10 1 in 200 Year Flood Extent

Scale	MM Project No.	Status
1:5,500	330177	INF

GIS File
Figure 9.10 1 in 200 Year Flood Extent.mxd

Rev P2

9.5 Impact identification and assessment

9.5.1 Construction Phase

9.5.1.1 Hydrology

Consideration of the hydrological impacts associated with the construction phase has been separated into channel morphology, sediment transport and water quality, as discussed in the following sub-sections.

Channel Morphology and Sediment Transport

With the raising of the site levels and introduction of diversion channels for the Khuliin River and tributaries, the natural floodplain and river morphology is being fundamentally altered through the site area. The required flood mitigation measures to protect the site are significant and permanent alterations to the natural drainage patterns.

Excavations, temporary earth movements and the construction of access roads may have an impact on channel connectivity and sediment transport across the site area. In areas of steeper gradient there is a risk of uncontrolled storm water runoff and erosion.

The unmitigated magnitude of impact is considered to be major. The sensitivity of the receptors is considered to be medium. As such the significance of impact has been determined as **major adverse**.

Surface Water Quality

There are a variety of activities and processes during the construction of the plant that have the potential to negatively impact on the surface water quality through discharges to the Khuliin River. These aspects include:

- Exposure of soils as a result of excavation and the removal of vegetation and compaction of soils as a result of heavy vehicle movements could contribute to increased runoff and suspended solids in the Khuliin River, as well as mobilising naturally occurring metals and metalloids, resulting in reductions in surface water quality.
- Improper use, storage and handling of hazardous materials associated with operation activities (including oils, lubricants, fuels used in maintenance activities and from vehicles, and cement) could result in localised contamination of surface water features.

The unmitigated magnitude of impact for the downstream watercourse and communities in relation to potential reductions in water quality are considered to be moderate. The sensitivity of the receptors is considered to be medium. As such the significance of impact has been determined as **moderate adverse**.

9.5.1.2 Hydrogeology

Consideration of the hydrogeological impacts associated with the construction phase has been separated in terms of the groundwater resource and in terms of the potential for groundwater contamination, as discussed in the following two sub-sections.

Water Resources

The vast majority of the water supply for the Ulaanbaatar economy is from groundwater, specifically from the extensive unconfined alluvial aquifers of the Tuul River Valley. Based on the findings of the WRA completed for the Project, the intensive use of the aquifers with the numerous wells, installed and pumping, is understood to have fully captured the exploitable resources when considering the city of Ulaanbaatar as a whole, leaving limited spare capacity. As such the principal impact of the Project in terms of water resources is that at times it may result in less water available for other users in Ulaanbaatar and surrounding vicinity.

It is intended that a WSA is put in place with USUG for the Project to be supplied as an industrial customer via a piped water supply. The Project requires 10-11MLD in winter to include the District Heating component and 2– 3MLD in summer. Provision of water by USUG, likely to be from the Upper Source wells, would ultimately mean the allocation of the water to different end users, not that more water is available.

The unmitigated magnitude of impact in relation to the water resources are considered to be moderate. The sensitivity of the receptors is considered to be medium. As such the significance of impact has been determined as **moderate adverse**.

Groundwater Contamination

There are a variety of activities and processes during the construction of the plant that have the potential to negatively impact the groundwater quality of the Khuliin Valley, designated as a SPZ, through discharges to and contamination of the ground. Since the groundwater reserves in the Tuul Valley, which form a large part of the water supply for Ulaanbaatar, are down-gradient of the Khuliin Valley, there is potential for longer term negative impacts on the groundwater quality in the Tuul Valley as well. Potentially contaminating aspects are discussed in detail in the Ground Conditions chapter (Chapter 12) and include, for example, the degradation of groundwater quality as a result of accidental leaks and spills of hazardous materials (including waste) during their transport, storage, handling and disposal.

Development on the alluvial floodplain and diversion channel may reduce recharge to the local aquifer within the site area because of the large area of hard standing. With the site drainage system routing runoff to the downstream end of the site the distribution of aquifer recharge may be changed. The unmitigated magnitude of impact for the groundwater in relation to potential deterioration in quality of the groundwater and drinking water supply are considered to be minor. The sensitivity of the receptors is considered to be high as downstream of the site is used for drinking water. As such, the impact has been determined as **moderate adverse** significance.

9.5.1.3 Flood Risk

Consideration of the flood risk impacts associated with the construction phase has been separated into the flood risk posed to the site itself, the impacts associated with construction in an active floodplain and the flood risk posed to downstream areas, as discussed in the following sub-sections.

Flood Risk to the Site

The risk posed by flash flooding to the site is significant and the impacts associated with flooding events are potentially extreme. The required diversion and channelization of the watercourses and replacement of structures as outlined in Section 2.6 will involve 14 equivalent months (excluding winter downtime) of construction according to the programme schedules. During this period prior to the site being protected from flooding there are variety of potential risks to construction activities as a result of natural riverine processes which have the potential to:

- Cause risk to life for personnel working on site and residents in the local area; this is exacerbated by the short response time of the catchment to rainfall events and high flow velocities.
- Cause failure of the upstream bridge and culvert structures, particularly the Ulaanbaatar Railway bridge over the Khuliin River immediately upstream of the site but also the road culvert over the East Tributary. This could consequently exacerbate flooding in the site and cause disruption to transport links to the site.
- Cause physical damage to the site infrastructure, particularly during construction of the diversion channel and mitigation measures, due to inundation by flood water and damage due to the velocity of flood water as well as the transport of eroded material.
- Limit access to the site facilities during wet conditions and flood events.
- Contamination of watercourses and a reduction in water quality as a result of the exposure of onsite chemicals, and other site materials to flood waters.

The unmitigated magnitude of impact is considered to be major. The sensitivity of the receptors is also considered to be high. As such the significance of impact has been determined as **major adverse**.

Flood Risk to Downstream Areas

The required diversion and channelization of the watercourses to protect the site from flooding has an impact on the communities that live downstream of the site. For the Valley area 200m immediately downstream of the site there is a modest increased risk of flooding due to higher flood velocities and flood levels than existing. At the time of writing, this area had been developed for housing (referred to as the Happy Valley development). Although largely developed (housing structures have been erected), the Happy Valley remains unoccupied; therefore, is not at risk of being negatively impacted in terms of flood risk by the development of the Project.

However, between the Happy Valley development and the confluence with the Tuul River (an approximate distance of 4km), the communities are already at risk of flash flooding. Fenced compounds containing a ger and other structures often back onto the river and are located in the low-lying floodplain. Whilst the Project does not increase the extent or depth of flooding occurring in these downstream areas, the channelization of flood flows does speed up the onset of flooding and it reduces the time available (by up to approximately 10 minutes) for communities downstream of the site (to the confluence with the Tuul River) to respond to a flood event following rainfall. Even though there may only be a few hours available anyway to respond to flooding this reduction in time available is not proportionally high.

The unmitigated magnitude of impact for the downstream communities in relation to increased flood risk is considered to be minor. The sensitivity of the receptors is also considered to be high. As such the significance of impact has been determined as **moderate adverse**.

9.5.2 Operational Phase

9.5.2.1 Hydrology

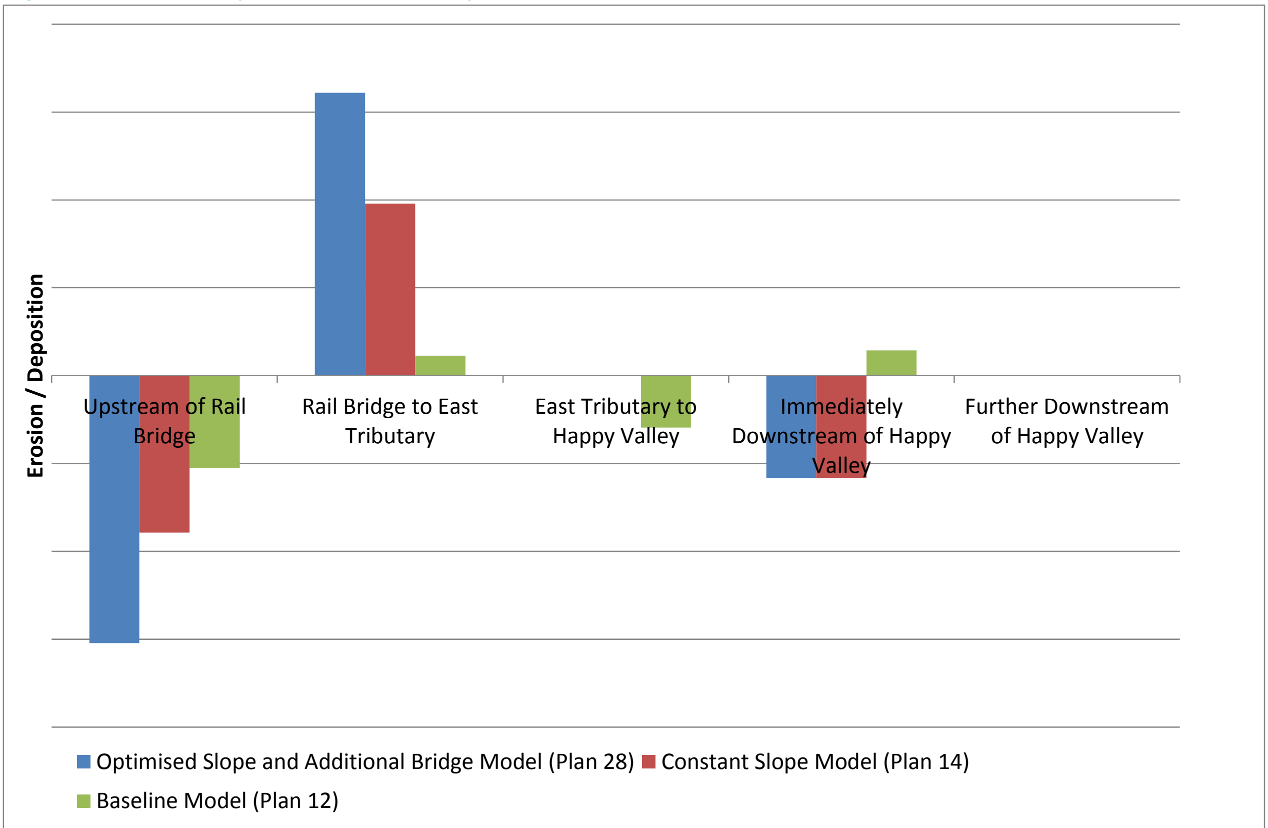
Consideration of the hydrological impacts associated with the operational phase has been separated into channel morphology, sediment transport and water quality, as discussed in the following sub-sections.

Channel Morphology and Sediment Transport

With the raising of the site levels and introduction of diversion channels for the Khuliin River and tributaries, the natural floodplain and river morphology is being fundamentally altered through the site area. The required flood mitigation measures to protect the site are significant and permanent alternations to the natural drainage patterns and sediment transport processes in the valley.

As part of the Flood Mitigation Outline Design Report, a sediment impact assessment was undertaken using the Sediment Impact Assessment Model (SIAM) module in HEC-RAS hydraulic modelling software. This identified the relative areas of sediment erosion and deposition through the site over a one year period. The results are shown in Figure 9.11.

Figure 9.11: Summary from Sediment Analysis



Note: Y-axis is dimensionless. Negative values indicate bed degradation (erosion) and positive values indicate bed aggradation (deposition).
Source: Flood Mitigation Outline Design Report (Mott MacDonald, 2014d)

The results indicate that in both design options, the changes in bed degradation and aggradation are more significant than the existing situation (baseline model). As a result of the implementation of the diversion channel there will be more erosion upstream of the Ulaanbaatar railway bridge. If this eroded material is not transported completely through the diversion channel (likely, except in larger flood events) it will be deposited in the channel both from the Khuliin River and East Tributary. Over time this could reduce the effectiveness of the diversion channel. The channel lining will prevent the erosion of material within the site area and as a result there may be a reduced supply of material at the end of the diversion channel. This downstream area may consequently be subject to increased erosion.

Over time natural meandering of the channels could serve to undermine the flood mitigation measures (both the structures outside the site boundary, and the diversion channels themselves) through erosion. Increased erosion may also result in bank instability and damage to other infrastructure. Alternative flow routes that pose a risk to the site may develop due to the deposition and erosion of material.

The unmitigated magnitude of impact is considered to be major. The sensitivity of the receptors is considered to be medium. As such the significance of impact has been determined as **major adverse**.

Surface Water Quality

Stormwater drainage from the coal stockyard and materials handling system has the potential to negatively impact on the surface water quality through discharges to the Khuliin River.

The unmitigated magnitude of impact for the downstream watercourse and communities in relation to potential reductions in water quality are considered to be moderate. The sensitivity of the receptors is also considered to be medium. As such the significance of impact has been determined as **moderate adverse**.

Hydrogeology

Consideration of the hydrogeological impacts associated with the operational phase has been separated in terms of the groundwater resource and in terms of the potential for groundwater contamination, as discussed in the following two sub-sections.

Groundwater Resources

Based on the findings of the WRA completed for the Project, the intensive use of the aquifers with the numerous wells, installed and pumping, is understood to have fully captured the exploitable resources when considering the city of Ulaanbaatar as a whole, leaving limited spare capacity. As such the principal impact of the Project in terms of water resources is that at times it may result in less water available for other users in Ulaanbaatar and surrounding vicinity.

It is intended that a WSA is put in place with USUG for the Project to be supplied as an industrial customer via a piped water supply.

USUG are currently undertaking a study to assess the viability of supplying the Project and will consider these impacts in more detail. The equitable supply of water to the Project and to other users will be the responsibility of USUG. However, the impact of the Project may result in reduced water availability for other users in Ulaanbaatar and the surrounding vicinity, when holistically considering the water resources of the city.

The unmitigated magnitude of impact in relation to the water resources are considered to be moderate. The sensitivity of the receptors is considered to be medium. As such the significance of impact has been determined as **moderate adverse**.

Groundwater Contamination

There are a variety of activities and processes during the operation of the plant that have the potential to negatively impact the groundwater quality of the Khuliin Valley, designated as a SPZ, through discharges to and contamination of the ground. Since the groundwater reserves in the Tuul valley, which form a large part of the water supply for Ulaanbaatar, are down-gradient of the Khuliin Valley there is potential for longer term negative impacts on the groundwater quality in the Tuul Valley as well. Potentially contaminating aspects are discussed in detail in the Ground Conditions chapter and in summary include:

- Degradation of groundwater quality as a result of accidental leaks and spills of hazardous materials (including waste) during their transport, storage, handling and disposal.
- Degradation of the groundwater quality as a result of drainage discharge to ground as a result of poorly managed drainage, or untreated/ insufficiently treated waste water.
- Storage of lignite coal and fuel ash and the generation of leachates with the potential to impact groundwater quality over time if the lining is compromised.

Development on the alluvial floodplain and diversion channel may reduce recharge to the local aquifer within the site area because of the large area of hard standing. With the site drainage system routing runoff to the downstream end of the site the distribution of aquifer recharge may be changed.

The unmitigated magnitude of impact for the groundwater in relation to potential deterioration in quality of the groundwater and drinking water supply are considered to be moderate. The sensitivity of the receptors is considered to be high. As such the significance of impact has been determined as **major**.

9.5.2.2 Flood Risk

Consideration of the flood risk impacts associated with the operational phase has been separated into the flood risk posed to the site itself and the flood risk posed to downstream areas, as discussed in the following sub-sections.

Flood Risk to the Site

The risk posed by flash flooding to the site is considered to be similar for the construction phase of the Project. However, given that the operational phase will be over a significantly longer period of time than the construction phase there is significantly increased likelihood of flood events occurring in the Khuliin Valley.

Additional impacts to those listed for the construction phase are that:

- Flash flooding could cause operational shutdown due to flooding of water-sensitive infrastructure on the site.
- Future development in the catchment could have an adverse impact on the flood risk at the site itself.

The unmitigated magnitude of impact without mitigation is considered to be major. The sensitivity of the receptors is also considered to be high. As such the significance of impact has been determined as **major**.

Flood Risk to Downstream Areas

The flood risk posed to downstream areas are considered to be similar for the construction phase of the Project. However, given that the operational phase will be over a significantly longer period of time than the construction phase there is significantly increased likelihood of flood events occurring in the Khuliin Valley.

9.6 Mitigation and enhancement measures

9.6.1 Incorporated in Project Design

The design of the Project has taken into consideration the hydrological, hydrogeological and flood risk sensitivities, with the aim to avoid significant impacts in relation to these aspects, as discussed in the following sections.

Channel Morphology and Sediment Transport

It is difficult to fully mitigate against the negative impacts on channel morphology and sediment transport in the Project Design but some mitigation measures can be applied. These include:

- Location of the diversion channels to mirror the current location of the Khuliin River where possible.
- Bends in the diversion channel to be gradual where possible.
- A flow transition area to be incorporated into the design in order to 'transition' the river flow back to natural condition.
- Erosion protection measures to be incorporated into the design upstream of all the diversion channels and structures in order to reduce the risk of erosion and potential undermining of the channels and structures.
- Refinement of the flood relief channel slope at the detailed design stage to help to reduce the risk of bank erosion, deposition in the channel and undermining of the flood relief channel at the upstream end.

Surface Water Quality

The following aspects of the design have been incorporated to mitigate against surface water quality impacts:

- Effluent discharge directly to the USUG sewerage system.
- Oily wastewater treatment including an oily water collection pond for primary treatment and two Corrugated Plate Interceptor (CPI) secondary treatment units.
- Recycling of coal contaminated water following clarification and filtration in the coal yard storm water pond.
- Sanitary wastewater to be directly discharged to the USUG sewerage system.
- Chemical wastewater to be collected and stored in a neutralization basin for batch treatment. Water is purified through a pressure filter for residual particles and an activated carbon filter for organic matter and suspended solids. Water will be reused in the coal and ash area prior to eventual discharge to the USUG sewerage system. Boiler blowdown water is also reused after chemical adjustment
- Coal yard stormwater will be collected and clarified in the coal yard storm water pond before being discharged to the USUG sewerage system or reused for dust suppression
- Ash yard stormwater will be collected and discharged to sand filters before being transferred to the pH regulating pond.

Water Resources

The mitigation measures incorporated in the Project design to address water resources issues include:

- Wastewater treatment and reuse on site
- Supply of water as an industrial customer from USUG allows for the best holistic management of the water demands for Ulaanbaatar and avoids competition over water supply
- Identify outer areas within the site which can be vegetated to allow for infiltration and groundwater recharge.

Groundwater Contamination

The mitigation measures incorporated in the Project design to address groundwater contamination issues include:

- Suitable storage, handling and disposal of hazardous materials in line with the Environmental Management Plan, including but not limited to use of drip trays, bunding and oil interceptors, and training for operatives
- Coal will be stored in clay lined compounds with drainage collection and treatment
- The site will have a drainage system for collection of storm water, domestic sewerage and operational wastewater
- Wastewater (chemical, oily water and storm water) will be treated onsite in the dedicated Wastewater Treatment Facility before discharge to a water recycling pond or to the USUG sewerage system
- Water storage ponds will be suitably lined and will be designed for storm water drainage.
- Effluent discharge directly to the USUG sewerage system.

Flood Risk to the Site

The mitigation measures to address flood risk to the site are an integral part of the Project design and consist of diversion channels, replacement structures, erosion protection measures and a flow expansion area. These are discussed in detail in Section 2.6. These mitigation measures are likely to provide a standard of protection to the site of between 1 in 100 years and 1 in 200 years. However, due to the hydrological and hydraulic uncertainties associated with the analyses, refinement of the design of the indicated mitigation measures may be required during detailed design to meet the required standard of protection, without that changing the overall nature of the mitigation measures proposed.

Flood Risk to Downstream Areas

The principal mitigations in relation to the increased flood risk to the Valley area 200m immediately downstream of the site is to work in conjunction with the relevant GoM agencies to ensure that long-term development is restricted in this area and also that the use of this land for the flow expansion area can be approved.

9.6.2 Construction Phase

Channel Morphology and Sediment Transport

The following mitigation measures will be applied on the Project:

- Construction of a temporary diversion channel for the Khuliin River in the first 3 months of the schedule prior to construction of the permanent diversion channel
- Implementation of temporary roads and drainage system as part of site preparation at the beginning of construction.
- Appropriate sequencing of temporary diversions and implementation of flood mitigation measures to ensure that channel connectivity is maintained throughout the construction period.

Surface Water Quality

The following mitigation measures will be applied on the Project:

- Further surface water quality baseline monitoring to be undertaken prior to commencement of construction.
- Avoid water wastage
- Undertake the appropriate storage, use and disposal of chemicals and wastes on site, including use of drip trays and designated, concrete work areas, to avoid possible discharges to local watercourses;
- Using spill kits on site and training staff in their use to avoid the discharge of chemicals and wastes to local watercourses
- Reduce the amount of sediment generated via stockpile coverings, erosion control blankets, paving expose areas, wetting down of exposed areas etc.
- Reduce the amount of sediment that leave site via sediment collection traps, silt fences and good site housekeeping
- Monitor water quality upstream and downstream of the site during construction to identify potential issues
- Test water quality from effluent treatment systems discharges prior to commencement of operation
- Landscaping to avoid steep slopes in the site area and in the vicinity of the flood mitigation measures
- Reinstatement of disturbed ground with vegetation cover.

Water Resources

The following mitigation measures will be applied on the Project:

- Avoid water wastage through procurement of water efficient equipment and fittings
- Minimise water usage in construction processes through best practice and use of water efficient technologies
- Raise awareness of water usage with staff
- Monitoring and prompt repairing of leaks.

Groundwater Contamination

The following mitigation measures will be applied on the Project during construction:

- Use best practice construction methodology
- Undertake a routine monitoring programme, during construction, to provide early warning of impacts to groundwater such that these can be managed before they become significant
- Development of an Emergency Preparedness and Response Plan (EPRP) and Spill Prevention and Response Plan in accordance with local, IFC and EHS guidance.

Construction in an Active Floodplain

The following mitigation measures will be applied on the Project:

- Construction of a temporary diversion channel for the Khuliin River in the first three (3) months of the schedule prior to construction of the permanent diversion channel. Temporary diversion of other tributaries where they could affect construction activities.
- Implementation of temporary roads and drainage system as part of site preparation at the beginning of construction.
- Appropriate sequencing of implementation of flood mitigation measures to ensure that channel connectivity is maintained throughout the construction period and areas of the site or equipment are not put at risk of flooding
- Designated flood evacuation areas on higher ground and staff briefings about the flood safety issues when operating in close proximity to water and in an active floodplain.
- Storage of chemicals, fuel and other construction materials in appropriately bunded and lined areas outside of the natural floodplain.

Flood Risk to Downstream Areas

The principle mechanism to mitigate against the slightly reduced time available for the downstream communities to respond to flooding is through the development of a simple flood warning system, such as emergency sirens. This should be undertaken in conjunction with NAMEM. The proposed areas to be covered by a warning area are shown in Figure 9.12. With the implementation of such a solution there is the potential to bring a positive impact when compared to the existing situation.

9.6.3 Operational Phase

Channel Morphology and Sediment Transport

During the operation of the project it will be necessary to keep the flood relief channels well maintained through the following mitigation measures:

- Removal of sediment deposited in the channel to ensure the diversion channel provides the required standard of protection
- Since the flood relief channel interferes with the natural processes of erosion and deposition it is recommended that any removed material is re-deposited at the downstream end of the diversion channel in order to mimic the natural transport processes
- The channels, structures and erosion protection measures should be inspected annually following the summer in order to:

  - identify any damaged areas in need of repair
  - identify any signs of river meandering or realignment that might affect the integrity of the flood mitigation measures or encourage alternative flood flow routes.

Surface Water Quality

The following mitigation measures will be applied on the Project:
- Avoid water wastage.
- Undertake the appropriate storage, use and disposal of chemicals and wastes on site, to avoid possible discharges to local watercourses.
- Using spill kits on site and training staff in their use to avoid the discharge of chemicals and wastes to local watercourses.
- Monitor areas of soil erosion within the site and around the flood mitigation measures and re-instate disturbed ground with vegetation or provide other mitigation to prevent erosion.
- Monitor water quality upstream and downstream of the site to identify potential issues and recommend mitigation as required in order to prevent contamination / discharges to the local watercourses.

Water Resources

The following mitigation measures will be applied on the Project:
- Minimise water usage in maintenance processes through best practice and use of water efficient technologies
- Raise awareness of water usage with construction and operational employees
- Monitoring and prompt repairing of leaks

Groundwater Contamination

The following mitigation measures will be applied on the Project:
- Use best practice construction methodology.
- Undertake baseline surveys of groundwater quality, and maintain an ongoing monitoring programme, during operation, to provide early warning of impacts to groundwater such that these can be managed before they become significant.
- Development of an EPRP and Spill Prevention and Response Plan in accordance with local, IFC and HSE guidance.
- In accordance with the site ESMMP, on-going monitoring and maintenance of the drainage system will be undertaken.

Flood Risk to the Site

The following mitigation measures will be applied on the Project in addition to the measures developed as part of the design of the Project:
- Monitor and inspect the diversion channels and flood mitigation structures to ensure that they remain well maintained.
- Clear deposited material from the channels to ensure that their design capacity is maintained.

- Review the channel performance following any major flood event.
- Liaise with GoM to implement development controls in the catchment to prevent increased flood risk to the site. These are shown in Figure 9.13 and Figure 9.14.

Flood Risk to Downstream Areas

The principle mechanism to mitigate against the slightly reduced time available for the downstream communities to respond to flooding is through the development of a simple flood warning system, such as emergency sirens. This should be undertaken in conjunction with NAMEM. The proposed areas to be covered by a warning area are shown in Figure 9.12. With the implementation of such a solution there is the potential to bring a positive impact when compared to the existing situation.

Legend

- Watercourses
- CHP5 Site Boundary
- Proposed Flood Warning Areas

Notes

Hatched areas do not correspond to flooded areas but relate to the approximate valley area containing the communities at risk of flooding. This marked area is indicative only and not definitive as flood risk may extend outside this area, particularly in the area close to the confluence with the Tuul River.

Implementation of a flood warning system for the Khulin Valley such as emergency sirens would need to cover all marked areas.

Data Sources

Site Watercourses - Digitised from satellite imagery and observations from site visit

Satellite Imagery - Pleiades 0.5m resolution, dated 24 August 2013

0 250 500 1,000 M

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Project Title

CHP5 ESIA

Drawing Title

Figure 9.12 Proposed Areas Covered by Flood Warning System

Scale	MM Project No.	Status
1:20,000	330177	INF

GIS File

Figure 9.12 Proposed Areas Covered by Flood Warning System.mxd

Drawing Number MMD-331600-C-DR-0012

Rev P1

Notes

General - Downstream Development Constraints apply in the area between the railway line and road immediately downstream of the site due to its potential to cause increased flood risk to the CHP5 site.

Red - No Development
This area forms the "flow transition area" immediately downstream of the site and should not be used for other development due to its potential to increase levels of flood risk at the CHP5 site.

Amber - No embankments / bridges / impoundments
Development of constrictions on flow in the valley in this area should be avoided. This would include dams, embankments and bridges crossing the valley. Footbridges and other developments that do not significantly restrict flood flows can be allowed.

Legend

Watercourses
CHP5 Site Boundary
Downstream Development Constraints
No embankments / bridges / impoundments
No new development

Data Sources
Site Watercourses - Digitised from satellite imagery and observations from site visit
Satellite Imagery - Pleiades 0.5m resolution, dated 24 August 2013

0 125 250 500 M

Client
GDF SUEZ Energy Asia Co. Ltd.

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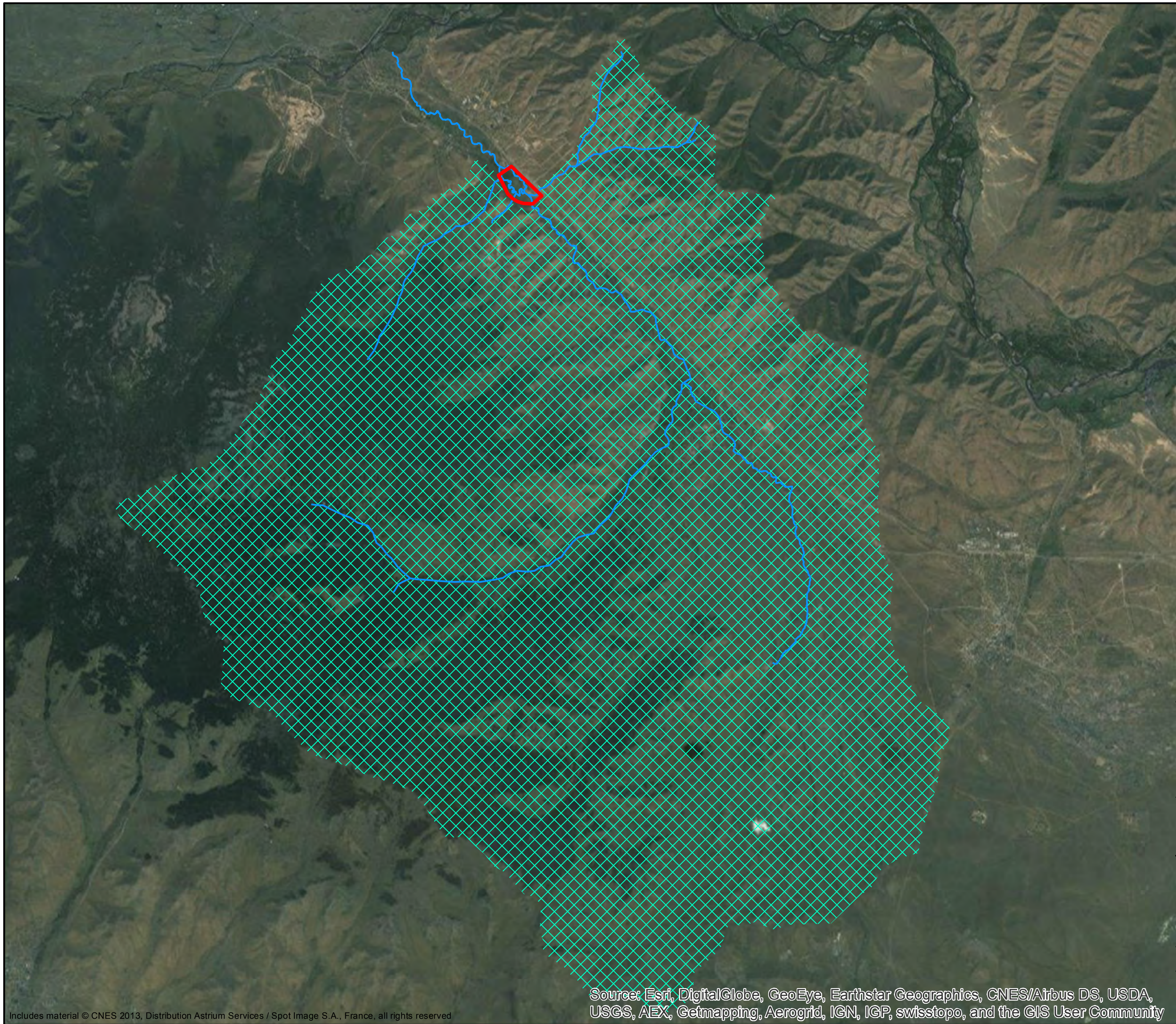
Project Title
CHP5 ESIA

Drawing Title
Figure 9.13 Proposed Khulin Valley Downstream Constraints on Development

Scale	MM Project No.	Status
1:10,000	330177	INF

GIS File
Figure 9.13 Proposed Khulin Valley Downstream Constraints on Development.mxd

Drawing Number MMD-331600-C-DR-0013 Rev P1



Legend

- CHP5 Site Boundary
- Watercourses
- Dam / Reservoir Development Constraints

Notes

Hatched areas marked "Dam / Reservoir Development Constraints" indicate areas where development of dams, reservoirs or significant water retaining structures (anything with a capacity over 10,000m3) should be avoided and requires consultation with CHP5 site owner due to the risk of potential failure of a structure and inundation of the CHP5 site.

This marked area has been derived based on the upstream catchment area draining to the CHP5 site.

Data Sources

Site Watercourses - Digitised from satellite imagery and observations from site visit

Satellite Imagery - Pleiades 0.5m resolution, dated 24 August 2013

0 1,500 3,000 6,000 M

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Project Title

CHP5 ESIA

Drawing Title

Figure 9.14 Proposed Khulin Valley Upstream Constraints on Development

Scale	MM Project No.	Status
1:120,000	330177	INF

GIS File

Figure 9.14 Proposed Khulin Valley Upstream Constraints on Development.mxd

Drawing Number MMD-331600-C-DR-0014

Rev P1

9.7 Residual impacts

Without mitigation, the Project would have a number of major adverse effects in terms of flood risk and potential contamination of groundwater. These effects will be significantly reduced through the responsible implementation of the mitigation measures, which are described in Section 9.6.

After the successful implementation of the mitigation, there remain some residual effects that have some significance and include:

- Hydrology
  - The natural floodplain and river morphology will be fundamentally altered through the site area. The required flood mitigation measures to protect the site are significant and permanently reduce the channel connectivity across the site and alter the natural drainage patterns.
  - There remains a minor risk to surface water quality downstream of the Project and the communities that use the river as a result of potential accidental discharge or leachate and additional soil erosion from disturbed areas.
- Hydrogeology
  - There remains a moderate residual risk to groundwater quality from potential accidental discharge, leaks or spills of hazardous materials, leachates and/ or contaminated soils to ground but through regular routine groundwater monitoring the impacts can be detected and managed accordingly.
- Flood Risk
  - Despite extensive flood mitigation measures there remains a moderate residual impact as the site remains in a poor location in terms of flood risk and is not ideal for the siting of critical infrastructure.
  - A minor residual impact associated with the flood risk to plant machinery and equipment and partially constructed flood mitigation measures during the construction stage.
  - A positive residual impact to downstream communities through the implementation of a flood warning system.

Table 9.6 summarise the residual impacts of the Project on the key hydrology, hydrogeology and flood risk aspects which occur within the AoI.

Table 9.6: Summary of hydrology, hydrogeology and flood risk impacts and mitigation

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
Construction and Operation						
• Diversion and channelization of local watercourses	• For Valley areas up to 200m downstream of the site there is an increased risk of flooding due to higher flood velocities and depths which will impact on the current development of the Happy Valley housing development. • For Valley areas between the Happy Valley housing estate and the confluence with the Tuul River (approximate distance of 4km) there is a reduction in the time available to flooding but no increase in the flood velocities or depths.	High	Minor	Moderate adverse	• For the Valley area 200m immediately downstream of the site: – Work with the relevant GoM agencies to ensure that long-term development is restricted in this area. – Obtain approval for use of this land for the flow expansion area. • For the Valley areas between the Happy Valley housing development and the confluence with the Tuul River: – Development of a simple flood warning system, such as emergency sirens. This should be undertaken in conjunction with NAMEM.	Moderate (Beneficial)
Construction						
• Site level raising • Development of diversion channels for Khuliin River and tributaries • Earth movements, excavations • Construction of access roads	• The natural floodplain and river morphology is being fundamentally altered through the site area. • The required flood mitigation measures to protect the site are significant and permanent alternations to the natural drainage patterns. • Reduction in channel connectivity across the site area. • In areas of steeper gradient there is a risk of uncontrolled storm water runoff. • Sediment transport through the site will be affected.	Medium	Major	Major adverse	• Further surface water quality baseline monitoring to be undertaken prior to commencement of construction. • Location of the diversion channels to mirror the current location of the Khuliin River where possible. • Bends in the diversion channel to be gradual where possible. • A flow transition area to be incorporated into the design in order to 'transition' the river flow back to natural conditions. • Erosion protection measures to be incorporated into the design upstream of all the diversion channels and structures in order to reduce the risk of erosion and potential undermining of the channels and structures. • Refinement of the flood relief channel slope at the detailed design stage to help to reduce the risk of bank erosion, deposition in the channel and undermining of the flood relief channel at the upstream end. • Construction of a temporary diversion channel for the Khuliin River in the first three (3) months of the schedule prior to construction of the permanent diversion channel. • Implementation of temporary roads and drainage system as part of site preparation at the beginning of construction. • Appropriate sequencing of temporary diversions to ensure	Moderate adverse

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
					that channel connectivity is maintained throughout the construction period.	
• Removal of vegetation and exposure and compaction of soils • Storage and handling of hazardous materials	• Reductions in surface water quality in the Khuliin River which is used by some local residents in the Valley as a source of water for washing.	Medium	Moderate	Moderate adverse	• Oily wastewater treatment including an oily water collection pond and treatment • Chemical wastewater to be collected and stored in a neutralization basin for batch treatment. Water will be reused to the maximum extent possible. • Undertake the appropriate storage, use and disposal of chemicals and wastes on site, including use of drip trays and designated, concrete work areas • Using spill kits on site and training staff in their use • Reduce the amount of sediment generated via stockpile coverings, erosion control blankets, paving expose areas, wetting down of exposed areas • Reduce the amount of sediment that leave site via sediment collection traps in accordance with GIIP, silt fences and good site housekeeping • Monthly monitoring of surface water quality upstream (at the south side of the railway bridge) and downstream (west of the project site boundary) of the site during construction to identify potential issues (excluding winter when there is no flow). Parameters to include those specified under MNS 4943: 2011. • Fortnightly monitoring of water quality discharged to the USUG sewerage system to ensure compliance with their effluent limits. • Landscaping to avoid steep slopes in the site area and in the vicinity of the flood mitigation measures • Vegetate bare ground prior to the start of plant operation.	Minor adverse
• Construction water demands, met via piped water supply	• Reductions in water availability for other users in Ulaanbaatar and the vicinity.	Medium	Moderate	Moderate adverse	• Choice of ACC rather than NDCT which significantly reduces the water requirements of the plant • Wastewater treatment and reuse on site • Supply of water as an industrial customer from USUG allows for the best holistic management of the water demands for Ulaanbaatar and avoids competition over water supply. • Avoid water wastage through procurement of water efficient equipment and fittings	Minor adverse

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
					• Minimise water usage in construction processes through best practice and use of water efficient technologies • Raise awareness of water usage with staff • Fortnightly monitoring and prompt repairing of leaks in accordance with construction phase inspection protocol	
• Removal of vegetation and exposure and compaction of soils • Discharge of wastewater and sanitary sewage • Storage and handling of hazardous materials • Construction of large areas of hard standing	Reductions in groundwater quality of the Khuliin Valley, designated as a SPZ, through discharge to and contamination of the ground as a result of: • Accidental leaks and spills of hazardous materials (including waste) • Uncontrolled or untreated drainage runoff Reduced recharge to the local aquifer within the site area. Site drainage system routing may alter distribution of aquifer recharge.	High	Minor	Moderate adverse	• Suitable storage, handling and disposal of hazardous materials in line with the ESMMP, including but not limited to use of drip trays, bunding and oil interceptors, and training for operatives • Ash and coal will be stored in clay lined compounds with drainage collection and treatment • The site will have a drainage system for collection of storm water, domestic sewerage and operational wastewater • Wastewater (chemical, oily water, sewerage and storm water) will be treated onsite in the dedicated wastewater treatment facility before discharge to a water recycling pond or to the USUG sewerage system • Wastewater emissions will comply with local water quality and discharge regulations and will not exceed maximum allowable concentrations for discharge of wastewater to the sewerage system. • Water storage ponds will be suitably lined and will be designed with extra capacity for storm deluge. • Use best practice construction methodology. • Monthly groundwater quality monitoring programme, during construction, to provide warning of impacts to groundwater such that these can be managed before they become significant. Test water quality from effluent treatment systems discharges during commissioning in accordance with USUG requirements. • Development of an Emergency Preparedness Response Plan and Spill Prevention and Response Plan in accordance with local, IFC and HSE guidance • Identify outer areas within the site which can be vegetated to allow for infiltration and groundwater recharge.	Minor adverse
• Flood Risk to site location • Operation of plant	• Site is currently at risk of flooding and encompasses the majority of the width of an active floodplain containing	High	Major	Major adverse	• Flood mitigation measures are an integral part of the Project design and consist of diversion channels, replacement structures, erosion protection measures and a flow	Moderate adverse

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
machinery and equipment in the floodplain • Storage and handling of hazardous materials in the floodplain	watercourses which will require diversion and channelization. • Physical damage to equipment and flooding of areas where the diversion channel and mitigation measures are being constructed • Limiting access to the site during wet conditions • Contamination of watercourses and a reduction in water quality as a result of the exposure of onsite chemicals, and other construction site materials to water • Health and safety risk to personnel working in the site area close to watercourses.				expansion area that are estimated to provide a standard of protection to the site of between 1 in 100 years and 1 in 200 years. • Flood mitigation measures are an integral part of the Project design and consist of diversion channels, replacement structures, erosion protection measures and a flow expansion area that are estimated to provide a standard of protection to the site of between 1 in 100 years and 1 in 200 years. • Construction of a temporary diversion channel for the Khuliin River in the first three months of the schedule prior to construction of the permanent diversion channel. Temporary diversion of other tributaries where they could affect construction activities. • Implementation of temporary roads and drainage system as part of site preparation at the beginning of construction. • Appropriate sequencing of implementation of flood mitigation measures to ensure that channel connectivity is maintained throughout the construction period and areas of the site or equipment are not put at risk of flooding • Designated flood evacuation areas on higher ground and staff briefings about the flood safety issues when operating in close proximity to water and in an active floodplain. • Storage of chemicals, fuel and other construction materials on site and at the construction laydown area in appropriately bunded and lined areas outside of the natural floodplain.	
Operation						
• Site level raising • Modification to the floodplain through the diversion channels for Khuliin River and tributaries	• The natural floodplain and river morphology is being fundamentally altered through the site area. • The required flood mitigation measures to protect the site are significant and permanent alternations to the natural drainage patterns. • Reduction in channel connectivity across the site area. • Over time natural meandering of the channels could serve to undermine the	Medium	Major	Major adverse	• Removal of sediment deposited in the channel to ensure the diversion channel provides the required standard of protection and is well maintained. • Since the flood relief channel interferes with the natural processes of erosion and deposition it is recommended that any removed material is re-deposited at the downstream end of the diversion channel in order to mimic the natural transport processes. • The channels, structures and erosion protection measures should be inspected annually following the summer in order to	Moderate adverse

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
	flood mitigation measures (both the structures outside the site boundary, and the diversion channels themselves) through erosion. • Alternative flow routes that pose a risk to the site may develop due to the deposition and erosion of material.				– Identify any damaged areas in need of repair. – Identify any signs of river meandering or realignment that might affect the integrity of the flood mitigation measures or encourage alternative flood flow routes.	
• Modification to the floodplain through the diversion channels for Khuliin River and tributaries	• Changes in bed degradation and aggradation are more significant with the presence of the diversion channel. • Increased erosion upstream of the Ulaanbaatar railway bridge. • Reduced effectiveness of the diversion channel from deposition of material in the channel. • Increased erosion downstream of the diversion channel due to a reduced supply of material within the site area • Potential for longer term bank instability, damage to and potential undermining of the diversion channels	Medium	Moderate	Moderate adverse	• Implementation of erosion protection measures at the upstream and downstream ends of the diversion channels • Refinement of the flood relief channel slope in detailed design to help reduce sediment transport through the site. • Maintain the flood relief channel by removing sediment deposited in the channel and re-deposited at the downstream end of the diversion channel. • Inspect flood relief channel and structures annual following the summer in order to identify any damaged areas in need of repair.	Minor adverse
• Discharge of wastewater from turbine rooms • Equipment washing discharge • Coal and ash yard drainage • Sanitary sewage discharge • Runoff from disturbed ground.	• Reductions in surface water quality in the Khuliin River which is used by some local residents in the Valley as a source of water for washing.	Medium	Moderate	Moderate adverse	• Oily wastewater treatment including an oily water collection pond and treatment and sludge management. • Recycling of coal contaminated water following clarification and filtration in the coal yard storm water pond • Sanitary wastewater to be collected and effluent discharge directly to the USUG sewerage system. • Chemical wastewater to be collected and stored in a neutralization basin for batch treatment. Water will be reused to the maximum extent possible. Water discharged will be treated to meet the required effluent standards. Boiler blowdown water is also reused after chemical adjustment • Coal yard stormwater will be collected and clarified in the coal yard storm water pond before being discharged to the USUG sewerage system or reused for dust suppression • Ash yard stormwater will be collected and discharged to sand filters before being transferred to the pH regulating pond	Minor adverse

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
					• Avoid water wastage • Periodic water use efficiency reviews to identify areas where water use may be reduced. • Provision of appropriate storage, use and disposal of chemicals and wastes on site • Use of spill kits on site and training staff in their use • Monitor areas of soil erosion within the site and around the flood mitigation measures and reinstate disturbed ground with vegetation or provide other erosion mitigation • Monthly monitoring of surface water quality upstream (at the south side of the railway bridge) and downstream (west of the project site boundary) of the site to identify potential issues (excluding winter when there is no flow). Parameters to include those specified under MNS 4943: 2011. Further mitigation as required. • Fortnightly monitoring of water quality discharged to the USUG sewerage system to ensure compliance with their effluent limits. • Monitor water quality upstream and downstream of the site to identify potential issues and recommend mitigation as required.	
• Operation water demands, met via piped water supply	• Reductions in water availability for other users in Ulaanbaatar and the vicinity.	Medium	Moderate	Moderate adverse	• Minimise water usage in maintenance processes through best practice and use of water efficient technologies • Raise awareness of water usage with staff • Monitoring and prompt repairing of leaks	Minor adverse
• Removal of vegetation and exposure and compaction of soils • Discharge of wastewater and sanitary sewage • Storage and handling of hazardous materials • Presence of large	Reductions in groundwater quality of the Khuliin Valley, designated as a SPZ, through discharge to and contamination of the ground as a result of: • Accidental leaks and spills of hazardous materials (including waste) • Uncontrolled or untreated drainage runoff • Storage of lignite coal and fuel ash and potential for the lining to be compromised. Potential for longer term negative impacts on the groundwater quality in the Tuul valley, the drinking water source for Ulaanbaatar.	High	Moderate	Major adverse	• Undertake baseline surveys of groundwater quality, and maintain an ongoing monthly groundwater quality monitoring programme, during operation, to provide warning of impacts to groundwater such that these can be managed before they become significant. • Development of an EPRP and Spill Prevention and Response Plan in accordance with local, IFC and EHS guidance. • Suitable design of temporary and permanent ash disposal areas in accordance with national and international guidance. • In accordance with the site ESMMP, on-going monitoring and maintenance of the drainage system and integrity of	Minor adverse

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
areas of hardstanding	Reduced recharge to the local aquifer within the site area. Site drainage system routing may alter distribution of aquifer recharge.				storage area linings will be undertaken.	
• Flood risk to site location	• Site is currently at risk of flooding and encompasses the majority of the width of an active floodplain containing watercourses which will require diversion and channelization. • Flooding has the potential to cause risk to life, damage site infrastructure, disrupt access and contaminate surface water due to exposure of coal stock, chemicals and other materials to flood water. • Potential for operational shutdown due to flooding of water-sensitive infrastructure on the site. • Future development in the catchment could have an adverse impact on the flood risk at the site itself.	High	Major	Major adverse	• Monitor and inspect the diversion channels and flood mitigation structures to ensure that they remain well maintained. • Clear deposited material from the channels to ensure that their design capacity is maintained. • Review the channel performance following any major flood event. • Liaise with GoM to implement development controls in the catchment to prevent increased flood risk to the site.	Moderate adverse

10 Greenhouse Gas

10.1 Introduction

This chapter considers the potential GHG associated with construction and operation of the Project. The key sources of emissions are from combustion of coal. These emissions are calculated as well as the emissions intensity (emissions of CO_2 per unit of heat and electricity).

10.2 Applicable legislation

10.2.1 National requirements

The Kyoto Protocol was ratified by the Mongolian government in December 1999. This recognised the general commitments of the Protocol. However, as a developing country, Mongolia was not given any binding emissions targets. The United Nations Framework Convention on Climate Change (UNFCCC) reporting guidelines requires all Parties to submit to the Conference of the Parties an annual national anthropogenic GHG emissions inventory of all GHG not covered by the Montreal Protocol. Mongolia therefore periodically reports on its emissions and response to climate change issues. This is the responsibility of the MEGD, although previous reports were produced by the Ministry of Nature, Environment and Tourism).

Mongolia's Second Communication to the UNFCCC outlines the main policy relevant to climate change. The National Action Programme on climate change was updated in 2010. This is the policy and strategy document designed to mitigate GHG emissions and respond to climate change, and identifies sectors most vulnerable to climate change. The Programme recognises that efforts to manage climate change should not affect the development of the country.

In the power sector, the actions are focused on developing renewable and clean energy, including clean coal, and improving energy efficiency in buildings and the industrial sector. Specific actions are summarised in the Second Communication and include, for the Energy Supply sectors:
- A renewable energy programme including solar
- Reduction of energy and losses in the transmission system
- Efficiency improvement of CHP, including the promotion of investment in new CHP plants
- Heat efficiency improvement in the ger district area

10.2.2 International requirements

Safeguard Requirement 1: Environment of the ADBs SPS contains a paragraph on GHGs:
- "The borrower/client will promote the reduction of project-related anthropogenic greenhouse gas emissions in a manner appropriate to the nature and scale of project operations and impacts. During the development or operation of projects that are expected to or currently produce significant quantities of greenhouse gases, the borrower/client will quantify direct emissions from the facilities within the physical project boundary and indirect emissions associated with the off-site production of power used by the project. The borrower/client will conduct quantification and monitoring of greenhouse gas emissions annually in accordance with internationally recognized methodologies. In addition, the

borrower/client will evaluate technically and financially feasible and cost-effective options to reduce or offset project-related greenhouse gas emissions during project design and operation, and pursue appropriate options."

Against this paragraph are the notes:
- "Even though the significance of a project's contribution to greenhouse gas emissions varies between industry sectors, the significance threshold to be considered for these requirements is generally 100,000 tons of carbon dioxide equivalent per year for the aggregate emissions of direct sources and indirect sources associated with electricity purchased for own consumption."

The EBRD Environmental and Social Policy (2014) sets out in Performance Requirement 3: *Resource Efficiency and Pollution Prevention and Control* that:
- "For projects that currently produce, or are expected to produce post-investment, more than 25,000 tonnes of CO_2-equivalent annually, the client will quantify these emissions in accordance with EBRD Methodology for Assessment of Greenhouse Gas Emissions. The scope of GHG assessment shall include all direct emissions from the facilities, activities and operations that are part of the project or system, as well as indirect emissions associated with the production of energy used by the project. Quantification of GHG emissions will be conducted by the client annually and reported to EBRD".

The EBRD Methodology for Assessment of Greenhouse Gas Emissions (2010) establishes a number of emissions categories as part of its assessment screening process:
- "Negligible (no GHG assessment necessary)
- Low (<20 kt/y CO2-equivalent per year
- Medium-Low (20 – 100 kt CO2-e /y)
- Medium-High (100 kt – 1 Mt CO2-e /y)
- High (>1 Mt CO2-e /y)".

Large thermal power production and this plant falls within the high category (>1Mt CO_2e per year) and therefore requires an assessment of its greenhouse gas emissions.

IFC Performance Standard 3, 'Resource Efficiency and Pollution Prevention', contains a section on greenhouse gases. It states that:
- "The client will consider alternatives and implement technically and financially feasible and cost effective options to reduce project-related greenhouse gas emissions during the design and operation of the project. These options may include, but are not limited to, alternative project locations, adoption of renewable or low carbon energy sources, sustainable agricultural, forestry and livestock management practices, the reduction of fugitive emissions, and the reduction of gas flaring"
- "For projects that are expected to or currently produce more than 25,000 tonnes of CO_2-equivalent, the client will quantify direct emissions from the facilities owned or controlled within the physical project boundary, as well as indirect emissions associated with the off-site production of energy used by the project. Quantification of greenhouse gas emissions will be conducted by the client annually in accordance with internationally recognised methodologies and good practice."

10.2.3 Guidelines and policies

The IFCs EHS Guidelines for Thermal Power Plants sets out guidance relating to emissions of GHG from thermal power plants. Under energy efficiency, the Guidelines note that CHP should be used where feasible, and that wherever possible, energy efficiency measures should be in place to maximise the energy output from fossil fuel uses, where new plant should aim to be in the top-quartile of performance for the country or regional for the same type of fuel and power plant size. However, the guidance also notes that local circumstances must be considered in determining the appropriate technological choice and resulting GHG emissions. Discussion on the technology choice is presented in Chapter 3 of this report.

The Guidelines also present typical emission rates for new thermal power plants. These are not presented for CHP plants, but values are presented for electricity plant. The typical values for sub-critical coal plant are between 896-1050gCO_2/kWh (net). Note these values do not account for differences in coal specifications across the world but provide indicative performance levels.

EBRD Methodology for GHG Assessments sets out approaches to considering and calculating emissions associated with new projects. The guidance indicates that emissions should be calculated for the direct emissions within the Project site boundary and from use of grid-connected electricity. Upstream and downstream emissions associated with a project (e.g. material use, use of products) do not need to be considered, however some consideration is given to pertinent sources of these emissions in this assessment. The guidance also suggests that emissions per unit of product output are presented in addition to the total emissions from the project. For fossil fuel combustion, the guidance sets out methods to calculate the total combustion emissions. In the case of this assessment, site specific data have been used based on the carbon content of the fuel.

ADBs ‘Linked Document 4: Greenhouse Gas Accounting – Related Issues’ document set out general principles in evaluating GHG emissions for projects and discusses relevant accounting issues. While this is not specific guidance for projects, it sets out ADBs expectations that assessments should be undertaken according to recognised methodologies and that gross (total) emissions are quantified for the Project.

10.3 Methodology and assessment criteria

10.3.1 Overview

This section discusses the methodology for quantifying the emissions associated with the operational phase of the Project. The methods adopted are consistent with the guidance set out in Section 10.2.3 for this type of project. There is small amount of variation in guidance on which emission factors to use for each emission sources and those adopted for this assessment are set out below.

10.3.2 Scope of assessment

10.3.2.1 Temporal scope

The plant will operate for a number of years, meaning that the energy produced and therefore fuel consumed will vary from year-to-year. GHG emissions have been considered for a typical but conservative one-year operational period. This is based on the projected annual fuel consumption and energy production of the plant.

10.3.2.2 Spatial scope

The assessment identifies the major potential sources of GHG emissions as a result of the operation and construction of the plant. These are presented in Table 10.1.

Table 10.1: Potential sources of GHG emissions associated with the Project

Emission source	Type of emission	Quantified in assessment?
Construction		
Combustion plant	Indirect – Scope 3[20]	No
Transmission line	Indirect – Scope 3	No
District heating network	Indirect – Scope 3	No
Operation		
Three main boilers	Direct – Combustion – Scope 1	Yes
Transport of fuel to site	Indirect – Scope 3	Yes
Switchgear	Direct – fugitive – Scope 1	No

The main source of direct GHG emissions is the combustion of fuel in the boilers, which is mostly CO_2. A small amount of N_2O is also emitted. The plant uses coal, and there are a number of different operating modes which produce varying amounts of electricity and heat and therefore consume different amounts of coal. Emissions have been calculated based on the fuel combusted, and presented as net emission rates based on the electricity and heat produced after the plant's own consumption is accounted for.

There will be some losses of electricity through the transmission system. This means that of the total amount of electricity and heat generated, some of the electricity and heat will not be consumed by customers and is a function of how the transmission systems operate. Any emissions associated with these losses have not been considered separately in this assessment and the data reflects 'as generated' values.

[20] Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc.

The coal will be delivered to site by rail, and there will be daily deliveries of coal to the plant which leads to an indirect source of GHG emissions for the Project, mostly in the form of CO_2.

GHG emissions from fugitive emissions of sulphur hexafluoride (SF_6) insulated switchgear during normal operation are expected to be insignificant compared to the other sources of GHG associated with the Project and have therefore not been considered further in this assessment.

This assessment does not include direct quantification of the impacts of construction of the Project and is limited to the effects of the operational phase. The methodologies adopted for this assessment focus on operational emissions, as required by the guidance. Construction and decommissioning emissions associated with a project of this type are insignificant compared to those released from operation over the life of the Project. Therefore a comparative analysis of these emissions has been made in reference to published literature.

10.3.3 Calculation approach

For each of the sources identified above which are to be calculated, the calculations follow the basic premise of:

Emissions from source = *Activity data* x *Emission Factor*

For each source the activity data and emission factor are selected based on the best available Project data and emission factors.

Direct emissions from combustion of coal have been calculated based on the estimated fuel consumption and the coal specification for the Project. The specification expected to be used for the Project is ‘Performance Coal’, which estimates that carbon content of the coal (through ultimate analysis) to be 39.4%. This specification has therefore been adopted in this assessment. The total coal consumed in a given scenario is multiplied by the carbon content on the conservative assumption that all the carbon is consumed in the combustion process and that this consumption is at the lower heating value. This total amount of carbon is converted to CO_2 based on the ration of CO_2/C (44/12) assuming all the carbon all oxidised. N_2O emissions have been estimated based on a fixed emission rate per unit of fuel consumed, based on the IPCC value for coal of 1.5 kgN_2O/TJ energy input and a global warming potential of 298. It is assumed the plant operates for 8,000 hours per year.

As well as reporting the total GHG emissions from the Project, once the emissions due to the combustion of fuel have been calculated, they are further apportioned between the electricity and heat produced. The apportionment provides an ‘emissions intensity’ for the plant, reflecting the relative efficiency of both generation processes. Because one unit of input energy potentially provides more than one unit of output energy (in terms of electricity and heat produced) the emissions must be split. This is done based on the process efficiencies of the two streams, following the guidance set out as part of the GHG Protocol. The ‘Allocation of Emissions from a Combined Heat and Power (CHP) Plant’ guidance and worksheet has been used to calculate these figures.

Emissions associated with the delivery of coal by rail have been based on the amounts of coal delivered from the Banganuur and Shivee-Ovoo mines. These assumptions are set out in the following sub-section. Based on the distance and amount of coal, the number of 'tonne-kilometres' (tkm) the coal travels is calculated. A two-way distance is used in the calculation. To this an emission factor for rail is applied, which has been taken from the GHG Protocol as being 0.0252kgCO_2/tkm.

10.3.4 Project data

Activity data for CHP5 has been taken from a number of sources. Table 10.2 outlines the activity data for the Project and the source of that data and Table 10.3 outlines the amount of coal delivered under each scenario. The Project can operate in a number of operational modes, and five operating Scenarios have been considered in this assessment reflecting different levels of heat and electricity generation.

Table 10.2: Project Activity Data - Combustion

Parameter	Unit	Scenario				
		1	2	3	4	5
Number of units operational	Number	3	3	3	3	3
Fuel input per unit	MWth	472	460	459	296	392
Net heat rate (LHV)	kJ/kg	12,389	13,243	12,029	13,692	10,158
Fuel carbon content	%			39.4		
Net power output - total of all units	GWh/y	3,292	3,002	3,298	1,866	3,337
Total heat demand - total of all units	GWh/y	3,692	4,696	3,204	2,400	-
Net electrical efficiency	%	29.1	27.2	29.9	26.3	35.4
Heat generation efficiency	%	32.6	42.5	29.1	33.8	-

Note: Carbon content based on project Performance Coal specification
Source: Performance coal specification
Project Heat and Mass Balance Diagram

Table 10.3: Project Activity Data – Coal Delivery

Parameter	Unit	Scenario				
		1	2	3	4	5
Amount of coal delivered	kt/year	2,865	2,793	2,787	1,795	2,381
Parameter	**Unit**	**Mine**				
		Baganuur	**Shivee-Ovoo**			
Proportion	%	30	70			
Distance (one-way)	km	120	250			

Note: It is assumed that the split of coal origin remains the same for all scenarios considered

10.3.5 Determining significance

It is typical in an ESIA to assess the significance of impacts with reference to the magnitude of the impact and the sensitivity of the receptor. GHG emissions are global in nature and it is difficult to link the emissions of a single project to a specific receptor, unlike other environmental impacts. In addition, greenhouse gas emissions are closely related to economic growth. In international agreements such as the UNFCCC and the Kyoto Protocol (discussed in Section 10.2.1), developing countries are given scope to increase their emissions. This is unlike developed countries which have high levels of emissions already and which are expected to reduce their emissions.

The relationship of individual project emissions to global atmospheric emissions, and uncertainty about the global atmospheric response, is very complex and means that determining the significance of project emissions on a local scale is not possible. The relationship between emissions from individual projects and national or international emissions reduction targets is also difficult to resolve as national and international policies contain provisions for growth and development.

There are currently no published guidelines for determining the significance of project greenhouse gas emissions in ESIAs. However, the Guidance Notes for IFC PS3 suggest the following criteria for evaluating project GHG emissions (Table 10.4). This guidance does not recommend how to assign significance to any of the impacts associated with a project, instead recommending how to present the impacts.

Table 10.4: Suggested IFC criteria for assessing greenhouse gas emissions impacts

IFC criteria	Comments
The project's greenhouse gas emissions relative to the host country's total national emissions.	This is discussed in the Residual Impacts section (Section 10.5.2)
The project's greenhouse gas emissions performance relative to good international performance or the host country's national average performance.	The emissions per unit area are compared to World Bank estimates. This is discussed in the Potential Impacts section (Section 10.5.2)
The annual trend of the project's greenhouse gas emissions performance over time.	This is discussed in the Potential Impacts section (Section 10.5.2)
Opportunities to further improve the project's greenhouse gas emissions performance.	This is considered in the Mitigation and Enhancement Measures section of the assessment (Section 10.6)

Source: Guidance notes for IFC Performance Standard 3.

These criteria are applied in this assessment. As a result, emissions are presented and their relevance is discussed in relation to the criteria. However, no level of significance is applied to the emissions.

10.3.6 Baseline conditions methodology

Baseline data was collected via a desk review. The following principal sources were considered in presenting the baseline assessment:

- Mongolia Second National Communication to the United National Framework Convention on Climate Change

- Durgun Hydropower Project CDM Project Design Document (project 0786)

10.3.7 Assumptions and limitations

Where possible, Project specific data has been used in order to inform the assessment and calculations.

For the combustion calculations, this is based on Project data for the Heat and Energy Balances of the plant. This documents the fuel inputs and electricity and heat generated in each operating scenario. The coal specification for the Project has also been used to calculate the GHG emissions per unit of coal consumed. This is the coal that will typically be consumed at the site. It has been assumed that the plant would operate for 8,000 hours per year. Emissions are calculated based on all of these sources of data and assumptions.

The actual emissions from the plant during operation would be based on how the plant ultimately operates. There is therefore some inherent uncertainty in what the actual GHG impact of the Project might be. However the assessment has used a worst-case assumption in determining the emissions by assuming that the plant would operate at the full loading of any given scenario for 8,000 hours in a typical year.

10.4 Baseline description

10.4.1 National emissions profile

Mongolia reported its national GHG inventory as part of its Second Communication to the UNFCCC in 2012. This contains the latest available data on emissions by sector. The latest year based on actual data is 2006 and data for 2004 to 2006 is presented in Table 10.5 below. The Second Communication also presents projections for GHG emissions in future years. These are presented for 2010, 2015 and 2020 for additional context. The data shows that emissions are expected to double in Mongolia between 2006 and 2030 with the majority of that growth in the Energy Sector.

Table 10.5: Mongolia National GHG Emissions, Actual and Projected Emissions by Sector ($ktCO_2e$)

	Actual	Actual	Actual	Projected	Projected	Projected
Sector	2004	2005	2006	2010	2015	2020
Energy	9,247	9,635	10,220	14,033	20,233	25,930
Industrial process	972	862	892	1,354	1,602	1,836
Agriculture	5,518	5,854	6,462	6,405	6,573	6,657
Land-use change and forestry	-2,112	-1,966	-2,083	-1,932	-1,785	-1,420
Waste	131	134	138	158	183	209
Total net emissions	13,755	14,519	15,628	20,018	26,806	33,212

Source: Mongolia Second National Communication

Mongolia does not officially report the overall emission intensity of the electricity grid or for heat produced. Because of this, it is not possible to set the context of the wider 'grid' emission intensity for electricity and heat.

Emissions data for CHP2, 3 and 4 were estimated as part of a Clean Development Mechanism (CDM) Project Design Document (project 0786), based on 2005 data. This indicated that the emission intensities based on 2005 data were (on a net basis):

- CHP2: 1,840gCO_2/kWh
- CHP3: 1,250gCO_2/kWh
- CHP4: 980gCO_2/kWh
- Darkhan TPP: 1,160gCO_2/kWh
- Erdenet TPP: 930gCO_2/kWh
- The operating margin for the grid was 1,050gCO_2/kWh.

These figures are based on an electricity only basis and do not account for the heat production from those plants, but provide an indication of the typical levels of CO_2 emissions for the existing plant.

While the CHP4 value has been presented in the Construction (Design and Management) (CDM) documentation, it may underestimate emissions. According to data provided to the Consortium by the Energy Regulatory Commission (ERC) for this project, the current gross efficiency of CHP4 is estimated to be 32% in electricity-only mode (as compared to an efficiency of 39.4% for CHP5). This is a lower efficiency than is implied in the CDM documentation, which also assumes a relatively high calorific value for coal. This would also apply to the other plant presented above

Assuming an efficiency of 32%, the emission rate would be between approximately 1,150-1,275gCO_2/kWh based on the assumption it uses coal from the same origins as assumed for CHP5.

10.5 Impact identification and assessment

10.5.1 Construction Phase

The construction of the combustion plant site itself as well as the transmission line and district heating pipework will lead to indirect emissions of GHG through the use of materials, construction plant and construction transport.

Emissions from these sources are considered 'scope 3 (indirect)' as the emissions do not occur within the site boundary and are owned by others. For thermal power plants, the emissions from these sources are generally considered to be small in comparison to the operational phase combustion emissions.

In the IPCC's AR5[21] assessment, life-cycle analysis was performed for a range of thermal power plant which included the direct emissions and indirect emissions from 'infrastructure and supply'. These are

[21] Krey V., O. Masera, G. Blanford, T. Bruckner, R. Cooke, K. Fisher-Vanden, H. Haberl, E. Hertwich, E. Kriegler, D. Mueller, S.

defined by the IPCC as “the remaining lifecycle emissions, mostly connected to the infrastructure of the entire energy system including the power plant itself, and supplies such as solvents”. The AR5 report presents these values in terms of emission rates per MWh. The data provided by the IPCC AR5 is indicative and would differ across regions.

For the category ‘Coal – average’ - the closest match to CHP5 - the emissions rate for the indirect emissions was calculated to be ‘11tCO_2/GWh (range of 10 – 13tCO_2/GWh)’ (note that tCO_2/GWh is equivalent to gCO_2/kWh used elsewhere in this report). Based on the expected electricity production of CHP5 in electricity only mode (Scenario 5), this indicates that the construction emissions represent around 1% of the emissions associated with the combustion emissions over the lifetime of the plant (for coal, assumed to be 40 years). Acknowledging the uncertainty in the IPCC data, the indirect emissions from construction are considered to be low in the context of the lifetime of CHP5.

The key sources of emissions in the construction phase will include the use of concrete and steel in all the major components of the Project, as well as impacts from the thermal power components such as the boilers and ducting.

10.5.2 Operational Phase

This section presents the calculated GHG emissions for the operational phase based on the approach and assumptions outlined in Section 10.3.

These calculations are based on the input data presented in Table 10.2. Emissions associated with the operational phase are presented in Table 10.6.

Table 10.6: Calculated emissions for the operational phase

Source	Unit	Scenario				
		1	2	3	4	5
Combustion emissions	ktCO_2 per year	4,158	4,058	4,048	2,601	3,455
Electricity intensity (net)	gCO_2e/kWh	665	711	645	735	1,036
Heat intensity (net)	gCO_2e/kWh	534	409	599	515	-
Delivery of coal	ktCO_2e per year	30	30	30	19	25

Total emissions from the plant range from around 2.5 to 4.1 million tCO_2e depending on the operating regime. For Scenarios 1 to 4, the emission intensity for electricity production while the plant is operating in CHP mode is below what would be typically expected for an electricity only plant. These values represent a typical year of operation and would occur in each year that the plant operated at the assumed parameters. Lower operational levels would reduce the total emissions.

Paltsev, L. Price, S. Schlömer, D. Ürge-Vorsatz, D. van Vuuren, and T. Zwickel, 2014: Annex II: Metrics & Methodology. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

In Scenario 5, which is a Scenario where only electricity is produced, the plant has a greater emissions intensity compared to Scenarios 1 to 4. This is more in-line with the typical emission rates for sub-critical coal plant (up to 900-1,050gCO_2/kWh) similar to this plant presented in the IFC Thermal Power Guidelines. It also has a lower emission rate than that expected for CHP4 since the efficiency in this mode is greater for CHP5.

Emissions associated with the delivery of coal to the Project are small in comparison to the emissions due to combustion.

10.6 Mitigation and enhancement measures

10.6.1 Construction Phase

The construction phase will lead to potential indirect emissions due to the construction of the Project, transmission lines and district heating system. These emissions will principally occur through the use of materials and other products, from the transport of those materials and waste to and from the site, and from the use of construction plant.

The following measures are suggested for implementation by the contractor in order to minimise these sources of emissions as far as possible.

- Keep the carbon footprint of all new assets as small as possible to minimise the overall amount of materials as far as possible;
- Use recycled materials in construction where possible, including reuse of materials won on-site;
- Source construction materials from local area where possible to minimise the amount of construction traffic movements, and consider whether certain items could be delivered by rail rather than road; and
- Establish sustainable construction management practices. This includes toolbox talks for workers about switching off plant and equipment when not in use, and regular servicing of plant and equipment.

10.6.2 Operational Phase

An analysis of the Project alternatives is presented in Chapter 3. This analysis identified the following relevant to potential GHG emissions:

- Based on the existing technology profile of Mongolia, conventional CHP is the most straightforward way to meet the existing gap in demand. Mongolia has a high potential for a number of renewable technologies, but there are challenges to delivering such technologies given the complex geography and existing technological capacity in Mongolia. Gas CHP is not currently considered an option given the lack of infrastructure to supply gas at present.
- Many of the alternative renewable technologies do not offer the potential for district heating
- The Project will adopt circulating fluidised bed technology which offers higher levels of efficiency compared to pulverised coal firing
- Alternative locations are unlikely to have a material effect on the overall impact of the Project.

Given the prevailing technology landscape, the development of CHP technology for this Project is in itself the key mitigation measure as this means that the plant maximises the energy output from the coal used in comparison to standalone electricity production. Therefore the plant should operate in CHP mode as much as possible as this would lead to fewer emissions than if the coal and heat were produced separately. Because the plant will typically operate in CHP mode, emissions are lower than those from a comparable standalone coal-based electricity generating plant.

One of the key determining factors of emissions for coal power plants is the coal quality. Less high quality coal is required per unit of electricity generated. The plant should avoid the use of low quality coal as much as possible to maximise the conversion rates within the plant and keep efficiencies as high as possible.

The Project should also implement monitoring systems within the plant to ensure that performance levels are maintained overtime and that emission levels remain as predicted and do not deteriorate.

As per the ADB Safeguards and IFC PS 3, the plant should provide an annual report on GHG emissions from operations, which should be submitted to the Ministry for Environment annually, as well as to the Project sponsors. This should be done in accordance with an internationally recognised methodology, such as the GHG Protocol or ISO 14064.

An assessment considering the potential for carbon capture and storage has been undertaken by the Consortium during the development of the project. As part of the assessment, work to identify the potential for CCS has been undertaken alongside a review of the existing technology for capture and transport. The assessment has identified that CCS is not currently viable. In addition to a lack of storage sites, there is yet to be a large scale demonstration of the technology in the region and therefore it is considered unlikely that the plant would be able to incorporate the technology at reasonable cost especially considering the economic situation of Mongolia.

10.7 Residual impacts

The Project will lead to emissions of GHG, principally CO_2 during the construction and operation of the plant. These emissions mainly arise from the combustion of coal to produce heat and electricity.

Indirect emissions from construction and the delivery of coal to the plant during operation are very small in the overall context of the Project.

During operation, for each of the Scenarios considered, the total emissions from CHP-5 (assuming it operates at full load) would represent a considerable part of national GHG emissions. Based on the projected 2015 total emissions for Mongolia of 26 million tCO_2e, CHP-5 could represent between 10% and 15% of total emissions while at the same time providing a substantial amount of heat and power. It is therefore important that the plant operates at the highest possible efficiencies and maximum benefit is derived from operating in CHP modes which provide the lowest emission intensities.

However, the use of CHP is in itself a key mitigation measure and means that, while these emissions will be important in the national context, the plant maximises the production of useful energy from the coal such that the predicted emission intensities for electricity from the plant are much lower than they might otherwise be from standalone electricity generating plant.

11 Ecology and Biodiversity

11.1 Introduction

This chapter presents the baseline conditions and the assessment of Project impacts on terrestrial and aquatic biodiversity and ecology. It identifies the relevant legislative framework and international requirements, and identifies and assesses potential significant adverse impacts, before defining appropriate mitigation measures that will be implemented as part of the Project. The baseline includes protected areas, habitats and species, with information being used from primary and secondary sources.

11.2 Applicable legislation and policy

11.2.1 National requirements

11.2.1.1 Mongolian legislation on biodiversity and nature conservation

The Mongolian legislation specific to biodiversity and nature conservation is summarised in Table 12.1 below.

Strictly Protected Areas (SPAs) in Mongolia are classified as follows:

- National Conservation Parks
- Nature Reserves
- National Monuments

National Conservation Parks are relevant to this Project and have the following three zones according to the Mongolian Law: virginal (pristine), protected and limited. The purpose of the 'virginal zones' is to keep the original state of the nature, and scientific research is the only activity that can be conducted in these zones. In 'protected zones', measures to enhance or restore the condition of flora and fauna can be implemented in addition to the scientific research. The Law on Special Protected Areas (2014) specifies the activities that are permitted in 'limited zones', including forest maintenance and clearing, organised ecotourism, exploitation of natural resources by local residents and for domestic use etc. This law also lists the activities that are prohibited in National Conservation Parks, including: exploitation of natural resources for commercial purposes, construction of buildings and facilities, hunting/capture of animals etc.

An SPA may have buffer zones established under Mongolian Law. Buffer zones are created to prevent or minimise adverse impacts on SPAs, increase public participation and secure their livelihoods, and to control the sustainable use of natural resources. Buffer zones can be either overlapping or outside the 'limited zones' of the National Conservation Parks.

The Law on Environmental Protection was adopted in 1995 and amended in 2012. The law focuses on regulating relations between the State, citizens, business entities and organisations in order to guarantee:

- The human right to live in a healthy and safe environment
- An ecologically balanced social and economic development
- The protection of the environment for present and future generations
- The proper use of natural resources

- The restoration of available resources

The 2012 revision of the law introduced a "polluter pays" principle, whereby the polluter is liable to pay compensation for damage caused to the environmental and natural sources. The 2012 revision specifies the amount of compensation that individuals or companies have to pay to the environment protection fund in case they determine losses to forest resources, animals, plants, water resources, land, subsoil and soil. The compensation varies between two and five times the environmental-economic loss depending on the resource affected.

The Law on Forests (2012) regulates the relations arising from protection, possession, sustainable use, restoration and reproduction of forests in Mongolia. Forests are classified as conservation forest zones and production forest zone.

The Law on Animals (2012) regulates the protection, breeding and reproduction of animals (except livestock and pets) and the proper use of their reserves. This law lists the endangered and rare animals that can only be hunted or captured under licence. All protected Mongolian species are listed in Annex #1 of Governmental Act #7 of 2012, which is an annex to the Law on Animals (2012).

Table 11.1: Mongolian legislation on biodiversity and nature conservation

Current Laws	Latest Changes	Previous Repealed/Revised laws
Law on Environmental Protection (http://faolex.fao.org/docs/texts/mon32709.doc)	Amended 2012	Law on Environmental Protection 1995
Law on Forests (http://www.fao.org/docrep/w8302e/w8302e07.htm)	Revised 2012	Law on Forests 2007
		Law on Prevention of Steppe and Forest Fires
Law on Special Protected Areas (http://faolex.fao.org/docs/pdf/mon77268E.pdf)	Amended 2014	Law on Special Protected Areas, 1994, 1997, 2002, 2003, 2004, 2006, 2008
Law on Buffer Zones (http://faolex.fao.org/docs/texts/mon78977.doc)	1997	n/a
Law on Protection of Plants	Amended 2011	Law on Protection of Plants 2007, 2010
Law on Natural Plants	Amended 2010	Law on Natural Flora, 1995, 1997, 2002 http://faolex.fao.org/docs/pdf/mon77264E.pdf
Law on Animals Annex #1 of Government Act #7 of 2012 http://www.legalinfo.mn/annex/details/2964?lawid=2734	Revised 2012	Law on Fauna, 2000 (http://faolex.fao.org/docs/pdf/mon77263E.pdf)
		Law on Hunting, 2000 (http://faolex.fao.org/docs/pdf/mon42018E.pdf)

11.2.1.2 National Biodiversity Conservation Action Plan (NBCAP)

A National Biodiversity Conservation Action Plan (NBCAP) was prepared in 1996 with the support of a wide range of people and organisations (MNE, 1996). The overall goal of the NBCAP was to identify and implement measures to protect biodiversity and restore degraded areas, and ensure that biodiversity is integrated into economic and social programs. The NBCAP proposed 17 specific objectives and 4 legal and institutional measures, as well as a wide range of actions covering protected areas, population control, legislation and policy on environmental impact assessment and land use planning, research and monitoring, education and training, public awareness-raising, agriculture, forestry, industry, transport, mining and oil exploitation, tourism, land reclamation, energy and ex situ conservation management. Two subsequent reviews of the NBCAP were completed in 2001 and 2009 (CBD, 2014).

11.2.2 International requirements

11.2.2.1 International Conventions

The following international biodiversity agreements and conventions have been ratified by Mongolia:
- Convention on Biological Diversity (CBD) – ratified 1993
- Ramsar Convention on Wetlands of International Importance – ratified 1996
- Convention on International Trade in Endangered Species of Fauna and Flora (CITES) – signed 1996
- Convention on the Conservation of Migratory Species of Animal Wildlife (CMS) – signed 1999
- World Heritage Convention – signed 1990

As part of the CMS, Mongolia signed a Memoranda of Understanding on Siberian crane (*Leucogeranus leucogeranus*), Saiga antelope (*Saiga tatarica* ssp. *mongolica*) and birds of prey (raptors).

Mongolia is a signatory of the CBD, whereby the CBD defines biodiversity as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems”. As a signatory, Mongolia has a responsibility to:
- Safeguard its biodiversity
- Introduce procedures requiring environmental impact assessment (in accordance with Article 14 of CBD) for projects likely to have significant impacts on biological diversity
- Introduce legislative provisions that ensure environmental policies and procedures are duly taken into account

The trade of the species listed in Annex II of the CITES is closely controlled.

11.2.2.2 IFC PSs and Guidance

The Project is required to meet the international standards of the IFC, which is part of the WBG. The international environmental and social safeguard policies of this organisation as they relate to biodiversity are outlined below.

The IFC PS6 (IFC, 2012a) and Guidance Note 6 (IFC, 2012b) has been used on the Project to define best practice and international standards. The IFC PS6 objectives are:

- To protect and conserve biodiversity
- To maintain the benefits from ecosystem services
- To promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities.

In accordance with IFC PS6, habitats are divided into modified, natural and critical habitats. Critical habitats can be either modified or natural habitats supporting high biodiversity value, including:
Habitat of significant importance to critically endangered and/or endangered species (international Union for Conservation of Nature and Natural Resources (IUCN) Red List)

- Habitat of significant importance to endemic and/or restricted-range species
- Habitat supporting globally significant concentrations of migratory species and/or congregatory species
- Highly threatened and/or unique ecosystems
- Areas associated with key evolutionary processes

Habitat destruction is recognised as a major threat to maintenance of biodiversity and to assess likely significance of impacts. IFC PS6 makes the following recommendations depending on habitat status:

- Modified Habitat: exercise care to minimise any conversion or degradation of such habitat, depending on scale of project, identify opportunities to enhance habitat and protect and conserve biodiversity as part of operations
- Natural Habitat: developer will not significantly convert or degrade such habitat unless no financial/technical feasible alternatives exist, or overall benefits outweigh cost (including those to biodiversity), and conversion or degradation is suitably mitigated. Mitigation must achieve no net loss of biodiversity where feasible; offset losses through creation of ecologically comparable area that is managed for biodiversity, compensation of direct users of biodiversity
- Critical Habitat: in areas of critical habitat the developer will not implement project activities unless there are no measurable adverse impacts on the ability of the critical habitat to support established populations of species described or on the functions of the critical habitat; no reduction in population of a recognised critically endangered or endangered species and lesser impacts mitigated as per natural habitats.

The new IFC PS6 guidance now recognises the importance of ecosystem services. Where a project is likely to adversely impact on ecosystem services, as determined by the impact assessment process, a systematic review to identify priority ecosystem services must be carried out, any impacts on affected communities must be identified and impacts on the ecosystem services minimised. An assessment of the potential effect of the Project on ecosystem services is provided in the Chapter 17.

In addition to IFC PSs, the following WBG/IFC EHS Guidelines are applicable to the Project:

- General EHS Guidelines (April, 2007)
- Thermal Power Plants (December, 2008)

11.2.2.3 EBRD

EBRD has adopted a comprehensive set of specific PRs that projects are expected to meet. Furthermore, EBRD is committed to promoting EU environmental standards as well as the European Principles for the Environment (EPE), which are reflected in the PRs.

The PR6 "Biodiversity Conservation and Sustainable Management of Living Natural Resource" is the relevant requirement for this assessment. PR6 applies to projects in all types of habitats, irrespective of whether they have been disturbed or degraded previously, or whether or not they are protected or subject to management plans.

The objectives of PR6 are:

- To protect and conserve biodiversity
- To avoid, minimise and mitigate impacts on biodiversity and offset significant residual impacts, where appropriate, with the aim of achieving no net loss or a net gain of biodiversity
- To promote the sustainable management and use of natural resources
- To ensure that Indigenous Peoples and local communities participate appropriately in decision-making
- To provide for fair and equitable sharing of the benefits from project development and arising out of the utilisation of genetic resources
- To strengthen companies' license to operate, reputation and competitive advantage through best practice management of biodiversity as a business risk and opportunity
- To foster the development of pro-biodiversity business that offers alternative livelihoods in place of unsustainable exploitation of the natural environment.

11.2.2.4 ADB

Requirements for assessing and addressing biodiversity effects of projects are set out within ADB SR1: Environment, Section D8 'Biodiversity Conservation and Sustainable Natural Resource Management'. This document is included as an appendix to the SPS.

Section D8 requires the environmental assessment process to focus on the major threats to biodiversity and for the borrower/client to identify measures to avoid, minimize, or mitigate potentially adverse impacts and risks and, as a last resort, propose compensatory measures, such as biodiversity offsets, to achieve no net loss or a net gain of the affected biodiversity.

Obligations on the borrower/client differ depending on whether the habitat is classified as modified, natural or critical. For areas of critical habitat the requirements state that no project activity will be implemented in areas of critical habitat unless:

- There are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function.
- The Project is not anticipated to lead to a reduction in the population of any recognized endangered or critically endangered species or a loss in area of the habitat concerned such that the persistence of a viable and representative host ecosystem be compromised.

- For any lesser impacts, mitigation measures will be designed to achieve at least no net loss of biodiversity. They may include a combination of actions, such as post-project restoration of habitats, offset of losses through the creation or effective conservation of ecologically comparable areas that are managed for biodiversity while respecting the ongoing use of such biodiversity by Indigenous Peoples or traditional communities, and compensation to direct users of biodiversity.

Where a project involves activities in a critical habitat, ADB requires the borrower/client to retain qualified and experienced external experts to assist in conducting the assessment.

11.2.2.5 JBIC

The JBIC requires that proponents of projects seeking financing undertake appropriate actions to prevent or minimise impacts on the environment and local communities such that unacceptable effects are avoided. A brief presentation of the JBIC's 'Guidelines for Confirmation of Environment and Social Considerations' (JBIC Environmental and Social Guidelines) is included in Chapter 5. More specific information is provided below.

Environmental checklists are provided by JBIC for different industry types that detail the environmental and social impacts that should be assessed by proponents of projects. The environmental checklists of particular relevance to the proposed Project include Environmental Checklist 11: Thermal Power and Environmental Checklist 15: Power Transmission and Distribution Lines. Within these documents, requirements to assess and address the specific impacts on biodiversity are provided under Category 3: Natural Environment, which covers (1) protected areas and (2) ecosystems and biota.
The following guidelines are applicable to both aforementioned checklists:

- The Project is to be implemented outside protected areas designated by the countries laws or international treaties and conventions. In addition, a project is not to have a significant impact on such protected areas.
- Necessary action is to be taken to prevent significant project impact on ecologically valuable habitats, the lives of endangered species and to ensure conservation of biodiversity.
- If significant ecological impacts are anticipated, adequate environmental protection measures are to be taken to reduce the impacts on the ecosystem.

The following guidelines are specific to the aforementioned checklists:

Environmental Checklist 11: Thermal Power
The amount of water used by the project should not adversely affect the aquatic environment (e.g. rivers). If impacts are anticipated, adequate measures should be taken to reduce the effects. Discharge of thermal effluents, intake of a large volume of cooling water or discharge of leachates should not adversely affect the ecosystem of surrounding water areas.

Environmental Checklist 15: Power Transmission and Distribution Lines
Adequate measure should be taken to prevent disruption to migration routes and habitat fragmentation of wildlife, and livestock. If improved access to the project is required, adequate measures for preventing impacts are to be considered. These impacts could include but are not limited to: destruction of forest,

poaching, desertification, reduction in wetland areas and disturbance of ecosystem due to introduction of non-native invasive species and pests. In cases where the project site is located in undeveloped areas, the new development should not result in extensive loss of natural environments.

11.3 Methodology and assessment criteria

11.3.1 Baseline conditions methodology

11.3.1.1 Desktop review

A desk-based review of available information from national and international sources was undertaken. This included:

- Convention on Biological Diversity website (http://www.cbd.int/)
- UNESCO database on World Heritage Sites (http://whc.unesco.org/en/interactive-map/)
- International Union for Conservation of Nature and Natural Resources (IUCN, 2014) Red List of Threatened Species (http://www.iucnredlist.org)
- Species protected in Mongolian law (http://www.legalinfo.mn/annex/details/2964?lawid=2734)
- BirdLife International Data Zone (http://www.birdlife.org/datazone/home).
- World Wildlife Fund (WWF) website (http://wwf.panda.org/)
- Mongolian threatened species and species of conservation concern recorded in the Red Book of Mongolia (MEGD, 2014) (http://redbook.mn/download/redbook.pdf) and the previous Mongolian red list series (http://www.nationalredlist.org/tag/Mongolia/) including;
  - Mongolian Red List of Mammals (Clark et al., 2006a; http://siteresources.worldbank.org/INTMONGOLIA/Resources/Conservation_AP_for_MongMammals_ENG.pdf);
  - Mongolian Red List of Birds (Gombobaatar and Monks, 2011);
  - Mongolian Red List of Amphibians and Reptiles (Clark et al., 2006b; http://siteresources.worldbank.org/EXTEAPREGTOPENVIRONMENT/Resources/Herpredlisteng.pdf);
  - Mongolian Red List of Fishes 2006;
  - Mongolian Red List of Plants 2011.
- Relevant reports and research papers

Information on the following nature conservation areas and other protected areas (existing or proposed) within or near the AoI has also been collected and reviewed:

- Ramsar Sites
- Key Biodiversity Areas (KBA)
- Important Bird Areas (IBA)
- World Heritage Sites (WHS)
- National conservation areas in Mongolia:
  - Forest Parks
  - Natural Tourism Parks Strict Nature Reserves
  - Watershed Protection Forests

- Strictly Protected Areas
- National Conservation Parks
- Natural Complex Areas
- Natural Reserves
- National Monument Areas
- Buffer Zones on Protected areas

11.3.1.2 Ecological surveys

Ecological surveys were undertaken by Mongolian environmental consultancy Nature Friendly in October and November 2013 and August 2014. The following surveys were undertaken:

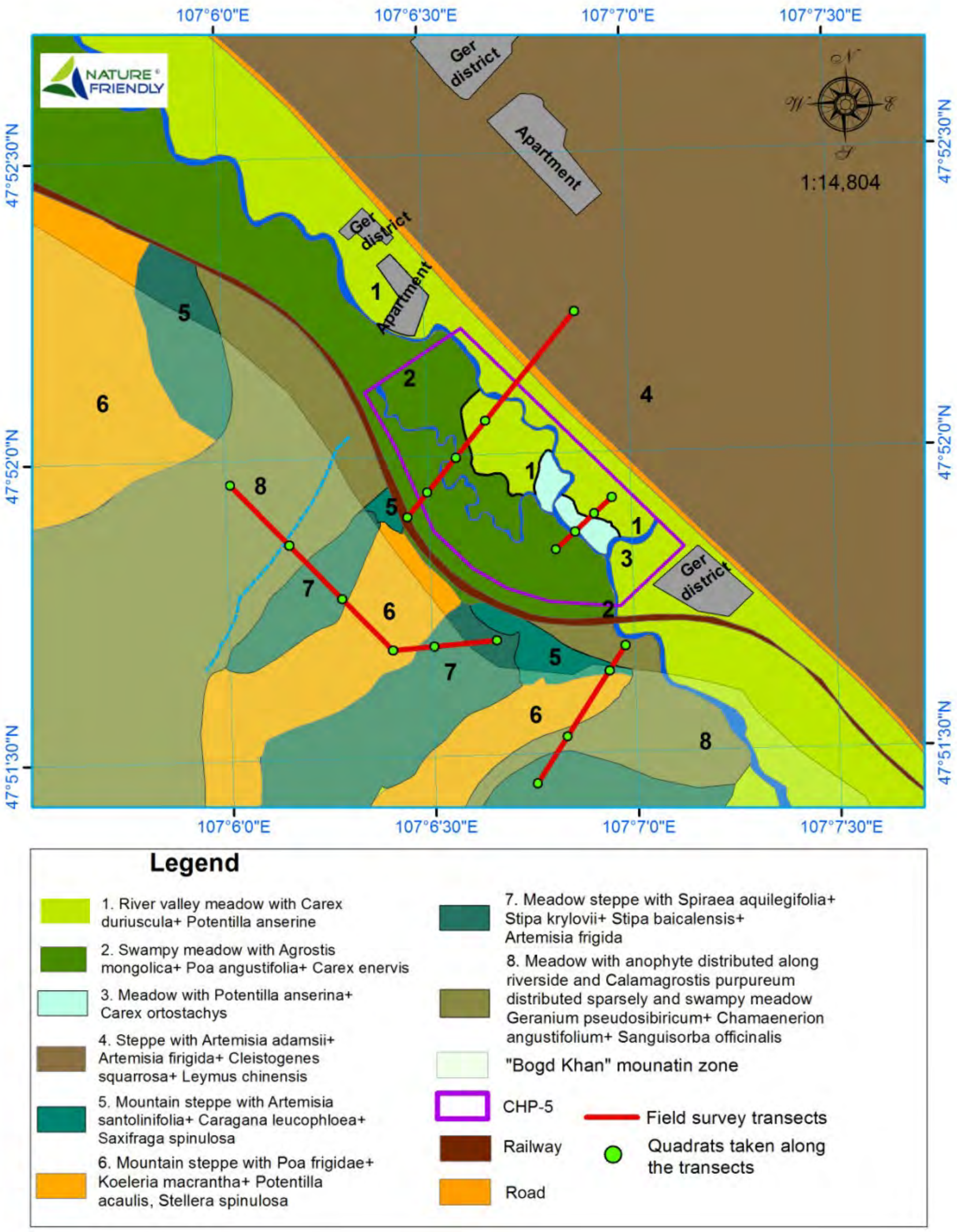
- Habitats, vegetation and flora
- Fauna including birds, mammals, herpetofauna, fish and terrestrial invertebrates.

The baseline ecology reports and data are included in Volume III, Appendix K of the ESIA. The following sections provide a brief summary of the survey methods used.

11.3.1.3 Habitats, vegetation and flora

Habitat, vegetation and flora surveys were carried out in October and November 2013. The aim of these surveys was to identify the broad habitat types, plant communities and threatened/protected flora within the AoI of the Project. The habitats, vegetation and flora were recorded along four transects crossing all project components (see Figure 11.1 and in Volume III, Appendix K for full details). Between four and six quadrats were taken along each transect and each transect was surveyed once. A vegetation map was produced (Figure 11.1) using a topographical map and aerial imagery.

Figure 11.1: Vegetation map and transect lines in the AoI of the Project

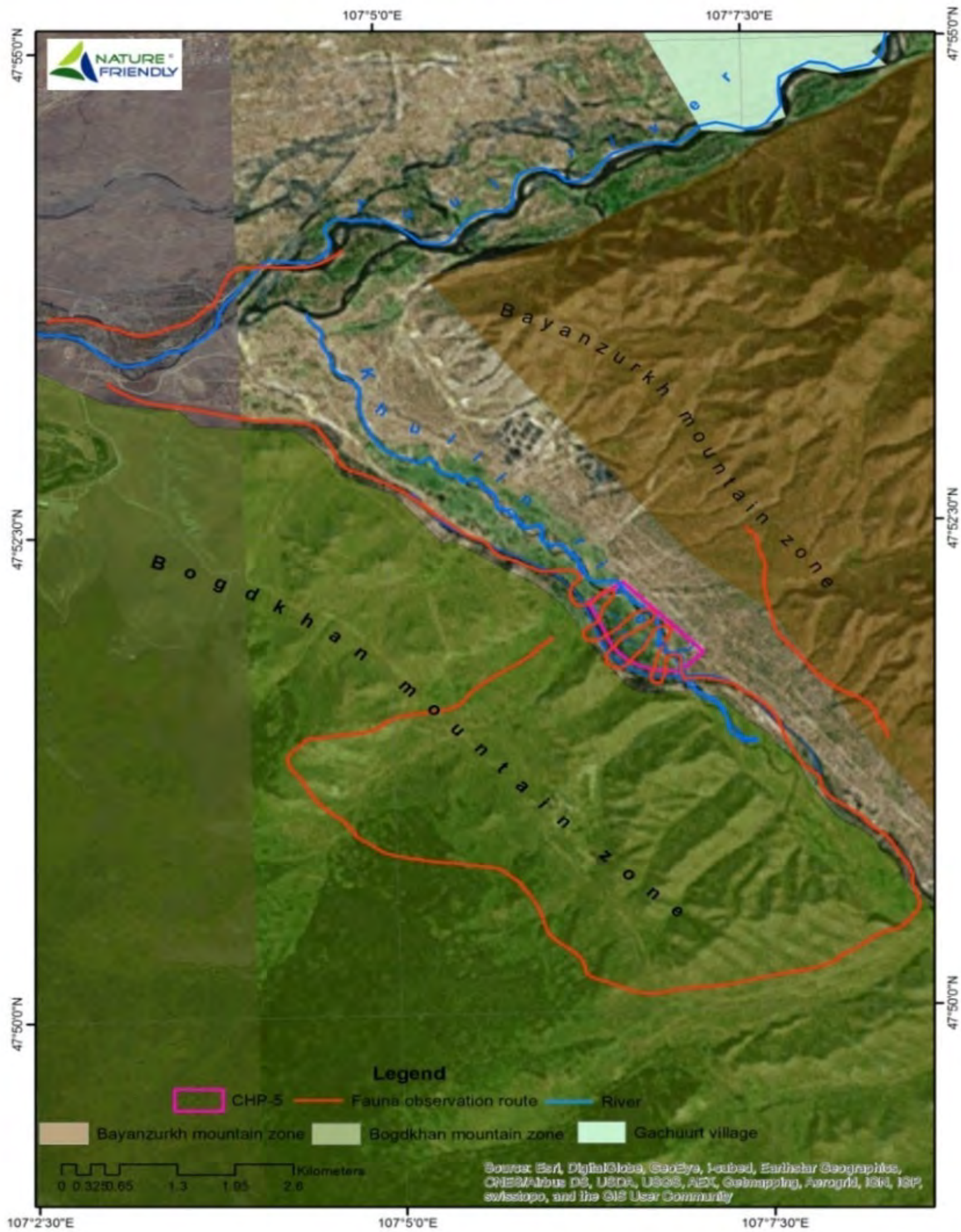


Source: Nature Friendly

Mammals

The presence of mammals was identified by observing diurnal species and recording their sound, tracks, droppings and remains along three transects established at the Project site and surrounding areas (see Figure 11.2. The likely occurrence of mammal species of conservation importance was also recorded based on the availability of suitable habitat conditions. The mammal survey methodology used was a rapid assessment (adapted from Hill et al., 2005), which is commensurate with the modified nature of the habitats in the Project area.

Figure 11.2: Fauna observation routes within the AoI of the Project



Source: Nature Friendly

Birds

All bird species were recorded using transects in the same locations as the mammals as mentioned above (Figure 11.2). Each survey transect was surveyed once in October 2013 and once in November 2013. It was considered that additional surveys at different times of year would not detect significant changes in species. The bird survey methodology used is a rapid assessment (adapted from Boldbaatar, 2002a, 2002b; Gombobaatar and Monks, 2011), which is commensurate with the modified nature of the habitats in the Project area.

Herpetofauna

Observations for reptiles and amphibians were carried out in August 2014 along the transects shown in Figure 11.2. A desk based study was also completed using literature (Munkhbayar et al., 2010). Reptile and amphibian surveys were not conducted in October / November 2013 due to reptiles being less active in the cold weather.

Fish

The Khuliin River flows through the Project site (see Table 12.2) and drains into the Tuul River, which in turn is one of the largest rivers of the Yenisei River basin. The field study conducted during August 2014 involved direct observations of the fish in the seasonal Khuliin River (which was very shallow and has clear water) and using fishing rods in the Tuul River.

Terrestrial Invertebrates

No field studies were conducted for terrestrial invertebrates. Data was drawn from the Bogd Khan Mountain and Tuul River basin insect study report prepared by The Insect Study Laboratory of the Mongolian Academy of Sciences (Enkhtuul, 2008).

11.3.2 Scope of assessment

11.3.2.1 Temporal scope

The biodiversity baseline conditions for the Project were assessed using field survey information collected in 2013 and 2014, as well as recent data from literature and online sources.

11.3.2.2 Spatial scope

An ecological impact assessment needs to identify all ecological features which occur with the areas which are likely to be affected by a project, this area being known as the AoI. As part of this ecological assessment, all ecological features within the AoI of each of the Project components were reviewed and species specific surveys were undertaken within representative areas of the habitats present. The AoI includes:

- Areas directly within the land take for the Project

- Areas which will be temporarily affected during construction, including access routes and the site compound
- Areas likely to be impacted by hydrological disruption
- Areas where there is a risk of pollution and noise disturbance during construction and /or operation.

For this assessment, the AoI consists of:
- The Project footprint and surrounding habitats to 300m
- Designated areas within 10km of the Project
- Protected and notable species within 2km of the Project.

The ecological baseline within the AoI was formulated from information obtained from a number of primary and secondary sources. Details on the methodologies used are provided above.

11.3.3 Assumptions and limitations

The ecological surveys only focused on the typical habitats and areas of ecological interest. Due to the scale of the Project, it was neither possible nor practical to survey the entire AoI of the Project.

Surveys were conducted in October/ November 2013 and August 2014; and as such it was not possible to survey all seasons when species are active.

This assessment has considered the nature of potential unexpected ecological features and precautionary mitigation measures along with additional monitoring included in Section 11.6.

11.3.4 Ecological Impact Assessment Methodology

The magnitude of the potential impacts upon each ecological feature has been assessed using the criteria defined in Chapter 5 of this ESIA.

The sensitivity of the ecological receptors has been translated into conservation value categories, which are detailed in Table 12.2 below. This approach is consistent with the criteria globally adopted for ecological impact assessment and is different to the sensitivity criteria described in Section 5.3.4.3 of this document.

The significance criteria used for the ecological assessment correlates with the general significance matrix outlined in Section 5.3.4.4, with the exception of the ‘very high’ and ‘high’ sensitivity categories.

Table 12.2: Criteria for determining conservation value (sensitivity) of the ecological receptors

Conservation value (sensitivity)	Examples	Species criteria	Habitat or site criteria
Very High	Very high importance and rarity. International scale with limited potential for substitution.	IUCN Critically endangered and endangered species.	Internationally designated sites (or equal status). Critical habitats of significant international ecological

Conservation value (sensitivity)	Examples	Species criteria	Habitat or site criteria
			importance.
High	High importance and rarity, national scale, or regional scale with limited potential for substitution, species of international status but not within designated areas.	IUCN Vulnerable species. European species and nationally protected species of significant population size and importance.	Nationally designated sites (or equal status). Areas of critical habitats of national ecological importance, and natural habitats of significant ecological importance and/or high biodiversity with limited potential for substitution.
Medium	High or medium importance and rarity, local or regional scale, and limited potential for substitution, species of national status but not within designated areas.	IUCN Near Threatened species. Nationally protected species or rare species, but not a significant population size and not of national importance.	Regionally important natural habitats. Natural habitats. Modified habitats with high biodiversity or under significant threat of loss within the region.
Low	Very low or low importance and rarity, and local scale.	IUCN Least Concern. Species of local national importance.	Undesignated sites and habitats of natural habitats of some local biodiversity and cultural heritage interest. Modified habitats with limited ecological value. Other sites with little or no local biodiversity and cultural interest. Modified habitats with limited biodiversity value.
Negligible	Very limited ecological importance.	IUCN Least Concern species. Species of no national importance.	Highly modified habitats of no biodiversity value.

11.4 Baseline description

11.4.1 Overview of Biodiversity in Mongolia

Mongolia is part of two terrestrial ecoregions and one freshwater ecoregion within the Palaearctic ecozone. An ecoregion is a large area of land or water that contains a geographically distinct assemblage of natural communities that: share a large majority of their species and ecological dynamics; share similar environmental conditions; and interact ecologically in ways that are critical for their long-term persistence The Altai-Sayan Ecoregion includes temperate coniferous forests stretching across Russia, Mongolia, Kazakhstan and China, and the Daurian Steppe ecoregion includes temperate grasslands, savannahs and shrubland stretching across China, Mongolia and Russia. The Russian Far East Rivers and Wetland ecoregion includes small rivers across China, Mongolia, and Russia) (http://wwf.panda.org/about_our_earth/ecoregions/ecoregion_list/).

Mongolia occupies an ecological transition zone in Central Asia where the Siberian taiga forest, Central Asian steppe, Altai Mountains and Gobi Desert meet. Mongolia's taiga, steppe and desert ecosystems have been less affected by human activity than is the case in neighbouring countries. Mongolia is divided into six natural belts and zones, consisting of the high mountain alpine belt, mountain taiga belt, mountain forest steppe, rolling steppe, and semi-desert and desert zones. This range of unique habitats gives rise to high levels of biodiversity over all flora and fauna groups (Gombobaatar et al., 2014).

There are over 5,682 plant species recorded in Mongolia, including 2,950 vascular plant species, 445 moss species, 999 lichen species and 1,288 algae species. More than 100 species of plants are currently used for medicinal purposes and more than 200 species for pharmaceutical purposes. In addition, 200 species are used for tea, 50 species for food and over 100 species are important for livestock feed. The area of Mongolia's forest fund occupies 12.1% of the total land area, comprising 140 species of trees and shrubs, with larch being the dominant species (CBD, 2014). Mongolia is host to 138 species of mammals. There are 472 bird species recorded in Mongolia, of which 391 are migratory. This high percentage of migratory bird species is due to the four major global migratory routes recognized in Mongolia: the East Asia-Australasia flyway, Central Asia flyway, West Pacific flyway and the Africa-Eurasia flyway. Due to Mongolia's harsh continental climate, it has relatively low herpetofauna diversity. There are six species of amphibians and 21 species of reptiles. Due to the country's landlocked position, Mongolia is dependent on its lakes and rivers for water, as are its 76 fish species. Over 13,000 species of insects are recorded in Mongolia including moth and butterfly species such as; *Leptidea morsei* F., *Nymphalis vau-album, Euphydryas intermedia, Triphysa phryne, Coenonympha glycerion, Lycaena helle, Coenonympha oedippus, Coenonympha hero, Cupido minimus*, and *Nymphalis polychloros* of which some have been recorded as nationally extinct or critically endangered in European countries (CBD, 2014) .

Mongolia is rich in natural resources, with mining having rapidly increased recently; however, environmental recovery work has not been carried out which is leading to ecosystems being negatively impacted by activities. Studies have indicated that in some areas, rivers inhabited by fish species in Mongolia are impacted by pollution from large and small gold mining operations and urban pollution, which both generate localised sedimentation that may bury eggs at the spawning grounds of certain fish species (e.g. sturgeon). However, the major threat to fish diversity remains overfishing and illegal fishing. The major threats to bird diversity in Mongolia are overgrazing by livestock, illegal logging of forests, fires, hunting and trapping. A further problem at some sites in recent years has been the use of rodenticides to control vole outbreaks, which has resulted in the poisoning of birds of prey and other important species (e.g. cranes) (CBD, 2014).

Over 128 plant species are registered as endangered or threatened. More than 80 plant species are intensively used for food and other purposes. The conservation of 19 insect species is under legal protection. Twenty-four globally threatened birds are known to have habitats in Mongolia. Species for which Mongolia plays a particular important role include the swan goose (***Anser cygnoides)***, saker falcon (***Falco cherrug***), white-naped crane (*Grus vipio*) and white-throated bushchat (*Saxicola insignis*). Negative trends in wildlife gene pools have been incurred, caused by negative changes in the numbers and quality of mammalian populations. Hunting game animals and nomadic animal husbandry are cultural elements upheld by Mongolians since ancient times, but many of these species' populations have been decreasing drastically (e.g. in the last 18 years, there has been a 92% decrease in red deer populations). Thirty-two species (23.3%) of Mongolian fauna are protected as rare species in the Mongolian Red Book and the Mongolian Law on Fauna (CBD, 2014).

Trends within Mongolia include habitat fragmentation and deterioration, the drying up of water sources, and desertification. As a result of the extensive use of grasslands, the integrity and sustainability of this ecosystem has been degraded. A 2007 water census recorded that 372 rivers and streams and 1,158 springs have dried up in the last 40 years. These dry rivers and lakes are evidence that aquatic and marshy ecosystems are deteriorating. The deterioration of water environments and water shortages in turn influences many biological species, especially bird species that rely on Mongolian lakes as a part of their migratory cycle. This is exacerbated by fires that have been affecting forests and steppes, destroying large portions of land and greatly affecting wildlife populations in a negative manner. As a consequence of many of these and other factors, but particularly global warming and climate change, desertification has impacted 77.2% of Mongolia's total area, especially affecting mammals living underground.

11.4.2 Protected Areas

The Project site is located between Bogd Khan Mountain National Park, SPA and Biosphere Reserve, Gachuurt Village, and Gorkhi – Terelj National Park, KBA and IBA (http://www.birdlife.org/datazone/sitefactsheet.php?id=28297) (refer to Figure 11.4 and Figure 11.5). It is considered that the boundaries of Bogd Khan SPA and Biosphere Reserve are not accurate on international databases (www.protectedplanet.net) and the boundary of the relevant national website is correct (www.bogdkhanuul.mn).

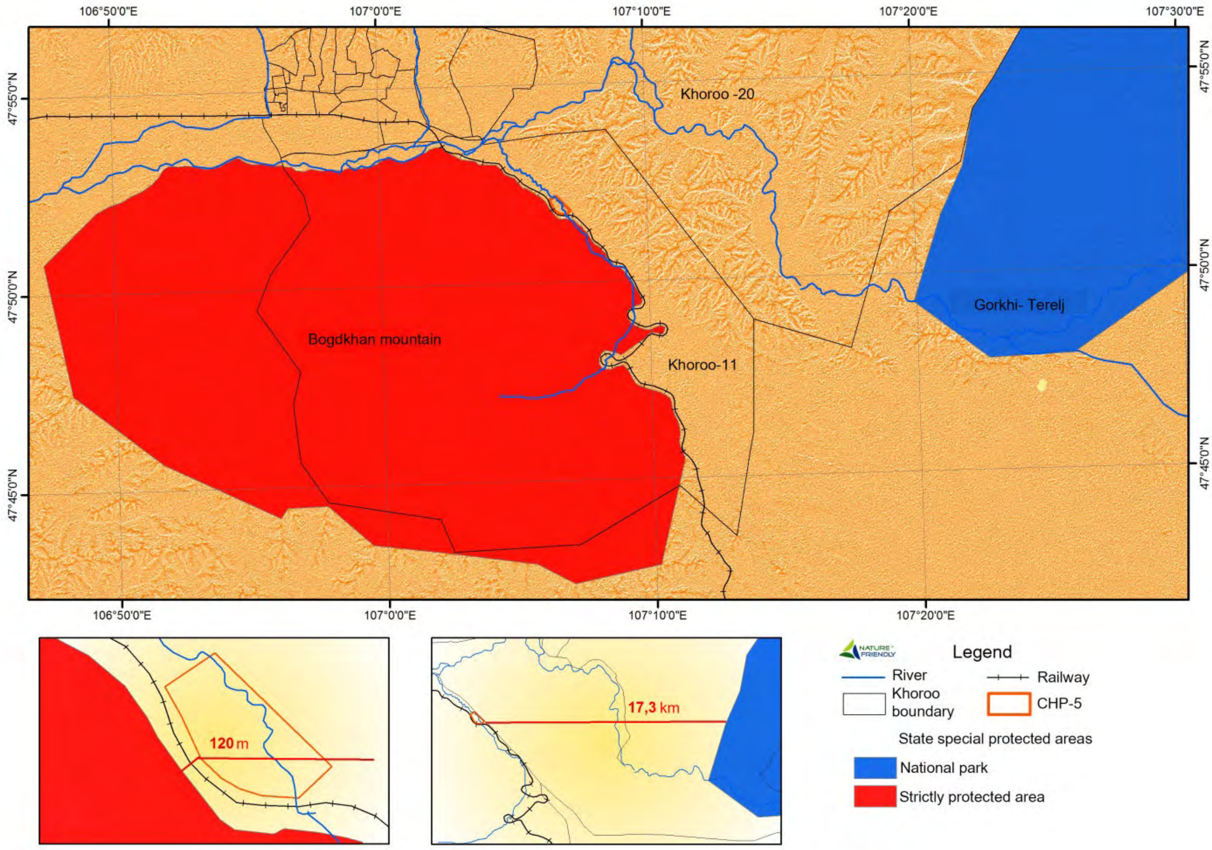
Bogd Khan Mountain zone covers 41,651 ha. It was designated as a National Park in 1783 making it the oldest national park in the world. It was also designated as an SPA (IUCN category Ib) in 1995 and a Biosphere Reserve under UNESCO in 1996. It was placed on the UNESCO World Heritage Tentative List in 1996, in the cultural category. The SPA has been divided into three categories (limited, protected and virginal) according to the Law on Protected Areas (refer to Section 11.2.1.1). The Project site is located 50m from the limited zone, and 2km from the protected zone. The SPA does not have an additional buffer zone as it overlaps with the limited zone of the National Park.

Bogd Khan SPA has preserved its biodiversity features from both Mongolian Daurian Steppe and forest taiga of Khan Khentii Mountain Range SPA and IBA (http://www.birdlife.org/datazone/sitefactsheet.php?id=28301). Due to impacts caused by human settlement, road and railway construction and operation, Bogd Khan Mountain has become more isolated from the 1,227,000ha Khan Khentii Mountain Range including Gachuurt village and Gorkhi – Terelj forest taiga, which has resulted in fragmentation of wildlife habitat.

Gorkhi - Terelj National Park (IUCN category II), IBA and KBA is approximately 20km to the east of the Project site and is contiguous with Khan Khentii SPA and IBA which is 60km north of the Project site. They both share similar habitats where significant populations of globally threatened species can be found, including the yellow-breasted bunting (*Emberiza aureola*) and saker falcon (*Falco cherrug*) which are both listed as endangered under the IUCN Red List.

The location of the Project site in relation to the Bogd Khan SPA and the Gorkhi - Terelj National Park are shown in Table 11.3

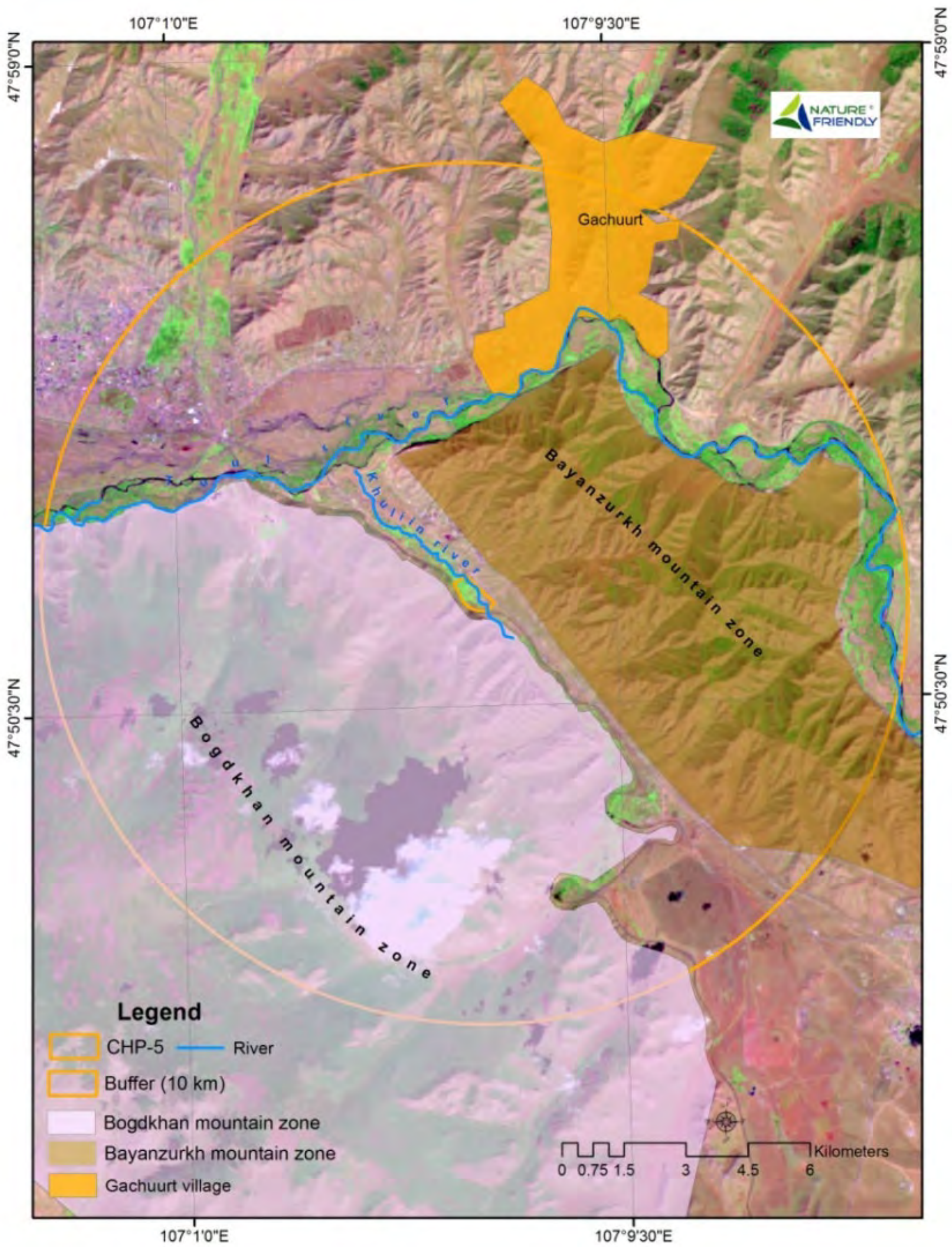
Figure 11.3: Distance of SPAs to the Project site



Source: Nature Friendly

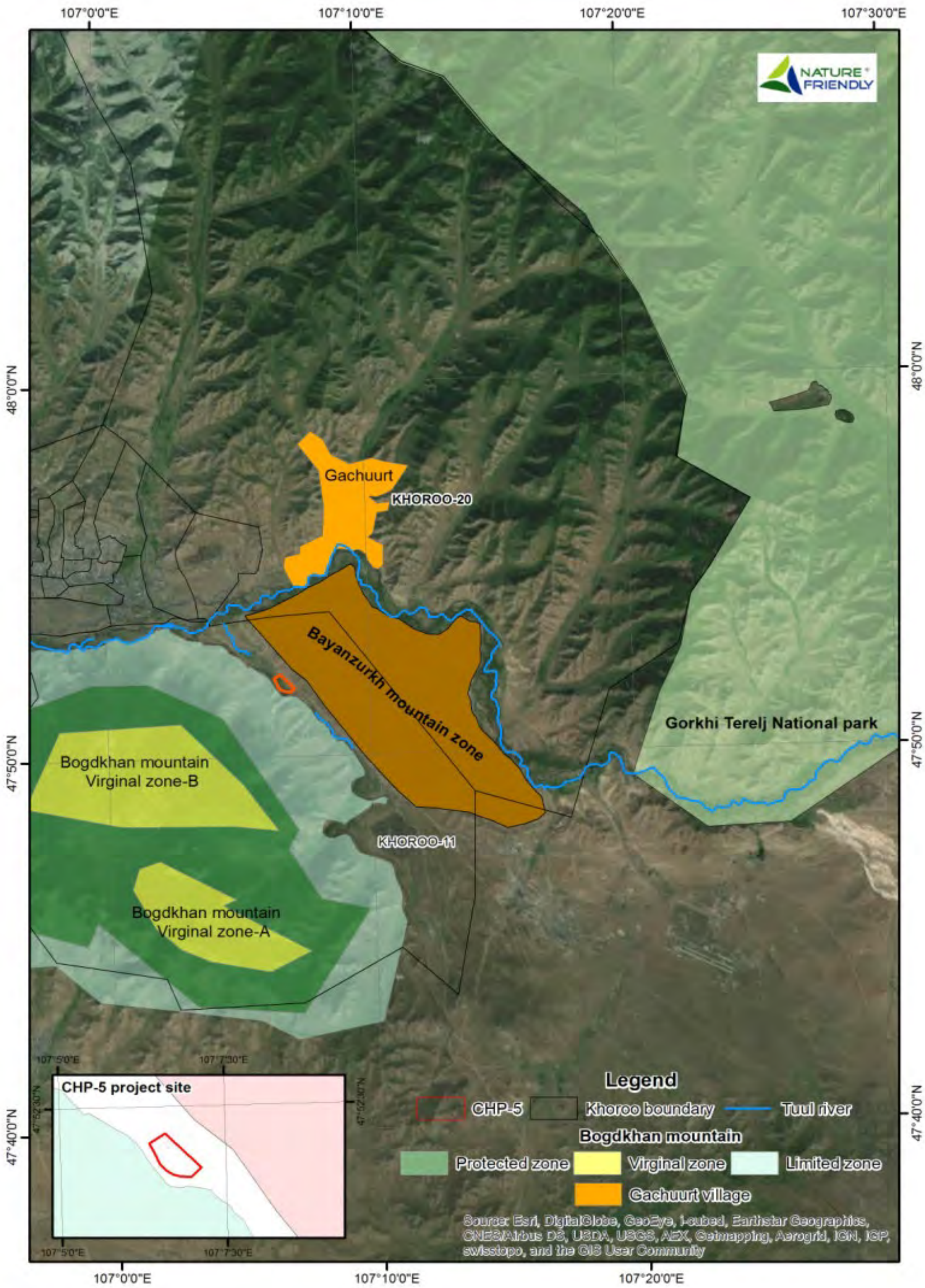
There are no Ramsar sites within 10km of the Project site. Bayanzurkh Mountain zone is not protected by law.

Figure 11.4: Protected areas within 10km from Project



Source: Nature Friendly

Figure 11.5: Protected areas within 20km of the proposed Project site, with Bogdkhan Mountain zones highlighted



Source: Nature Friendly

11.4.3 Habitats and plant communities

The sections below present a summary of the broad habitats and plant communities in the AoI of the Project. The habitats in the AoI and their IFC PS6 category and conservation value are listed in Table 12.3. Using the criteria in the IFC PS6 (IFC, 2012a) and IFC Guidance Note 6 (IFC, 2012b), none of the habitats within the AoI are likely to be classified as critical habitat.

The Project area is located within the Daurian Steppe ecoregion. Eight plant communities were identified within the Project site and the surrounding areas (see Table 11.3 below and Figure 11.1 above). The Project site itself comprises three vegetation communities including river valley meadow, marginal river meadow and meadow.

An ephemeral watercourse, Khuliin River crosses the Project area in the summer months entirely due to storm precipitation. The river is very shallow and has clear water. There is no aquatic vegetation due to the lack of summer flows and permanent surface water and limited habitat for fish.

All plant communities recorded in the Project area are degraded as a result of overgrazing and other human pressures.

Table 11.3: Habitats and plant communities within the AoI of the Project

Habitat and plant community type	Within Project area	IFC habitat category	Conservation value
Seasonal river	Y	Natural	Medium
River valley meadow Carex *duriuscula+Potentilla anserine*	Y	Natural	Medium
Marginal river meadow *Agrostis mongolica+Poa angustifolia+Carex enervis*	Y	Natural	Medium
Meadow *Potentilla anserina+Carex ortostachys*	Y	Natural	Low
Steppe *Artemisia adamsii +Artemisia frigida +Cleistogenes squarrosa + Leymus chinensis*	N	Natural	Low
Mountain steppe *Artemisia santolinifolia + Caragana leucophloea + Saxifraga spinulosa*	N	Natural	Medium
Mountain steppe *Poa frigidae + Koeleria macrantha + Potentilla acaulis, Stellera chamaejasme, Artemisia frigida*	N	Natural	Medium
Meadow steppe *Spiraea aquilegifolia + Stipa krylovii + Stipa baicalensis + Artemisia frigida*	N	Natural	Low
Meadow with anophyte distributed along riverside, *Calamagrostis purpureum* distributed sparsely and marginal meadow *Geranium pseudosibiricum + Chamaenerion angustifolium +Sanguisorba officinalis*	N	Natural	Low

11.4.4 Flora

During the flora surveys in October and November 2013, a total of 113 species were recorded in the Project site and the surrounding areas, including the Bogd Khan mountain zone and nearby settlements. Among these, 44 plant species were recorded within the proposed Project site comprising of 45ha (see Appendix K in volume III for a full list of plant species identified in the 2013 surveys).

None of the species recorded in these surveys are rare, endemic and/ or threatened in Mongolia (Mongolia Red Book 2013) or threatened globally (IUCN, 2014). None of the plants recorded on site are listed as "Extremely Rare" on the Law on Natural Flora (see Table 11.1). A total of 19 species of medicinal plants are found to be in on the Project site and AoI, of which eight species occur within the Project area.

11.4.5 Fauna

Mammals

Bogd Khan Mountain is rich in mammal species with a total of 50 species having been recorded (Enkhtuul, 2008).

During the October/November 2013 surveys, a Siberian chipmunk *Eutamias sibiricus* was recorded in the forest of Bogd Khan Mountain, approximately 2km from the project area. Domestic animals and horses were found grazing on the Project area. No other mammals were observed during the field surveys, potentially due to the lack of suitable habitats.

The Project area has potential to support mammal species such as Mongolian five-toed jerboa (*Allactaga sibirica*), narrow-headed vole (*Microtus gregalis*), and long-tailed ground squirrel (*Spermophilus undulatus*). According to the previous studies, Bogd Khan Mountain supports four species which are on the IUCN or Mongolian red lists (Table 11.4). Full lists of mammal species occurring within the Bogd Khan Mountain, including rare and threatened species, can be seen in Appendix K in Volume III of the ESIA.

Red deer (*Cervus elaphus*) has been previously sighted in the Project area. It is listed as Least Concern on the IUCN Red List and is protected under the Mongolian Law on Animals. There has been an observed decline of greater than 80% over the past three generations due to exploitation and habitat loss; this has led to increased legal protection of the species. The species is primarily targeted for its antler velvet, which is highly valued in traditional medicines.

During the September-October rut, Mongolian populations of red deer congregate in large groups in open lowland areas (Lovari et al., 2008) and could therefore potentially use the site. This is considered very unlikely because of human settlements, road traffic and railway fences prevent the movement of animals.

Tarbagan marmot (*Marmota sibirica*) is listed as Endangered on the IUCN Red List. The species was not sighted during surveys but it has been found in the wider area previously (Enkhtuul, 2008). The Tarbagan marmot is distributed in piedmont and mountain steppes and alpine meadows (up to 3,800 m) in Tuva, and Transbaikalia (Russia), Mongolia, and China. Given the habitats recorded on the Project site, this species is unlikely to occur there. Most of the species' global range is in Mongolia; however, the species is experiencing an ongoing decline in population size, estimated at 70% over the past 10 years due to exploitation and disease. Hunting is only permitted between August 10th and October 15th depending on population size (Batbold et al., 2008).

Siberian musk deer *(Moschus moschiferus*) has previously been recorded in the wider area but was not sighted during the 2013/2014 surveys. It is listed as Vulnerable on the IUCN Red List and Critically Endangered in the Mongolian Red Book. The species is also listed under CITES Appendix II (refer to Section 11.2.2.1). Hunting has been prohibited since 1953 and it is protected as Endangered under the Law on Animals 2012. Inhabiting mountainous taiga (broadleaf and needle forest), these animals are unlikely to be present in the Project area as movement is restricted (due to the reasons stated above) and a lack of suitable habitat.

The forest sable *(Martes zibellina*) was also previously recorded from 2km of the Project site but not during the 2013/2014 surveys. It is listed as Least Concern on the IUCN Red List and Rare in the Mongolian Red Book. The fur of this species is highly valued contributing to population decline. Hunting of this species was entirely prohibited in Mongolia between 1953 and 2000, but is currently permitted between October 21st and February 16th (Abramov and Wozencraft, 2008). The species is primarily found in dense coniferous forests and therefore unlikely to be found near to the Project area.

Table 11.4: Threatened and protected mammal species potentially within the AoI

Scientific name	English name	IUCN Red List	Legal protection	Mongolian Red Book
Cervus elaphus	Red deer	LC	Annex #1 of Governmental Act #7 of 2012 Protected under Appendix III of the Bern Convention	-
Marmota sibirica	Tarbagan marmot	EN	-	-
Moschus moschiferus	Siberian musk deer	VU	Listed under CITES appendix II Law on Animals 2012	CR
Martes zibellina	Forest sable	LC	Annex #1 of Government Act #7 of 2012	R

Birds

A total of 39 bird species were observed in the Project area, forest zone and the nearby forest in the protected area during October/ November 2013 surveys. The Tuul River valley, within 5km of the project site, is likely to be a migratory corridor given records (http://birdsmongolia.blogspot.co.uk/) of cinereous vulture *Aegypius monachus*, saker falcon *Falco cherrug* and horned lark *Eremophila alpestris* in October 2014 and rare and scarce migrants in January 2015, i.e. water pipit *Anthus spinoletta* and hooded crow *Corvus cornix* (third modern-day record for Ulaanbaatar).

Of the 39 species, 24 are resident species with 10 occurring within the Project area itself; very high numbers of Daurian jackdaws *Corvus dauuricus*, were also recorded. Other resident birds are distributed within the neighbouring Bogd Khan Mountain. Full lists of resident and migratory bird species occurring within the Bogd Khan Mountain can be seen in Appendix K in Volume III of the ESIA. No habitats for rare species were observed during the baseline surveys and none of the bird species observed are listed as threatened on the IUCN Red List, Mongolian Red Book or protected under Annex #1 of Government Act #7 of 2012.

Of the species recorded in the wider area, bearded vulture *Gypaetus barbatus* is listed as Near Threatened on the IUCN Red List, Endangered on the Red Book of Mongolia and is protected under Annex #1 of Government Act #7 of 2012, and Annex 2 of CITES. It is known to occur in the Bogd Khan Mountain and its surrounding valleys and rocky mountains, but it is not considered likely to occur at low altitude in the project area. Saker falcon is known from the Tuul Valley and is listed as Endangered on the IUCN Red List and protected under Annex 2 of CITES. It is adapted to hunting mid-sized diurnal terrestrial rodents close to the ground in open grassy landscapes such as desert edge, semi-desert, steppes and arid montane areas (BirdLife International, 2013). Saker falcon uses cliffs or copses for nesting and therefore breeding is very unlikely to occur in the project area.

Herpetofauna

No reptiles or amphibians were found in the Project site during the surveys undertaken in August 2014.

The Tuul River, located 5km from the site is part of the distribution range of the Siberian salamander (*Salamandrella keyserlingii*). The Siberian salamander is listed as Endangered in the Red Book of Mongolia and protected under Annex #1 of the Government Act #7, 2012. The species is listed as Least Concern on the IUCN Red List due to its wide distribution but protection measures in Mongolia include creation of Strictly Protected Areas and National Parks such as Khan Khentii SPA and Bogd Khan Mountain SPA. It is found mainly in wet coniferous, mixed, deciduous forests in the taiga zone and forest steppe and along the edges of woods (adjacent to stagnant or semi-flowing waters) (Kuzmin et al., 2008). It is more rarely found in meadows, willow stands, fields, suburban and urban areas and therefore unlikely to be present on the Project site.

Fish

The Khuliin River runs through the Project area temporarily each summer, draining into the Tuul River. No fish species were observed during the field studies in August 2014 along the Khuliin River and it is not used by local communities in the Project area for fishing (refer to Chapter 17. Three species of fish were captured from the Tuul River including sharp-snouted lenok (*Brachymystax lenok*)*,* Arctic grayling (*Thymallus arcticus*) and Siberian stone loach (*Barbatula toni*) (see Appendix K in Volume III of the ESIA). Sharp-snouted lenok are locally threatened from illegal fishing and gold mining and used to be listed as Vulnerable on the previous Mongolian Red List of fishes; however, it is not in the current Red Book of Mongolia. There is a possibility that some of fish species swim from the Tuul River into the Khuliin River during their growth stage.

Terrestrial Invertebrates

The Bogd Khan Mountain SPA supports 1,660 insect species of 174 families and 16 orders. Of these, five insect species are registered in the Red Book of 2008 of Bogd Khan Mountain (see Table 11.5 below). The Apollo butterfly (*Parnassius apollo*) is listed as Vulnerable on the IUCN Red List and protected under Annex #1 of Governmental Act #7, 2012 and Annex 2 of CITES. Due to the active feeding of birds in the area and unsuitable habitats for insect species, occurrences for rare insect species within the Project area are considered to be low. Full details and photographs of insects observed during August 2014 surveys can be found in Appendix K in volume III of the ESIA.

Table 11.5: Threatened and protected insect species in Bogd Khan Mountain

Scientific name	English name	IUCN Red List	Legal protection	Mongolian Red Book
Parnassius apollo	Apollo butterfly	VU	Annex #1 of Government Act #7, 2012 Annex 2 of CITES	-
Papillo machaon	Swallowtail butterfly	-	Annex #1 of Government Act #7, 2012	-
Deilephila elpenor	elephant hawk moth	-	Annex #1 of Government Act #7, 2012	-
Hemaris tityus	the narrow bordered bee hawk-moth	-	Annex #1 of Government Act #7, 2012	-
Bombus modestus	Odestus bumblebee	-	Annex #1 of Government Act #7, 2012	-

The Project site is a natural habitat of low conservation value and the AoI within 2km has some elements of natural habitat of moderate conservation value.

11.5 Impact identification and assessment

This section describes the likely ecological impacts of the main activities associated with the Project prior to mitigation being applied. The impacts are presented for each project phase i.e. construction, operation and decommissioning. Impacts on ecological features of negligible conservation importance are not assessed or discussed in this chapter.

11.5.1 Construction Phase

During the construction of the Project, the potential impacts could include:

- Permanent habitat loss of 45ha during construction of the Project, construction of a new railway line within the Project footprint and loading facilities
- Temporary habitat loss of approximately 14- 15ha to the east of the Project site during laydown of temporary facilities during construction
- Permanent loss of habitat and disturbance to surrounding habitats to the selected borrow pit site
- Noise and light disturbance from construction activities affecting birds and mammals

- Dust deposition around working areas affecting adjacent habitats and the species they support
- Increased risk of localised pollution events due to use of construction vehicles affecting adjacent habitats
- Localised changes in air quality resulting from construction activities and increased vehicle movements through the area
- Accidental introduction and dispersal of invasive species from construction activities

11.5.1.1 Protected Areas

The limited zone of Bogd Khan Mountain National Park SPA, the IBA and Biosphere Reserve identified in Section 12.4.2 are located 50m from the Project boundary; the protected zone of the SPA is located 2km away and the virginal zones are both located within 5km of the Project site. Due to the distance from the Project site, the above protected areas are unlikely to be affected by the works. However, there is the potential that illegal hunting by workers could occur during construction which could affect species within the protected areas. The conservation value of the protected area is considered to be very high (international importance), but impact magnitude is minor due to this potential risk. The resulting ecological effects are therefore **moderate**.

Noise from general construction works affecting the fauna of the Bogd Khan National Park is assessed qualitatively as not being significant. However, short term, temporary impacts due to construction works close to the site boundary may cause significant adverse effects if the exposure to this is sudden. However, it is anticipated that noise generated during the early stages of construction will be gradual and allow time for sensitive fauna to move away and avoid being adversely affected.

Gorkhi – Terelj National Park, KBA and IBA, and Khan Ketti IBA are located over 20km from the Project site boundary. Therefore the magnitude of any project impacts is considered to be negligible. The conservation values of these sites are very high but the overall ecological effects are considered to be **negligible**.

11.5.1.2 Project Site and Surrounding Habitats

The Project site comprises three vegetation communities and a seasonal river (See Figure 11.1 and Table 11.3). The Project will result diversion of the Khuliin River and in the decrease in the value of the Khuliin River (seasonal) in its natural state as this will be converted to a man-made channel and loss of habitat on the Project site. The seasonal river is considered to be of low conservation value (sensitivity) and the impacts of the works will be moderate in magnitude; therefore in the absence of mitigation, the effect is of **minor adverse** significance.

Mountain steppe is of medium conservation value but it is very unlikely to be affected by the Project. Impact magnitude is negligible, and therefore the effects are of **negligible** significance.

The other habitats in the Project area and AoI are of low conservation value. Sections closest to the Project could be affected by indirect degradation of natural habitat through dust deposition. Impact magnitude will be negligible/low outside the project area and moderate within the project area. The effects are therefore of **minor adverse** significance at most.

11.5.1.3 Notable Flora

The surveys undertaken in 2013 indicated mainly common species of flora are present on the Project site and within the AoI. These are generally considered to be of low conservation value (low sensitivity). The plant species on site will be directly affected by the development. Indirect impacts on species within the AoI may include increased dust and disturbance through off-road driving. Impacts on locally important species such as medicinal plants are considered to be minor / moderate in magnitude and the effects likely to be of **minor adverse** significance.

Accidental introduction and dispersal of invasive species from construction activities could increase the magnitude of the impacts in the absence of mitigation measures as they will compete with native flora. However, the effects would still be of **minor adverse** significance.

11.5.1.4 Notable Fauna

Mammals

No mammals of international conservation concern or listed on the Red Book of Mongolia were observed within the Project site or the AoI during the 2013 surveys. There are previous records for threatened and/or protected mammals in the AoI that are listed on the IUCN Red List and the Red Book of Mongolia, including red deer, tarbagan marmot, Siberian musk deer and forest sable. It is unlikely that any of these mammals would be found on the Project area itself due to unsuitable habitats and as human settlements, road traffic and railway fences prevent the movement of animals. The magnitude of the impacts on these threatened species is therefore negligible. The conservation value of those species is high but the overall effects are considered to be negligible.

The other mammal species recorded in the AoI are of low conservation value and the Project impacts are likely to be of low adverse magnitude for the same reasons as explained above. The effects on other mammal species are considered to be of **minor adverse** significance.

Birds

Impacts on globally or nationally threatened bird species are considered to be negligible (unlikely), given that none were recorded on the Project site or in the AoI of the Project and the project site does not provide a suitable habitat. The Saker Falcon, previously recorded in the Tuul River valley is listed as Endangered on IUCN and listed on CITES Appendix II. The bearded vulture, previously recorded on Bogd Khan Mountain, is listed as Endangered in the Red Book of Mongolia and is protected under Mongolian law (see 11.4.5 above). These species are considered to be of high conservation value but given the likely distance from the works and unsuitable habitat within the Project area (IUCN, 2014), the Project impacts on these species can be considered to be of negligible magnitude and therefore the effects are **negligible**.

The other bird species recorded in the project area and AoI are common and as such are considered to be of low conservation value. They are likely to be affected during the construction of the Project because of noise, artificial lighting, habitat loss and presence of people. The impact magnitude on these species is likely to be minor to moderate adverse and therefore the significance of the effects is **negligible to minor adverse**.

Herpetofauna

The potential impact on globally or nationally threatened reptiles and amphibians are considered to be **negligible**, given that none were recorded in the Project area or AoI of the Project. The Siberian salamander is of high conservation value as it is listed as Endangered in the Red Book of Mongolia and protected under Annex #1 of the Government Act #7, 2012 (refer to Section 11.4.5). The magnitude of the impact is negligible as populations are located around the Tuul River which is over 5km from the Project site. There is also no suitable habitat on the Project site and surrounding area as the Khuliin River is seasonal and the Siberian salamander requires both forest and wetland habitats (Kuzmin et al., 2008). The effects is therefore of **negligible** significance. Although no common species of herpetofauna were recorded during the 2013/2014 surveys, a precautionary approach has been used, as there is suitable habitat within the Project area. If present, these species are likely to be common and of low conservation value; they are likely to be affected during the construction of the Project because of habitat loss and disturbance. Impact magnitude on these species is likely to be minor / moderate and therefore the significance of the effect is **minor adverse**.

Fish

No globally or nationally threatened fish species were recorded in the Khuliin River in the Project area or AoI of the Project. Sharp-snouted lenok are present in the wider area in the Tuul River; this species was listed as Vulnerable on the old Mongolian red list of fishes (2006) but it does not appear on the current Red Book of Mongolia. They are considered to be of regional and medium conservation value. Given their likely distance to the Project area, impacts are considered to be of negligible magnitude and therefore effects are **negligible**.

Impacts to other fish populations recorded in the Tuul River are unlikely due to the distance from the Project area. Other fish populations are considered to be of low conservation value but using the precautionary principle other fish recorded in Tuul River may use Khuliin River during the wet season. The Project impacts are likely to be of moderate magnitude due to seasonal habitat loss but the effects on other fish species are considered to be of **minor adverse** significance.

Terrestrial Invertebrates

Those species previously recorded on Bogd Khan Mountain, and listed as Vulnerable in the Red Book of Mongolia (refer to Section 12.4.5) are considered to be of high conservation value. However, given the likely distance from the works and unsuitable habitat within the Project area, construction impacts on these species can be considered to be of negligible magnitude and therefore effects are **negligible**.

Common species of terrestrial invertebrates present within or adjacent to the Project area are of low conservation value. The magnitude of the impacts is moderate due to habitat loss and the overall effects are of **minor adverse** significance.

11.5.1.5 Borrow pit

A borrow pit will be required for site levelling, construction of foundations and for flood mitigation. The location of the borrow pit has not yet been determined and the potential impacts on flora and fauna is not known. The EPC contractor will be required to identify a suitable site in accordance with the requirements set out in Chapter 2.

11.5.2 Operational Phase

During operational activities of the Project, the potential adverse impacts on habitats, flora and fauna may include:

- Increased noise and disturbance to fauna due to: increased railway use for the delivery of lignite coal and limestone and exportation of ash; and loading of materials and traffic increase
- A low pollution risk from the storage of the lignite coal.
- Disturbance affecting birds and mammals from light and human presence from operation activities;
- Pollution risk arising from waste ash affecting adjacent habitats

Further information is provided in the following sections where relevant.

11.5.2.1 Protected Areas

The risk to protected areas being affected during operation is considered to be negligible given the distance to the works area. The air quality assessment presented within chapter 7 demonstrates that the Project will have minimal contributions to air quality concentrations within the National Park.

Project impacts on protected areas during operation are therefore predicted to result in a **negligible** effect (very high/high conservation value and negligible magnitude).

11.5.2.2 Sensitive Habitats

There are no sensitive habitats on the Project site and AoI that will be affected during operation. The habitats close to the Projects may be affected by indirect degradation due to dust deposition or pollution (in the absence of mitigation). They are of low and medium conservation value and impact magnitude is negligible/ low; the project effects on habitats are therefore of **minor adverse** significance at most.

Transmission lines constructed in the degraded steppe habitat may require maintenance occasionally. The conservation value of this habitat is low and the magnitude of this impact is low so the effects are of **minor adverse** significance.

11.5.2.3 Notable Flora

Indirect impacts on the common species (of low conservation value) identified within the AoI may include increased dust and pollution through the operation activities of the Project. However, since loading will occur within the existing industrial area and air quality will not change markedly compared to the baseline conditions, these impacts are considered to be low in magnitude and the effects likely to be of **minor adverse** significance.

11.5.2.4 Notable Fauna

Mammals

The impact magnitude on threatened mammal species of high conservation value is considered to be negligible during operation as there is no suitable habitat within 2km of the Project site. The overall effects are therefore **negligible**.

Noise disturbance during operation may have adverse impacts on all mammals in the wider area, but these impacts are likely to be low in magnitude and for common species, of low conservation value. Therefore, the overall effect is of **minor adverse** significance.

Herpetofauna

No globally or nationally threatened reptiles and amphibians were recorded in the Project area or AoI of the Project. The Siberian salamander is of high conservation value as it is listed as Endangered in the Red Book of Mongolia and protected under Annex #1 of the Government Act #7, 2012 (refer to Section 11.4.5). The magnitude of the impacts during operation is negligible and the overall effect is therefore **negligible**.

The common herpetofauna that may be present within the AoI are of low conservation value. They are unlikely to be affected during the operation of the project. Impact magnitude on these species is likely to be negligible and therefore the effects are **negligible**.

Fish

Sharp-snouted lenok (of medium conservation value) is present in Tuul River which may be affected by pollution from the Project and increased water abstraction (low impact magnitude); the effects are considered to be of minor adverse significance in the absence of mitigation. Other fish recorded in Tuul River are of low conversation value and the project impacts are also likely to be of moderate magnitude. The effects on other fish species are considered to be **minor adverse** in the absence of mitigation.

Terrestrial invertebrates

Impacts on terrestrial invertebrates of international and national importance are unlikely due to unsuitable habitat on the Project area and the 2km distance of Bogd Khan Mountain protection zone. Five nationally threatened species (high conservation value) and one globally threatened species, Apollo butterfly (very high conservation value) were recorded in Bogd Khan Mountain. However, given the likely distance from the Project, the impact magnitude is considered to be negligible and therefore effects are **negligible**.

Common species of terrestrial invertebrates present within the wider area of the Project are of low conservation value, the magnitude of the impacts during operation is minor as a result of potential pollution arising from the Project and the overall effects are **minor adverse**.

11.6 Mitigation and Monitoring

11.6.1 Overview

Mitigation measures have been developed for key biodiversity features to ensure the systematic implementation of the mitigation hierarchy i.e. avoid, reduce (minimise), remedy (restore) and offset (or other forms of compensation). This will allow for the careful management of risk, the best possible outcomes for the Project without compromising the health, function and integrity of the ecological systems. It is recommended that consultation is undertaken with the Bogd Khan National Park authority to confirm that it has no concerns regarding the Project with respect to potential impacts on the park's ecology and biodiversity value.

11.6.2 Avoidance Measures Incorporated in Project Design

The design of the Project has taken into consideration the environmental and ecological sensitivities, with the aim to avoid significant impacts on the areas of high nature conservation value, in particular:

- The Project location has been chosen in an area where existing infrastructure can be maximised for the delivery of lignite coal and limestone and the transport of waste ash from the Project site to the offsite disposal facility.
- The Project will comply with safety standards to avoid spillages and leakages from chemicals, liquids, the temporary storage of ash and other substances stored onsite. Set procedures will be followed where spillages and leakages do occur.

11.6.3 Generic mitigation measures

The following generic mitigation measures will be applied on the Project:

- All construction and operational working areas will be kept to the minimum to reduce habitat loss and degradation.
- Access routes for construction and operational activities outside the existing cleared area (if required) will be kept to a minimum. Plans will be implemented to minimise levels of construction traffic activities where possible, and to restrict the construction of additional temporary roads. These actions will significantly reduce potential impacts on habitats and disturbance to species.
- Artificial lighting used on construction sites and camps will be minimised, shaded and directed downwards to avoid light spillage and disturbance to birds, mammals and other wildlife.
- Noise disturbance and vibration will be kept to a minimum through measures such as ensuring proper maintenance of construction machinery and equipment and complying with national standards.

- Measures, such as wind breaks, water spray will be implemented for reduction of dust during the working period.
- Consultation with the Bogd Khan National Park authority to identify appropriate mitigation measures during construction of the Project.
- All workers engaged in the Project will be made aware of the environmental and ecological sensitivities on the Project site and surrounding areas.
- Ban on hunting to be included in the worker code of conduct.

11.6.4 Construction Phase

11.6.4.1 Sensitive Habitats and Notable Flora

There are no internationally or nationally protected habitats likely to be affected by the Project. The Project will result in 45ha of permanent habitat loss within the Project footprint. There will be additional temporary habitat clearance required temporary construction laydown area and the borrow pit. The locations for the Project workers accommodation facilities are to be selected based on minimum land requirements and minimum likely ecological and environmental impacts.

Any additional habitat clearance required will be restored on-site (if the impact is temporary) or recreated off-site through new planting using native species that do not require special irrigation measures. The compensation amounts for natural resources are specified in the Mongolian Law on Environmental Protection (2012), and they are a multiplier of the ecological and economic value of the resources lost: three times for forests and five times for plants. The Mongolian Law on Forest (2012) states that 10 or more seedling and saplings should be planted for each harvested tree. This Project will not affect any forest, but the route of the water pipeline is not known at this stage.

Light water sprays will be implemented for reduction of dust during construction.

11.6.4.2 Non-native Invasive Species

Non-native (alien) invasive species are the second threat to the global biodiversity after habitat destruction. The likelihood of invasions by non-native species is higher in habitats that are altered and disturbed, for example during construction. Invasive species have the following traits:
- Fast growth
- Rapid reproduction
- High dispersal ability
- Ability to alter growth form to suit current conditions
- Tolerance of a wide range of environmental conditions
- Ability to live off of a wide range of food types
- Association with humans

Any development project poses a risk of spreading invasive species, including plants, fish and invertebrates in particular. IFC PS6 (IFC, 2012a) includes the following best practice measures with regard to Alien Invasive Species (AIS):

- Must not intentionally introduce *alien species* unless this is in accordance with existing national regulatory framework.
- Must not deliberately introduce AIS irrespective of national regulatory framework.
- Introduction of alien species (e.g. in planting) must be subject to a risk assessment.
- Implement measures to avoid accidental introduction or spreading of alien species (see below).
- Consider the implementation of measures to eradicate AIS from natural habitats.

Detailed guidelines on the prevention and management of AIS have been published by IPIECA (2010) for the oil and gas industry, but these guidelines are relevant to many other project types, including this Project. Preventative, control and monitoring measures will be implemented with regard to the following aspects of the Project:

Packaging and movement of materials
- Minimise traffic and the distance it has travelled
- Source goods/materials locally where possible
- Contain any AIS and report their presence

Vehicles and plant
- 'As-new' wash-down is essential before entering non-infested areas and after working in infested areas
- Train contractors and employees and raise awareness regarding AIS
- Pressure wash vehicle tyres in a contained area to reduce the spread of AIS
- Contain and destroy residue
- Record and report the presence of any AIS

Soil and vegetation
- Minimize disturbance to, or movement of, soil and vegetation
- Prevent soil damage and erosion
- Ensure imported soil/other materials are safe and free of AIS (source from a reputable supplier, request information on the soil's origin and certification of AIS-free status if possible)
- Prevent AIS establishment on exposed stored soil (do not store bare soil near known sources of AIS, consider using matting to cover exposed soil)
- Ensure infested material is disposed of safely
- Retain as much natural vegetation as possible

Habitat reclamation
- Use native plants for reinstatement and landscaping
- Assess any non-native species (to be used in landscaping) for AIS potential
- Consider that some AIS may be soil-based

11.6.4.3 Notable Fauna

Habitat loss will be minimised, and where possible a phased vegetation clearance should be undertaken, to ensure animals are able to escape the works area during construction. Noise and disturbance will be minimized through best practice measures during construction and operation (see below).

The following best practice noise reduction measures will be implemented to reduce impacts on fauna during construction:

- Avoidance of unnecessary revving of engines and switch off equipment when not required.
- Vehicles and equipment will be properly maintained to meet the manufacturers' noise rating levels. Any silencers or bearings which become defective would be replaced as soon as possible.
- Using reverse warning systems incorporating broadband noise where practicable.
- Using enclosures for noisy plant such as pumps or generators.
- Minimising drop height of materials.
- Limiting the use of particularly noisy plant or vehicles where practicable.
- Plant and vehicles will be operated with noise control hoods closed.

Pollution prevention through the correct implementation of best practice measures to minimise habitat loss and degradation.

11.6.5 Operational Phase

11.6.5.1 Sensitive Habitats and Notable Flora

No internationally or nationally protected habitats within the AoI are likely to be affected by the operation of the Project.

11.6.5.2 Pollution prevention and control during operation

Pollution prevention and treatment measures will be implemented as recommended WBG/IFC EHS Guidelines, a long-term ash management plan will be prepared and will include measures to reduce air pollution and adverse impacts on habitats, flora and fauna.

11.6.5.3 Notable Fauna

Disturbance from noise, light and human presence will be minimized through best practice measures during construction and operation.

Pollution prevention through the correct design of waste water treatment and implementation of best practice measures to minimise habitat loss and degradation.

11.6.6 Monitoring

Monitoring of ecological mitigation will be conducted for the duration of the construction phase. These requirements, along with associated responsibilities and reporting requirements will be detailed in the CESMP. The Environmental Manager will be responsible for ensuring that measures included in this chapter and the CESMP are implemented during the construction of the Project. Specialist advice from a qualified ecologist will be obtained when required. The environmental reporting responsibilities during construction (including ecological) will be described in the CESMP.

11.7 Residual impacts

Without mitigation the Project would have a number of **minor and moderate adverse** effects on the biodiversity. These effects will be reduced through the responsible implementation of the mitigation measures, which are described in Section 12.6.

After the successful implementation of the mitigation, the only residual effects are likely to be of minor significance and include:

- Small areas of natural habitats and common species of flora and invertebrates to be affected directly during construction (seasonal river, river valley meadow, marginal river meadow, river valley steppe).
- Common bird species affected during construction because of habitat loss/disturbance, noise and artificial lighting from construction activities
- Fish species of national conservation value, which may be affected cumulatively by pollution of River Tuul during operation

Table 11.6 summarises the residual impacts of the Project on the key ecological features which occur within the AoI. The impacts of negligible significance in the absence of mitigation are not included in this table because no further mitigation is required.

Table 11.6: Summary of biodiversity and ecology impacts and mitigation

Receptor	Potential Impacts	Conservation value (Sensitivity)	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
Construction						
Sensitive habitats						
Seasonal river, river valley meadow, marginal river meadow	Permanent loss on the Project footprint	Medium	Moderate	Moderate adverse	• Pollution prevention and best practice measures to minimise habitat loss and degradation • Measures to prevent the spread of AIS – development of an AIS and pest management plan.	Minor adverse
Meadow	Permanent habitat loss on the Project footprint	Low	Moderate	Minor adverse	• Pollution prevention and best practice measures to minimise habitat loss and degradation • Measures to prevent the spread of invasive species	Minor adverse
Steppe, meadow steppe, meadow with anophytes	Temporary and permanent habitat loss due to construction of transmission lines Sections closest to the Project could be affected by indirect degradation of natural habitat through dust deposition.	Low	Minor / Negligible	Negligible	• Pollution prevention and best practice measures to minimise habitat loss and degradation • Measures to prevent the spread of AIS.	Negligible
Notable Flora						
Common species	Direct loss and degradation of common flora within the Project area. Indirect impacts on species within the AoI including increased dust and disturbance through off-road driving. Introduction of invasive species competing with native flora	Low	Minor/ Moderate	Negligible / Minor adverse	• Pollution prevention and best practice measures to minimise habitat loss and degradation • Measures to prevent the spread of invasive species	Minor adverse
Notable Fauna						
Common bird species	Loss of small areas of breeding and foraging	Low	Minor/ Moderate	Minor adverse	• Minimise habitat loss/disturbance, noise and artificial lighting.	Minor adverse

Receptor	Potential Impacts	Conservation value (Sensitivity)	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
	habitat. Disturbance caused by noise, presence of people and artificial lighting.					
Common herpetofauna species	Loss of small areas of foraging habitat. No species recorded during the site visit but precautionary principle used as there is suitable habitat.	Low	Minor/ Moderate	Minor adverse	• Minimise habitat loss/disturbance • Phased habitat clearance	Negligible
Common species of fish	Loss of the seasonal Khuliin River and any fish species on the Project site. Fish being drawn into water intake structures.	Low	Moderate	Minor adverse	• Pollution prevention and best practice measures to minimise habitat loss and degradation	Minor adverse
Common terrestrial invertebrate species	Impacts likely due to habitat loss	Low	Minor/ Moderate	Minor adverse	• Pollution prevention and best practice measures to minimise habitat loss and degradation	Minor adverse
Operation						
Sensitive habitats						
Seasonal river, river valley meadow, marginal river meadows, mountain steppe	Degradation of habitats remaining outside Project area, owing to air pollution	Medium	Minor	Minor adverse	• Pollution prevention and best practice measures to minimise further habitat degradation	Negligible
Notable Fauna						
Common mammal species	Disturbance from noise, light pollution and human presence; Increased dust and pollutants from operation	Low	Minor	Negligible	• Best practice measures for reducing noise, artificial lighting and disturbance.	Negligible
Common bird species	Disturbance caused by noise, presence of people and artificial lighting.	Low	Moderate	Minor adverse	• Best practice measures for reducing noise, artificial lighting and disturbance.	Minor adverse

Receptor	Potential Impacts	Conservation value (Sensitivity)	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
Fish of regional conservation value	Pollution of watercourses during operation.	Medium	Minor	Minor adverse	• Best practice pollution prevention measures • Regular water quality monitoring	Minor adverse
Terrestrial invertebrates of national conservation value	Impacts to terrestrial invertebrates unlikely due to unsuitable habitat on the Project area and the 2km distance of Bogd Khan mountain protection zone.	High	Negligible	Negligible	• Best practice pollution prevention measures	Negligible

12 Ground Conditions

12.1 Introduction

This chapter considers the potential impacts to ground conditions associated with construction, operation and decommissioning of the Project. Specific objectives of this assessment are to assess:

- Potential impacts of the Project on geology and soils, from the construction phase, subsequent operation and the decommissioning phase of the Project
- Potential impacts on geology, soils and groundwater from existing contaminated land if present in the Project Area and future contamination which may result from the proposed Project.

Appropriate mitigation measures to avoid or reduce any identified significant impacts are also presented.

Each phase of the Project –construction, operation and decommissioning has the potential to impact on soils, with subsequent potential implications on soil quality and land use. In addition, there is potential to affect groundwater quality if mobilisation of contamination occurs. The geology and soils of an area can also impose constraints on the construction, particularly if contaminated or unstable lands are present. Such constraints will be considered in both the Project design as well as in construction and operational procedures. Sensitive receptors associated with ground conditions comprise key features, such as designated (regionally, nationally or internationally) important geological sites or agriculturally or ecologically valuable soils. There is also potential for secondary impacts from existing or future contaminated ground to sensitive receptors that may be nearby, such as human health (nomad farmers, contractors and site/maintenance workers), wildlife and livestock.

Based on the perceived connectivity between the above receptors and the ground conditions, the effects on these receptors with respect to impacts from contaminated ground are discussed in this chapter.

12.2 Applicable legislation

12.2.1 National requirements

The prevailing legislation in Mongolia is the Law on Environmental Protection 2012. New amendments introduced that polluters are now liable to pay compensation for damage caused to the environment and natural resources. The amount of compensation payable is dependent upon the natural resources that have suffered the damage.

Other relevant legislation and standards are presented below.

12.2.1.1 The Law on Hazardous Substances and Chemicals (revised in 2006)

This law regulates the production, export, import, storage, trade, transport, use and disposal of toxic chemicals. However, this law covers not only toxic and hazardous chemicals, but also other chemical substances, including chemicals that are explosive, combustible, petrol, oil, diesel fuel, pesticides and consumer chemicals. The law sets out general provisions, requirements for protection and administrative penalties. In order to use chemicals for industrial purpose, the operators must obtain a licence from the

MEGD, follow a risk assessment strictly and classification/list of chemicals approved by joint Ministry orders. Companies are required to obtain approval in terms of the storage of chemicals and their disposal.

12.2.1.2 Law on Subsoil (1995)

The Law on Subsoil contains provisions that grant power to authorities in Mongolia to protect and regulate the use of subsoil. In addition to mining and geological exploration, subsoil may be used for building facilities underground including burying of oil, gas, other poisonous substances and industrial waste or waste water drainage system.

12.2.1.3 The Law on Soil Protection and Combating Desertification (2012)

This law was established with the objective to prevent, reduce and combat desertification. The law includes provisions for the protection of soil from pollution and a requirement to remediate land following any pollution event.

The Mongolian Standard on Environmental Protection and the Hydrosphere (MNS 3342: 1982): outlines the general requirements for protection of groundwater from contamination. The standard also includes measures to prevent groundwater contamination particularly with respect to the storage, use and disposal of hazardous materials (preventing leaks and spills) and to suitably manage groundwater contamination should impacts occur.

Mongolian Standards for Drinking Water & Effluent Wastewater (MNS 4943: 2000): this details the drinking water quality standards for a range of inorganic and organic parameters, and the maximum permitted concentrations of pollutants allowable in effluent that is to be discharged to ground.

Mongolian Standards for Soil Quality (MNS 5850: 2008): this details the maximum acceptable limit for concentrations of inorganic substances in soils. The Mongolian standards for acceptable levels, toxic levels and hazardous levels of inorganic substances in soils are summarised in Table 12.1.

Table 12.1: Mongolian Standards for Inorganic Substances in Soils

Substance	Acceptable Level (mg/kg)				Toxic Level (mg/kg)	Hazardous Level (mg/kg)
	Clay Soil	Clay Loam	Sand	Maximum		
Lead	100	70	50	100	500	1200
Cadmium	3	1.5	1	3	10	20
Mercury	2	1	0.5	2	10	20
Arsenic	6	4	2	6	30	50
Chromium	150	100	60	150	400	1500
Chromium VI	4	3	2	4	20	50
Tin	50	40	30	50	300	500
Strontium	800	700	600	800	3000	6000
Vanadium	150	130	100	150	600	1000

Substance	Acceptable Level (mg/kg)				Toxic Level (mg/kg)	Hazardous Level (mg/kg)
	Clay Soil	Clay Loam	Sand	Maximum		
Copper	100	80	60	100	500	1000
Nickel	150	100	60	150	1000	1800
Cobalt	50	40	30	50	500	1000
Zinc	300	150	100	300	600	1000
Molybdenum	5	3	2	5	20	50
Selenium	10	8	6	10	50	100
Barium	25	20	15	25	100	300
Fluoride	200	150	100	200	800	1500
Cyanide	25	15	10	25	50	100

Source: MNS 5850:2008, Table 3 and Table 4

12.2.2 International requirements

12.2.2.1 IFC PSs and guidance

Key international standards and guidelines relating to international best practice for the assessment and management of contaminated land, and good practice for pollution prevention and control include the following:

- IFC PS3 Resource Efficiency and Pollution Prevention, in Performance Standards on Social and Environmental Sustainability (IFC, 2012)
- IFC Guidance Notes: Performance Standards on Social and Environmental Sustainability (IFC, 2012), specifically Guidance Note 3: Resource Efficiency and Pollution Prevention
- WB/IFC General EHS Guidelines: Environmental, Contaminated Land (IFC, 2007)
- WB/IFC EHS Guidelines for Thermal Power Plants (IFC, 2008)

The objective of the IFC guidance on resource efficiency and pollution prevention (IFC, 2012) is to avoid or minimise adverse impacts on human health and the environment, for the duration of a Project, by avoiding or minimising polluting activities, avoiding emissions and promoting the use of sustainable resources. Specifically in relation to this assessment, actions include avoiding, or minimising, the release of pollutants (to air, water and land), identifying and, where necessary managing, existing pollution, and avoiding the generation of hazardous and non-hazardous wastes.

The IFC guidance for contaminated land (IFC, 2007) provides a broad outline of the requirement for risk screening, risk management, detailed quantitative risk assessment and risk reduction measures, where risk factors: source, pathways and receptors are likely to co-exist. The risk screening involves identification of contamination, sampling and testing, evaluation of the results and verification of sensitive receptors and exposure pathways. Where necessary, a detailed risk assessment builds on the risk screening and involves detailed ground investigation to identify the scale of contamination.

12.2.2.2 ADB Safeguards

Requirements for assessing and addressing contamination land effects of projects are set out within ADB Safeguard Requirements 1: Environment, Section D9 ‘Pollution Prevention and Abatement’.

ADB SPS 1, Environment requires:

- Pollution prevention and abatement: during the design, construction, and operation of the project the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the WBG/IFC EHS Guidelines.

12.2.2.3 EBRD Performance Requirements

EBRD guidance, including the EBRD sub-sectoral Environmental and Social Guidelines: Building and Construction (2010), which sets out guidance on the potential issues relating to contaminated land and how these can be managed.

In addition the EBRD (2014) Performance Requirement 3 (Resource Efficiency and Pollution Prevention Control) sets out the following requirements:

- The client will avoid or minimise the use of hazardous substances and materials, and consider the use of less hazardous substitutes for such substances and materials so as to protect human health and the environment from their potentially harmful impacts.
- The client will apply appropriate risk management measures in order to minimise or control the release of such substances/materials into land resulting from their production, transportation, handling, storage, use and disposal relating to project activities.
- Adopt the mitigation hierarchy approach to addressing adverse impacts on human health and the environment arising from the resource use and pollution released from the project.

12.2.2.4 JBIC Guidelines

Environmental checklists are provided by JBIC for different industry types that detail the environmental and social impacts that should be assessed by proponents of projects. Further details of relevant JBIC checklists are provided in Section 4.3.5 of this ESIA.

The following guidelines are set out in the aforementioned checklists:

- Adequate accident prevention measures (e.g. installation of prevention facilities and equipment and establishment of prevention management framework) should be taken for storage, loading/unloading, and transportation of hazardous and dangerous materials.
- Adequate measures should be taken to prevent soil contamination as a result of the project activities.

12.3 Methodology and assessment criteria

The methodology for assessment of ground conditions is broadly consistent with the general ESIA methodology for the Project outlined in Chapter 5. However, specific criteria for determining sensitivity of ground conditions and the magnitude of the impacts are presented below.

Table 12.2 presents the criteria for determining the sensitivity of geological and soil receptors. This has predominantly been reviewed with regard to the agricultural value of the soil, which is considered the most likely sensitive potential use for soils in the area, and sites of local and/ or international geological importance.

Table 12.2: Sensitivity criteria

Importance/ Value of Feature	Definition
High	Agricultural Land (soil of excellent quality with no limitations, can support a very wide range of agricultural crops); or nationally or internationally important for its geology.
Medium	Agricultural Land (soil of good quality with minor limitations, can support a wide range of agricultural crops); or regionally important for its geology.
Low	Agricultural Land (soil of good to moderate quality with moderate to moderately severe limitations, can sometimes support a wide range of agricultural crop, or cereals, pasture and scrubland); or locally important for its geology.
Negligible	Agricultural land (soil of poor quality with severe limitations, supports mainly scrubland); or not important for its geology.

The potential for secondary impacts to human health receptors, as result of contamination of soil, are also assessed in this chapter. Human health receptors are considered to be of high value.

Table 12.3 presents the criteria for determining the magnitude of impacts on geology and soils. Areas of land affected have been reviewed qualitatively rather than with absolute figures with regards to the relative availability of similar soil types in the region.

Table 12.3: Magnitude criteria

Magnitude of Impact	
Major	**Results in loss of feature.** The Project (either on its own or with other projects) may result in physical removal or degradation (including loss of structure and contamination) of a large area of soil relative to the availability of similar such soil type in the area.
Moderate	**Results in impact on integrity of feature or loss of part of feature.** Physical removal or degradation (including loss of structure and contamination) of a moderate area of soil relative to the availability of similar such soil type in the area.
Minor	**Results in minor impact on feature.** The impacts result in the physical removal or degradation (including loss of structure and contamination) of a minor area of soil relative to the availability of similar such soil type in the area.
Negligible	**Results in an impact on feature but of insufficient magnitude to affect the use or integrity.**

Magnitude of Impact	
	The impact would lead to no observable change in the features.

The significance criteria used for the assessment is in line with the significance matrix provided in Chapter 5.

12.3.1 Baseline conditions methodology

The evaluation of baseline conditions uses a variety of sources, including information on geology, soils, hydrogeology and the existing contamination status of the soils and groundwater in existing and proposed construction areas of the Project. The baseline conditions for the site have been assessed based on the following information:

- Geotechnical ground investigation for the CHP5 Project (Soil Trade LLC, 2014)
- Water resources assessment (Mott MacDonald, 2014)
- Seismic Hazard Assessment for the CHP5 Project (Mongolia Research Centre of Astronomy and Geophysics (RCAG), 2014)
- Results of soil analysis undertaken in the area of the Khuliin River – by the Mongolian State University of Agriculture on behalf of Nature Friendly 28 November 2013.

12.3.2 Scope of assessment

12.3.2.1 Temporal scope

This assessment has considered the potential impacts arising from construction, operation, decommissioning and demolition of the Project.

Impacts relating to contamination will be assessed based on information on potential historical, current and future sources of contamination. For historical sources this is based on soil testing data and, in the absence of this, information available regarding historical and current land use.

12.3.2.2 Spatial scope

For this assessment, the study area includes the land within the boundary of the Project area, which comprise the power plant, access road and the surrounding area within a maximum distance of 500m from the boundary of the Project areas. Provided suitable mitigation is incorporated, operations associated with Project activities are unlikely to significantly affect overall, geology and soils outside of the Project area and no contamination effects are envisaged at distances greater than 500m from the site boundary.

12.3.3 Assumptions and limitations

To the extent that some of the assessment is based on information obtained in ground investigations, persons using or relying on this report should recognise that any such investigation can examine only a fraction of the subsurface conditions. As such, unexpected ground conditions may be present that have not been identified at this stage of the Project. Uncertainty relating to the ground conditions will be addressed in the design of the Project. Before commencing construction, an assessment, including suitable laboratory chemical testing, will be undertaken to provide a baseline of soil quality. Furthermore, suitable mitigation measures will be in place, detailed in the construction environmental management plan, to manage unexpected contamination if identified during the construction works.

A geotechnical investigation to provide subsurface information for the engineering feasibility of the Power Plant was carried out by Soil Trade LLC between 06 December 2013 and 23 January 2014. The ground investigation included assessment of soil quality with respect to the potential for chemical attack on man-made structures. The ground investigation did not include chemical testing to assess the potential presence or level of contamination in soils or groundwater. It has not, therefore, been possible at this stage to undertake any quantitative assessment of soil conditions with respect to risks to human health or water resources. This assessment is therefore based on available information on historical land use practices and, where present, the potential contamination risks associated with these. Further investigation will be required prior to construction to assess the baseline soil quality at the project site and any potential risks. The assessment of the potential for ground contamination has been undertaken based on available information on current and historical land use.

Due to the limited information available on the transmission line and district heating pipeline routes and construction design, this assessment does not assess the route specific ground conditions for these Project components. The potential impacts of associated activities have been assessed based on the assumption that they will be similar to other components of the Project.

12.4 Baseline description

12.4.1 Landscape and Topography

The Project site is located in the relatively flat but tectonically fractured Khuliin Valley, which is surrounded by the Bogd Khan and Bayanzurkh mountain ranges on each side of the valley. Ground surface across the site and immediate surrounding area is naturally rolling and varies in elevation between 1,355m and 1,362m above a datum which was not defined (Soil Trade LLC, 2014). The site slopes downwards southeast to northwest direction. Vegetation is sparse comprising grasses and scrub.

12.4.2 Geology

The geology of the Ulaanbaatar region consists of Cambrian, Devonian and Carboniferous rocks which were intruded by granitic rocks in the Jurassic and Triassic periods and subsequently covered by Cretaceous, Tertiary and Quaternary deposits (Mott MacDonald, 2014).

According to the ground investigation borehole logs, the Quaternary superficial deposits generally comprise interbedded silty gravel and silty clayey gravel of varying thicknesses, occasionally overlying silty clayey sand with gravel. The underlying bedrock encountered in the Project area, which investigated to a depth of 20m below the surface, is composed of a highly weathered and fissured sandstone and siltstone of Carboniferous age.

Groundwater was generally encountered at depths between 0.5m and 3.5m below ground level (Soil Trade LLC, 2014).

12.4.3 Soils

The ground investigation undertaken by Soil Trade LLC encountered very loose top soil predominately comprising silty clayey sand, found to be more clayey in some areas. The top soil ranged between 1m and 2m in thickness and up to 3.2m in one location.

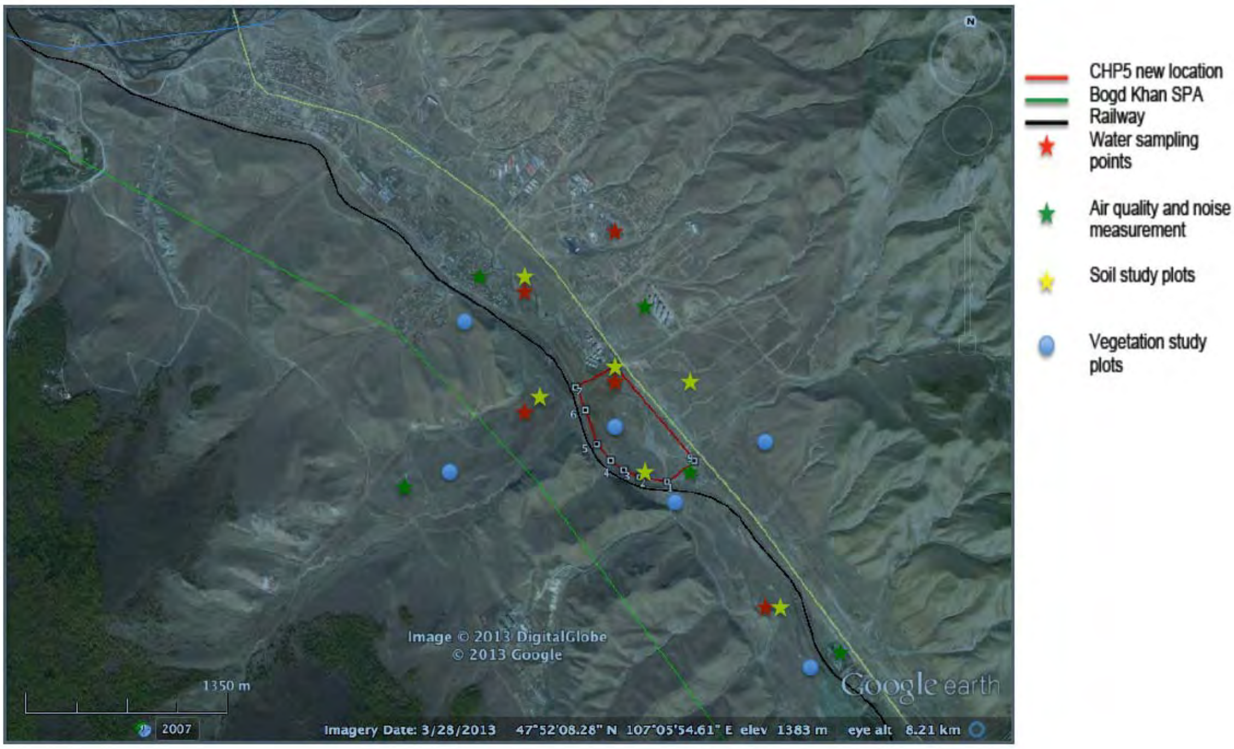
In the southwest part of the Project site the ground is swampy and water logged during the summer. During the winter months, in the southwest part of the site (approximately 30% of the Project area) the soils swell as the ground freezes and the ground surface becomes mounded and lumpy.

Accumulations of granular material caused by washout during flood events are found in the northeast of the site.

Soil samples were collected during the ground investigation undertaken by Soil Trade LLC. The results of chemical testing indicate that the soil pH ranges between 5.8 and 6.3. The soluble sulphate and chloride concentrations were found to be less than 0.1%, and are considered likely to have a negligible corrosive effect on concrete material. No other analyses were analysed from the ground investigation samples and so no further assessment on the actual soil quality can be undertaken.

Soil samples were collected in the Project area by the Mongolian State University of Mongolia (Nature Friendly) in 2013. Samples were taken from five locations, two on the southern and northern site boundary, one approximately 1km to the north on the eastern side of the Khuliin River, and two less than 500m from the site boundary to the east and west. The soil sampling locations are presented on a survey location plan, provided by Nature Friendly, as yellow stars in Figure 12.1 below. Soils were tested for a number of analyses including pH, conductivity, humus, calcium, magnesium and nitrate. The humus content of the soils was found to be low, generally less than 2%. The pH was found to be less acidic (between pH 7-8) than indicated in the Soil Trade testing results for soils on the Project site.

Figure 12.1: Survey Location Plan



Source: Nature Friendly, 2013

12.4.4 Permafrost and seasonally frozen ground

The ground investigation undertaken in 2014 identified a very discrete area of permafrost in the south of the Project area at BH18 (Soil Trade LLC, 2014, Appendix M), with ground temperatures between -3.46 ºC and +2.9ºC between 2m and 15m depth, generally increasing with depth. The permafrost is considered to be permanent as it remains frozen for longer than two consecutive years, without demonstrating seasonal thawing.

Seasonally frozen ground is encountered across the majority of the Project area at depths between 2.6m and 6.1m below ground level (bgl). The geotechnical study undertaken by Soil Trade LLC (2014) considered the shallow frozen ground encountered during the ground investigation to undergo changes as a result of seasonal freeze thaw cycles.

12.4.5 Seismicity

Much of Mongolia lies within the highly seismic areas of the Central Asian seismic belt and it is therefore subject to major continental earthquakes. According to the Mongolia RCAG, Mongolia can be subdivided into two regions, the highly seismic activity plate interior in western Mongolia and the low seismic activity stable continental plate in eastern Mongolia. The most destructive earthquakes (>7 intensity on the 12 point Medvedev-Sponheuer-Karnik (MSK) scale) generally occur in the west.

As an area, Ulaanbaatar is generally considered to be seismically stable, although several active faults have been identified in the area. Observations of seismic activity around Ulaanbaatar since 2005 show that several active Quaternary faults have caused earthquakes of between 6 and 8 on the MSK scale in the Ulaanbaatar area in this period (Mongolia RCAG, 2014).

A seismic hazard assessment of the Project site was undertaken by the Mongolia RCAG in 2014. The RCAG have undertaken both probabilistic and deterministic hazard assessments for the site using existing data on seismic activity and active fault information, and through seismic surveys at the CHP5 development site. Peak Ground Acceleration (PGA) levels and the associated MSK levels were calculated.

Based on the detailed seismic assessments, the RCAG concluded that the probabilistic seismic intensity for the CHP5 development site reportedly lies between 7 and 8 on the MSK scale (for return periods of between 475 and 975 years), corresponding with very strong to potentially damaging observed effects. The RCAG reported that a 975 year return period is considered to best represent the seismic activity of the area and the calculated protection level at a PGA of 0.24g (8 on the MSK scale) is considered acceptable (RCAG, 2014).

12.4.6 Historical and potential future contamination sources

12.4.6.1 Potential for Historical Contamination

The Project site and the surrounding area (within 500m) have not previously been used for industry and therefore are unlikely to have been subject to significant contaminating activities. Groundwater within the Project area is therefore unlikely to have been significantly impacted by contamination caused by industrial or any other activities.

No soil quality testing has been undertaken in the Project area to assess the baseline soil contamination conditions. However, based on the absence of any significant historical sources it is considered unlikely that soil will have been impacted by any significant anthropogenic sourced contaminants.

Due to the limited information available on the route of the transmission line and district heating pipeline, the specific ground conditions associated with these Project components have not been assessed. However, it is considered likely that parts of the route will pass through currently or historically industrialised areas which have the potential to have been subject to contaminating activities. Soil quality and groundwater quality may potentially be impacted by contamination in these areas. Assessment of the ground conditions along the route will be undertaken as part of a separate assessment.

12.4.6.2 Potential Contamination due to Construction and Operation works

The main potential contamination impacts from the construction and operation of the power plant and associated infrastructure will be associated with the transport, storage and use of hazardous materials. The main potential future sources of contaminants are considered to be:

- Coal dust from the storage and use of lignite coal (particularly associated with crushing activities)
- Bottom and fly ash storage, and transport of ash to the to the emergency ash storage area on site (potential associated heavy metal and Polycyclic Aromatic Hydrocarbon (PAH) contamination), and subsequent transport of ash to the off-site ash disposal area
- Fuel oil used for boiler start up (storage of 1000m^3 on Project site)
- Surface run-off as a pathway for contamination (storm drainage)
- Waste water (operational and sewage) including oily water run-off, chemical waste, and coal and ash yard storm water
- Storage and use of chemicals at the construction laydown area and Project site during construction
- Storage and use of chemicals, such as those for water treatment. Chemicals used are likely to include hydrochloric acid and caustic soda

Contamination has potential implications for soil and groundwater quality. Impacts to soil are discussed below, while secondary impacts to groundwater are discussed further in Chapter 9.

For all aspects of the construction and operation works, there is the potential for secondary health-related impacts to construction and site workers from the handling of hazardous or contaminative materials. Where relevant, these impacts are also discussed in the sections below. However, if appropriate Personal Protective Equipment (PPE) is worn, with suitable health and safety risk assessments undertaken and standard good construction methods are adhered to, the possibility of construction workers being impacted by contaminated land is likely to be low.

12.4.7 Value of Geology and Soils

The geology in the Project area is assessed as having a **negligible** geological value, as there are considered to be no national or internationally recognised sensitive geological features in this part of the Project area.

At the time of this study there were no data available on soil fertility in the Project area. However, available data on ground conditions indicates that soils within and surrounding the Project area are poorly vegetated and are not currently used for arable farming. Further to this, the area is subject to seasonal flooding during the summer months, making the soils water logged and swampy and freezing during the winter months. As such, it is likely to be suitable only for seasonal grazing. The soils are considered to have a **low** value / sensitivity based on the criteria for determining sensitivity of features (refer to Section 12.3).

12.5 Impact identification and assessment

12.5.1 Overview

The main Project components which may impact on soil quality are considered to be:

- Site preparation including levelling ground preparation within the Project site.
- The construction and operation of the Project, including the temporary construction laydown area (14-15ha) east of the site on the opposite side of the Nalaikh road

The following assessment also covers seismic risk in relation to potential contamination impacts.

Potential impacts relating to the above components are discussed jointly in the following sections. Where necessary, impacts specific to the individual components will be discussed separately. Based on an initial assessment for this Project, the principal potential impacts to soil during all phases of the Project include:

- Storage and handling of soils, and subsequent loss or degradation of soils via erosion as a result of ground works
- Degradation of soil or groundwater quality as a result of leaks and spills of hazardous materials (including waste) during their transport, storage, handling and disposal
- Storage of ash generated from the combustion process and the generation of leachates with the potential to impact groundwater quality

Soil and groundwater are potentially at risk of contamination from the construction, commissioning and operational activities of all of the Project facilities, including the management of wastewater and other fluids generated by the Project and the storage and handling of other hazardous materials. There is also the potential for secondary impacts to groundwater and human health as a result of soil contamination.

The potential for impacts to soil and groundwater from contamination resulting from construction and operation of the Project are discussed below. It should be noted that at the time of writing this report, there was no available information on the existing soil and groundwater quality in relation to any existing contamination. The following impact assessment is based on our understanding that no significantly polluting activities have previously been undertaken in the Project area. Given the relatively similar nature of both the construction phase and future decommissioning phase, it is anticipated that the impacts described below can be attributed to both.

For all aspects of the construction, operation and decommissioning works, there is the potential for secondary impacts, from contaminated soils affected by the works, to construction and site workers via the handling of hazardous materials or soils. Where relevant, these impacts are also discussed in the following sections. However, the Project will be constructed and operated in accordance with national and international standards which include use of appropriate PPE and adherence to standard construction methods. As such, the possibility of construction workers being impacted by contaminated soil or other hazardous material is considered to be low.

12.5.2 Construction Phase

Construction of the Project and associated infrastructure will be undertaken on previously undeveloped greenfield land. This will lead to the loss of approximately 45ha of land for the development. Whilst the magnitude of this effect is considered to be major and negative, the soils at the Project area are considered to have a low value due to their limited agricultural value. The overall impact of removing soils or making them unavailable for seasonal grazing, in terms of soil quality, is therefore considered to be **moderate adverse**.

12.5.2.1 Site Preparation

Prior to construction, the Project site will require preparation including cutting and filling activities for site levelling, construction of foundations and for flood mitigation. Flood mitigation to be instated at the site comprises realignment of the Khuliin River in a large concrete constructed channel (the Khul Channel) around and along the north-eastern edge of the site.

Due to the moderate steep gradient of the site, this will require significant cut and fill activities to remove soil in the more elevated southeast corner and infill in lower areas at the upstream and downstream locations. Existing levels in the northern area of the site will also be raised to provide further flood protection. The volume of fill required is estimated to be 917,243m^3. This equates to an average depth of fill of 0.5m across the site area. Much of this material is expected to come from the borrow pit, the location of which is yet to be determined and from the excess soils excavated for construction of the Khuliin Channel.

Site levelling will require significant movement and reworking of soils which could lead to degradation, erosion and/or loss of soil cover. Compaction of soils can cause secondary impacts on soil drainage. The soils in the Project area are considered to have a negligible value. The area affected is considered to be significant in size (45ha) and the effect will be permanent, therefore the magnitude is considered to be major adverse. Impacts to the soil are assessed as **minor**.

Site levelling activities will, where possible, use locally sourced soils from the cutting activities. Where insufficient material is available, there will be a requirement to import soils from the surrounding land (outside the Project area) to fill depressions and provide a level surface for building construction. The provenance and quality of the imported material is not known. If contaminated soils are imported to the site, this could affect the soil and groundwater quality at the site. As such, any imported soils will be tested for appropriate chemicals and assessed to determine if they are suitable for use on the site.

The site levelling will have a significant impact on the soil drainage properties which will in turn affect the drainage of potential flood water and precipitation run-off and infiltration. This will have an effect on groundwater recharge in the area, which is discussed in Chapter 9).

12.5.2.2 Construction Activities

Disturbance of soils during construction, particularly due to movement of vehicles, may lead to erosion of the upper soil layers. A subsequent secondary effect of erosion includes creation of dust. Based on our knowledge of the site history (the majority of the site does not appear to have been developed or used for industrial purposes), it is considered unlikely that the soil quality at the Project site has previously been impacted by anthropogenic contamination. However, creation of dust may have implications for human health and ecological receptors near to areas where construction activities are to be carried out. The potential impacts from the creation of dust are discussed in more detail in the Chapter 7 (air quality).

The transmission line and district heating pipeline may potentially pass through more industrialised areas within Ulaanbaatar, in these areas soils may have historically or more recently been impacted by potentially contaminating activities. This assessment does not assess the route specific ground conditions associated with these Project components; this will be undertaken as part of a separate assessment when the route and construction design has been confirmed.

Construction of the buildings and hard surfacing, and re-vegetation (if possible) of undeveloped areas will act to reduce further erosion.

12.5.2.3 Contamination of Soil

During construction, a range of potentially hazardous substances would be used, such as oils, lubricants, fuels and cement. These materials will also require transport to the site. Accidental spills or leakages of hazardous substances may result in local contamination of soils, with potential implications for groundwater. However, with current best practice construction site management, the likelihood of this occurring will be minimised to a negligible risk.

The magnitude of contamination impacts to soils would be minor to moderate adverse. However, based on the negligible value of soils in the Project area, the impacts to soils are assessed as **negligible**.

12.5.2.4 Wastewater

A range of potentially contaminated waste liquids will also be produced during construction activities including: concrete wash water; sewage effluent; surface runoff and waters for hydro testing, washing and cleaning (particularly during facility start up). All wastewater and liquid waste streams for the Project will ultimately be treated by the dedicated onsite wastewater treatment facility prior to the discharging (pump) effluent from the plant into USUG’s sewage piped system adjacent to the site boundary. However, during construction, particularly prior to construction of the site drainage system, it is anticipated that some run-off will not be captured by the sites drainage system.

If uncontrolled or untreated, discharge of waste waters could have a minor magnitude of impact on soils and subsequently on the groundwater due to the composition of the water and potential presence of pollutants. Based on the negligible value of soils in the Project area, impacts to soils are assessed as **negligible**.

Secondary impacts to groundwater are discussed in more detail in Chapter 9.

12.5.2.5 Borrow Pit

As discussed in Section 12.5.2.1, significant volumes of earthen material will be required for site levelling, construction of foundations and for flood mitigation. This will be sourced from a borrow pit; however, at present the location of the pit is not yet known. A site will need to be identified by the EPC contractor in accordance with the criteria set in Chapter 2 and further assessment will be required prior to construction to determine the likely impacts of blasting and excavation on ground conditions at the borrow pit site.

The following factors will be important to consider in the future assessment:
- Landscape and topography
- Seismicity
- Geology and soil types
- Current and historic land use and the potential for ground contamination

12.5.3 Operational Phase

12.5.3.1 Contamination

Similar to the construction phase, the main potential contamination impacts for the Project are associated with the use, transport and storage of hazardous materials, and liquid waste disposal. Pollutants associated with the Project activities include fuel oil used for boiler start up, coal dust, bottom and fly ash and other chemicals related to the site processes, such as those for water treatment (including hydrochloric acid and sodium hydroxide). Impacts may result from leaks and spills from the storage and use of hazardous materials stored at the plant. Due to the incorporated design and environmental mitigation measures that will be in place this is very unlikely.

Coal will be transported to the power plant via railway where it will be transferred, using a conveyor, to a coal storage yard. The coal will then be crushed prior to use in the CFB boiler. Soil contamination can result from the loss of coal or coal dust into the ground. Coal stockpiles can be the source of particulate pollution in watercourses if washed out of the stockpile. Leachate from the stockpile may contain contaminants associated with coal such as heavy metals, and can present a risk to surrounding soil, groundwater and surface water if freely draining with the quality of the leachate depending on the coal composition.

Bottom and fly ash will be stored separately in silos at the site before being transported via rail and/or road to a remote ash disposal site. An emergency ash storage area (~72,600m^3 capacity) for the temporary storage of dry ash will also be located at the site. Ash leachate has the potential to impact soil and groundwater quality if not managed appropriately, and appropriate design mitigation will be applied to prevent infiltration to groundwater. In the longer term during the operational lifetime of the Project it is proposed to recycle the ash, which can be used in construction, such as cement manufacturing.

Hydrocarbons such as fuel oil, lubricating oil and degreasing solvents are highly mobile and can potentially contaminate a wide area. On encountering groundwater the liquids may migrate laterally over a wide area, presenting risks to groundwater resources further afield. Some liquids may also migrate vertically in groundwater presenting a contaminant risk to deeper aquifers.

Water treatment chemicals could present a risk to the environment if present in discharge waters, runoff, or if introduced to the environment via leaks and spills.

In accordance with local legislation and international guidance, all hazardous materials will be stored in bunded containers or on lined surfaces with surface drainage to a foul water treatment system.

The coal and ash storage areas will be lined with compacted clay and will have incorporated drainage. Ash temporarily stored in this area will be stored in impermeable bags within the emergency ash disposal area. The exact design and required thickness will be determined during project detailed design phase, with the minimum requirement that there shall be no possibility of infiltration in the groundwater. Dust will be managed at coal transfer points (using a dust collection system) and the coal storage area will be surrounded by a concrete wall to reduce the potential effects of windblown dust from the coal storage area.

Many of the chemicals used at the site are highly mobile and can potentially contaminate a large area. Without suitable mitigation, chemicals entering groundwater may migrate laterally, presenting risks to groundwater resources further down gradient. Some liquids may also migrate vertically in groundwater presenting a risk to deeper aquifers. The risks to groundwater from contamination are discussed in the Chapter 9.

12.5.3.2 Seismic Impacts

The Project site reportedly has a potentially high seismic risk (with a calculated probabilistic seismic intensity of between 7 and 8 on the MSK scale. Earthquakes not only present a risk to building structures and human health, but also have the potential to damage drainage structures and containers for storage of hazardous materials. Impacts may result from resultant leaks and spills of hazardous materials and site drainage and process waste.

12.5.3.3 Wastewater

The power plant design will include a comprehensive wastewater drainage and treatment system. All wastewater and liquid waste streams for the Project will be collected and treated by the dedicated onsite wastewater treatment facility. The system will be capable of treating wastewater such as chemical wastewater, oily wastewater, sewage, coal yard storm water and ash yard storm water. All waste water will be treated to meet agreed quality standards before it is discharged to USUG’s sewage piped system adjacent to the site boundary.

There is a potential for impacts to soil, groundwater and surface water from failure of the treatment process or ineffective drainage, due, for example, to blockages or insufficient capacity. There is a potential for contamination impacts if collection ponds are not appropriately lined or maintained.

The coal storage yard will be located on a sealed surface (200mm clay) with a surface drainage collection system which will discharge to a settlement pond where it will then undergo treatment before discharge. The ash storage yard will also been lined with clay, surface water will undergo filtration prior to pH treatment and discharge. Oily water runoff will be collected in a sump and pumped to a collection pond where the oil will be skimmed off and transferred to an oil sludge pond. The remaining water will be treated prior to disposal at the site boundary. If the drainage system is not adequately maintained, becomes blocked or damaged or the lining becomes damaged so that water drains to the ground, the resultant discharge has the potential to impact groundwater and soil quality.

For all of the above, the potential impacts to soils are assessed as negligible, due to their low value. The potential impacts to groundwater are considered to be more significant and are discussed further in the Chapter 9.

12.5.3.4 Impacts on Soil Quality

Contamination has the potential to affect soil quality locally at the Project site. Depending on the extent of contamination (small or large spill/ leak) the magnitude would be minor to moderate. Soil is considered to be a negligible value receptor. Based on its low value, the significance of impacts to soils is assessed as **negligible**.

Storage and handling of hazardous materials onsite will be undertaken in accordance with the site environmental health and safety plan to minimise the risk of leaks and spills and therefore the potential for impacts to the environment and human health.

If not suitably controlled soil contamination has the potential to impact groundwater, human health and ecology. There is no agricultural activity within the Project area. The most likely receptors include site operatives and visitors who may come into contact with contaminated dusts, most likely via inhalation and ingestion. Human health receptors have a high value. Based on the most likely exposure route (inhalation and ingestion of dust) and the likely contamination related to the processes (organics mainly comprising hydrocarbons, and heavy metals), health impacts could be short-term or chronic and therefore the magnitude would be moderate adverse. Taking into account the potential impact to human health, the significance of this effect is assessed as **major adverse** without mitigation. However, incorporating spill protection measures in plant design and monitoring during the operational phase will reduce the impact significance.

Waste waters will be collected and treated for re-use on site. Accidental releases of contaminated waste water could occur due to poorly maintained drains or damage to the drainage system/ treatment works. The magnitude is assessed as minor adverse. Potential impacts to soils from accidental wastewater discharge are assessed as **negligible** due to the negligible value / sensitivity of soil.

12.6 Mitigation and enhancement measures

12.6.1 Overview

The main impacts on soils for all aspects and phases of the Project are considered to be erosion and contamination. This is particularly significant during the early construction phase when ground disturbance, leaks and spills are more likely.

Before commencing construction, an assessment, including suitable laboratory chemical testing, will be undertaken to provide a baseline of soil and groundwater quality.

During construction, contamination impacts from leaks and spills will be mitigated through use of best practice construction methodology in line with local regulations and international guidelines. Impacts from waste can be suitably mitigated by following a project specific waste management plan. For all aspects of the Project a comprehensive HSE Plan will be implemented in accordance with international standards, aimed at preventing accidents, injuries and work-related diseases through the identification of the causes of physical, chemical and biological hazards and by prioritising hazard elimination, hazard control and hazard minimisation.

The mitigation measures identified below are incorporated into the following sections of the assessment to identify any residual impacts after mitigation.

12.6.1.1 Mitigation of Risks to Human Health

Impacts to human health during all stages of the development can be prevented by following good site practice and use of appropriate PPE in accordance with the WBG/IFC EHS General Guidelines (2007). Suitable PPE includes: eye protection; body/leg protection; foot protection; hand protection; hearing protection; lung protection and head protection.

Physical exposure to soil and dust can result in a risk to site workers. Good site practice and appropriate use of PPE in line with the WBG/IFC EHS General Guidelines will be maintained during construction works. Such requirements should be reviewed on a regular basis and PPE should be maintained and replaced when worn out. Occupational monitoring of workers will be undertaken in order to confirm the effectiveness of use of PPE and if required the PPE requirements will be revisited.

Other measures for protection of human health include: communication of potential hazards to workers; safe storage of hazardous materials; provision of suitable welfare facilities including clean water for washing and drinking; provision of suitable ventilation systems in workers accommodation; environmental monitoring (e.g. gas and vapour monitoring) and emergency preparedness and response plans.

An emergency response plan will be prepared, detailing procedures, response personnel, medical support, equipment, evacuation procedures and measures for limiting or stopping potential events.

12.6.1.2 Mitigation of Seismic Risks

Further assessment will be required to establish the site specific risk to the development from seismicity in the area, to ensure that the structures are designed to a suitable standard to withstand earthquakes.

12.6.2 Construction Phase

A CESMP will be developed for the site in accordance with international standards, prior to construction. This document will outline the practices and procedures during the construction phase and will be further developed for the operational phase, to ensure minimal associated environmental impacts.

Mitigation measures required for construction of the Project are summarised in Table 12.5:

Table 12.4: Mitigation Measures Required During the Construction Phase

Process/Activity	Impact	Mitigation
Site Preparation (cut/ fill and levelling) and vehicle movement	Vegetation loss and compaction, resulting in erosion of desert soils leading to: soil and further vegetation loss, change in drainage structure, clogging of drainage features/streams/rivers by wind-blown dusts and sediments in rainwater run off	Where possible vehicles to use defined access roads/tracks. Where travelling off road, keep vehicle movements to a minimum. Earthworks to be undertaken during suitable weather conditions i.e. low wind strength to minimise the level of wind-blown dust. Damping down of soils may also be used to prevent creation of dust.
Earthworks/ intrusive construction works	Mobilisation of dust and secondary impacts on human health	Use best practice construction methodology in line with local regulations and international guidelines. Undertake earthworks during suitable weather conditions i.e. low wind strength to minimise the level of windblown dust. Damping down of soils may also be used to prevent creation of dust. Contractors to wear suitable PPE to protect against inhalation of dust. A risk assessment will be carried out to identify the level of PPE required in line with site specific risk factors.
Leaks and spills of Hazardous Materials	Soil quality with secondary impacts on groundwater quality and human health.	Limited information is available on soil quality at the site. Undertake soil and groundwater quality baseline assessment for the Project area, including soil and groundwater contamination testing. Establish baseline values for the site, to compare future monitoring to and to identify the conditions the site should be returned to in future when the power station has closed and is to be decommissioned. Use best practice construction methodology in line with local regulations and international guidelines to minimise the potential for leaks or spills to occur. Hazardous materials will be suitably stored to prevent leaks and spills. Drip trays will be used to intercept leaks and spills from equipment and during refuelling. Adequate bunding will be provided for all fuel and chemical storage. Develop and implement an EPRP and a separate Spill Prevention and Response Plan in accordance with local

Process/Activity	Impact	Mitigation
		Emergency Response regulations and IFC and HSE guidance. Clean-up contaminated material in case of fuel leaks.
Waste water from construction, integrity testing and cleaning	Soil quality with secondary impacts on groundwater quality and human health.	Use best practice construction methodology in line with local regulations and international guidelines. All waste water requiring treatment will be processed in the dedicated wastewater treatment facility.

There is potential for impacts to the health of contractors and site workers during construction activities when handling hazardous waste materials. A comprehensive OHS Plan aimed at preventing accidents, injuries and work-related diseases through the identification of the causes of physical, chemical, biological and radiological hazards and by prioritising hazard elimination, hazard control and hazard minimisation would be implemented.

12.6.3 Operational Phase

Mitigation measures required for operation of the Project are summarised in Table 12.5 below:

Table 12.5: Mitigation Measures Required During the Operational Phase

Process/Activity	Impact	Mitigation
Leaks and spills of Hazardous Materials	Soil quality with secondary impacts on groundwater quality and human health.	Use best practice in line with local regulations and international guidelines for operation of the Project. Drip trays will be used to intercept leaks and spills from equipment and during refuelling. Develop and implement an EPRP and a separate Spill Prevention and Response Plan in accordance with local regulations and IFC and HSE guidance. Clean-up contaminated material in case of fuel leaks. Hazardous materials will be suitably stored to prevent leaks and spills. Bunding at least 110% of largest container will be provided for all fuel and chemical storage. Double or triple skinned bunding will be used where necessary.
Site drainage (including ash and coal storage yards)	Soil and groundwater quality	All drainage and process water will be collected, treated at the water treatment plan prior to discharge off-site and/ or re-use on site. Treatment will include separation of oil from the water, pH adjustment and biological treatment. All storage ponds will be suitably lined and will be monitored for leakages. In accordance with the site ESMMP, on-going monitoring and maintenance of the drainage system will be undertaken. Wastewater emissions will comply with local water quality and discharge regulations and will not exceed maximum allowable concentrations for discharge of wastewater to land and water.
Storage of wastewater in ponds	Soil and groundwater quality	Ponds will be fully lined to prevent leaks and spills. The ponds will be designed with extra capacity for storm deluge.

Process/Activity	Impact	Mitigation
Transport, handling, storage, drainage and use of potentially contaminating materials	Soil, groundwater and surface water quality	By implementing the mitigation detailed above, for leaks and spills and drainage, potential impacts to soil and groundwater quality can be minimised. Routine quarterly monitoring of groundwater quality and level at up-gradient and down-gradient locations in the vicinity of the power plant. Assessment of any changes in groundwater conditions, to ensure groundwater quality is not degraded by the Project activities and to provide early warning should impacts occur.

As with the construction phase there is a potential for impacts to the health of site workers when handling hazardous materials. These will be addressed through the implementation of Health and Safety systems.

12.7 Residual impacts

Following the implementation of mitigation as set out in Sections 12.6.2 and 12.6.3 the residual impacts are set out in Table 12.6. There are not expected to be any significant residual impacts.

Table 12.6: Summary of ground contamination impacts and mitigation

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
Construction						
Site Preparation (cut/ fill and levelling) and vehicle movement	• Erosion • Damage to soils	Negligible	Major adverse	Minor adverse	• Best practice construction techniques • Where possible vehicles to use defined access roads/tracks. • Where travelling off road, keep vehicle movements to a minimum. • Earthworks to be undertaken during suitable weather conditions i.e. low wind strength to minimise levels of wind-blown dust. Damping down of soils may also be used to prevent creation of dust.	Negligible
Earthworks/ intrusive construction and deconstruction works	• Mobilisation of dust with potential secondary impacts to human health	High	Minor adverse	Moderate adverse	• A CESMP will be developed for the site. • Best practice construction techniques • Implementation of a comprehensive Occupational Health and Safety Plan. • Good site practice and appropriate use of PPE in line with the WBG/IFC EHS General Guidelines.	Negligible
Leaks and spills of hazardous materials	• Soil quality	Negligible	Minor adverse	Negligible	• A CESMP will be developed for the site. • Best practice construction techniques • Compliance with local and international guidance • Develop and implement an EPRP and a separate Spill Prevention and Response Plan in accordance with local regulations and IFC and HSE guidance.	Negligible
	• Potential secondary impacts to human health	High	Minor adverse	Moderate adverse		
Waste water from construction, integrity testing and cleaning	• Soil quality	Negligible	Minor adverse	Negligible	• A CESMP will be developed for the site. • All waste water to be collected and processed at the sites Waste Water Treatment Plant (WWTP). • All waste water will be treated to meet agreed quality standards before it is discharged into the sewerage system. Waters that do not meet the criteria will be treated further, or suitably disposed	Negligible
	• Potential secondary impacts to human health	High	Minor adverse	Moderate adverse		

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
Operation						
Leaks and spills of hazardous materials (and site drainage/ waste waters if damage occurs)	• Soil quality	Negligible	Minor to moderate adverse	Negligible	• Compliance with local and international guidance for operation of CHP • Develop and implement an EPRP and a separate Spill Prevention and Response Plan in accordance with local regulations and IFC and HSE guidance • Undertake routine groundwater monitoring to monitor impacts to groundwater quality (by comparison with baseline levels) - providing an early warning system for impacts to groundwater down gradient of the site. • Implement site inspection protocol	Minor adverse / Negligible
	• Potential secondary impacts to human health	High	Minor to moderate adverse	Moderate to major adverse		
Site drainage from ash and coal storage yards	• Soil quality	Negligible	Minor to moderate adverse	Negligible	• Compliance with local and international guidance for operation of thermal power plants. • All drainage and process water will be collected, treated at the WWTP prior to discharge off-site and/ or re-use on site. • All storage ponds will be suitably lined. • In accordance with the site ESMMP, on-going monitoring and maintenance of the drainage system will be undertaken.	Minor adverse / Negligible
	• Potential secondary impacts to human health	High	Minor to moderate adverse	Moderate to major adverse		
Transport, handling, storage, drainage and use of potentially contaminating materials	Soil, groundwater and surface water quality	Negligible	Minor to moderate adverse	Negligible	• Implement mitigation for leaks and spills. • Routine quarterly monitoring of groundwater quality and level, at up-gradient and down-gradient locations in the vicinity of the power plant. • Assessment of any changes in groundwater conditions, to ensure groundwater quality is not degraded by the Project activities and to provide early warning should impacts occur.	Negligible

13 Traffic and Transport

13.1 Introduction

This chapter considers the potential traffic and transportation impacts associated with the construction, operation and decommissioning of the Project. It considers the receptors external to the Project site which have potential to be sensitive to the traffic and transport generated and associated with the Project and the significance of these impacts.

The assessment presented in this chapter focuses on a number of aspects, including:

- Road and rail networks external to the development site which could require upgrade or experience wear and tear
- Delays to other road users as a result of abnormal loads transportation or from exceedance of road network capacity
- Scheduling impacts (i.e. as a result of increased freight on major routes)
- Road safety implications (i.e. as a result of increased traffic flow)
- Impacts on other environmental receptors, including ecology and water, as a result of, for example, run-off of contaminants

During both the construction and operational phase of the Project there will be a number of transportation activities associated with the Project. Depending on the phase, the number and type of traffic movements will alter. The generic types of movements for each phase are described in Table 13.1. The impacts of traffic movements associated with decommissioning of the Project are assumed to be no greater than those associated with construction and therefore decommissioning is not considered separately.

Table 13.1: Predicted Traffic and Transportation Activities

Project Lifecycle Stage	Project Activity or Element
Construction and Decommissioning	• Earthmoving, foundations, excavations • Import of plant equipment – much of which will constitute abnormal loads • Delivery of resources to site (concrete / water) • Disposal of solid waste generated • Delivery of mechanical and electrical equipment • Delivery of materials and equipment • Delivery of earthen materials onto site • Movement of construction workforce between workers accommodation and construction site
Operation	• Import of coal from Baganuur and Shivee-Ovoo coal mines • Export of products from the power plant (namely waste ashes) • Import of chemicals • Maintenance activities and equipment • Daily ingress and egress of workers

13.2 Applicable legislation

13.2.1 National requirements

No national legislation has been identified for the management of traffic and transport in terms of environmental assessment.

13.2.2 International requirements

In terms of traffic and transport, the principles of the assessment have been developed in line with IFC PS1 (Assessment and Management of Environmental and Social Risks and Impacts) and Performance Standard 4 (Community Health, Safety and Security), and with EBRD PR1 (Assessment and Management of Environmental and Social Impacts and Issues) and PR4 (Health and Safety). The main policy and legislative objectives of each document which are relevant to this assessment chapter are summarized in Table 13.2.

Table 13.2: IFC and EBRD Standards

Performance Standard	Key Policy and Legislative Objectives
PS1 (Assessment and Management of Environmental and Social Risks and Impacts) PR1 (Assessment and Management of Environmental and Social Impacts and Issues)	• To identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence • To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment • To ensure that affected communities are appropriately engaged on issues that could potentially affect them • To promote improved social and environment performance of companies through the effective use of management systems
PS4 (Community Health, Safety and Security) PR4 (Health and Safety)	• To avoid or minimize risks to and impacts on the health and safety of the local community during the project life cycle from both routine and non-routine circumstances • To ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security

13.2.2.1 ADB

SR1: Environment requires that an environmental assessment considers all potential impacts and risks of a project on physical, biological and socioeconomic and physical cultural resources. The transportation of Project related materials during both construction and operation is a key part of the project activities and as such requires to be assessed as part of this ESIA.

13.2.2.2 JBIC Environmental and Social Guidelines

There are no specific environmental and social requirements for traffic and transport in the JBIC environmental and social guidelines.

13.3 Methodology and assessment criteria

13.3.1 Overview

The assessment has been undertaken using primary data collected during site visits in August 2014 and secondary data identified through a desk-top study. The methodology for the assessment can be summarised as follows:

- Establishment of baseline – an examination of existing traffic and transport routes which lead to the proposed Project area, using knowledge gained from the site visit
- Trip generation – The estimated number of traffic movements associated with the Project for the peak construction periods.
- Assessment of impacts based on predicted volumes of vehicle movements generated by both the construction and the operational phases. Possible effects arising as a result of the additional traffic have been identified and their significance assessed. The significance criteria adopted for the assessment of impacts is set out in Chapter 5.
- Development of mitigation to reduce any significant impacts to an acceptable level and to identify good practice measures to minimise the overall environmental impact from traffic and transportation associated with the Project.

13.3.2 Determining Significance of Impacts and Effects

The significance of potential impacts is a function of the presence and sensitivity of receptors and the magnitude of the impact in terms of duration, spatial extent, reversibility and likelihood of occurrence. The generic criteria for defining magnitude, sensitivity and overall significance are presented in Chapter 5 have been applied to this traffic and transport assessment.

The magnitude of transport impacts is, to an extent, subjective. The determination of the magnitude will therefore be based upon professional judgement taking into account the perceived sensitivity of the receiving environment.

13.3.3 Assumptions and limitations

The data made available for this section comes principally from the following sources:

- Information provided by the Consortium and the EPC contractor
- Observations made during the site visits undertaken by Nature Friendly and Mott MacDonald.

This assessment has been undertaken in the absence of the following data:

- Detailed traffic counts on the main roads been compiled over a number of days, weeks or months or accounting for peak travel periods (early morning and evenings).
- Precise origins of materials and spare parts during construction and operation and exact transportation methods and routes.

To overcome some of the absences of data, a number of assumptions have been made to undertake this assessment. These assumptions are based on experience of similar projects and knowledge of the likely transportation routes that materials may take. Professional judgement has been used to reduce the level of subjectivity within these assumptions as far as possible and where professional judgement has been used an explanation for assumptions reached has been provided.

13.3.4 Environmental Mitigation

Appropriate mitigation measures for the minimisation of traffic and transport related effects will be identified. Where there is the potential for aspects of the Project to cause cumulative traffic and transport related effects, or where other existing or proposed developments may lead to cumulative effects, the assessment will consider the combined effects and identify applicable and relevant mitigation measures.

Occupational health and safety requirements in relation to moving vehicles within the working area are addressed in the ESMMP. Potential nuisance (e.g. noise, air quality) and other environmental impacts caused by increased traffic are considered within the relevant environmental chapters in this ESIA.

13.4 Baseline description

13.4.1 National context

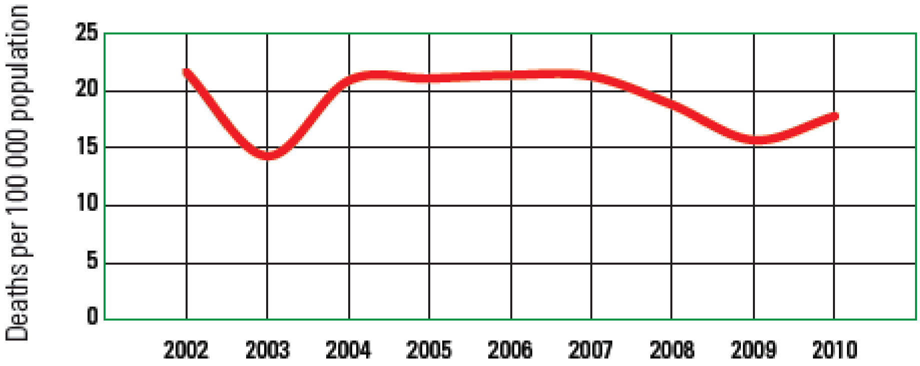
Mongolia has approximately 49,250km of roads. The top-tier road networks connect regional centres with Ulaanbaatar cover a distance of approximately 11,200km, of which only around 2,500km are paved. Around 1,960km of this network has gravel surfacing, with 1,900km having an improved and levelled earth surface. Mongolia joined the transport networks of Asian Highway and Trans-Asian Railway Network of UNESCAP and is implementing the Trans-Mongolia Project. Mongolia is now being connected to Asian Highway system and routes of AH3 (1,009km), AH4 (758km), and AH32 (2,325km).

According to the US Overseas Security Advisory Council (OSAC), driving standards in Mongolia are very poor and road safety is a major concern.[22] The WHO data sheet on road safety[23] reports that approximately 18 deaths occurred per 100,000 people in Mongolia in 2010 (refer to Figure 13.1). Approximately 25% of road traffic deaths in Mongolia are among pedestrians, as identified by Figure 13.2.

[22] https://www.osac.gov/Pages/ContentReportDetails.aspx?cid=12181

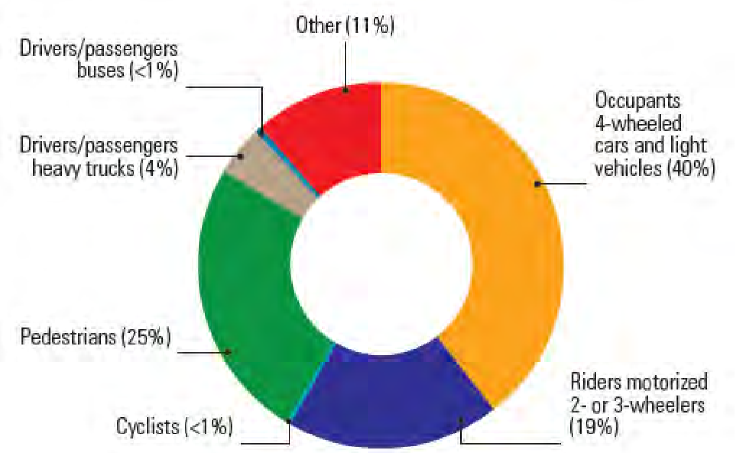
[23] http://who.int/violence_injury_prevention/road_safety_status/2013/country_profiles/mongolia.pdf

Figure 13.1: Trends in Road Traffic Deaths



Source: 2011, Health statistics (data from Centre for Health Development)

Figure 13.2: Deaths by Road User Category



Source: 2010, Health statistics.

Rail transport in Mongolia is an important means of travel in the landlocked nation with few paved roads. With no sea-ports of its own, Mongolia is reliant on railways, alongside its roads, as its primary means of reaching a broader group of trading partners as its mining export industry expands and for the movement of materials and products around the country. The main railway section of the Mongolian Railway is a trunk line between Sukhbaatar, on the Russian border, through Ulaanbaatar to Zamyn Uud, on the Chinese border – a distance of around 1,400km. In reasonably good condition, this section of line is the main transit route for cargo moving between China and the Russian Federation via Mongolia. Rail carries the bulk of Mongolian cargo tonnage, due to spur rail lines that connect to the major coal mines.

As a result of the vast distances between cities and poor road condition, the domestic and international air transport system of Mongolia is relatively well developed. Airfreight plays an important role in Mongolia's air traffic. A new airport is currently under construction on the outskirts of Ulaanbaatar. The NUBIA is located in the Khushigiin Khundii valley, Sergelen sum, Tuv province, approximately 50km southwest of Ulaanbaatar. The airport will be capable of handling approximately three million passengers per year.

13.4.2 Transportation in Ulaanbaatar

The number of automobiles in Ulaanbaatar City has increased rapidly. In 1990, the number of vehicle registered was approximately 10,000; in 2013 it reached 375,000 in Ulaanbaatar. Over 180,000 vehicles are on the city roads daily.[24] There is an inadequate supply of public transport services in Ulaanbaatar, with the dominant form of public transport used being bus. According to the Ulaanbaatar City Master Plan study by JICA (2009), total transportation demand in the city comprises walking (31%), car (23.7%), taxi (9.4%), bus (33.4%) and others (2.5%).

Traffic volume doubled between 1998 and 2011 in Ulaanbaatar, causing traffic delays around the city. In the same period, the average speed of traffic decreased by half on major roads: In 1998 the average speed was approximately 30-40 km/h; however, in 2011 the average speed was estimated to be 16-20 km/h. During peak hours in and around the city centre, the average speed can be as low as 5-8 km/h indicating the extent of traffic congestion.[25]

The poor quality of roads coupled with inadequate intersection geometry and outdated signalling systems that make controlling traffic in the city almost impossible. Traffic congestion is steadily getting worse, which contributes considerably to the poor air quality in Ulaanbaatar.

13.4.3 Road Survey

During a site visit in August 2014; a number of basic traffic counts were undertaken, the objective of which was to collect various vehicle numbers to determine indicative traffic flows along the Bagakhangai – Nalaikh Road. A visual inspection of the road quality at the traffic count points and in the general vicinity of the site was also undertaken. The quality of the local roads is considered to be poor.

Table 13.3 present the traffic data collected. Locations for data collection were chosen as they captured traffic passing the key turn off to the site.

Table 13.3: Traffic count

Date of Traffic count	Time and duration of traffic count	Cars	Buses	Minibuses	Light good vehicles / vans	Heavy goods vehicles / trucks
14/08/14	11.00-12.00	587	15	41	84	61
16/08/14	11:30-12:30	1,017	19	41	73	51

[24] Ministry of Roads and Transportation. 2014. Urban Transport System in Ulaanbaatar city: Regional Expert Group Meeting on Sustainable and Inclusive Transport Development, 29 September -1 October 2014, Ahmedabad, India

[25] http://www.unescap.org/sites/default/files/4b.2_UT%20System_Ulaanbaatar.pdf

The traffic count results indicate that there are relatively low vehicle numbers on the Bagakhangai – Nalaikh Road. During the site survey it was considered that traffic on the road was free flowing with limited congestion observed.

13.4.4 Rail Capacity Survey

On behalf of the Consortium, Mott MacDonald undertook a Railway Capacity Verification Study (document reference 335074/TAI/TWT/001/A) on the Mongolian railway network, a single track railway from Russia to China passing the Mongolian capital Ulaanbaatar. This railway is part of the Trans-Asian Railway and has several branch lines. Study simulations show that the transportation of the materials to and from the power plant at peak load will be possible on the current rail network.

13.5 Impact identification and assessment

13.5.1 Construction Phase Impacts

13.5.1.1 Overview

A variety of construction materials will be delivered to the site during the construction period, including:
- Earthen material for site levelling (coming on-site from borrow pits)
- Excavated materials being taken off site to spoil disposal sites
- Large plant items
- Materials for construction of infrastructure including site roads, vehicle parking and walkways
- Steel
- Concrete
- Building materials
- Piping
- Specialist equipment.

Transportation of material from the borrow pit

The current estimated volume of material required for levelling the site is 917,243 m^3. Approximately 700,000m^3 of material will be sourced from a borrow pit and transported to the Project site by truck. Based on a 16 month period for the delivery of earthen materials for site levelling, it is expected that there will be 10 movements per hour, six days a week over a nine hour working period. Furthermore, it has been assumed that productivity will be reduced by 75% on average during the four winter months.

Earthen material and concrete will be required for the construction of foundations for a number of plant components, including the boilers and the steam turbine generator. In addition to the above, approximately 635,000m^3 of earthen material and concrete will also be delivered to site by truck. Therefore, it has conservatively been assumed that an additional 10 vehicle movements will be required over the same 16 month duration.

Construction materials

The current estimate for construction materials and equipment to be brought onto site is approximately 494,540 freight tons, which will be sourced from both national and international locations. Construction materials and equipment for the Project will be transported by road and rail to the construction site; air freight and barges have not been considered as a main transport option for the Project. During the construction phase there are a number of key factors that will be taken into account when finalising the logistics plan. These include, for example, the size of containers that can be transported on the national railway system or the maximum size of abnormal loads that can access the site via key access roads.

A majority of construction material and equipment (circa 85%) will be gathered in Xingang Port (from the overseas market) or Erlian (from the China market) and then transported to the Project site by railway (refer to Figure 13.3). Oversized, overweight and/or unbalanced materials and equipment, however, will be transported to site via truck from both Xingang and Erlian (refer to Figure 13.4). Figure 14.6 shows the proposed road routes for transporting materials arriving at Ulaanbaatar rail station to the Project site. Table 13.4 provides estimates of the weight (in freight tonnes) of materials and equipment to be transported to the Project site and includes the sourcing countries and transportation method.

Table 13.4: Construction materials weight (freight tonnes)

Items		Weight (tonnes)	Sourcing Countries	Transportation Method
Civil Material		278,709	Mongolia	Road
Soil		2.5-3 million*	Mongolia	Road
Architectural Material		139,598	Mongolia	Road
Mechanical Material	Boiler	37,847	Korea	Road for heavy, oversized items; Rail for all others
	Steam turbine	1,670	Czech Republic	
	ACC	6,693	China	
	Other	19,418	Various	
Electrical		6,060	Various	
Other Bill of Plant (BOP) materials		4,544	Various	
Total		**2,994,539 - 3,491,539**		

Note: * Based on estimated incoming materials of 917,243 m

Figure 13.3: Proposed Route for Transportation of Materials and Equipment by Rail

Source: The Consortium

Figure 13.4: Proposed Route for Transportation of Materials and Equipment by Road

Source: The Consortium

Mott MacDonald

Figure 13.6: Proposed route for transportation of materials and equipment by road from the Ulaanbaatar rail station to the Project Site

Source: The Consortium

13.5.1.2 Capacity of rail networks

The additional rail movements (per month) are considered to be low and there is capacity on the existing network. The magnitude of additional movements is conservatively considered to be minor.

The sensitivity of the transport network is conservatively considered to be medium based on the existing rail conditions. The railway from Russia to China passing the Mongolian capital Ulaanbaatar is only a single track and at risk to bottlenecking and breakdowns. The effect of construction movements associated with the Project on the capacity of the rail network is **minor adverse.**

13.5.1.3 Capacity of road networks

The additional daily road traffic movements necessary for construction phase are considered to be high when compared to the number of existing movements and the existing capacity on the surrounding road network. However, in the centre of Ulaanbaatar the road network does not have additional capacity to absorb additional vehicle movements generated by construction traffic, the recently developed bypass road on the south of the city, allows for the additional capacity for construction materials that would be sourced on the west side of Ulaanbaatar. Material sourced from the east and south of Ulaanbaatar will not need to transit in Ulaanbaatar. As exact numbers are not available at this stage, the magnitude of additional movements is conservatively considered as major.

Based on observations made during the site visits, it is considered that capacity of the roads is limited and there are typically high levels of congestion. Furthermore, construction materials transported to Ulaanbaatar by rail will arrive at Ulaanbaatar rail station and then be offloaded onto vehicles to be transported to site, passing through the south east of Ulaanbaatar city.

Applying the significance criteria concludes the effect of construction movements associated with the Project on the capacity of the local road network and in Ulaanbaatar is of **major adverse** significance.

13.5.1.4 Transboundary Effects

During construction, the Project intends to use international road and rail networks to transport materials to site. It is therefore possible that the Project could have transboundary effects, such as air pollution and GHG emissions from the use of Heavy Goods Vehicles (HGV) or the increased risk of injury to other road users due to accidents involving equipment delivery trucks. The overall impacts on the transboundary shipment of goods for construction are considered to be **negligible** due to the relatively short period of construction, the use of major transport routes and the relatively low overall volume of goods being imported.

13.5.1.5 Wear and Tear

With respect to the physical effects of construction traffic, it is considered that trucks (including those carrying abnormal loads) will have an effect of moderate magnitude on the local road infrastructure. The sensitivity of the local road network to truck movements is considered to be medium due to the poor quality of the road. The use of HGVs on the road network has a potential to contribute to deterioration of the roads. However, the overall the effect of construction traffic on highway ‘wear and tear’ is therefore assessed to be **moderate adverse.**

The sensitivity of the rail network is conservatively considered to be medium based on the single track line. The deterioration of the network could have a minor impact on rail users. The significance of wear and tear on the network is therefore conservatively considered to be **minor adverse**.

13.5.1.6 Abnormal Loads

Abnormal loads will be delivered via a combination of rail and road. A detailed Construction Traffic Management Plan (CTMP) will be developed in consultation with the local transport authority to identify appropriate solutions to the transportation of abnormal loads.

The exact number of abnormal loads is not known at present and will not be known until later in the detailed design phase and during the final construction plan. The magnitude has been assumed as minor as it would be intermittent and only temporary. The sensitivity of the abnormal movements is described as medium as there are a number of road users which may be affected, particularly in the areas surrounding Ulaanbaatar. The impact of abnormal loads is therefore judged to be **minor adverse.**

13.5.1.7 Road Safety

The exact number of additional vehicles during the construction phase is not known. However, as the majority of these vehicles will be HGVs, the magnitude of the increase in numbers related to road safety is assessed as being moderate. The sensitivity of people in residential areas along the proposed construction transport is considered to be high as there will be vulnerable road users such as pedestrians. The impact of construction traffic on road safety is therefore assessed to be **major adverse** significance.

13.5.1.8 Nuisance

The additional HGV road movements as a result of construction activities and operation of plant and heavy machinery has the potential to have an adverse effect on sensitive receptors, including increased noise or elevated dust levels. In particular, nuisance will be caused by vehicles regularly crossing the road from the construction laydown area to the power plant site and the large numbers of vehicles transporting spoil and material from the borrow pit. On this basis the effect is considered to be **major adverse**.

13.5.1.9 Effects of vehicle movements associated with the borrow pit

Significant volumes of earthen material for site levelling, construction of foundations and for flood mitigation will be sourced from a borrow pit and transported to the Project site by road. The location of the borrow pit has not yet been determined and the EPC contractor will be required to identify a suitable site in accordance with the requirements set in Chapter 2, which includes consideration of suitable access routes with sufficient capacity.

It is expected that the transportation of materials will have a significant impact on road users; however, further assessment will be required by the EPC contractor prior to construction to determine the likely impacts.

13.5.2 Operational Phase

As discussed in Section 2.3.1, it is expected that three trains from Shivee-Ovoo coal mine and two trains from Baganuur coal mine will deliver coal to site each day during the operation of the Plant. Coal will be transported on site by conveyors. One additional train will also deliver 1,037 tonnes of limestone daily, potentially from the Shivee-Ovoo mine region.

With regards to ash, the ash silos and associated infrastructures shall be designed for discharging ash onto wagons as well as onto trucks, in order to transport the ashes to a remote ash disposal area, to an on-site emergency ash disposal area (by trucks) or to any ash off-taker (by train or truck). It is expected that ash will be transported off site via rail.

The operation of the Project will generate limited volumes of solid waste, which will be collected by a licenced waste carrier for disposal or recycling (estimated to be one to two vehicles per day). Currently no contract for a licenced carrier for disposing of or recycling waste is in place.

Operation of the Project will involve the daily commute of operations personnel to and from the Project site. At present it is expected that the majority of these workers will reside in Ulaanbaatar city either in their existing accommodation or in purpose built accommodation for the Project. The operations workforce for both the Project will operate in shifts and it is planned that shuttle buses will transport the majority of workers to and from the site. There will be some provision for car parking at the Project site and it is expected that some additional car journeys to and from the Project site will also be made.

13.5.2.1 Capacity - Operational Workforce

The operation of the Project is not expected to significantly affect the existing number of movements on the local road network. Although a significant number of new jobs will be created, the majority of the workforce will be transported by bus and will be spread across the day. However, the additional movements created by the workforce could have an impact on the traffic and congestion in Ulaanbaatar city.

In accordance with the significance criteria, the sensitivity of the receiving road network is considered to be low on the local network and medium close to Ulaanbaatar city and the magnitude of effect negligible. Consequently the significance is assessed to be **negligible**.

13.5.2.2 Capacity – Movement of Lignite

The operation of the Project will require 10,187 tonnes of lignite per day, which will be imported from the Baganuur and Shivee-Ovoo coal mines by rail. It is expected that limestone will also be delivered to the site via rail and ash will be taken off site to the ash disposal site. As discussed in Section 13.4.4, a separate Railway Capacity Verification Study undertaken by Mott MacDonald estimated that there is the required capacity on the network to accommodate the additional rail movements to and from the Project site. The study showed that there was sufficient capacity on the railway network to accommodate additional rail movements form the development of the Amgalan HOB and expansions to CHP3 and CHP4. The magnitude of the additional rail movements is described as moderate. There is additional capacity on the rail line and local road network so the sensitivity is described as low. In accordance with the significance criteria, the effect of transporting the products is assessed to be **minor adverse.**

13.5.2.3 Transboundary Effects

During operation, there is not expected to be any cross border movement of vehicles. The exception to this would be for the transportation of spare plant items at discrete points in time (such as outages and maintenance periods), however this would be limited.

13.5.2.4 Wear and Tear

During the operational phase of the Project, there will be additional traffic on the existing road network. Given the current quality condition of the roads surrounding the Plant, the sensitivity on the receiving local road network is considered to be medium, the magnitude of effect moderate due to the expected number of large goods vehicles required to transport materials from the site on an annual basis and consequently impact significance assessed to be **minor adverse**.

The sensitivity of the rail transport network is conservatively considered to be medium based on the single track line. The deterioration of the network could have a minor impact on rail users. The significance of wear and tear on the network is therefore conservatively considered to be **minor adverse**.

13.5.2.5 Abnormal Loads

It is not anticipated that abnormal loads on the road will be required as part of routine operations consequently the impact significance is judged to be **negligible**.

13.5.2.6 Road Safety – within the Plant

There will be a number of vehicle movements associated with operational workforce and deliveries and transportation of goods to the Project site. Although the workforce will be provided with clear walkways and be fully briefed on health and safety and be equipped with high visibility jackets, the potential impacts are predicted to be of a moderate magnitude. The sensitivity of the workers on site is considered to be low due to the requirement for site operations to conform to international safety standards. The significance of the impact on road safety and accidents within the site boundary is considered to be **minor adverse.**

13.5.2.7 Road Safety - outside the Plant

The exact numbers of additional vehicles is not known, however it is not expected that a large number of HGV's will be used during operation. Those used would be to transport materials, such as chemicals and small plant equipment. Given existing road use and driving conditions, the magnitude of the increase in numbers related to road safety is described as minor. The sensitivity of road users such as pedestrians, particularly in areas where the main traffic routes pass residential areas, is considered to be high. Given the low levels of road traffic to be generated by the Project during operation, the potential impact of operational traffic on road safety is conservatively assessed to be **moderate adverse.**

13.5.2.8 Nuisance

The additional HGV road movements and rail movements as a result of operation activities has the potential to have an adverse effect on sensitive receptors, including increased noise or elevated dust levels. The current number of trains per day is low and the existing numbers will not significantly increase. The number of HGV movements associated with operations is also expected to be low. On this basis the significance effect on nuisance is considered **negligible**.

13.6 Mitigation and enhancement measures

Two potentially significant impacts have been identified during this assessment – capacity impacts on the road network in Ulaanbaatar city and road safety outside the site boundary; mitigation measures are proposed to address these potential impacts. All other potential impacts were assessed as being of minor or negligible significance, however, good practice measures and recommended measures to reduce minor or negligible impacts are also outlined in Table 13.5.

It has been recommended that the Consortium / EPC contractor undertake a survey of the proposed transport routes to better characterise:
- Traffic levels and flows
- Route suitability
- Road quality (to determine existing levels of wear and tear).

At this time it is assumed that mitigation proposed for construction will be duplicated for the decommissioning phase. However, it is expected that mitigation based on future knowledge and best practice will be recommended as part of any future detailed decommissioning plan.

Mitigation is presented in this section by *theme* of impact due to the applicability of mitigation measures to impacts resulting from all scheme components.

Table 13.5: Mitigation and Enhancement Measures

Impact Theme	Mitigation and Enhancement Measures
Reduced safety of vulnerable road users on the local roads and of residents at any residential areas affected by construction or operational traffic	Measures to reduce the risk to vulnerable road users and occupants of residential properties in the vicinity of roads which will be affected by construction and operational traffic will be identified as part of the detailed Construction Traffic Management Plan (CTMP) prior to construction. The CTMP will draw on international best practice in developing and ensuring the implementation of suitable strategies, Consultation the appropriate highways authority to ensure identified measures take into account local circumstance.
Delays to road users as a result of earthen materials movements,	A detailed CTMP will be developed in consultation with the local transport authority to identify key issues and appropriate solutions. The CTMP will be produced in

Impact Theme	Mitigation and Enhancement Measures
construction materials deliveries and abnormal loads	accordance with applicable international standards. Earthen material vehicle movements will avoid peak times, and where road crossing is required movements will be timetabled to ensure that vehicles arrive and leave at the same time (two-way movement) Disruption to road users will be minimised as far as possible by utilising the power plant site for the storage of materials in combination with the construction laydown site, and by providing onsite parking for HGV's to reduce congestion on the road during materials delivery.
Wear and tear on local roads as a result of traffic volumes and abnormal roads	Measures to reduce wear and tear will be included as part of the CTMP.
Improved safety for other motorists	Erect signs in each direction along the Bagakhangai – Nalaikh Road where the road is single carriageway about the dangers of overtaking. Identify opportunities to improve the road infrastructure around the Project site such as the widening of the roads to improve safety. Provision of information regarding construction activities and activities throughout the operational lifetime of the Project through stakeholder consultation.
Nuisance impacts on sensitive receptors (i.e. noise and dust)	A detailed CTMP will be developed in consultation with the local transport authority to identify key issues and appropriate solutions Implement detailed Air Quality Management Plan (AQMP) to mitigate any potential negative risks to the environment, workers or the community resulting from air emissions during construction and operation; and Dust Monitoring Action Plan (DMAP) to mitigate any potential negative impacts that dust, PM_{10} and $PM_{2.5}$ may cause to the identified sensitive receptors during operation only (refer to Chapter 7) Implement Noise and Vibration Control Plan (NVCP) during construction to control noise and vibration caused by construction, traffic, operations, and other activities (refer to Chapter 8)

13.6.1 Proposed Monitoring

Procedures for monitoring the effectiveness of the mitigation measures proposed in this section are provided in the ESMMP and will be expanded upon in the Project specific CTMP and an operational traffic management plan (TMP). Monitoring will be undertaken to determine the effectiveness of mitigation measures in terms of safety and nuisance.

13.7 Residual impacts

Residual effects are those effects that remain after mitigation has been implemented. A tabulated summary of impacts associated with the development and the residual impacts following mitigation is presented in Table 13.6. There will be a significant impact on traffic during the construction phase owing to the significant quantities of materials, primarily earthen materials for site excavation, site levelling and foundation construction. At this stage, measures to mitigate these impacts are under consideration by the Consortium and the EPC contractor and will be further developed as the Project progresses.

Table 13.6: Summary of traffic and transport impacts and mitigation

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
Construction and Decommissioning						
Capacity – rail network	Additional volume of traffic on the rail network resulting in disruption to existing users	Medium	Minor	Minor adverse	• Schedule rail use, in collaboration with network operator.	Negligible
Capacity – road network	Additional volume of traffic on the road network resulting in disruption to existing users	High	Major	Major adverse	• Where possible deliveries of materials and movements of construction workers will be planned to avoid the busiest roads and times of day when traffic is at its greatest. • The Consortium and EPC contractor to identify opportunities for use of rail during construction for the transport of materials and equipment to limit the use of roads (and in particular by abnormal loads).	Minor to Major adverse
Transboundary effects	GHG emissions from the use of Heavy Goods Vehicles (HGV) or the increased risk of injury to other road users due to accidents involving equipment delivery trucks	Medium	Negligible	Negligible	• Utilise low emissions vehicles for the transportation of materials (wherever practicable). • The CTMP will identify appropriate haulage routes to minimise impacts on road users.	Negligible
Wear and tear – roads	Wear and tear as a result of type of traffic and volumes	Medium	Moderate	Moderate adverse	• Measures to reduce wear and tear will be included in the CTMP. Provisions for rail maintenance to be discussed with network operator. • Undertake roads assessment of proposed road routes to understand any logistical constraints. As part of the roads assessment, complete a survey to establish a baseline of the road quality. • Through above surveys, establish liaison with roads authority for the review of roads and necessary maintenance.	Minor
Wear and tear – rail	Wear and tear to rail network as a result of additional rail volumes	Medium	Minor	Minor adverse		Negligible
Abnormal loads	Delays to road users as a result of abnormal loads	Medium	Minor	Minor adverse	• Abnormal loads will be scheduled for night time periods or outside of peak traffic hours to minimise disruption. Local residents will be	Negligible

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
					informed of the schedule for abnormal roads in advance	
Road safety	Reduced safety of residents of Ulaanbaatar and surrounding villages, particularly vulnerable groups such as pedestrians.	High	Moderate	Major adverse	• The CTMP will draw on international best practice in developing and ensuring the implementation of suitable strategies to improve pedestrian safety. • At the site area traffic controllers will be present at the main road in order to reduce risk for vehicles passing by and CHP5 workforce.	Minor adverse
Nuisance	Effect on sensitive receptors as a result of increased noise or elevated dust levels from HGV movements and plant operation,	Medium	Major	Major adverse	• A detailed CTMP will be developed in consultation with the local transport authority to mitigate key nuisance issues and identify appropriate solutions. • Implement detailed Air Quality Management Plan (AQMP) to mitigate any potential negative impacts to the environment, workers or the community resulting from air emissions • Implement a NVCP to control noise and vibration caused by construction, traffic, operations, and other activities	Minor adverse
Operation						
Capacity – Operational workforce	Exceedance of road network capacity resulting in disruption to existing users	Low	Negligible	Negligible	• Provide shuttle busses to transport workers to the Plant and reduce the need to drive. • Implement local employment programme	Negligible
Capacity – Movement of feedstock	Increase number of HGV movements on the road network resulting in disruption to existing users	Low	Moderate	Minor adverse	• Primarily, feedstock, ash and other materials will be transported to and from the Plant using rail; road use will be limited to the transport of fuel oil, urea, consumables and solid wastes. • Traffic survey undertaken to determine the capacity and quality of the road network.	Negligible
Transboundary effects	Potential spillage of fuel oil during transportation	Medium	Negligible	Negligible	• Implement effective control systems, route selection, method of transport and a spill response plan combine to reduce any potential transboundary impacts to a minimum.	Negligible
Wear and tear – roads	Wear and tear as a result of type of traffic and volumes	Medium	Minor	Minor adverse	• Measures to reduce wear and tear will be included in the CTMP. Provisions for rail maintenance to be discussed with network	Negligible

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
Wear and tear – rail	Wear and tear to rail network as a result of additional rail volumes	Medium	Minor	Minor adverse	operator. • Undertake roads assessment of proposed road routes to understand any logistical constraints. As part of the roads assessment, complete a survey to establish a baseline of the road quality. • Through above surveys, establish liaison with roads authority for the review of roads and necessary maintenance.	Negligible
Road safety within the Plant area	Reduced safety of workforce in the Plant area	Low	Moderate	Minor adverse	• Workers should be informed and reminded of road safety via tool box talks and staff notice boards.	Negligible
Road safety outside the Plant	Reduced safety of residents of Ulaanbaatar, particularly vulnerable groups such as pedestrians	High	Minor	Moderate adverse	• Measures to reduce the risk to vulnerable road users and occupants of residential properties in the vicinity of access routes should be identified as part of the detailed CTMP. The CTMP should draw on international best practice in developing and ensuring the implementation of suitable strategies. • Warning signs for overtaking of vehicles should be erected along the Bagakhangai – Nalaikh Road	Minor adverse
Nuisance	Effect on sensitive receptors as a result of increased noise or elevated dust levels from additional HGV movements and rail deliveries during operation,	Medium	Negligible	Negligible	• A detailed CTMP will be developed in consultation with the local transport authority to mitigate key nuisance issues and identify appropriate solutions. • Implement detailed AQMP mitigate any potential negative risks to the environment, workers or the community resulting from air emissions; and a DMAP mitigate any potential negative risks that dust, PM_{10} and $PM_{2.5}$ may cause to identified sensitive receptors	Negligible

14 Landscape and Visual

14.1 Introduction

The purpose of the landscape and visual assessment presented in this chapter is to recognise, understand and interpret the character and value of the landscape setting of the Project. The assessment identifies the predicted impacts of the proposed Project design on the landscape resource and views and assesses their significance.

14.2 Applicable legislation

14.2.1 National requirements

No landscape or visual amenity related national legislation has been identified.

14.2.2 International requirements

The assessment is undertaken in consideration of the principles expressed in the ADB SR1: Environment, EBRD Environmental and Social Policy 2014, IFC PSs 2012 and JBIC's Guidelines for Confirmation of Environmental and Social Considerations, 2015.

The relevant international guidelines for this Project are those set out by the international guidelines. Whilst these guidelines do not specifically reference landscape and visual impacts, all have guidelines on cultural heritage (EBRD's PR8: Cultural Heritage and IFC's PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources) which specifically include consideration of unique natural features and landscapes that embody cultural values. The key objectives of the IFC's PS6 are to protect and conserve biodiversity and to promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities.

There is no particular reference to landscape and visual subject in the ADB Safeguard Policy Statement, 2009. The JBIC's Guidelines for Confirmation of Environmental and Social Considerations, 2015 require landscape to be included in the scope an environmental and social assessment for funded projects.

14.2.3 Guidelines and policies

14.3 Methodology and assessment criteria

There are no published guidelines relevant to landscape and visual aspects in Mongolia. The methodology for the Landscape and Visual Impact Assessment (LVIA) was developed using 'Guidelines for Landscape and Visual Assessment' (GLVIA) produced by the Landscape Institute (LI) and Institute of Environmental Management and Assessment (IEMA) in 2013 (Second Edition) which is internationally recognised as good practice. The use of this guidance was also supplemented by the following guidance:

- Guidelines on the Environmental Impact of Wind Farms and Small Scale Hydroelectric Scheme, SNH, 2001

- Visual Representation of Wind Farms, Good Practice Guidance, SNH, 2007.

The methodology for landscape and visual assessment is generally compliant with the methodology for the ESIA. There are subject variations which make the methodology related to the landscape and visual topic more comprehensive (than the general ESIA methodology) following the GLVIA guidelines.

14.3.1.1 Landscape

The baseline study identified the existing character of the landscape, its constituent elements, features and its geographical and historical context. It assessed the condition of the landscape, the way it is experienced, the value attached to it and its susceptibility to change.

Landscape sensitivity considers the robustness of the landscape to accommodate change. The evaluation of the sensitivity of the landscape resource was based on factors and attributes which affect the value of the landscape and its susceptibility to change. These criteria are set out in Table 14.1 below.

Table 14.1: Landscape Sensitivity Criteria

Sensitivity	Criteria	Examples
High	National designation or importance	Special protected landscapes around sacred mountains and national parks.
Medium	Regional – locally important landscapes or features	Areas of open countryside that are undeveloped and contribute to the character of Mongolia's landscapes.
Low	Common or degraded landscapes	Areas of urban intrusion or uncontrolled development in the open countryside.

14.3.1.2 Visual amenity

The baseline study identified the people who might be affected by the Project within the study area. The sensitivity of different visual receptors varies according to the interest they take in their visual environment, distance from the site, viewing opportunity and the duration of the view. The visual receptors were categorised into the groups reflecting proximity to the site and viewers' expectations, as set out in Table 13.2 below:

Table 14.2: Visual receptors sensitivity

Visual Receptor	Sensitivity to Change
Permanent residents	High – Permanent residents are likely to be highly sensitive receptors due to permanent disruption of views.
Temporary residents	Medium – Seasonal occupants of the area would be affected by visual changes for part of their year.
Travellers	Low – Travellers are of low sensitivity as visual disruption is for a short period of time.

14.3.1.3 Identification of potential impacts

Impacts on the landscape resource may arise from changes to overall landscape character or to individual elements or features. Factors that may affect the magnitude of change to the landscape resource and visual amenity include:

- The extent of the loss of existing landscape elements and change to the view due to the loss/addition of features
- The degree to which aesthetic or perceptual aspects of the landscape are altered by the introduction of new landscape components
- The scale and appearance of the proposed power plant and the degree of contrast/integration with the existing view
- The scale of the geographical area affected by the Project
- The distance of the visual receptor from the development and the angle/position of view
- The duration and reversibility of the effect

The impact magnitude criteria are identified in Table 14.3 below.

Table 14.3: Landscape and Visual Magnitude Criteria

Magnitude	Criteria
High	Total loss or fundamental alteration to key landscape elements and key views and/or addition of new features that substantially alter the character of the landscape, visual amenity and views.
Medium	Partial loss or alteration to key landscape elements and key views and/or addition of new features that form prominent new elements that are largely characteristic of their setting, but alter the character of the landscape, visual amenity and views.
Low	Minor loss or alteration to landscape elements and key views and/or addition of new features that form largely inconspicuous elements in the landscape, resulting in a detectable change in the character of the landscape, visual amenity and views.
Negligible	No change to, or very minor loss of landscape elements and key views and/or additions of new features that do not alter the character of the landscape, visual amenity and views.

The stack, at 170m, will be the tallest structure. The base of the stack will be in excess of 25m high. Therefore, it is considered that the guidelines for assessing the visibility of wind farms are relevant to this Project. No Mongolian guidance on landscape and visual assessment in relation to wind farms is available; consequently this assessment uses the guidance provided by Scottish Executive Planning Advice Note 45/2002 (currently superseded). This states that the general perception of the prominence of a wind farm (or in the case of the Project - a stack) will depend on distance from the Project as outlined in Table 13.4:

Table 14.4: General perception of a wind farm in an open landscape

Distance	Perception
Up to 2km	Likely to be a prominent feature
2-5km	Relatively prominent
5-15km	Only prominent in clear visibility – seen as part of the wider landscape
15-30km	Only seen in very clear visibility – a minor element in the landscape

Source: 'Planning Advice Note 45', Scottish Executive (2002) mentioned in 'Visual Assessment of Windfarms: Best Practice' Scottish Natural History, 2002

Whilst it is evident that visibility will vary with weather conditions, season, time of day and direction of view, this provides useful guidance on this aspect on the likely magnitude of impact.

14.3.1.4 Significance of effects

Effects have been evaluated by combining the assessment of both magnitude and sensitivity to predict the significance of effect as defined in Table 13.5

Table 14.5: Significance of effect on Landscape Resource and Visual Amenity

Magnitude of Impact	Sensitivity		
	High	Medium	Low
High	Major	Major/*moderate*	Moderate*/minor
Medium	Major/*moderate*	Moderate*	Moderate*/minor
Low	Moderate*/minor	Minor	Minor/negligible
Negligible	Minor/negligible	Minor/negligible	Minor/negligible

Source: Based on GLVIA, IEMA and LI, 2013

Effects are beneficial/adverse or neutral. Significance is accorded to major and moderate effects (*).

14.3.2 Baseline conditions methodology

Key sources of baseline information included mapping provided by the local consultants, aerial photography and field survey collected by Mott MacDonald specialists. No landscape character assessment data is available at national, regional or local level.

14.3.3 Scope of assessment

14.3.3.1 Temporal scope

The temporal scope of the assessment assesses site preparation and construction of the Project (both assessed under the 'construction' phase which is expected to be 57 months in total and operation which will be for a minimum of 25 years).

14.3.3.2 Spatial scope

A visual envelope (VE) was used to establish the spatial scope of the study area. The VE is defined as the approximate area from which the project will be visible from the eye level of a person standing on the ground and is identified as 15km buffer from the Project site.

14.3.4 Assumptions and limitations

14.3.4.1 Assumptions concerning the baseline environment

Where appropriate, visual receptors were grouped rather than identified individually for the purposes of the assessment. The assessment focussed on the public domain and photographs illustrating typical views were taken from publically accessible locations.

14.3.4.2 Assumptions concerning prediction of impacts

The description of the significance of the visual effect relate to groups rather than individual properties. In quantifying effects, the assessment process aims to be as objective as possible. However, whilst in some instances changes to a view can be factually defined, or direct loss of features quantified, the evaluation of landscape character and visual effect frequently requires qualitative judgements to be made. This is generally considered acceptable if based on 'professional expertise', supported by clear evidence, reasoned argument and informed opinion. The conclusions of this assessment therefore combine objective measurement with informed professional interpretation.

14.4 Baseline description

The Project site is located on an uncultivated and undeveloped site, located approximately 16km to the south-east of Ulaanbaatar, in the territory of 11 Khoroo of Bayanzurkh district. The site is located within the Khuliin Valley, at about 3km distance from the confluence of the Khuliin River and the Tuul River. The Project site covers an area of 45ha. A temporary construction laydown area of 15ha will be located north east of the site across the paved road from the Project site.

The open land on which the site is located is contained to the north-east by the main paved road (sometimes referred as highway) from Ulaanbaatar to Nalaikh (and further to the Chinese border in Erenhot), which runs in the north-west – south-east direction. The Transmongolian railway line connecting Ulaanbaatar to China and Russia runs to the south-west of the site and marks the limit of the Bogd Khan National Park, a protected area of more than 400 km^2 located just south of Ulaanbaatar. The National Park is one of the oldest national parks in the World claiming its existence since 1778 and is known for its pristine ecosystem, wildlife and historical monuments. Between the highway and the railway road, there is a small auxiliary road, which leads to the national park and which contains the site from the south-east.

Although the Project site itself is located in the valley with a relatively flat valley bed, the study area is characterised by the mountainous landscape. Two mountain ranges run parallel to the valley, which curves to the north-west towards Ulaanbaatar and its extensive residential areas. Settlements, although less dense than in the city, spread almost to the site boundary, mainly along the north side. However, there is a ger community located just outside the side, at its south-east corner, between the existing highway and the railway line and other scattered ger residents. Further to the south of the Project site, is the main residential area of the Bayanzurkh district.

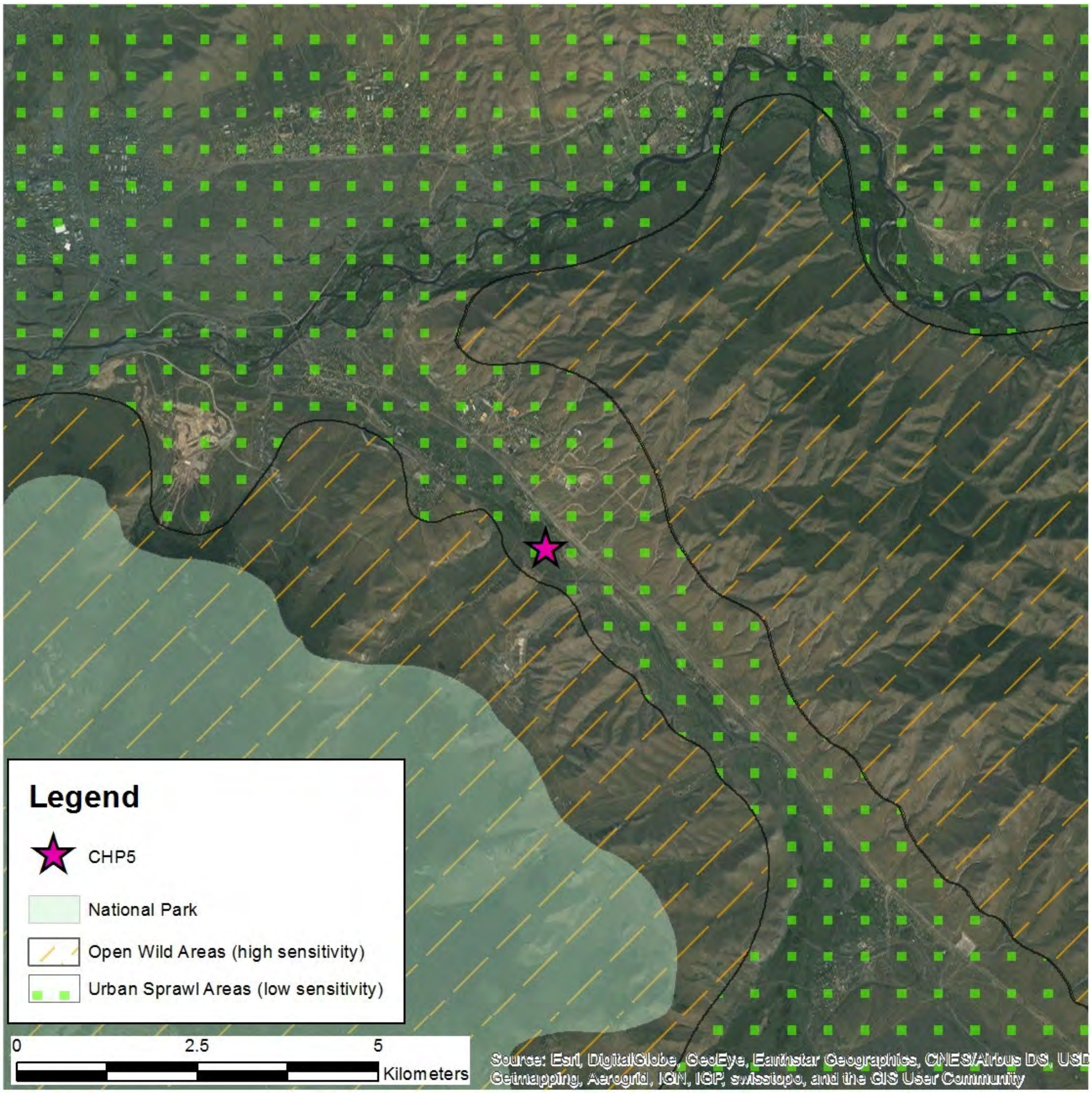
The vegetation in the immediate surroundings of the site is sparse, with limited amount of trees, mostly located along the river. Further within the mountains, especially in the Bogd Khan National Park, the woodland cover is dense, with deciduous trees dominating forests.

The general landscape of the study area is dominated by its natural rolling landform and vast skies. The mountain tops and ridges within the study area and beyond provide good vantage points from which the surrounding landscape can be seen. Even though there is a strong presence of human settlements close to the site and the centre of Ulaanbaatar is located approximately 16km from the Project site, there remains a sense of openness about the study area. However, it has been observed in the last few years that there has been ongoing development in the area, resulting in an increase in the urban nature of the local area.

The landscape of the corridors containing the proposed transmission lines, heating pipe and access roads is characterised by settlements spread within the valley and on the slopes of the surrounding mountains.

According to the landscape sensitivity table (Table 14.1), the sensitivity of the landscape within the site and its close surroundings and along the infrastructure corridors, is low due to the detracting influences of areas of urban sprawl caused by uncontrolled residential and commercial development. The parts of the study area located within the mountainous landscape, are characterised by open and undeveloped wilderness, a key characteristic of the Mongolian landscape. The sensitivity of this area is considered to be high. The indicative division of the landscape character areas within the study area is shown on Figure 13.1 below.

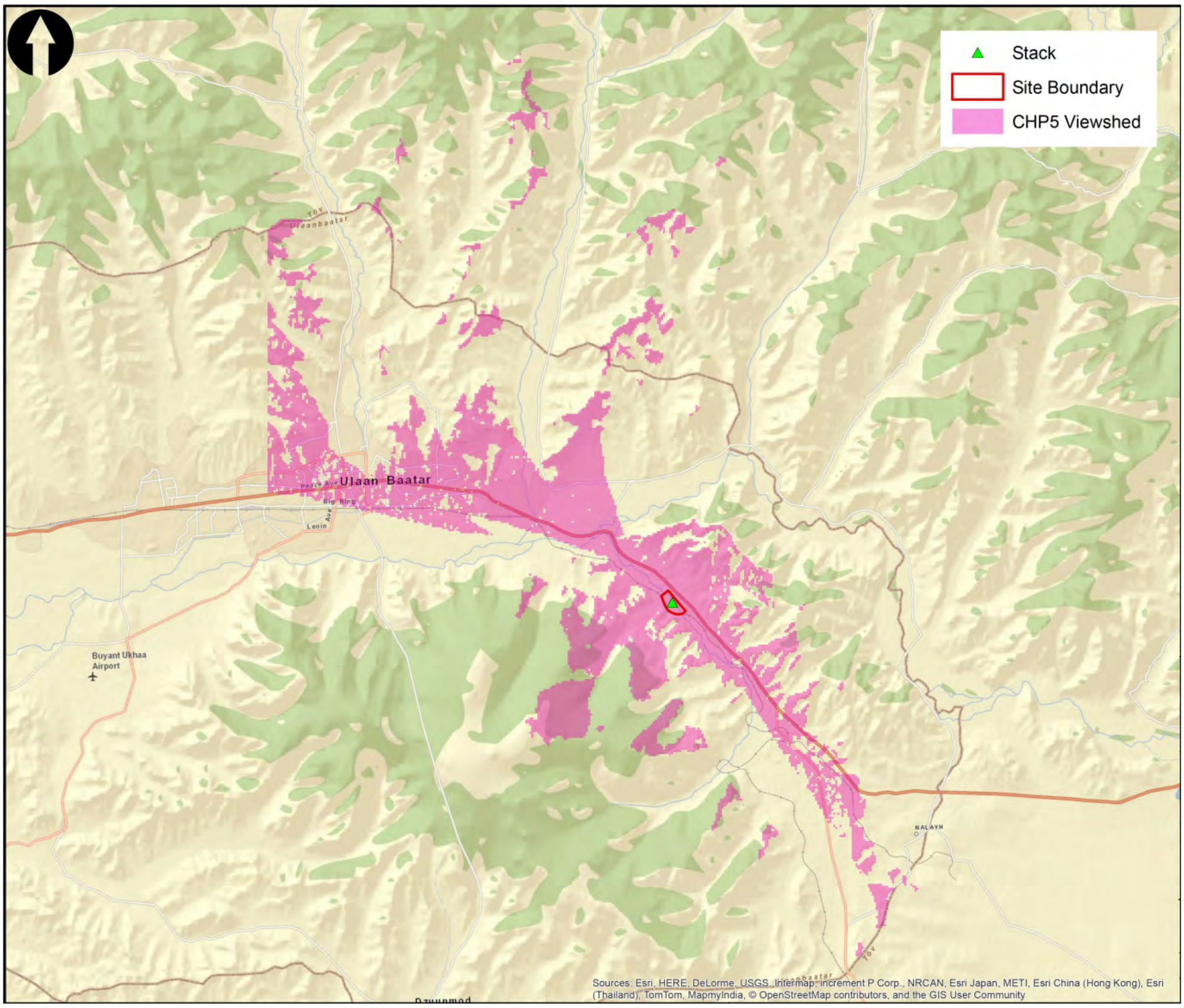
Figure 14.1: Landscape character areas



Source: Mott MacDonald, 2015

The visual envelope comprises the area of the valley bottom, stretching to the north towards the urban areas of Ulaanbaatar and south towards, but not reaching, Nalaikh town and is limited to the west and east by the mountain ranges. Figure 14.2 below illustrates the extent of the visibility of the stack within the surrounding area. Views of the stack will mostly be possible within the valley and on the slopes of the neighbouring hills.

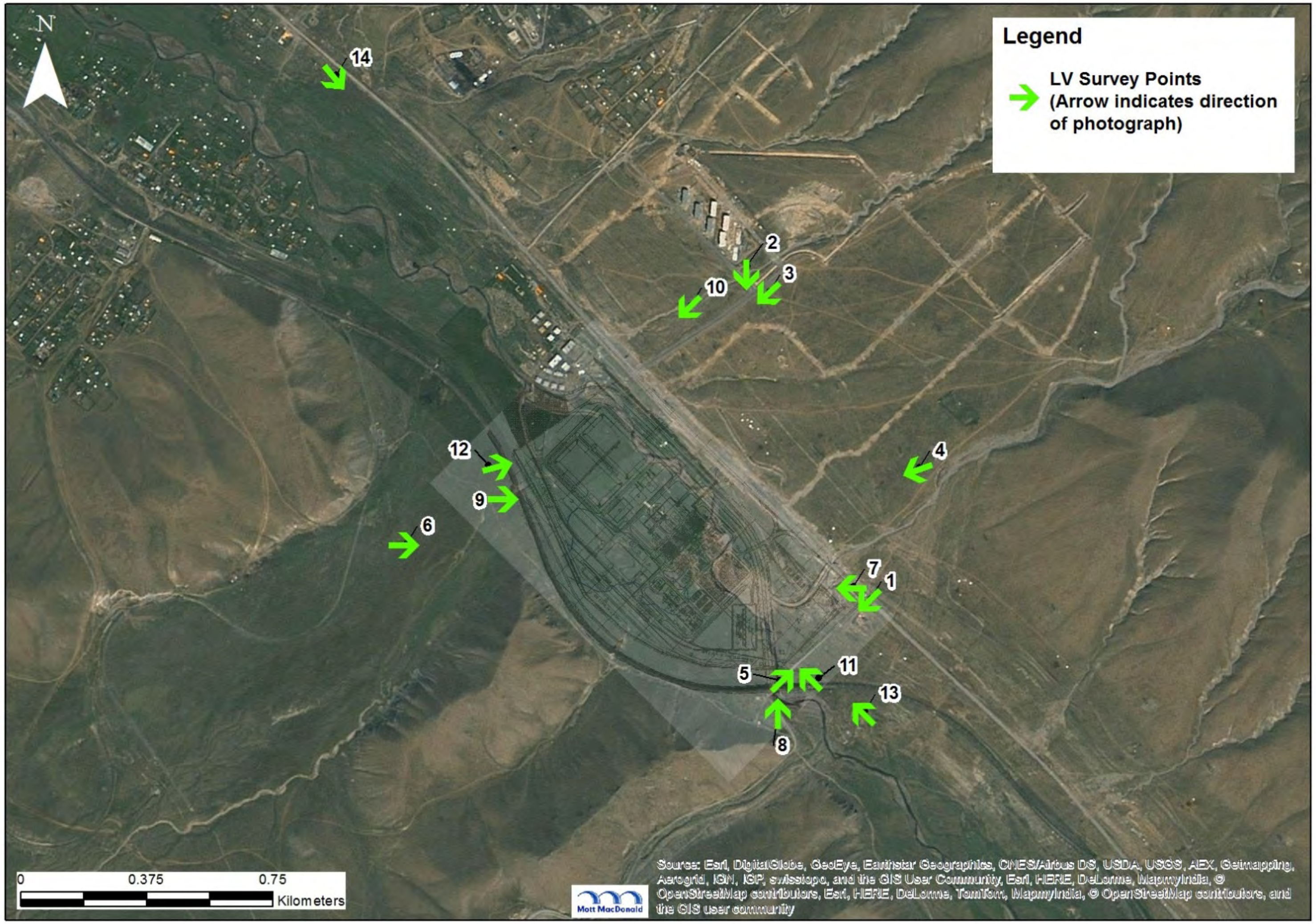
Figure 14.2: Theoretical extent of visibility



Source: Mott MacDonald, 2015

The key visual receptors constitute residents in communities surrounding the Project site, as well as further located residential receptors on the periphery of Ulaanbaatar and recreational users of the mountain ranges. These receptors are of high sensitivity. The travellers on the highway and the railway are of low sensitivity due to the short period in which they see the views.

Figure 14.3: Location plan for viewpoint photographs (Figure 14.4 to Figure 14.17



Source: Mott MacDonald, 2015

Figure 14.4: View from south-east corner of the site looking south-west; the isolated ger community lives in the properties in the middle ground.

Source: Mott MacDonald, 2014

Figure 14.5: View from the Happy Valley development looking south along the valley towards the site.

Source: Mott MacDonald, 2014

Figure 14.6: View from the corner of the Happy Valley development looking south-west towards the site. The national park is in the background of the view.

Source: Mott MacDonald, 2014

Figure 14.7: View from the valley bed looking west towards the site. The existing transmission lines run along the highway.

Source: Mott MacDonald, 2014

Figure 14.8: View from the river bed by the railway bridge looking east towards the ger community.

Source: Mott MacDonald, 2014

Figure 14.9: View from the north-west corner of the site, at the bottom of the mountains, where the park ranger lives, looking east towards the site.

Source: Mott MacDonald, 2014

Figure 14.10: View from the ger community looking west towards the site.

Source: Mott MacDonald, 2014

Figure 14.11: View from the area of the railway bridge located to the south of the site of the river Khuliin .

Source: Mott MacDonald, 2014

Figure 14.12: View from the area of the railway bridge located in the north-west corner of the site, looking towards the site beyond the bridge.

Source: Mott MacDonald, 2014

Figure 14.13: View from the Happy Valley housing development towards the site with the mountainous area of the national park in the background.

Source: Mott MacDonald, 2014

Figure 14.14: View from the area of the southern railway bridge looking north towards the site and the urban area of the Ulaanbaatar fringes.

Source: Mott MacDonald, 2014

Figure 14.15: View from the north-west corner of the site looking towards the Happy Valley development and the residential estate comprising a number of blocks of flats.

Source: Mott MacDonald, 2014

Figure 14.16: View from the settlements within the Khuliin valley located approximately 2km from the site, looking south towards the site.

Figure 14.17: View of the proposed construction laydown area

Source: Mott MacDonald, 2014

14.5 Impact identification and assessment

This section considers the impacts and effects during the construction and operation of the Project on the landscape resource and visual amenity.

Potential impacts and effects on landscape character and on visual amenity during construction will arise from the:

- Presence of construction traffic, construction plant and equipment, temporary construction roads, earth movement and stockpiling of materials
- Construction laydown area
- Borrow pit and spoil disposal established for the Project
- Construction activities associated with the Project
- Construction vehicle movements
- Presence and views of floodlighting, if night time works are required.

Potential impacts and effects on landscape character and on visual amenity during operation will arise from the presence of the:

- the Project with its large buildings, predominantly the boiler house at a height of 64 metres
- 170m stack
- Ancillary structures and access roads

14.5.1 Construction Phase

14.5.1.1 Landscape

The activities associated with the construction of the Project will affect the settlements extending from Ulaanbaatar, the wide valley of Khuliin River and the mountainous parts of the study area. The construction of the Project will result in land disturbance, with earth moving activities. The engineering works to waterways including the diversion of the river through the Project site will result in changes to the immediate landscape, with channelled walls constructed to replace the meandering river in the site. The presence of the construction machinery, compounds, a large number of construction workers and construction traffic on local roads will affect the local landscape character and will decrease levels of tranquillity. New machinery will be temporarily introduced to the landscape, with large cranes and other equipment, construction traffic, storage areas and potentially intrusive lighting. The presence of construction activities, although temporary in nature, will affect the local landscape character significantly.

Table 13.4 identifies that the visibility of tall elements up to 5km are perceived as relatively prominent. Within the 5km area, the construction works will create a partial alteration to key landscape elements and will introduce structures which will form prominent new elements within the landscape, leading to a medium magnitude of change. Given the medium - high sensitivity of the local landscape and medium magnitude of change, it is predicted that impacts as a result of temporary construction works will be of **moderate – major adverse** significance upon landscape character.

14.5.1.2 Visual amenity

Construction activities will be prominent in the view up to 2km away and visible but less prominent up to 5km away. The plant and machinery including high cranes, compounds, storage areas, new roads and construction traffic will be visible from ridges of the local mountains and from the developed areas of the valley to the north and south of the site. Visual receptors will be able see the construction site and activity both during the day and at night. This will be a noticeable change to the night time view as currently the site is unlit at night. Further located existing residential settlements may by lit at night, however, the light pollution at night is currently insignificant. Although temporary in nature, the construction works will constitute prominent new elements in local views. Given the high sensitivity of the permanent and close receptors and the medium magnitude of change, the predicted levels of significance are **moderate-major adverse**.

14.5.2 Operational Phase

14.5.2.1 Landscape

The presence of the Project within the Khuliin River valley will affect the local landscape of the proposed site and its surroundings: the Project comprises very large buildings, extensive areas for ancillary facilities including coal storage areas and a 170m high stack. The Project and especially the stack will constitute a focal point within the open landscape of the wide valley. Although there are similar developments located on the western edge of Ulaanbaatar, they are to the north of the national park and are not intrusive elements within the Khuliin River valley. The Project will be the only major industrial facility in this area and therefore will be immediately apparent from the tops of hills and ridges and also from the bottom of the valley. During the operations stage, the plume from the stack will be evident in the wider landscape. The development of the Project will result in a change in landscape character of the area as it becomes further industrialised. Due to the large scale of the new structures, the Project will be perceived as heavy and will be the dominating element in the landscape. The newly channelled river will change the local landscape of the river plain to more urbanised, less natural corridor with concrete walls and steep slopes to the river banks.

The presence of the Project will constitute an addition of new features that form prominent new elements that are largely characteristic of their setting, but alter the character of the local landscape. Overall, given the medium sensitivity of the local landscape and medium magnitude of change, the predicted levels of significance are **moderate - major adverse**.

14.5.2.2 Visual amenity

The proposed power plant will become a prominent element in the view from the surrounding areas and for the closest visual receptors.

Residents in nearby properties within the 2km from the Project will have their views dominated by the power plant. Similarly, recreational users of tracks within the mountain ranges on both sides of the valley will experience changes to their existing views and will have close views of the Project. Receptors located further within the valley to the north and south of the Project will have views of the Project, however, due to the air perspective and weather conditions, views of the Project will be less prominent from locations approximately 5km away from the Project site. Depending on atmospheric conditions, the occasional plume from the stack may be visible over a wide area, creating an element within views which will be out of place within the existing views. The presence of the new elements will be regarded for close receptors as a partial alteration to key views and an addition of prominent new features in the view that alter the visual amenity and views. Given the high sensitivity of the closest receptors and medium magnitude of change it is predicted that the significance of effect will be **major adverse** for the closest visual receptors within 2km of the Project site. The sensitivity of more distant residents is medium and of travellers is low given they will temporarily pass through the affected area. Given the magnitude of change being low to medium, the predicted levels of significance will be **moderate to minor adverse**.

14.6 Mitigation and enhancement measures

The buildings and structures of the Project will be large scale. It is therefore, not possible to screen these due to their size and the openness of the surrounding landscape. However, the following mitigation measures are proposed to alleviate, to some extent, the potentially significant effects.

14.6.1 Construction Phase

Mitigation measures proposed during construction include:

- Minimise the amount of land take required.
- Maintaining strict requirements for vehicles to remain on roads at all times through a traffic management plan to be established
- Site lighting should be restricted outside normal working hours, to levels acceptable for health and safety requirements.
- Where temporary lighting is required outside of normal working hours, this should downlit to reduce lighting overspill.
- Tracks or temporary site roads should be constructed at the beginning of the construction period to minimise disturbance of other ground. Movement of vehicles should be confined to these routes to avoid soil compaction.
- Reinstate vegetation where construction areas and access tracks are no longer required.

14.6.2 Operational Phase

Mitigation measures during operation will be:

- No external lighting should be installed unless to satisfy technical, security and safety requirements.
- The lower parts of the Project buildings and ancillary structures should be painted in colours of the surrounding landscape – shades of earthy browns and greys.
- Design of the river diversion to avoid creating artificial-looking engineered banks, instead retaining natural flows and meanders.

14.7 Residual impacts

Table 14.6 provides a summary of the landscape and visual impacts and proposed mitigation for the Project. The proposed power plant, the stack and the ancillary infrastructure will constitute a prominent and dominating element in the local landscape and key views due to its large scale and extensive footprint with a 170m high stack. Given the mass of the power plant and its scale, the implementation of the proposed mitigation measures, will alleviate the adverse effects to some degree, however, these mitigation area unable to minimise negative effects completely. Therefore, the large scale of the construction process means that, despite the implementation of mitigation measures, the residual impact is expected to remain of **moderate - major** significance for both landscape character and visual amenity, particularly those located immediately adjacent to the Project site. Similarly, due to the large size of the Project, with implementation of mitigation measures, the residual impact is expected to be of **moderate adverse** significance for landscape character and **major adverse** for closest receptors (within 2km from the scheme), where mitigation will have limited effect. For receptors located further from the site, with implementation of mitigation measures, the residual impact is expected to be of **moderate to minor** significance.

Table 14.6: Summary of landscape and visual impacts and mitigation

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
Construction						
Construction of the power plant with ancillary structures and facilities Presence of construction laydown area, storage areas, plant and machinery including cranes, vehicles and construction traffic.	Change in landscape character of the site and surrounding area Decrease in tranquillity levels Loss of vegetation within the flood plain Change in the river corridor Introduction of construction elements including machinery, compounds and traffic into the landscape Increase in light pollution levels	**Landscape** Medium for local landscape of the valley and high for mountainous areas and the National Park **Visual amenity** High for close receptors Medium for receptors located further away	**Landscape** Medium **Visual amenity** Medium	**Landscape** Moderate - Major adverse **Visual amenity** Moderate - Major adverse	• Land occupation should be limited to the minimum necessary for the works • Maintaining strict requirements for vehicles to remain on roads at all times, if possible. • Imported soil should be brought from local areas. • Site lighting should be restricted outside normal working hours • Tracks/access routes should be constructed at the beginning of the construction period to minimise disturbance of other ground. Movement of vehicles should be confined to these routes to avoid soil compaction. • Identify opportunities for landscaping of the site. • Identify resettlement opportunities for those most affected by the Project.	Landscape Moderate adverse The large scale of the construction process means that, despite the implementation of mitigation measures, the residual impact is expected to remain of moderate significance Visual amenity Moderate - Major adverse The large scale of the construction process means that, despite the implementation of mitigation measures, the residual impact is expected to remain of moderate significance
Operation						
Presence of new power plant	Changes to landscape character Introduction of new elements within the landscape Changes to views Introduction of plume in certain atmospheric conditions	**Landscape** Medium for local landscape of the valley and high for mountainous areas and the national park	**Landscape** Medium	**Landscape** Moderate - Major adverse	No external lighting should be installed unless required for technical, security and safety reasons. The lower sections of the power plant structure and ancillary structures should be painted in colours of the surrounding landscape – shades of earthy browns and grey. Works to the river and flood plain should avoid creating artificial-looking engineered banks, instead retaining natural flows and meanders, where the design and site constraints permit.	Landscape Moderate to major adverse Given the large scale of the new power plant, with implementation of mitigation measures, the residual impact is expected to be of moderate adverse significance.

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
		Visual amenity High for close receptors Medium for receptors located further away	**Visual amenity** Medium	**Visual amenity** Moderate - Major adverse	Identify resettlement opportunities for those most affected by the Project.	Visual amenity Major adverse (for close receptors) Given the large scale of the new power plant and the stack, with implementation of mitigation measures, the residual impact is expected to be of major adverse significance. For further located receptors - with implementation of mitigation measures, the residual impact is expected to be of moderate to minor significance.

15 Cultural Heritage

15.1 Introduction

This chapter describes the potential impacts of the construction and operation of the Project upon known and potential cultural heritage aspects of the area and sets out the proposed mitigation in order to minimise the impact of the Project upon the cultural heritage resource. The cultural heritage baseline assessment identified existing cultural heritage features within and adjacent to the site and the general nature of archaeological deposits in Ulaanbaatar, particularly around the Bogd Khan Mountain. This chapter assesses the impact of the Project on identified cultural heritage resources, addressing direct impacts on cultural heritage assets (disturbance or destruction through construction/excavation) and indirect impacts (setting and pollution at tangible cultural heritage sites or loss/damage to intangible forms of culture).

Cultural Heritage is understood to mean the remains of monuments, groups of buildings, and archaeological sites (Information from UNESCO; Convention concerning the Protection of the World Cultural and Natural Heritage 1972).

Cultural heritage, both of intangible and tangible resources may be threatened by construction work that involves ground work which may damage or remove in-situ remains or affect the landscape or setting within which a feature or site may be located. Inappropriate development can affect the likelihood of the preservation of archaeological remains and can create adverse impacts on the setting of national and locally important buildings and landscapes. Further impacts can be created by removing important associations through the changing of visual reference points and the removal of important associated remains.

15.2 Applicable legislation

15.2.1 National requirements

15.2.1.1 Law of Mongolia, Protection of Cultural Heritage (2005)

The preservation of cultural heritage in Mongolia is prescribed under the Law of Mongolia, Protection of Cultural Heritage of June 2001 (as amended in 2005).This law regulates the protection of physical and intellectual items of historical, cultural, and scientific significance, which may represent any particular period, regardless of ownership.

A principle for the preference that cultural heritage should remain in-situ is also stipulated within this law. Within Mongolian legislation further divisions between heritage assets are within the terminology of ‘tangible’ (fixed structures, buildings, relics) and ‘intangible’ (The ‘Naadam’ tradition and oral traditions dance and costumes). Heritage is classified further as ‘common’ ‘valuable’ or ‘unique and valuable’, with protection based at local, regional and national levels.

15.2.1.2 Law on Special Protected Areas (2008)

This law regulates the development and utilisation of natural landscapes, in order to keep particular features of their importance (including historical and cultural sites) from inappropriate use. It sets out the requirements of both developers and local authorities in terms of their commitment to ensuring these aims are maintained.

15.2.2 International requirements

15.2.2.1 ADB SR1: Environment

Paragraph 11 of ADBs SR1 requires the conservation of physical cultural resources and efforts to be made to protect these resources through the appropriate assessment being completed. A chance finds procedure for the management and conservation approach for materials that may be discovered during project implementation.

15.2.2.2 IFC PS8 Cultural Heritage

IFC PS8 recognises the importance of cultural heritage for current and future generations, and aims to ensure that clients protect cultural heritage in the course of their project activities. The standard sets out requirements for the protection of cultural heritage, defines key terminology (tangible and intangible cultural heritage) and sets out the role of the developer within this framework.

15.2.2.3 EBRD Environmental and Social Policy PR8; Cultural Heritage.

EBRD PR8 aims to protect cultural heritage and to guide clients to avoiding or mitigating adverse impacts on cultural heritage in the course of their business operations. PR8 is similar to IFC PS8 as it too sets out terminology and the role of the developer in mitigating impacts to cultural heritage.

15.2.2.4 International Council on Monuments and Sites (ICOMOS), Charter for the Protection and Management of the Archaeological Heritage (1990).

This charter sets out the definition of archaeological heritage (Article 1) and provides guidance for the protection of archaeological heritage. Article 2 and 3 set out legislative guidance for the protection of cultural heritage.

15.3 Methodology and assessment criteria

The assessment was undertaken using the methodology outlined within Chapter 5 of this ESIA.

The importance and sensitivity of archaeology and cultural heritage receptors will be based on a three point scale (high, medium or low). Assessment of importance is based on a combination of designated status and professional judgement.

The magnitude of impact will be determined as the predicted change to the existing baseline environment during construction and operation of the scheme (ranging from negligible (no impact) to major impact).

The significance criteria used for the assessment is in line with the matrix given in Chapter 5.

Major and moderate effects are considered to be significant. The assessment will also consider cumulative effects, where several types of effect act on the same resources and/or receptors. In some cases it may be that several minor effects may, individually, not be significant but acting together may produce a significant effect on a sensitive cultural heritage resource.

15.3.1 Baseline conditions methodology

This report section presents, and augments, the results of a cultural heritage baseline study and walkover survey undertaken by Nature Friendly LLC and MASIA in 2014. This is followed by assessment of the potential impacts associated with the Project.

The information sources consulted (where available) included:
- National Representative List, Mongolia
- UNESCO List of Tangible and Intangible Cultural Heritage
- MCA-Mongolia: ESOC – Draft EIA/EMP for the Bayanzurkh Bridge and Road Activity
- Mongolian Academy of Sciences, Institute of Archaeology (MASIA) heritage research study, March 2014
- Published and unpublished (grey literature) articles
- Various relevant websites

15.3.2 Scope of assessment

Information has been gathered within a 1km radius of the centre of the proposed Project site. The extent of the study area is sufficient to identify impacts to cultural heritage from the proposed development.

In accordance with national and international guidelines, the assessment has considered both tangible and intangible cultural heritage and includes both upstanding and below ground archaeological remains.

The assessment has considered both temporary and permanent construction impacts on cultural heritage. Temporary construction impacts will be impacts on setting through construction-related activities; permanent impacts can be physical, for example the removal of buried archaeological assets or setting related. All operational impacts are permanent.

Construction impacts on cultural heritage remains are likely to arise as a result of the following activities:
- Temporary and permanent land take
- Demolition and site clearance
- Excavation, ground disturbance and compaction
- Use of plant and machinery

- Building up site levels with made-ground
- Construction of new infrastructure
- Modification of existing infrastructure
- Visual intrusion and disruption to access during construction
- Creation of increased noise / dust during construction

These activities could lead to the following effects on cultural heritage remains:
- Total or partial loss/damage of the above- and/or below-ground archaeological remains both known and unknown.
- Demolition, alteration, dismantling and re-location of cultural heritage
- Structural damage due to proximity of excavation, demolition works, vibration etc
- Temporary alteration and/or visual intrusion into the setting/character of a designated site or undesignated site of national or regional significance
- Temporary effects on the access to, and amenity of, designated sites or undesignated sites of national or regional significance

15.3.3 Assumptions and limitations

The assessment relies on the accuracy of the baseline data provided by the sources outlined in Section 15.3.1. Also, the current understanding of the extent and survival of archaeological remains within the study area is likely to be limited due to lack of excavation data within the Project.

It should be noted that there is always some degree of uncertainty in relation to these sources which include:
- Databases can be limited as they are not based on a systematic search of the region but rather they rely on recording above ground and easily visible remains.
- There are no records of archaeological investigations recorded within the databases.
- Documentary evidence is inevitably biased towards more recent time periods and many documents are inherently biased. Older primary sources often fail to accurately locate sites and place names change with time and are often duplicated in different locations.
- Grid coordinates for monuments are sometimes rounded to such an extent that the actual location of the item can be difficult to locate.
- The presence of buried archaeology is not always obvious during walk over surveys. There is always the potential for unknown buried archaeology to be present on the site.

15.4 Baseline description

15.4.1 Site location

The Project site is located is on the flood plain area in the Khuliin River. The Project site is located within the 11 khoroo of Bayanzurkh district, between the main road of Ulaanbaatar-Nalaikh and the rail road from

Ulaanbaatar to Choir. The site is slightly inclined from southeast to the northwest, with the ground surface elevation varying between 1,355m and 1,362m (Soil Trade LLC, 2014).

15.4.2 Literature review

This section summarises the past archaeological findings in Ulaanbaatar Province based on a literature review. The results are presented below in chronological order.

Mongolian archaeology comprises the culture and the history of the people and past city states that have left cultural remains in Mongolia; the time period covered ranges from 800,000 years ago up to 700-800 years ago. Rock paintings of Bronze Age origin have been found at Ikh Tengeriin Am caves. Located 18km to the north of the development, these paintings are in red ochre and largely depict deer and Ibex. Some of the major concentrations of petroglyphs have been interpreted as being within areas of winter camps of pastoralists, and associated with Khirgisuur; a burial structure including a central mound and a round or square surrounding frame (Waugh, 2010).

Ulaanbaatar was founded in 1639 as Urguu, a mobile monastery-town. It was often moved to various places along the Selenge, Orkhon, and Tuul Rivers. In 1778, the city settled at its current location near the confluence of the Selbe and Tuul Rivers and beneath Bogd Khan Uul, which was at the time also on the caravan route from Beijing to Kyakhta (Waugh, 2010).

In 1778, the Emperor of Manchur passed resolutions to formalize the sacred values of the Bogd Khan Mountain and provide for official protection of the site. Mongolia submitted Bogd Khan and two other sacred mountains for tentative inclusion on UNESCO's World Heritage List (in 2010) as a mixed cultural-natural site. These features remain on the Tentative List for consideration.

The Project site lies 500m to the northeast of the Bogd Khan Mountain a, strictly protected area, one of several conservation categories established by Mongolian law (Nature Friendly, 2014). The mountain range is 2,261m in height and is a UNESCO Biosphere Reserve (conferred in 1996). The mountain's landscape is dense coniferous forests and bare rock on the upper slopes, with open grassland, including wildflower meadows, at lower elevations. According to Mongolia's National Red List, threatened animal species are present within the forested areas.

Established in 1750, the Manzushiry Monastery housed more than 350 monks and had 20 associated temples, including schools of medicine, astrology, and philosophy, before it was destroyed in the 1930's. On the south side of the protected area, monks have begun the process of rebuilding the Monastery and numerous archaeological sites have been discovered in the preserve, including cave paintings that archaeologists date to three thousand years ago.

In addition, Bogd Khan represents the blending of traditional shamanistic Mongolian beliefs (demonstrated by the survival of Ovoos from Bronze Age to moden periods) with Tibetan Buddhist thought. According to Sukhbaatar, the main feature of Mongolia's strength in protecting nature is buried deep within its legends, stories, and names about the natural surroundings.). Previous archaeological study at the site

During investigations in 2011 into the historical and cultural heritage sites along the Bayanzurkh tollgate to Nalaikh junction located to the east of the Project site, (Euroconsult Mott MacDonald 2011), the remains of Maikhant 1st tomb (11th to 14th centuries) was identified. An archaeological survey of the area from Nalaikh junction to the Uliastai junction found remains of three large human statues, related to nature conservation, a railway memorial statue; a personal Russian memorial statue; two ovoos (sacred stone built structures); and one hammer statue belonging to the Nalaikh district. These are considered to be out of the area of interest from CHP5.

During March 2014, a research team from the Institute of Archaeology, Mongolian Academy of Science conducted an archaeological study within the project site (45 hectares). The archaeological walkover study was carried out with a special permit issued by MASIA. During the study, two broken pieces of modern vertical grave stones were found from the flood channel in the north eastern part of the Project site (from the year of 2005, and being a mantra engraved on the monument), shown in Figure 15.1 and Figure 15.2. It is considered most likely that these broken pieces of grave stone were transferred to this location probably due to a strong flooding event or waste dumping during construction works elsewhere.

Figure 15.1: Modern era grave stone found in the flood channel northeastern part of the Project site (1)

Source: MASIA, 2014

Figure 15.2: Modern era grave stone found in the flood channel northeastern part of the Project site (2)

Source: MASIA, 2014

The study identified no ancient historical and archaeological items within the Project site, as clarified by a letter from MASIA (B. Gunchinsuren) stating the results of the walkover survey were negative. It is possible that below ground remains of archaeological interest do exist within the site; however, this is considered unlikely as the plant location is situated largely on a river bed and flood basin, with historically frequent flooding events which has prevented major settlement and structures being established on the site.

15.5 Impact identification and assessment

Cultural heritage, both of intangible and tangible resources, may be impacted by construction activities undertaken for the development of the power plant and during construction of the associated facilities (new 220kV transmission line, water management, new railway sidings and the district heating pipeline).

The main Project site has been previously undeveloped, with the exception of individual house building. This has the potential to damage or remove in-situ archaeological remains, which may exist below ground level and not have been identified during the walkover survey. The archaeological walkover survey found no surviving archaeological remains at ground level, but the excavation of foundations for the power plant structures may uncover buried remains of archaeological interest. The close proximity of the Project site to the Bogd Khan Mountain suggests that there is a potential that archaeological remains may be encountered within the site and these have the potential to be associated with key historic periods.

Flooding has been identified at the site, and this has the potential to both mask and seal (as well as remove) archaeological deposits to depths which are not apparent during a site walkover survey. Given the lack of data available regarding the Project site, it is uncertain as to the levels of archaeological remains likely to be encountered within the site, although MASIA have stated that they consider the site to have a low archaeological potential based on the results of a walkover survey.

The scale of the new development of the Power Plant also has the potential to affect the setting of the historic landscape of the Bogd Khan Mountain.

The creation of new structures has the potential to impact on intangible heritage by the creation of new noise sources. In Mongolian folklore, the sound of the wind is associated with bad luck and there is a widespread belief related to “wind whistling”. According to historic beliefs, when a person whistles, she or he is calling for the wind. This superstition reportedly extends to any whistle-like sound.

There may also be cumulative effects from the accumulation of effects on the setting of the Bogd Khan Mountain and the removal of features which are associated with this, which may extend into the site.

15.5.1 Construction Phase

During the construction phase, the Project has the potential to impact on previously unidentified archaeological remains. The potential impact on unknown archaeological remains is expected to give rise to a minor magnitude impact on remains of low value, resulting in a **negligible** impact.

The construction of the Project has the potential to affect the setting of the Bogd Khan Mountain reserve (a UNESCO Man and Biosphere (MAB) site) and affect the special natural status which is afforded by this protection. The potential impact is likely to give rise to a moderate impact on a high value heritage feature, resulting in a **major adverse** impact.

Borrow Pit

At this stage the location of the borrow pit required for construction has not been defined. However, as part of the site selection process, the proximity of the site to areas protected for their cultural heritage importance should be considered as a criterion. Furthermore, liaison with MASIA will be required to receive approval from the authorities that the site selected does not have archaeological or cultural heritage importance.

15.5.2 Operational Phase

The operation of new machinery in a previously largely undeveloped area has the potential to introduce new noise impacts into an area located to the east of the Bogd Khan Mountain. This has the potential to give rise to a minor impact on a high value heritage feature, resulting in a **moderate adverse** impact.

15.6 Mitigation and enhancement measures

Mitigation measures will comply with those recommended in the IFC PS 8 (which the JBIC standards are aligned to) and the EBRD PR 8: Cultural Heritage i.e. preservation in situ will be achieved where possible by avoiding identified cultural heritage assets. Where this is not possible a suitable mitigation strategy will be proposed in order to minimise disturbance to the cultural heritage resource and to preserve the resource by record should there be no available alternative. This approach is also in accordance with the ADB Environmental Safeguards Policy (article 11).

It is recommended that consultation is undertaken with the Bogd Khan National Park authority to ensure that it has no concerns regarding the Project with respect to potential impacts on the park's cultural heritage value.

15.6.1 Construction Phase

An archaeological watching brief will be implemented during ground works for the Project and for the ancillary structures and facilities will document any archaeological remains within the Project site.

The scope of the watching brief is outlined as follows:
- To be prepared for unexpected finds in all areas of the Project
- To look out for burned or blackened material, brick or tile fragments, coins, pottery or bone fragments, skeletons, timber joists or post holes, brick or stone foundations or in-filled ditches during excavations
- To call on the guidance of an archaeologist where there is any uncertainty

The main phases of monitoring for the pipeline construction will be during topsoil stripping, site levelling and excavation works. Monitoring will include all other Project areas to be stripped of topsoil, including the construction laydown area and rail sidings.

If addressed in the right time and manner, finds may not necessarily affect the progress of the works. Further, with the correct advice provided in a timely manner, delays can be significantly reduced.

If any unexpected finds are encountered during earthworks or excavation works the following mitigation approaches will be employed by the Project:
- Work will be immediately stopped in the area
- The find(s) will be demarked and protected via fencing / blocking off and the site manager and Project Environmental Officer will be contacted

- The cultural authority MASIA will be informed in order to seek guidance and specialist advice for management of the find(s) and how best to proceed, given its nature and extent
- All finds of human remains will be reported to the local coroner
- All finds will be recorded

A ‘chance finds procedure’ in line with international best practice will be developed and implemented by the Project during the construction phase to capture in more detail the above mitigation approach. The Consortium will consult with the relevant authorities including MASIA to ensure that the procedure is acceptable to them and that it complies with local and national regulations.

The use of native tree planting at the extents of the site and during the construction of the CHP5 has the potential to affect the setting of the Bogd Khan Mountain reserve (A UNESCO MAB site) and affect the special natural status which is afforded by this protection. A **moderate adverse** effect will remain, as mitigation has limited potential to reduce the changes to the baseline caused by the new visual receptors of the Project infrastructure.

15.6.2 Operational Phase

Installation of landscaping during construction based activities has the potential to mitigate operational phase effects by reducing the effect on the setting, although given the size of plant this would be limited.. Rigorous control of noise levels by implementation of planning conditions would also serve to reduce the levels of noise emitted and decrease the impact the power plant and associated facilities would have on cultural heritage within the locality. This would reduce the noise impact to the Bogd Khan Mountain reserve to cultural heritage to **minor adverse**.

15.7 Residual impacts

Following mitigation there remains a significant impact to cultural heritage from the proposed development of the Project site. This is due to the impact to the setting of the Bogd Khan Mountain reserve. It is considered that the scale of the development is likely to produce visual receptors which will affect views into and from the reserve. However, it is also considered that the use of landscaping, and architectural design have the potential to reduce the scale of the impact and as the mountain reserve is located 500m from the Project, there are opportunities to ensure that key views are maintained. It is considered that the development offers substantial economic benefits which would outweigh the impact on the heritage asset.

Table 15.1: Summary of archaeology and cultural heritage impacts and mitigation

Activity	Potential Impacts	Sensitivity	Magnitude	Effect Significance	Mitigation or Enhancement	Residual Impacts
Construction						
Excavation of foundations for construction of new Project structures	Removal of buried archaeological remains	Low	Minor	Negligible	Chance finds and recovery strategy to be implemented. Archaeological monitoring during ground works for roads, foundations of the Project generation units, substation foundations and to ensure archaeological remains are recovered appropriately during any ground disturbance. Establish exclusion zones or temporary barriers from known cultural heritage sites so that no works undertaken within this area. All workers to be given briefing prior to works, so that should any remains be encountered, MASIA representatives are informed and remains are suitably recorded.	Negligible
Creation of new Project infrastructure	Setting of the Bogd Khan Mountain	High	Moderate	Major adverse	Where feasible, identify areas where landscaping could be used to soften the effect of the new infrastructure. Use of topographic differences to create cuttings where associated features are not visible across long ranging distances. Reduction of visual impact of the new infrastructure.	Moderate adverse
Operation						
Increased noise levels from operation of plant and associated facilities (e.g. rail)	Setting of Bogd Khan mountain	High	Minor	Moderate adverse	Installation of landscaping during construction based activities around the site to include native tree species to soften the effect of the new infrastructure.	Minor adverse

16 Waste and Materials Management

16.1 Introduction

This chapter outlines the proposed approach for managing the key solid waste streams likely to arise during the different phases of the Project.

Waste management is a key aspect to be assessed by the Project in order to achieve minimisation of raw material consumption, maximise opportunities for waste reuse and recycling and ensure that any final treatment or disposal of wastes generated by the Project is conducted in an environmentally sound manner, particularly for hazardous wastes.

Specific details related to the management (receipt, handling and storage) of hazardous raw materials from a health, safety and environment perspective are also presented in this chapter given the similarities between their management and the management of waste/hazardous waste. The objective of hazardous materials management is to avoid their use or, when avoidance is not feasible, minimise uncontrolled release of hazardous materials or accidents (including explosion and fire) during their handling, storage and use.

The scope of this chapter is limited to material usage and all solid wastes and those liquid wastes that are not treated via the onsite waste water treatment works.

16.2 Applicable legislation

16.2.1 National requirements

16.2.1.1 Law on Waste

The Law on Waste (2012) replaced three laws: Law on Household and Industrial Waste; Law on Prohibiting Export and Transportation of Hazardous Waste; and Law on Prohibition of plastic bags use. This law is relevant to the Project as industrial waste will be generated.

Mongolia has also developed the following regulations which are also relevant to this Project:

- A rule on classification, collection, temporary storage, transportation, treatment of hazardous wastes (2002)
- Regulation and procedures on disposal and landfill of hazardous waste of business entities, and requirements on waste containers and waste disposal sites (2006)
- Methodology for calculating waste norms (2006)
- Payment calculation methodology for hazardous waste (2006)
- Classification and characteristics and hazard level of waste; with joint order No. 324/318/336 of Ministers for environment, health, and education, culture and science (2006)
- Regulation on labeling hazardous waste (2006)
- Regulation on national reporting and inventory of hazardous waste (2009)

16.2.1.2 Law on Hazardous Substances and Chemicals

The Law on Hazardous substances and chemicals (revised 25 May 2006) regulates the production, export, import, storage, trade, transport, use and disposal of toxic chemicals. However, this law covers not only toxic and hazardous chemicals, but also all the chemical substances, including chemicals that are explosive, combustible, petrol, oil, diesel fuel, pesticides and consumer chemicals. It is divided into three charters covering general provisions, requirements for protection and administrative penalties.

There are several increased restrictions in the new version of the chemicals law, including more control over chemical substances, with special emphasis on their import. As provided by the law, chemicals shall be imported only through a few designated border ports and strict control and monitoring will be started from this point. In addition, classification of chemicals will be done in accordance with international standards. Risk assessment issues are also reflected in the law.

In order to use chemicals for industrial purpose, a licence must be obtained from MEGD. The Consortium will be required to get approval for material storage location and waste disposal sites.

Additional national legislation relevant to hazardous substances and chemicals is listed below:
- Classification list of hazardous substances and chemical approved by joint order of the Minister of Nature and Environment and Minister of Health (2008)
- Regulation on producing, importing, exporting, trading and using hazardous chemicals by joint order of Minister of Nature and Environment and Minister of Foreign Affairs (November 1, 2009)
- Regulation on storing, transporting, using and eliminating hazardous substances and chemicals approved by joint order by Minister for Environment, Minster of Health, and Chief of National Emergency (February 3, 2009)
- Regulation on risk assessment of hazardous substances and chemicals by joint order by Minister of environment and green development, Minister of Health, and Chief of National Emergency Management Agency (October 25, 2012)
- The list of chemical substances that coding by joint order by Minister of environment and Minister for health (2008)

16.2.2 International requirements

16.2.2.1 IFC Performance Standards (2012)

IFC PS 3 on Pollution Prevention and Abatement requires reference to be made to the relevant EHS Guidelines; these are technical reference documents with general and industry-specific examples of GIIP. The EHS Guidelines contain the performance levels and measures that are normally acceptable and applicable to projects.

The underlying principle of IFC PS 3 is the minimisation and avoidance of pollution in the first instance. In the context of waste management this means employing strategies and implementing measures which avoid waste generation.

The following WBG/IFC EHS Guidelines contain relevant information related to all waste management and hazardous materials management for the proposed Project:

- The WBG/IFC EHS Guidelines for Thermal Power Plants (2008)
- The WBG General EHS Guidelines (2007)

The WBG/IFC EHS Guidelines for Thermal Power Plants state that large volume coal combustion wastes (CCW) can include fly ash, bottom ash and boiler slag. Low volume wastes from coal fired power plants typically include, amongst others and wastewater treatment sludges.

The WBG/IFC EHS Guidelines for Thermal Power Plants give recommendations and methods for the prevention, minimisation and control to reduce the volume of solid wastes from thermal power plants. These are best practice guidelines and should be followed in the development and operation of all new plants.

In addition, IFC PS 3 requires the Project to implement technically and financially feasible measures for improving efficiency in the consumption of material inputs. This applies across all Project phases.

All three guidelines have been used to frame the materials usage and waste management approach for the proposed Project and to assess the Project's ability to meet GIIP.

16.2.2.2 EBRD Performance Requirements

EBRD PR3 on Pollution Prevention and Abatement requires the avoidance or minimisation of hazardous and non-hazardous waste materials and to reduce its harmfulness as far as practicable. EBRD are committed to promoting EU environmental requirements.

Waste Directive

The main European measure in relation to waste is Directive 2008/98/EC[26]. Under the Directive; EU Member States must work towards encouraging the prevention or reduction of waste and its harmfulness, through the development of clean technologies, product improvements and disposal techniques. The recovery of waste is also encouraged, as is the prohibition of uncontrolled dumping. In summary, the Waste Directive:

- sets out concepts and definitions related to waste management
- provides measures to minimise the negative effects of the generation and management of waste on human health and the environment (and in particular without risk to water, air, soil, flora and fauna and without causing a nuisance through noise or odours
- aims to reduce the use of resources through the development of a waste policy.

[26] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/218586/l_31220081122en00030030.pdf

Hazardous Waste Directive

Directive 91/689/EEC[27] on hazardous waste, lists wastes which can be classified as hazardous and requires EU Member States to publish a hazardous waste management plan, in accordance with the guidelines set out in Directive 2008/98/EC.

This directive specifies that all waste delivery sites (hazardous and non-hazardous) must also be identified and registered and relevant labeling standards adhered to when such waste is collected, transported and stored.

European Waste Catalogue

The European Waste Catalogue (EWC) classifies waste materials and categorises them according to what they are and how they were produced and it is referred to in a number of EU Directives and Commission decisions regarding waste management. Reference is made to this as a method of best practice for classifying wastes when describing the appropriate handling and storage methods.

16.2.2.3 Asian Development Bank

With respect to waste and materials management, the ADB SPS 2009 promotes resource conservation and waste minimisation. Where waste cannot be recovered or reused, the guidelines require that it will be treated, destroyed, and disposed of in an environmentally sound manner.

16.2.2.4 JBIC Standards

The JBIC Environmental and Social Guidelines, April 2012, require environmental impacts to be investigated and examined, which include factors related to human health and safety as well as the natural environment. This is particularly relevant to materials usage and the generation of waste which has the potential to impact on finite resources and can lead to pollution discharges to the environment if wastes are not handled and disposed of in a best practice fashion.

Environmental Checklist 11 for Thermal Power requires projects to consider whether wastes (such as waste oils, and waste chemical agents), coal ash, and any other by-products generated by the power plant operations are properly treated and disposed of in accordance with the host country's standards.

In addition, project proponents are required to refer to the appropriate parts of the IFC PS for specific requirements and adherence to these standards are considered to result in compliance.

16.3 Methodology and assessment criteria

The assessment of impacts from waste generation has been conducted on the basis of a desk-based review of Project information provided by the Project parties.

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[27] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31991L0689&from=EN

An assessment of the significance of impacts with regards to the waste generated by the Project has been made for the construction, operational and decommissioning phases. The significance of potential impacts is a function of the presence and sensitivity of receptors and the magnitude of the impact in terms of duration, spatial extent, reversibility and likelihood of occurrence.

The assessment follows the standard assessment structure outlined in Chapter 5.

16.3.1 Baseline conditions methodology

Baseline information for this assessment has been collected through a desk-based research of the Project area, utilising online secondary sources. Where appropriate, primary information from the Consortium has been used to supplement this information.

16.3.2 Scope of assessment

16.3.2.1 Temporal scope

The temporal scope covers the potential impacts related to the consumption of raw materials (including receipt, handling and storage) and subsequent management and disposal of waste arising from the construction, operation and decommissioning phases of the Project.

16.3.2.2 Spatial scope

In terms of considering the consumption of raw materials (including receipt, handling and storage) and subsequent management and disposal of waste, the spatial scope of the Project encompasses the proposed Project site including the temporary construction laydown area and borrow pit. Any other waste transferred and disposed offsite will be done so by licensed contractors.

16.3.3 Assumptions and limitations

All generated and/or managed hazardous and non-hazardous materials and waste streams presented in this chapter are based on current plans available for the Project. They are subject to change once the exact construction methodology is determined.

As discussed in Section 16.4.3, the principal materials for construction have been identified and include earthen materials, cement and steel; although, the exact quantities of each material have not yet been calculated. Similarly, there are a number of other materials, including lubricants, paints, plastics and timber that will also be procured directly by the EPC contractor; at this stage the exact quantities of these materials required for the Project are not known; however, detailed plans and procedures will be produced to include this information.

The principal waste streams are believed to have been identified and therefore the waste management protocols and philosophy presented in Section 16.6 of this chapter would not be expected to change significantly as a result of potentially minor modifications to the actual waste streams and quantities which are ultimately generated as a result of the Project.

16.4 Baseline description

16.4.1 Overview

This section presents the baseline characterisation of the Project area's materials use and waste management procedures, to enable comparison of the current situation with changes anticipated to the identified social and environmental receptors as a result of the Project.

As a result of population increase (urbanisation) and an increase in Gross Domestic Product (GDP) per capita, Ulaanbaatar experiences significant issues related to solid waste management (SWM), in particular with illegal dumping. According to JICA[28], 150,000 tonnes of solid wastes have produced annually in Ulaanbaatar City, mostly composed of plastics, glass, organic, paper, metal and inorganic wastes. Based on estimates from the WHO[29], 0.35 – 0.54 kg waste is being produced, per person, per day.

The Municipal Governor's Office is responsible for waste treatment in Ulaanbaatar, supported by agencies including the environmental protection authority and district maintenance companies. However, these governing authorities have limited human resources, financial resources or the machinery or technology to properly manage waste.

There are very few waste disposal sites / landfill near the city and those facilities that are in place usage are over their capacity. The waste collection and transportation system does not operate effectively due to a limited number of waste collection vehicles. Approximately 75% of total waste is collected by city waste maintenance organisations and 15% is transported by the organisations with their own trucks and 5-10% of waste is left without being transported.

Limited solid waste segregation facilities exist and waste separation is managed manually. There is limited recycling of waste due to a lack of recycling facilities, excluding some small private businesses.

Legally, Mongolia has different categorisation in terms of the waste. According to the Law on Household and Industrial Waste of Mongolia, waste is categorised by two classifications depending on its source - household and industrial, and by its impacts to the environment and human health - hazardous. A hazardous waste is a subset of solid waste.

Despite national legislation on waste categorisation for hazardous wastes, there is not a disposal site and treatment facility for hazardous waste in Mongolia. In reality, most solid waste is delivered to disposal areas without any elementary classification.

[28] http://www.jica.go.jp/mongolia/english/activities/activity13.html

[29] http://www.must.edu.mn/pdf/7420Dashnyam%20Altantuya.Shanghai.pdf

16.4.2 Materials Use

The principal materials that are expected to be required/consumed as part of the construction specific components of the Project are summarised in Table 16.1. This information is based on current designs of the Project.

Table 16.1: Primary Construction Materials

Work Item	Earthen Material (m^3)	Steel (tons)	Concrete (m^3)	Comments
Generation Units	252,192	17,614	54,288.1	-
Stack	10,241.7	765	5,193	Based on Stack Height of 200m
Coal storage	247,835	221.3	20,418	-
ACC	27,213	2,100	2,182	-
Waste water treatment facility	7,527.3	17.7	4,875.9	-
Chemical storage areas	646	25.3	182.5	-
Site profiling	917,243			700,000m^3 from borrow pit, remainder reused onsite Excluding Diversion Channel
TOTAL	**1,462,898**	**20,743.3**	**87,139.5**	

There will also be a number of other materials required/consumed during the construction of the Plant, including: lubricants, oils, fuel (diesel), paint, plastics, packaging materials (paper, cardboard, timber) and food; the exact quantities of these materials are not yet known.

Table 16.2 covers the estimated operational phase materials which will be used. Within this table the materials considered to be of a hazardous nature are highlighted, these will require bespoke consideration, particularly any final treatment or disposal options. Some materials will have a known consumption and storage volume whereas the consumption and volume of other materials will be dependent on routine maintenance and outage activities therefore it is difficult to give exact volumes for all materials.

Table 16.2: Materials and chemicals used during operations

Material	Activity	Type	Storage capacity
Coal fuel	Combustion Unit	Non-hazardous	300,000 tonnes
Limestone	Combustion Unit	Non-hazardous	2 x 2,600m^3
Sand	Combustion Unit	Non-hazardous	100 tonnes per unit

Material	Activity	Type	Storage capacity
Urea Solution	Combustion Unit	Hazardous	To be defined[30]
Ammonia	CEP Discharge / Deaerator Discharge	Hazardous	To be defined
Oxygen Scavenger	CEP Discharge / Deaerator Discharge	Hazardous	To be defined
Phosphate	Steam Drum	Hazardous	To be defined
Diesel Fuel	Boiler start-up burners, Auxiliary boiler, Emergency diesel Generator(s), diesel fire water pump Site vehicles	Hazardous	2x500 m^3
Hydrochloric Acid (HCl)	Water treatment/ steam cycle	Hazardous	To be defined
Sodium Hydroxide (Caustic Soda) (NaOH)	Water treatment	Hazardous	To be defined
Cement and concrete	Maintenance and outage activities	Non-hazardous	Minimal
Paints, oils and fuels, lubricants, cleaners, solvents	Maintenance and outage activities	Hazardous	Minimal
Ferrous and non-ferrous metals	Maintenance and outage activities	Non-hazardous	Minimal
Fluorescent tubes	Maintenance and outage activities	Hazardous	Minimal
Batteries	Maintenance and outage activities	Hazardous	Minimal
Wood and timber	Maintenance and outage activities	Non-hazardous	Minimal
Plastic	Maintenance and outage activities	Non-hazardous	Minimal
Glass	Maintenance and outage activities	Non-hazardous	Minimal
Paper and cardboard	Maintenance and outage activities	Non-hazardous	Minimal

Source: Consortium

[30] To be defined in the operational site waste management plan

During detailed engineering design stage, a detailed Materials Handling and Storage Plan will be developed in accordance with the EPC contractors estimated material volumes for both construction and operations and suitable materials storage facilities will be provided.

No materials that are banned under the following conventions and guidelines will be used in connection with Project works:

- Materials defined as Annex A or Annex B materials under the Stockholm Convention (2004)
- Chemicals listed in Annex III of the Rotterdam Convention of prior informed consent for certain hazardous chemicals and pesticide in international trade

16.4.3 Material Storage

A number of materials storage facilities will be provided for the construction of the Project, which includes:

- Storage facilities for cement, steel and other bulk construction materials
- Hazardous materials including oils and chemicals
- Dedicated fuel delivery, storage and handling area of fuel
- Covered and uncovered storage areas for general construction materials

16.4.4 Borrow Pit

It is expected that 917,243m^3 earthen materials will be required to raise the level of the Project site and a further 545,655m^3 (based on figures presented in Table 16.1) will be required for other construction activities, including the development of foundations for the boilers and steam turbine generator. At this stage, however, a borrow pit for the site has not yet been identified. A Borrow Pit and Spoil Management Plan will need to be developed to ensure that the pit is appropriately managed including control of slope stability and erosion.

16.4.5 Solid Waste

Wastes will be generated during both the construction and operational phases of the Project, the likely waste types from both the construction and operational phases of the Project include solid, liquid, hazardous, non-hazardous and inert wastes.

Potential hazardous waste types generated during the construction and operational phases across the Project may include: waste oils and solvents, lubricants and contaminated soils (potentially from leakage and spillage).

For the purposes of the construction phase it is envisaged that there will be the following Project staff quarters/facilities and maintenance/construction areas which will result in the generation of waste:

- Construction worker camp, providing accommodation for a maximum of 3,200 construction workers (at peak)
- Site offices and other site facilities, which will include a concrete batching plant and mixing plant and main stores

Considering the proposed facilities and construction works, the following waste streams are expected to be generated as part of the construction phase:

- Excavation spoil associated with site levelling and site profiling activities
- Concrete and concrete washings from concrete batching plants required for the construction of Plant
- Iron and steel scrap
- Non-ferrous scrap
- Waste oil and lubricants from turbine installation and vehicle maintenance/repair
- Oil contaminated cloths from turbine installation and vehicle maintenance/repair
- Oily debris from shop sumps and spill clean-ups
- Packaging and pallets from deliveries
- Domestic waste, including glass, plastics, paper and cardboard
- Batteries
- Fluorescent tubes
- Timber and woody debris (from land clearing)
- Organic household waste
- Paints and chemicals
- Tyres
- Medical waste (arising from medical facilities at the construction worker camp).

16.4.5.1 Spoil and Excavated Material

The most significant waste stream (in terms of volume) which will be generated as a result of the construction phase of the Project is spoil due to excavation of the Project area during the site preparation and construction phases. It is estimated that approximately 460,000m^3 of spoil will be excavated on site, 242,757m^3 transported from the Project area and transported to a spoil disposal site the location of which has not yet been identified. It is the responsibility of the EPC contractor to identify an appropriate spoil disposal site prior to construction.

In addition, 700,000m^3 of borrowing soil will be transported from the borrow pit site to level or profile the Project area prior to construction. Details of vehicle movements for the transportation of borrowing soil have been identified in Chapter 13.

16.4.5.2 Hazardous and non-hazardous wastes

Table 16.3 presents the hazardous and non-hazardous wastes that are likely to be produced on site during both the construction and operational phases of the Project. The quantities of these hazardous waste materials are not anticipated to be high; however as part of the Site Waste Management Plan (SWMP) an estimate of waste materials to be produced will be calculated based on assessment of the materials requirements.

Table 16.3: Predicted hazardous and non-hazardous waste streams

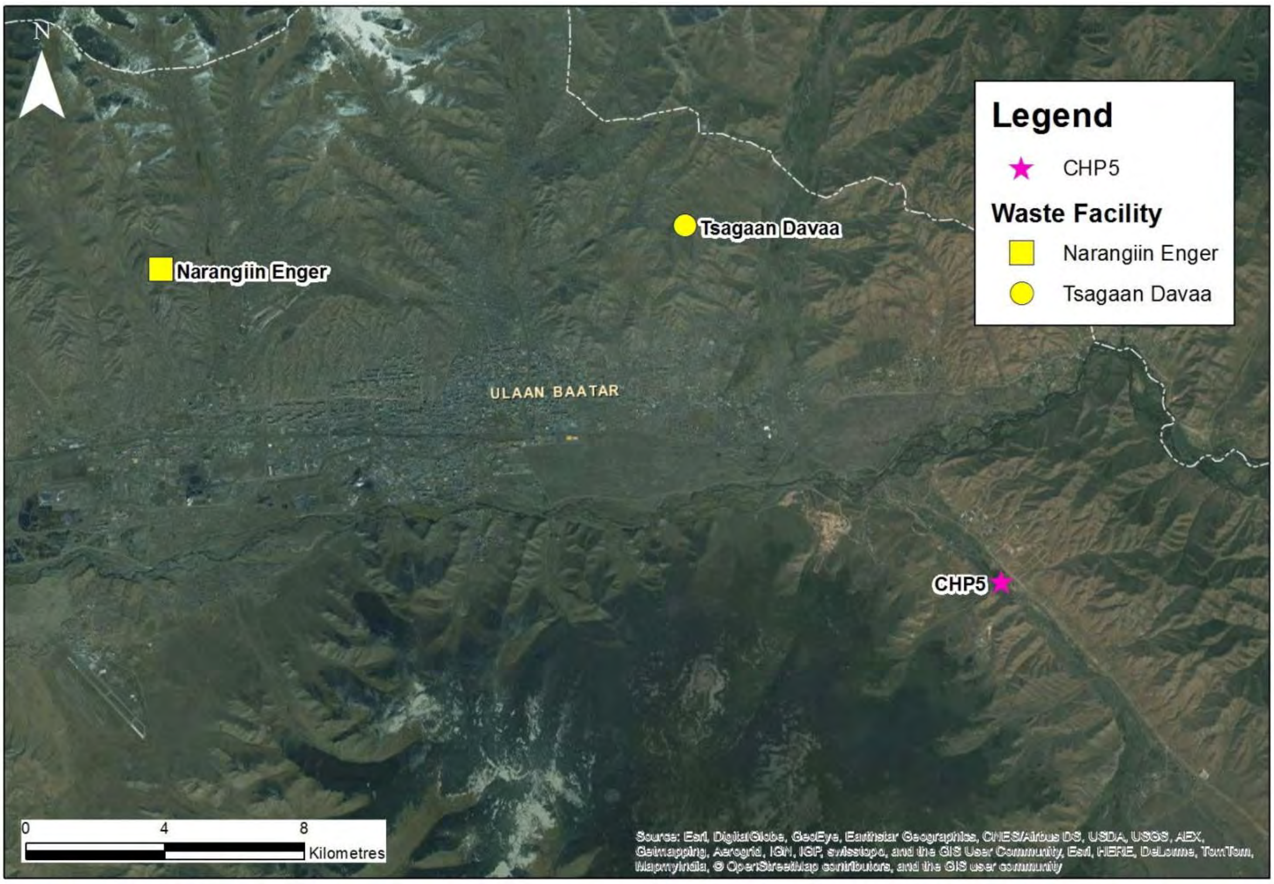
Hazardous	Non-hazardous		
Oils and lubricants and contaminated cloths	Excavation spoil	Paper and cardboard	General domestic waste

Hazardous	Non-hazardous		
Oily debris from workshop sumps/spill clean-ups	Concrete	Timber	Organic household waste
Batteries	Concrete washings	Woody debris	
Fluorescent tubes	Iron and steel scrap	Bricks and tiles	
Paints and chemicals	Non-ferrous scrap	Pallets	
Contaminated material	Packaging	Glass	
Medical waste	Plastics	Tyres	

Figure 16.1 identifies two approved landfill sites in close proximity to the site which may be used for the construction and operational phases. Further assessment will be required by the EPC contractor to determine the appropriateness of these sites and the final locations of Project landfill sites will be included in the SWMP. Waste will be transported to site using an appropriate licensed waste carrier. Consultation will be held with Ulaanbaatar Municipality and Municipal Emergency operating center where hazardous waste disposal is required.

Disposal of any medical waste must be undertaken at licensed facilities. Suitable sites with adequate medical waste disposal facilities (i.e. hospital incinerators) will be identified by the EPC contractor and be detailed in the SWMP. The SWMP will also identify recycling of non-contaminated waste material.

Figure 16.1: Nearby waste centres



16.5 Impact identification and assessment

16.5.1 Introduction

This section presents the identification and assessment of the potential adverse impacts from materials and waste during the Project's construction and operational phases.

The following sections discuss the potential environmental impact, and proposed handling/storage and disposal methods for each of the materials and waste streams that may arise during the two phases of the Project. Measures to mitigate the likely adverse impacts and enhance the beneficial impacts and benefits of the Project are presented in Section 16.6.

16.5.2 Construction Phase

16.5.2.1 Overview

This section aims to characterise the raw materials to be consumed and the waste streams which are envisaged to arise from construction activities associated with the development of the Project. The same types of wastes and material are anticipated to be generated/ used during decommissioning phase and therefore are also addressed here.

16.5.2.2 Material Use

Materials used during construction will principally comprise the items of equipment for the Project, as well as materials used for site preparation such as rods for piling and buildings, concrete for foundations and auxiliary structures, steel for buildings, materials for fitting out the interiors of buildings etc.

Smaller quantities of other materials will be used throughout construction. Mitigation proposed to minimise the use of materials is discussed in Section 16.6.

The principal potential impacts which can arise from the generation of waste from all phase of the Project are as follows:

- Use of potentially finite and/or scarce resources
- Ineffective spoil/excavated material handling, storage and disposal causing contamination of the environment
- Contamination of environments (surface watercourses, groundwater and soils) due to leakage and spillage of materials (such as fuel, oils and chemicals) from poor materials handling and storage arrangements
- Occupational health and safety from exposure to hazardous materials
- The elevated dust levels and other emissions to air as a result of the operation of the concrete batching plant at the construction site
- The embedded CO_2 associated with the chemical process and heat input required for its production
- Transportation of construction materials to site resulting in GHG emissions and nuisance effects (noise and dust)

16.5.2.3 Waste Generation

Table 16.4 summarises waste streams that are expected to be generated during the construction phase of the Project as well as their potential impacts, how they will be handled/stored and the method of disposal for each waste stream.

There are three general classifications of wastes, namely non-hazardous wastes, hazardous wastes and inert construction wastes. Each waste stream has been identified as belonging to one of the following classifications:

- Inert construction wastes are wastes that are solid and when disposed of are not expected to undergo physical, chemical or biological changes to such an extent as to produce substances that may cause an adverse effect. Such wastes include but are not limited to excavated spoil, concrete, glass, ceramic materials, unpainted scrap metal, and dry timber or wood that has not been chemically treated.

- Non-hazardous wastes are all wastes that are not hazardous wastes and are not inert construction wastes. This includes common garbage, office wastes, construction wastes that are burnable such as boxes, and treated sewage effluent and sewage sludge.
- Waste materials are classified as hazardous wastes when they exhibit on or more of the characteristics shown below or are hazardous by definition: explosive, flammable, spontaneous combustion potential, oxidizing potential, toxic, and corrosive.

Table 16.4: Construction Wastes: Potential impact, proposed handling / storage and offsite disposal methods

No.	Type of Waste	Source	Potential Unmitigated Impacts	Mitigation and Management
Non-Hazardous				
1.1	• Excavation spoil	• Associated with site preparation works and the excavation of the Project area.	• Contamination of receiving environments • Fugitive dust emissions • Disposal of spoil and excavation material which occupies large amounts of land • Visual amenity associated with disposal sites • Transportation resulting in GHG emissions and nuisance effects	• Spoil disposal site. Collection by approved licensed carrier • Development of a Borrow Pit and Spoil Management Plan
1.2	• Concrete	• Associated with the construction of the Plant	• Fugitive dust emissions • Additional pressure on the use of existing landfill, where waste reuse or recovery is not feasible • Transporting waste materials from the Project site resulting in GHG emissions and nuisance effects	• Waste concrete can be crushed and used as road material or fill, or where possible, buried in a local landfill site. Soils contaminated by cement can also be used as landfill cover. • If surplus quantities for the above are present collection and disposal by licensed carrier for recovery and re-use.

No.	Type of Waste	Source	Potential Unmitigated Impacts	Mitigation and Management
1.3	• Concrete Washings	• Associated with the construction of the Plant.	• Contamination of receiving environments	• Concrete wash water to be reused on site wherever possible. • On site concrete batching should include wash water recirculation. • Remaining wash water to be stored and allowed to evaporate. • Any remaining wash water to be fully treated (fine solids removed by filtration or settlement and pH corrected to 6-9) before being discharged to any surface water only if properly permitted (i.e. not to bare ground).
1.4	• Iron and steel scrap • Non-ferrous scrap • Packaging • Plastics • Paper and Cardboard • Timber • Woody debris • Bricks and tiles • Pallets • Glass • Tyres	• Associated with the construction of the Plant.	• The use of landfill, where waste reuse or recovery is not feasible • Visual amenity impacts associated with poor storage of waste • Transporting waste materials from the Project site resulting in GHG emissions and nuisance effects	• Collected by competent carrier for recycling. • Scrap metal will be sold for recycling, as appropriate.
1.5	• General domestic waste	• Kitchen and worker facilities	• The use of landfill, where waste reuse or recovery is not feasible • Visual amenity impacts associated with poor storage of waste • Windblown litter and potential odour and health risks by attracting vermin	• Wastes to be segregated and opportunities will be identified for composting biodegradable waste • Collected in covered containers and sent to licensed local disposal site.[31]
Hazardous				
1.7	• Oils and lubricants and contaminated	• Associated with the construction of the Plant	• Contamination of receiving environments	• Recovery and re-use options to be fully explored. Collected by a licenced

[31] Districts in Ulaanbaatar have established service companies to dispose of waste materials. The EPC contractor will be responsible for contacting these companies and arranging to use their services and facilities.

No.	Type of Waste	Source	Potential Unmitigated Impacts	Mitigation and Management
	rags		• Improper handling, storage, and collection of hazardous waste, where reuse, recovery recycling is not feasible	carrier. Where recovery and re-use is not feasible handling to a carrier via the Municipal Emergency operating center who will identify the hazard level of waste prior to identifying an appropriate disposal location.
1.8	• Batteries • Fluorescent tubes • Paints and chemicals	• Associated with the construction of the Plant	• Contamination of receiving environments • Improper handling, storage, and collection of hazardous waste, where reuse, recovery recycling is not feasible	• Collected and disposed by a licenced carrier.
1.9	• Medical waste	• First aid and on-site medical facility	• Contamination of receiving environments • Health and safety: risk of infection and exposure to diseases	• Further assessment required by the EPC contractor to identify suitable facilities for the disposal of medical waste. Details will be included in the SWMP.
1.10	• Contaminated material • Oily debris from worksite and spill clean-ups	• Spills and leaks on site including accidental spillage and leakage of chemicals, fuels, oil and lubricant from on-site fuel storage tanks and equipment maintenance	• Improper handling, storage, and collection of hazardous waste • Improper transportation of hazardous materials to the designated treatment/disposal facilities may pose a risk of contamination to the land, groundwater and surface water	• Collected by licenced carrier to be disposed of in a licensed facility. • Liaison with Municipal Emergency operating center who will identify the hazard level of waste prior to identifying an appropriate disposal location.
1.11	• Used solvents	• Contamination of environments.	• Collected in bunded, segregated drums and suitably stored on a temporary basis within a waste management area.	• • Liaison with Municipal Emergency operating center who will identify the hazard level of waste prior to identifying an appropriate disposal location.

Other potential impacts arising from construction waste include:

- Fugitive emissions, such as dust, associated with the handling and storage of some waste streams
- Visual amenity impacts associated with improper storage of waste
- Visual amenity associated with the large spoil disposal site
- Contamination of environments (particularly surface watercourses, groundwater and soils) due to leakage and spillage from poor waste handling and storage arrangements
- Transportation of construction wastes resulting in GHG emissions and nuisance effects (noise and dust)

- Windblown litter and potential odour
- Health risks from vermin

The environmental impacts of generated wastes associated with the construction phase of the Project will be short term and mostly reversible. These potential impacts will be effectively managed through the establishment of detailed waste management plans in line with the framework waste management plan as outlined in the ESMMP (Volume IV). The specific details of such waste management plans will be prepared by the construction contractor, the key elements of which are summarised in Section 16.6.2.

16.5.3 Operational Phase

16.5.3.1 Overview

One of the key environmental issues within the large-volume coal combustion is the generation of a relatively large quantity of wastes, including fly ash; bottom ash and boiler slag. Within the Project these unavoidable waste streams will be treated in recovery and / or abatement systems, recycled where possible, sold to external users or in the last resort will be disposed of as waste.

16.5.3.2 Material Use

Impacts from Operational Material Use

Exact quantities of materials used during operations will depend on the optimised operating regime of the Plant; however, the likely quantities of each key material have been presented in the following sections.

The primary environmental impacts associated with material use during operations are:
- Contamination of environments (particularly surface watercourses, groundwater and soils) due to leakage and spillage of materials (such as fuel, oils and chemicals) from poor materials handling and storage arrangements
- Surplus materials requiring disposal i.e. out of date, excess to requirement, damaged
- Disposal of packaging waste
- Occupational health and safety from exposure to hazardous materials
- Transportation of materials to site resulting in GHG emissions and nuisance effects

Lignite

The main material used during the operational phase of the Project will be lignite, or brown coal, which is considered to be a low ranking type of coal. The coal used from Baganuur and Shivee-Ovoo mines will be unloaded from rail wagons at the south of the site and then transferred via a conveyor to the coal storage yard. A rotary wagon dumper will be used to empty each wagon onto the conveyor. Coal will be conveyed up to the coal storage area from the underground hopper. During winter, coal transported to the site will be defrosted in rail wagons before unloading in an infrared coal defrosting facility located adjacent to the coal unloading area onsite, which will be operated for a maximum of 22.5 hours per day.

The coal storage yard will be 41,580m^2 and has been sized to provide capacity for approximately 30 days of operation. The coal storage yard will be surrounded by a wind shield consisting of a concrete wall and fabric pad to prevent the spread of dust. A telescopic coal unloading chute will be installed to reduce the height at which coal falls from the coal conveyor and sprinklers using recycled water will be installed around the coal yard to minimise fugitive dust emissions. The storage yard will be lined with approximately 200mm of firmly compacted clay to prevent the infiltration of contaminated water into the soil. Coal will be taken from the coal storage area by conveyor to be crushed and then onto the CFB boilers for combustion. To control fugitive particulates, dust collection systems are provided at the coal transfer points. The coal storage yard will be located at the northern point of the site.

A coal storage management plan to minimise the risk of spontaneous combustion of coal or coal dust will be implemented for the operation of the Project.

Typical environmental impacts associated with coal are as follows:

- Contamination of receiving environments (particularly surface watercourses, groundwater and the ground) due to runoff associated with poor handling and storage arrangements.
- Fugitive emissions, such as dust associated with the handling and storage of the coal.
- Visual amenity impacts associated with poor storage.

Limestone

During operation, limestone will be used to reduce the levels of sulphur dioxide in flue gases released via the stack. This will be achieved by injecting limestone into the boilers' fluidised beds where it will react with the sulphur during combustion to form calcium sulphate. The limestone demand will depend on the sulphur content of the coal and the coal consumption.

The required quantities of limestone for the power station are approximately 100,000 tonnes per annum. The power station has the processing infrastructure to accept limestone rocks for storage and treatment from these sources with minimal processing.

An unloading facility for limestone will be similar to the wagon tipper used for unloading coal. It is expected that limestone will be transported from local limestone mines. The milled limestone will be stored in two storage silos, (with estimated capacities of 2,600m^3), before being delivered to each boiler by a conveyor.

Fugitive emissions, such as dust associated with the handling and storage of the limestone, are considered to be the only likely environmental impact associated with limestone.

16.5.3.3 Waste Management

Waste streams that will arise during operation will include:

- Furnace bottom ash and fly ash
- Oily contaminated materials, such as oily rags
- Lubricating and auxiliary oils
- Trace contaminants in the fuel (introduced through the ash-handling wastewater discharges)

- Empty chemical containers
- Solvents, paints
- Spent filters and ion exchangers
- Delivery packaging
- Waste clean-up collected as a result of spills, leakages and/or accidental discharge

It is expected that waste material will be generated as a result of routine maintenance and equipment outages. The exact type and quantity of the waste arising will be dependent upon the nature of those activities. Waste streams typically associated with a major outage for a coal fired power plant are similar to those encountered during construction. Provision for the identification of suitable management for these waste streams will be required prior to any significant outage activities being carried out.

Furnace Fly Ash and Bottom Ash

One of the most significant waste by-product streams which will be generated during the operation of the Project will be furnace bottom ash and fly ash. Together they are considered to be coal combustion wastes, as defined by the WB/IFC EHS Guidelines for Thermal Power Plants.

It is anticipated that in average, approximately 1,370 t/day (500,000 tonnes per annum) of ash will be produced by the Project during operations, of which 274 t/day (100,000 per annum) is expected to be bottom ash with the remaining 1095 t/day (400,000 per annum) being fly ash. Based on the lowest coal quality value, providing a conservative assumption for ash generation to maximum yearly generated ash amount is 650,000 tonnes.

Fly ash is the result of the combustion of coal and is ash which has become entrained in the flue gases which emanate from the units. The Project will be installed with pulse-jet fabric filters which serve to remove fly ash particles from the flue gases thereby lowering the particulate concentration prior to emission to air via the exhaust stack. The dust will fall down into pyramidal-shaped hoppers which collect the ash. Fly ash will be collected from the hoppers and transported to a remote disposal area, via waggons and trucks. There will be two types of fly ash; dry and slurry type.

Furnace bottom ash is produced from the non-combustible material that settles to the bottom of the boiler and remains in the form of unconsolidated ash. Bottom ashes extracted from the boiler are mainly agglomerated. Bottom ash will be collected from the transition hopper to a common bottom ash silo and subsequently loaded onto open trunk trucks or onto wagons for offsite removal.

Typical environmental impacts associated with ash production are the same as those associated with coal, but also includes the use of landfill where waste re-use or recovery is not feasible, which is a finite resource.

Discussion on the selection of a suitable site for the ash disposal site is provided in Section 16.6.2.2.

16.5.3.4 Summary

Table 16.5 presents the high level waste handling strategy for the operational phase of the Project. It includes the expected source of each waste stream, the potential environmental impact which could occur, along with the expected disposal / final removal method.

Table 16.5: Overview of the operational phase waste handling strategy for the Project

Waste	Source	Potential environmental Impact	Disposal method
Furnace Bottom Ash	• Associated with routine and on-going maintenance in the facility and outages	• Potential contamination of receiving environment • Fugitive emissions • Visual amenity impacts • Increased waste miles • Non hazardous	• Will be transported for offsite disposal via covered rail wagons. Feasibility studies for ash disposal sites are under consideration • Options for commercial ash use to be periodically reviewed.
Fly Ash	• Associated with routine and on-going maintenance in the facility and outages	• Potential contamination of receiving environment • Fugitive emissions • Visual amenity impacts • Increased waste miles • Non hazardous	• Will be transported for offsite disposal via covered rail wagons. Feasibility studies for ash disposal sites are under consideration • Options for commercial ash use to be periodically reviewed.
Sludge from boiler feed water unit	• Power Plant	• Hazardous • Potential contamination of receiving environment	• Collected and disposed of by a licensed contractor
• Oil contaminated sludge • Oily contaminated materials e.g. oily rags • Lubricating / auxiliary oils • Water Treatment Sludge • Empty chemical containers • Solvents, paints • Spent filters and ion exchangers • Spent resins	• Associated with routine and on-going maintenance in the facility and outages	• Hazardous • Potential contamination of receiving environment	• Recovery and re-use options to be fully explored. Collected by a competent carrier. Where recovery and re-use is not feasible, then disposal in a licensed facility in liaison with the Municipal Emergency Operating Centre.
Contaminated packaging	• Primarily associated with any chemical deliveries	• Hazardous • Unknown contaminants and potential contamination of receiving environments • Use of finite landfill resource	• Collected by a competent carrier for recovery and re-use after separate collection from the source.

Waste	Source	Potential environmental Impact	Disposal method
Effluents collected as a result of spills, leakages and/or accidental discharge.	• Associated with routine and on-going maintenance in the facility and outages	• Hazardous • Potential contamination of receiving environments	• Collected by a competent carrier for recovery and re-use after separate collection from the source.
Fluorescent tubes	• Associated with routine and on-going maintenance in facilities and workshops	• Hazardous • Fluorescent tubes contain mercury • Use of finite landfill resource	• Collected by a competent carrier for recovery and re-use.
Waste oil	• Associated with routine and on-going maintenance in the facility and outages	• Hazardous • Potential contamination of receiving environment	• Recovery and re-use options to be fully explored. Collected by a competent carrier. Where recovery and re-use is not feasible then disposal in a licensed facility.
Waste Electronics and Electrical Equipment (WEEE)	• Maintenance and replacement of electrical equipment	• Hazardous • Potential contamination of receiving environment • May contain heavy metals depending on the item	• Recycling options to be fully explored. Collected by a competent carrier. Where recycling is not feasible then disposal in a licensed facility.
Concrete	• Associated with outages and maintenance	• Recovery potential • Visual amenity impacts • Use of finite landfill resource	• Collected by a competent carrier for recovery and re-use.
General domestic waste	• Kitchen and workers facilities	• Potential contamination of receiving environment. • Visual amenity impacts • Use of finite landfill resource	• Recyclable components to be fully segregated (see the following rows). Residual waste to be disposed of to landfill.
Paper and Cardboard Plastic	• From packaging and deliveries etc.	• Potential contamination of receiving environment. • Visual amenity impacts	
Glass	• Maintenance, deliveries, workers facilities		
Iron and steel scrap Non-ferrous scrap	• Associated with outages and maintenance	• Potential contamination of receiving environment. • Visual amenity impacts. • Recycling potential.	• Collected by a competent carrier for recovery and re-use.
Pallets	• Associated with deliveries	• Potential contamination of receiving environment. • Visual amenity impacts	
Timber	• Associated with routine and on-going maintenance in the facility and outages	• Recycling potential.	

Waste	Source	Potential environmental Impact	Disposal method
Green waste	• From the surrounding settlements and the facility	• Potential contamination of receiving environment • Composting potential	• Collected and stored. To be re-used as low grade compost material for landscaping.

16.5.4 Decommissioning

The principal pieces of infrastructure which will require removal as part of the decommissioning phase are as follows:

- Powerhouse equipment and buildings
- Fuel storage tanks
- Wastewater treatment structures
- Coal handling storage facilities
- Ash silos

From a waste management perspective, the principle waste stream likely to be generated during decommissioning are the large volumes of concrete associated with the different buildings and structures.

Advanced planning will be required in order to categorise each waste stream and identify a potential re-use/recovery option. This will be particularly important for concrete and metal given the large quantities likely to be generated.

Prior to the eventual decommissioning of the project, a Decommissioning Environmental Management Plan (DEMP) will be prepared detailing the best practice approach that will be adopted. The DEMP will include a section on waste management detailing the environmental protection controls that will be put in place for the storage, safe handling arrangements of each waste stream and the recovery / re-use / recycling pathways, or disposal methods for those wastes which can be recovered, re-used or recycled.

16.5.5 Impact Significance

The Project will be operated under best practice methods for storing and disposing of materials and waste. Table 16.6 provides a summary of the impact significance associated with material handling and waste management.

Table 16.6: Summary of Impact Significance

Activity	Potential Impact	Sensitivity	Magnitude	Impact Significance
Construction / Decommissioning				
Use of raw materials	Use of potentially finite and / or scarce resources.	Medium	Moderate	Moderate adverse
Waste generation, handling and storage	Contamination of environments (particularly surface watercourses, groundwater and the ground) due to leakage and spillage of wastes	Medium	Moderate	Moderate adverse

Activity	Potential Impact	Sensitivity	Magnitude	Impact Significance
	associated with poor waste handling and storage arrangements			
	Fugitive emissions, such as dust, associated with the handling and storage of some waste streams	Medium	Major	Major adverse
	Visual amenity impacts associated with poor storage of waste	Low	Minor	Negligible
Spoil handling and disposal	Disposal of spoil and excavation material which results in land take.	Low	Major	Minor adverse
Choice of final waste disposal option	The use of landfill, which is a finite resource	Medium	Minor	Minor adverse
	Increased waste miles from transporting waste materials from the Project site.	Low	Negligible	Negligible
Operation				
Use of raw materials	Use of potentially finite and / or scarce resources.	Medium	Major	Major adverse
Waste generation, handling and storage	Contamination of receiving environments due to leakage and spillage of waste streams from the operation of the Project	Medium	Moderate	Moderate adverse
	Fugitive emissions associated with the handling and storage of operational waste streams	Medium	Major	Major adverse
Choice of final waste disposal option	The use of landfill, which is a finite resource	Medium	Minor	Minor adverse
	Increased ‘waste miles’ from transporting waste materials from the Project site.	Low	Minor	Minor adverse

16.5.6 Cumulative Impacts

The Project is unlikely to result in cumulative effects in relation to waste arising from the Project; minimal wastes produced should place only limited additional demand on local waste facilities. The Project will employ a waste hierarchy in order to reduce its waste to landfill and thus limit its impact.

Opportunities to re-use and recycle waste arising from the Project need to be investigated further prior to the construction phase commencing.

16.6 Mitigation and enhancement measures

16.6.1 Overview

General waste management and overall management of hazardous materials will be managed for the construction and operational phases as follows:

- Detailed construction phase materials storage, handling and use plan and waste management plan and which will form part of the construction phase ESMMP.
- Operational phase materials storage, handling and use procedures and a waste management procedure which will both form part of an overall Environmental and Social Management System. The waste management procedure will be required to include a Site Waste Management Plan (SWMP).
- Detailed construction phase hazardous materials storage, handling and use plan and waste management plan.
- The use of Material Safety Data Sheets (MSDS) will be used for all hazardous chemicals and substances during the construction and commissioning phases of the Project.
- Best practice waste management begins with waste prevention and minimisation which is achieved through the efficient storage, handling and use of raw materials. To achieve this aim for the Project in both construction and operational phases, the following material use and handling measures will be considered and imbedded into the construction ESMMP and operational phase procedures as appropriate.
- Re-using materials on site wherever possible. The most significant opportunity in the construction phase is with respect to excavated spoil.
- Instituting good housekeeping and operating practices, including inventory control to reduce the amount of waste resulting from materials that are out-of-date, off-specification, contaminated, damaged, or excess to plant needs.
- Instituting procurement measures that recognise opportunities such as ordering the correct amount of materials to be delivered when needed, reducing the amount of packaging used by suppliers and establishing a take-back system with suppliers.
- Seeking ways to reduce raw material consumption through efficiency audits in the operational phase.
- Substituting raw materials or inputs with less hazardous or toxic materials wherever economically and technically feasible.

16.6.2 Materials Storage, Handling and Use

This section presents mitigation measures for the use of materials during the construction and operation of the Project.

Best practice waste management begins with waste prevention and minimisation, which is achieved through the efficient storage, handling and use of raw materials. To achieve this aim for the Project during the construction and operational phases, the following material use and handling measures will be embedded in the Project ESMMP:

- Re-using materials on site wherever possible; the most significant opportunity in the construction phase is with respect to excavated spoil

- Establishing good housekeeping and operating practices, including inventory control to reduce the amount of waste resulting from materials that are out-of-date, off-specification, contaminated, damaged, or excess to plant needs
- Implementing procurement measures that recognise opportunities such as ordering the correct amount of materials to be delivered when needed, reducing the amount of packaging used by suppliers and establishing a take back system with suppliers
- Seeking ways to reduce raw material consumption through efficiency audits in the operational phase
- Substituting raw materials or inputs with less hazardous or toxic materials wherever economically and technically feasible

A Materials Handling and Storage Plan will be developed for the Project which will identify storage areas to be established during the construction phase and will require these to be specifically designed giving due consideration to the following requirements:

- Located away from sensitive receptors
- Not at risk from theft or vandalism
- Protection from the elements
- Easily accessible in a safe manner
- Well ventilated
- Unlikely to be damaged
- Bunded and with spill kits provided close by (as necessary for hazardous liquids)

The construction and operational procedures will include reference to the control measures in order to minimise the likelihood of incidents associated with materials storage, handling and use. This will include the following:

- Identification of the necessary bunding and spill kit requirements
- Details of the correct procedure for handling and storing any hazardous materials
- A map showing the material storage locations
- Vehicle and equipment fuelling to only be undertaken in designated areas on impermeable surfaces with adequate spill protection in place
- Training requirements (as necessary) with respect to materials handling procedures, use of PPE, spill procedures and emergency response procedures
- The correct procedure for reporting any environmental incidents related to spills/ leakages.

16.6.2.1 Coal Storage, Handling and Use

The BAT reference document for Large Combustion Plants states that the following measures should be in place for the unloading, storage and handling of coal:

Table 16.7: Unloading, storage and handling of fuel and additives BAT

Material	Pollutant	BAT
Lignite	Dust	• The use of loading and unloading equipment that minimises the height of fuel drop to the stockpile, to reduce the generation of fugitive dust • Grassing over long-term storage areas of coal to prevent fugitive emission of dust and fuel loss caused by oxidation in contact with the oxygen of air

Material	Pollutant	BAT
		• Direct transfer of lignite via belt conveyors or trains to the on-site coal storage area • Placing transfer conveyors in safe, open areas aboveground so that damage from vehicles and other equipment can be prevented. • The use of cleaning devices for conveyor belts to minimise the generation of fugitive dust • The use of covered conveyors with well designed, robust extraction and filtration equipment on conveyor transfer points to prevent the emission of dust • Rationalising transport systems to minimise the generation and transport of dust within the site • The use of good design and construction practices and adequate maintenance.
	Water Contamination	• Coal storage must be on sealed surfaces with drainage, drain collection and water treatment for settling out • The collection of surface run-off (rainwater) from coal storage area that washes fuel particles away and treating this collected stream (settling out) before discharge.
	Fire Prevention	• Survey storage areas for coal with automatic systems, to detect fires, caused by self-ignition and to identify risk points.
Limestone	Dust	• Enclosed conveyors, pneumatic transfer systems and silos with well designed, robust extraction and filtration equipment on delivery and conveyor transfer points to prevent the emission of dust.

Source: EC Reference Document on Best Available Techniques for Large Combustion Plants (2006) and Best Available Techniques (BAT) Reference Document for the Large Combustion Plants (Draft 1, 2013)

16.6.2.2 Ash Disposal

Sites for the ash disposal facility to service the Project are currently being investigated and will be assessed separately to this ESIA.

For the selected site, an ash management plan will be produced prior to operations commencing and will include the following:

- Quantitative balance of ash generation
- Disposal, utilisation and reuse quantities/locations
- Cell structure and their protocol within site
- Size of ash disposal site
- Information on leachate collection and drainage
- Ash transportation arrangements (open and closed rail wagons/tank trucks depending on wet/dry ash) and expected number
- Monitoring required (groundwater/noise/leachate) during operations
- Access/security arrangements
- Design of the ash disposal site in accordance with International Best Practice.

In some cases ash produced by power plants can be used as construction material. Opportunities to reuse the ash generated from the combustion process will be researched and regularly reviewed.

16.6.3 Construction and Operational Waste Management Plans

This section presents the waste management measures designed to manage the solid waste generated on the Project during the construction and operational phases.

16.6.3.1 Temporary waste storage and handling

Temporary waste storage facilities are expected to be provided for the construction and operational phases. It is envisaged that these will be scaled down once the Project moves into the operational phase. These are intended as a secure, short-term storage for all waste streams generated on site prior to being collected by relevant waste collectors for treatment and/or final disposal. They will be designed to include the following:

- Separate storage areas for hazardous and non-hazardous wastes
- Separate skips for each waste stream to allow segregation in order to maximise reuse and recycling opportunities
- All skips to have a suitable coverings
- Liquid wastes/oil/chemicals to be stored in tanks or drums located in bunded areas which can hold 110% of capacity of the largest tank or drum or, for multiple drum storage, 25% of the total volume of material stored
- Spill kits to be provided in proximity to hazardous material and waste storage areas and to be regularly inspected and replenished so as to be fully available at all times
- Store hazardous waste in closed containers away from direct sunlight, wind and rain in designated storage areas
- Provide adequate ventilation where volatile wastes are stored
- Handling and storage shall be carried out by trained staff
- Provide readily available information on chemical compatibility to workers including labelling each container, demarcation of the area (e.g. on a facility map/site plan)
- Conduct periodic inspections of waste storage areas and document the findings
- Prepare and implement spill response and emergency response plans to address an accidental release and leakage

16.6.3.2 Construction Phase Waste Management Strategy

Management Plans and Procedures

The SWMP will identify predicted waste streams, appropriate handling, reuse and recycle opportunities and, as a last resort, disposal methods. The SWMP will be prepared in accordance national waste regulations and the IFC General EHS Guidelines (2007) and the EWC.

The construction SWMP will include the following mitigation measures;

- The best practice waste handling and final treatment options (ie reuse, recycling, recovery or disposal) for each waste stream
- The procedures for the reduction of waste production

- The correct methodology for establishing the spoil disposal site (i.e. topsoil, overburden, and low quality materials will be properly removed, stockpiled near the site, and temporarily preserved for any necessary site rehabilitation)
- A description of the control measures the spoil disposal site (such as spot checking of spoil loads)
- Contractor training requirements with respect to waste handling procedures
- Waste generation data collection for each waste stream by volume. This will include the proportion of each waste stream going for reuse, recycling or disposal. Any unusual waste volumes will be investigated
- Any waste monitoring as deemed to be necessary
- An audit schedule which details the frequency of waste management audits and those responsible for undertaking them
- The correct procedure for reporting any environmental incidents related to waste
- The specific regulatory reporting requirements as they relate to waste.

Spoil Disposal Site

The principal waste stream which will be generated during the construction phase is excavation material/spoil. A Borrow Pit and Spoil Management Plan will be developed in accordance with national legislation, guidelines and international requirements for the handling and storage of spoil during the construction phase of the Project; this will include but not be limited to:

- A description of the control measures at the spoil disposal site
- Segregation of topsoils and subsoils
- Management of storage piles including weather protection, heights of piles and erosion protection
- Drainage and flood control
- Slope protection
- Monitoring and inspection

16.6.3.3 Operational Waste Management Strategy

For the operational phase, the production of a detailed waste management procedure for all operations at the Project is going to be fundamental to ensuring best practice waste management is undertaken and becomes embedded into the operational philosophy of the Project. The waste management procedure will highlight the relevant policy and legislation and include a SWMP, which will contain:

- The establishment of a waste management hierarchy philosophy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes
- A map showing each waste storage location for the Project
- A description of each waste generated by the operation of the facility, the appropriate handling methodology, the correct approach for storage and the correct route for removal/disposal off site
- Staff training requirements with respect to waste handling procedures
- Waste generation data collection for each waste stream by volume, according to the EWC. This will include the proportion of each waste stream going for reuse, recycling or disposal; any unusual waste volumes will be investigated
- Any waste monitoring as deemed to be necessary

- An audit schedule which details the frequency of waste management audits and those responsible for undertaking them
- A section related to continuous improvement and corrective actions where audit findings can be recorded and incorporated into the waste management procedure; this will also highlight any new and feasible reuse or recycling opportunities which may arise over time
- A mechanism by which to routinely track waste consignments from the originating location to the final waste treatment and disposal location
- The correct procedure for reporting any environmental incidents related to waste
- The specific regulatory reporting requirements as they relate to waste

In addition, a valid copy of all waste carriers' licences will be kept on site. All transfer and consignment notes related to waste transferred will be completed in full and contain an accurate description of the waste and be signed by the producer and carrier before waste leaves the site.

It is expected that the control measures described herein will be largely sufficient in avoiding the potential environmental impacts typically associated with waste generation.

16.6.4 Proposed Monitoring

Waste management monitoring for the Project will be undertaken by the Consortium as part of the construction and operational waste management plans detailed in the ESMMP. Monitoring data will be analysed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken.

16.7 Residual impacts

The mitigation measures identified above will ensure that the vast majority of waste generated as a result of the Project will be managed according to environmental best practice and the risk to the environment is significantly reduced. Following application of the mitigation measures the resultant residual impacts are presented in Table 16.8.

Table 16.8: Summary of waste and materials impacts and mitigation

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
Construction						
Use of raw materials	Use of potentially finite and / or scarce resources.	Medium	Moderate	Moderate adverse	• Re-use of materials on site wherever possible. The most significant opportunity in the construction phase is with respect to excavated materials. • Inventory control to reduce the amount of waste resulting from materials that are out-of-date, off-specification, contaminated, damaged, or excess to plant needs • Implementing procurement measures that recognise opportunities such as ordering the correct amount of materials to be delivered when needed, reducing the amount of packaging used by suppliers and establishing a take back system with suppliers • Substituting raw materials or inputs with less hazardous or toxic materials wherever economically and technically feasible.	Minor adverse
Waste generation, and storage	Contamination of environments due to leakage and spillage of wastes associated with poor waste handling and storage arrangements	Medium	Moderate	Moderate adverse	• Develop a waste management handling procedure as part of the ESMMP prior to construction. • Identify a suitable temporary storage location for each waste stream • Both the onsite and offsite waste storage facilities will be include the following: – Separate storage areas for hazardous and non-hazardous wastes – Separate skips for each waste stream to allow segregation in order to maximise re-use and recycling opportunities – All skips to be covered to avoid wind-blown litter and dust. – Liquid wastes/oil/chemicals to be stored in tanks or drums located in bunded areas which can hold 110% of the total storage volume. – Spill kits to be available at all times.	Minor adverse

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
	Fugitive emissions, such as dust, associated with the handling and storage of some waste streams	Medium	Major	Major adverse	Cover any skips used for the temporary storage of waste	Minor adverse
	Visual amenity impacts associated with poor storage of waste	Low	Minor	Negligible	• Develop a waste management handling and storage procedure • All waste storage vessels to be covered at all times	Negligible
Spoil handling and disposal	Disposal of spoil and excavation material which results in land take.	Low	Major	Minor adverse	• Undertake assessment to determine whether spoil is appropriate material (strength/grade) to be used for construction material / concrete batching • For materials which cannot be re-used, the disposal method will be in spoil disposal site; the location of this site has not been finalised. • Topsoil and overburden will be carefully removed from the selected spoil disposal site and stockpiled nearby and preserved for eventual use as rehabilitation material once the spoil disposal site is no longer required. • Control measures the spoil disposal site (such as spot checking of spoil loads) to ensure that only material excavated from the Project is deposited there.	Negligible
Choice of final waste disposal option	The use of landfill, which is a finite resource should be final recourse	Medium	Minor	Minor adverse	• In conjunction with the relevant authorities, undertake assessment of availability of landfill sites and other waste disposal facilities in Ulaanbaatar and surrounding area. • Characterise each waste type as either hazardous or non-hazardous and determine the hazardous class and applicable requirements • Seek to minimise waste production in the first instance • Where waste streams are unavoidable, highlight potential re-use and recycling opportunities according to current best practice and local opportunities	Minor Adverse
	Increased waste miles	Low	Negligible	Negligible	• In conjunction with the relevant authorities,	Negligible

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
	from transporting waste materials from the Project site.				identify waste handling facilities in close proximity to the Project • Review on an on-going basis the locally available re-use/recycling facilities to ensure they can accept the waste streams.	
Operation						
Use of raw materials	Use of potentially finite and / or scarce resources.	Medium	Major	Major adverse	• Implementing good housekeeping and operating practices, including inventory control to reduce the amount of waste resulting from materials that are out-of-date, off-specification, contaminated, damaged, or excess to plant needs • Implementing procurement measures that recognise opportunities such as ordering the correct amount of materials to be delivered when needed, reducing the amount of packaging used by suppliers and establishing a take back system with suppliers • Seeking ways to reduce raw material consumption through efficiency audits in the operational phase • Substituting raw materials or inputs with less hazardous or toxic materials wherever economically and technically feasible.	Moderate adverse
Waste generation and storage	Contamination of receiving environments due to leakage and spillage of waste streams from the operation of the Plant.	Medium	Moderate	Moderate adverse	• As above	Minor adverse
	Fugitive emissions associated with the handling and storage of operational waste streams	Medium	Major	Major adverse	• As above	Minor adverse
Choice of final waste disposal option	The use of landfill, which is a finite resource should be final recourse	Medium	Minor	Minor adverse	• As above	Minor adverse
	Increased waste miles	Low	Minor	Negligible	• As above	Negligible

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
	from transporting waste materials from the Project site.					
Decommissioning	Prior to decommissioning, a DEMP will be prepared.					

17 Socio-economics and Communities

17.1 Introduction

17.1.1 Overview of the assessment

This chapter looks at how people and communities may be affected as a result of the Project in terms of the way they live, work and interact with one another on a day-to-day basis. The broad objectives of this assessment are to ensure that key potential socio-economic and community impacts have been identified, assessed, mitigated and managed in a consultative and constructive manner.

Social and community impacts have been assessed and identified as significant in relation to employment generation, land acquisition and resettlement, and the beneficial impact of the provision of electricity and heating. Consideration has also been given to avoiding and mitigating occupational and community health, safety and security risks from construction activities.

Environmental impacts from construction activities could also have a cumulative effect on local community receptors such as schools and hospitals, however to avoid double counting of impacts these have been addressed within their respective chapters and are not covered again here. Specifically: air quality impacts are assessed in chapter 7; noise is covered in chapter 8, dust in chapter 7 and traffic in chapter 13.

17.1.2 General approach

The process followed has been one of analysing, monitoring and managing the intended and unintended socio-economic and community consequences - both positive and negative - of the Project, and any social change processes invoked by the interventions.

The socio-economics and community assessment undertaken for this international ESIA has been carried out to meet the requirements of the Equator Principles, IFC, EBRD, ADB and JBIC. The approach and methodology draws on guidance for social impact assessment by the International Association for Impact Assessment (IAIA)[32]. The IAIA conceptualises social impacts as changes to one or more of the following:

- People's way of life – how they live, work, play and interact with one another on a day-to-day basis
- Their community – its cohesion, stability, character, services and facilities
- Their culture – their shared beliefs, customs, values and language use
- Their environment – the quality of the air, water, food, amenity, safety and pollution risks
- Their health and wellbeing – physical, mental, social and spiritual wellbeing and perceptions of safety.
- Their personal and community property rights – access issues and economically affects

Adverse impacts will be avoided and wherever possible, management and mitigation measures have been identified to reduce their effects on the community. Where impacts are beneficial, measures are designed to enhance the effects and share their benefits more widely, in particular amongst local people who may also be affected negatively by the Project.

32 International Association for Impact Assessment, Social Impact Assessment: International Principles, May 2003.

17.2 Applicable legislation and standards

17.2.1 National requirements

17.2.1.1 Overview

This sub-section outlines the key Mongolian legislation applicable to the social elements of the Project. The Mongolian requirements are being dealt with in detail within the DEIA which is being prepared simultaneously with the ESIA to meet Mongolian legislative requirements.

17.2.1.2 Labour Legislation

The Mongolian Labour Code (1999) is the main piece of legislation guiding employment in Mongolia. It covers collective contracts and agreements, labour contracts, remuneration, working hours, working conditions, public holidays, vacations, safety, employment of minors and the disabled, dispute resolution and labour monitoring by the State.

17.2.1.3 Occupational Health and Safety

Safety and sanitation standards are covered in general terms in the Labour Code and the Constitution and there is a series of more detailed laws, the principal of which is the Law on Labour Safety and Hygiene (2008). The Law on Labour Safety and Hygiene covers requirements for industrial buildings and facilities, requirements for machinery and equipment, requirements for hazardous chemicals and explosives, fire safety, medical check-ups, personal protective equipment, training, rights to favourable working conditions and investigation of accidents and occupational diseases.

17.2.1.4 Community Health and Safety

The Law on Sanitation (1998) is a public health law which provides for the rights of individuals to healthy and safe living and working conditions. It defines the rights and duties of individuals and businesses in this regard. The states that the following areas must meet with Government regulations and requirements:

- Drinking and household water supply
- Air quality
- Soil quality and safety, waste disposal, sewage facilities, water holes and lavatories
- Working conditions
- Food sanitation
- Importing products, substances, materials and technologies
- Activities in environments that are noisy or that are impacted by vibration, electromagnetic fields or radio waves

The Law on Radiation Protection and Safety applies to the use of any materials or equipment considered to be a source of radiation. The Law on Household and Industrial Waste (2004) regulates the collection, transportation, storage, reuse and disposal to landfill of household and industrial waste. Permission to landfill waste is granted by Khoroo or District Governors and organisations undertaking industrial activities that generate a significant amount of waste must landfill that waste in a designated landfill that meets prescribed standards. The Law on Hazardous and Toxic Chemicals (2006) covers the import, export, transportation, storage, use, and control of toxic chemicals. It imposes measures to prevent the impact of toxic and hazardous substances on human health and the environment.

17.2.1.5 Security

Security for the Project will be provided in accordance with the laws of Mongolia which include:
- Law on Private Security (2001)
- Law on Contracted Security Services (2000)
- Law on Firearms (2001)
- Law on State Weapons Tax (1993)

The following government procedures will be followed too:
- Procedure for registration and monitoring the legal entity to provide contractual security services
- Procedure on installing warning siren and emergency light to the vehicle
- Procedure on monitoring training activity of security guards
- Training curriculum for security guards
- Guidelines in the use of force by security guards without using firearm, professional gear and weapon, and instruction on using guard dog

17.2.1.6 Land Law

The laws of Mongolia that regulate tenure, allocation, expropriation and transactions associated with land and other immoveable assets include the following:
- The Constitution (1992)
- The Law of Mongolia on Land (2002)
- The Law on Allocation of Land to Mongolian Citizens for Ownership (2003) (Land Allocation Law)
- The Civil Code (2002)

These will be described in more detail in the RP that is being developed for the Project.

17.2.1.7 Gender Law

In response to a three year study by the ADB and the National Commission on Gender Equality, a law of gender equality[33] was passed in 2011. It is based on principles of equality, non-discrimination, government responsibility, gender mainstreaming and gender sensitive data and information. The law prohibits gender discrimination and promotes special measures to ensure equality of men and women. It guarantees equal rights in state structure, economic, social and cultural spheres, including in employment, labour relations, family relations, education and healthcare.

[33] Law of Mongolia on Enforcement of the Law ion Promotion of Gender Equality, February 2, 2011

17.2.2 International requirements

17.2.2.1 Overview

Information is given on the relevant standards of the potential lenders as far as they relate to social sustainability below. Cultural Heritage is covered in Chapter 16.

17.2.2.2 ADB Requirements

ADB's Safeguard Policy Statement (2009) consists of three operational policies that aim to avoid, minimise, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalised by the development process. The three Safeguard Requirements (SR) address:

- Environment (SR1) – triggered for this project, as described in chapter 4
- Involuntary resettlement (SR2) – triggered for this project, as described below
- Indigenous peoples (SR3) – not triggered for this project, as described below

SR2 is triggered by this project and this covers physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. This covers losses and involuntary restrictions that are full or partial, permanent or temporary.

The proposed category for this Project under SR2 is category B, which means that the potential adverse environmental impacts are less adverse than those of category A projects. These impacts will be site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. A RP is being produced for the Project in accordance with ADB Category B requirements for SR2.

It is proposed that SR3 is not triggered by the Project because there Indigenous Peoples are not thought to be directly adversely affected by the Project, as described further in baseline section 17.4.7. This will be verified and supported by primary data evidence following the completion of the socioeconomic affected people's surveys in progress in October 2015.

The ADB also has a Social Protection Strategy (2001) that requires developers, contractors, sub-contractors and suppliers to comply with the ILO core labour standards in its operations (as discussed further in section 17.2.2.8 below).

ADB's Handbook on Poverty and Social Analysis (2007) identifies additional labour standards that reinforce CLS, such as those related to workers with family responsibilities, protection of migrant workers, working hours for young workers, and industrial relations. Other labour standards that complement the CLS and contribute to inclusive social development cover such subjects as occupational health and safety, employment promotion, minimum wages and payment of wages, social security, and labour administration and labour inspections.

ADB's Policy on Gender and Development (GAD) (1998) adopts mainstreaming as a key strategy in promoting gender equity. The GAD Policy aims to mainstream gender considerations into all ADB activities, including macroeconomic and sector work, and lending and technical assistance (TA) operations. The key elements of ADB's policy include gender sensitivity, gender analysis, gender planning, mainstreaming, and agenda setting. The GAD Policy aims to ensure that special design features and strategies are built into projects to facilitate and encourage women's involvement and ensure tangible benefits to women.

Efforts have been made to encourage women's involvement in the Project and the realisation of benefits to women and special livelihood restoration measures for resettlement affected women through the resettlement action plan.

17.2.2.3 EqPs III

As discussed in Chapter 4 of this ESIA, Mongolia is defined as a non-designated country by the EqPs and as such, if an EP commercial bank co-finances the Project, it is necessary to demonstrate compliance with the all the applicable IFC PSs and supporting WB/IFC EHS Guidelines.

17.2.2.4 IFC PSs and EHS Guidelines

A number of IFC PSs are considered to be potentially relevant to this assessment, namely:
- IFC PS1 – Assessment and Management of Environmental and Social Risks and Impacts
- IFC PS2 – Labour and Working Conditions
- IFC PS4 – Community Health, Safety and Security
- IFC PS5 – Land Acquisition and Involuntary Resettlement

As noted above in relation to ADB safeguards, issues related to PS7 on Indigenous Peoples are not applicable.

17.2.2.5 IFC Environment Health and Safety Guidelines

PS2 and PS4 in relation to occupational and community health and safety respectively require reference to be made to the relevant WB/IFC EHS Guidelines. These are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The following EHS Guidelines are considered applicable to the Project:
- General EHS Guidelines (April 2007)
- Thermal Power Plants (December 2008)
- Electric Power Transmission and Distribution (April 2007)

This assessment outlines mitigation measures aimed to ensure compliance with these guidelines in Section 17.6.

17.2.2.6 EBRD Requirements

The EBRD PRs 1, 2, 4 and 5 describe EBRD's social policies applicable to this Project. Their full titles are as follows:

- EBRD PR1 – Environmental and Social Appraisal and Management
- EBRD PR2 – Labour and Working Conditions
- EBRD PR4 – Community Health, Safety and Security
- EBRD PR5 – Involuntary Resettlement and Economic Displacement

The EBRD PRs are very similar in content to the corresponding IFC PSs. As with IFC PS7, EBRD PR7 on Indigenous Peoples has been scoped out as no Indigenous Peoples have been identified in the Project area.

17.2.2.7 JBIC Requirements

Prior to funding a project, JBIC ascertains whether it complies with the relevant aspects of the IFC Performance Standards. Those that are applicable to the Project are discussed earlier in this Section. In addition, where appropriate, JBIC also uses, as reference points or benchmarks, standards established by other international financial institutions, other internationally recognised standards and/or good practices established by developed countries such as Japan regarding environmental and social considerations.

17.2.2.8 International Labour Organisation Conventions

The International Labour Organisation (ILO) of the United Nations is responsible for overseeing compliance with international labour standards ('conventions' that national governments are signatories to). The ILO conventions reflect common values and principles on work-related issues and Member States can choose whether or not to ratify them. The ILO regularly monitors the implementation and the application of the conventions as well as developments in countries generally, whether or not they have chosen to ratify ILO conventions.

Mongolia has been a member of the ILO since 1968 and has ratified the ILO's core labour standards which are comprised of eight conventions:

- Freedom of association and collective bargaining (conventions 87 and 98)
- Elimination of forced and compulsory labour (conventions 29 and 105)
- Elimination of discrimination in respect of employment and occupation (conventions 100 and 111)
- Abolition of child labour (conventions 138 and 182)

Other ILO Conventions related to labour and employment ratified by Mongolia include:

- Occupational Safety and Health Convention
- Minimum Age (Underground Work) Convention
- Workers' Representatives Convention
- Maternity Protection Convention
- Employment Policy Convention
- Tripartite Consultation (International Labour Standards) Convention

17.3 Methodology and assessment criteria

17.3.1 Scope of assessment

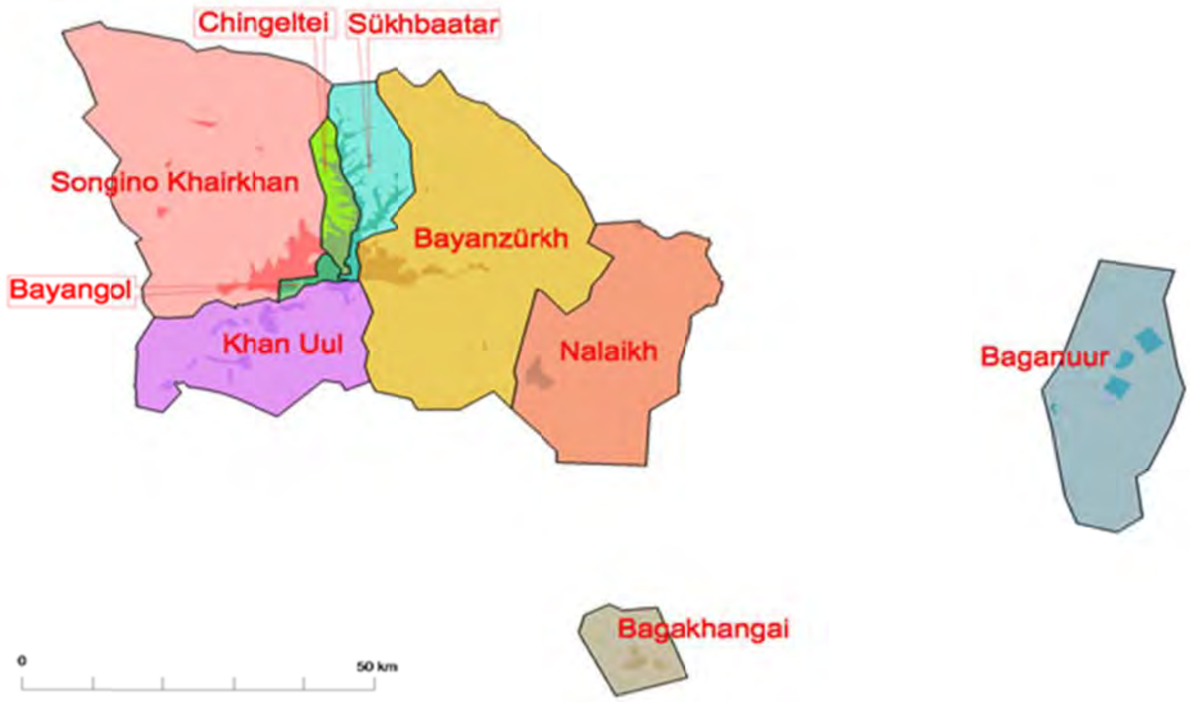
The Project has been assessed by comparing the existing social baseline conditions with the change expected over time as a result of the Project. The temporal scope of assessment includes the following phases of the Project:

- Resettlement and site preparation, expected 2016
- Main construction phase, which is expected to commence in 2016, lasting up to four years
- Operations: expected to commence in 2020
- Decommissioning: the plant is expected to have a lifetime of at least 25 years and an assessment of any works necessary to keep the plant operating will be undertaken at that time.

The social baseline conditions are those assumed to be prevailing immediately prior to the start of resettlement and site preparation.

The spatial scope of the social and community assessment has been defined by geographical and administrative boundaries[34]. Mongolia's is divided into 21 provinces (or aimags) one of which is Ulaanbaatar, which consists of nine districts, the boundaries of which are shown in Figure 17.1.

Figure 17.1: District boundaries of Ulaanbaatar



34 Ulaanbaatar is divided into nine municipal districts and each of these is subdivided into sub-districts (or khoroos).

Source: Ulaanbaatar and Bayanzurkh District statistics book, 2009-13

The Project site is located in the Bayanzurkh district about 20 kilometres south-east of Ulaanbaatar city in the Khuliin Gol Valley, next to the existing main railway. Each district is divided into khoroos (sub-districts) and the project is in Khoroo 11. The Project's impacts have been assessed at three scales and baseline data is presented for each:

- **Wider area of influence (WAI):** consists of the population of Mongolia as a whole.
- **Local area of influence (LAI):** consist of the Ulaanbaatar City, the Bayanzurkh District communities in the sub-district of Khoroo 11.
- **Immediate area of influence (IAI):** this is the site and the neighbouring residences that are expected to be most affected and experience physical displacement and resettlement, as shown in the satellite imagery presented in Chapter 2.

The residential and livelihoods land use of the IAI site is discussed further in baseline section 17.4.3.

17.3.2 Data sources

Information for this assessment has been obtained from a number of secondary data sources including the national DEIA which was initially undertaken in early 2013 and more recent data from the Mongolian National and Ulaanbaatar statistical websites.[35] All sources are referenced in the chapter.

As of October 2015, primary data on the affected communities within the Project's IAI is being obtained through household socioeconomic surveys that are being undertaken of the households that are expected to be displaced by the Project. This will provide sex disaggregated data on all of the baseline topics and this chapter will be updated with this information once it is available and prior to finalisation. This will reflect the reality of those people living without official permits who are not be represented by official statistics.

Further information has been gained through the consultation activities detailed in Chapter 6 and additional consultation data is being collected through the resettlement action and livelihood restoration planning process. This will include focus group discussions with resettlement affected women.

17.3.3 Significance Criteria

The significance of an effect has been determined by the interaction between its magnitude, and the sensitivity of receptors affected. Professional judgement has been used by appropriately qualified social scientists when assigning significance. The use of these two concepts for this assessment is outlined below.

The sensitivity of receptors has been estimated through consideration of their socio-economic vulnerability, measured by their capacity to cope with social impacts that affect their access to or control over additional or alternative social resources of a similar nature, ultimately affecting their wellbeing. Sensitive or

[35] Source: http://ubstat.mn/StatTable

vulnerable receptors are generally considered to have less means to absorb adverse changes, or to replicate beneficial changes to their resource base than non-sensitive or non-vulnerable receptors.

When considering sensitivity the type of resources in question varies between receptors. For example, a community's vulnerability has generally been measured in terms of its resilience to loss of community facilities, whereas an individual's vulnerability has generally been considered in relation to their resilience to deprivation and loss of livelihood assets or opportunities (such as jobs, productive land or natural resources). Impacts that increase impoverishment risks contribute to vulnerability. Impoverishment risks include landlessness, joblessness, homelessness, marginalisation, increased morbidity and mortality, food insecurity, loss of access to common property resources and social disarticulation. Table 17.1 below presents the guideline criteria that have been used to categorise the sensitivity of receptors.

Table 17.1: Sensitivity Criteria

Sensitivity of receptors	Definition
High	An already vulnerable social receptor with very little capacity and means to absorb proposed changes or with very little access to alternative similar sites or services.
Medium	An already vulnerable social receptor with limited capacity and means to absorb proposed changes or with little access to alternative similar sites or services.
Low	A non-vulnerable social receptor with some capacity and means to absorb proposed changes and with some access to alternative similar sites or services.
Negligible	A non- vulnerable social receptor with plentiful capacity and means to absorb proposed changes and with good access to alternative similar sites or services.

Source: Mott MacDonald

The magnitude of an impact has been determined by consideration of the extent to which it results in social receptors gaining or losing access to or control over socio-economic resources resulting in a beneficial or adverse effect on their individual and collective wellbeing. Wellbeing is considered as the financial, physical and emotional conditions and quality of life of people and communities.

For beneficial impacts, the extent to which local wellbeing is likely to be enhanced has been considered. This is in accordance with the international movement in social impact assessment practice towards an increased focus on enhancing long-term development benefits for local communities' sustainability, as opposed to only considering mitigation of adverse effects. As such, the magnitude criteria include consideration of the extent to which benefits are shared with and or realised by local people and communities.

The assessment of magnitude has been undertaken in two steps. Firstly, key social impacts associated with the project and their related beneficial and adverse, direct and indirect, and cumulative effects have been identified. Secondly, the magnitude of impacts and effects have been categorised as either major, moderate, minor or negligible based on consideration of the parameters listed below along with professional judgement:

- Likelihood
- Duration

- Scale – number of people or groups affected
- Spatial extent

Table 17.2 below summarises the typical varying degrees of impact magnitude.

Table 17.2: Magnitude Criteria

Magnitude (beneficial or adverse)	Definition (considers likelihood, duration, number of people affected, spatial extent and local benefit sharing))
Major	A highly likely impact that would have implications beyond the project life affecting the wellbeing of many people across a broad cross-section of the population and affecting various elements of the local communities', or workers', resilience.
Moderate	A likely impact that continues over a number of years throughout the project life and affects the wellbeing of specific groups of people and affecting specific elements of the local communities', or workers', resilience.
Minor	A potential impact that occurs periodically or over the short term throughout the life of the project affecting the wellbeing of a small number of people and with little effect on the local communities', or workers', resilience.
Negligible	A potential impact that is very short lived so that the socio-economic baseline remains largely consistent and there is no detectable effect on the wellbeing of people or the local communities' or workers', resilience.

Source: Mott MacDonald

The relationship between sensitivity and magnitude and how this is used to determine significance of impacts is depicted in the overall significance matrix presented in Section 5.

17.3.4 Assumptions and limitations

The key limitation related to the absence of readily available secondary data for a range of factors, and the obstacles in place to accessing official data. This is will be overcome through the survey activities that are being undertaken to inform the RP that is being prepared for the Project.

17.4 Baseline description

17.4.1 Overview

Below is an analysis of the baseline socioeconomic and community profile consisting of the following sub-sections:

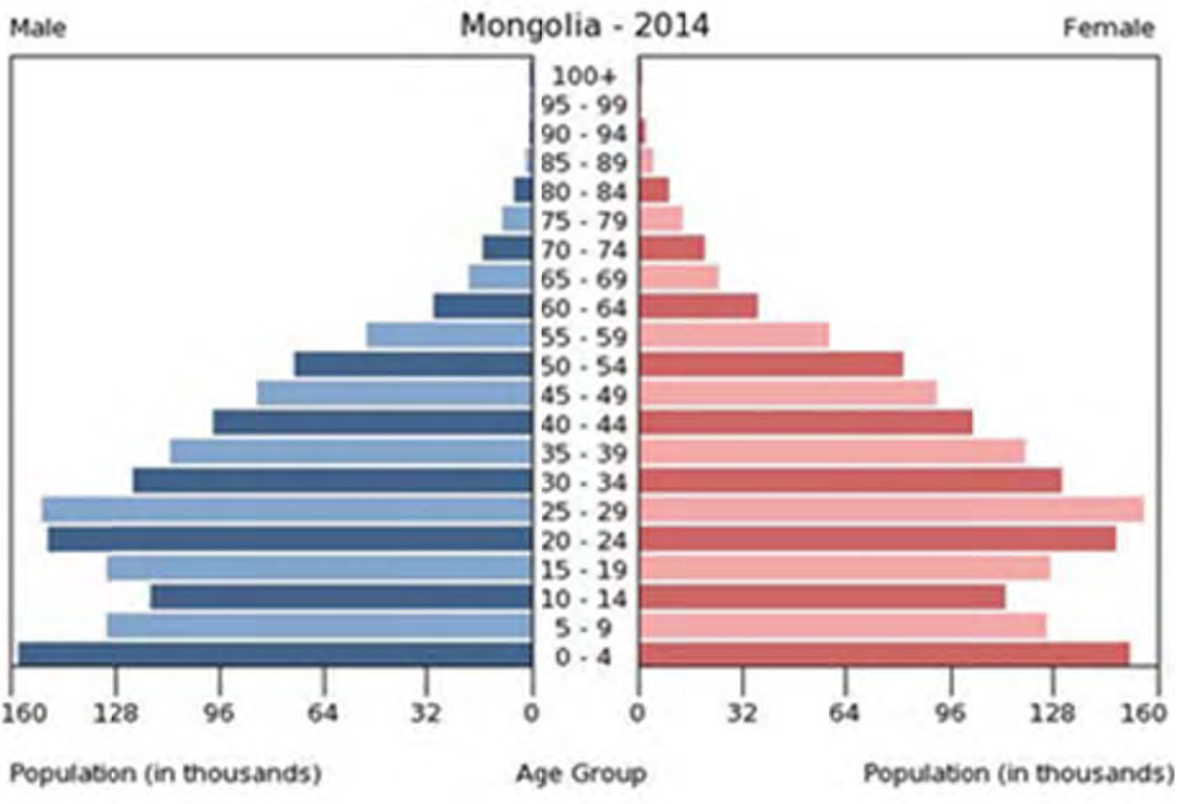
- Demographic profile
- Local residential and community land-use
- Economy, employment, education and skills
- Access to electricity, heating and water
- Health
- Ethnicity, religion and language
- Governance
- Gender relations

- Poverty, deprivation and vulnerable groups

17.4.2 Demographic profile

Mongolia is one of the most sparsely populated countries in the world. Its geographical area of 1,564,116km² is inhabited by a population of 2.95 million (1.8 people/km²)[36]. Mongolia's total population is increasing at an annual rate of 1.37%. Figure 17.2 reflects the age distribution in Mongolia and shows that approximately 30% of national population is below the age of 14, with a very large number in the 0-4 age group. However, National Census 2010 data analysis shows that between 1979 and 2010, the total number of 0-14 age group has reduced from 44.3% to 27.3%, so there is a positive trend. The working aged population (age 15-64) makes up almost all of the rest 69.1% and there are very few people over the age of 65, this group comprising just 4% of the population.

Figure 17.2: Mongolia's population pyramid



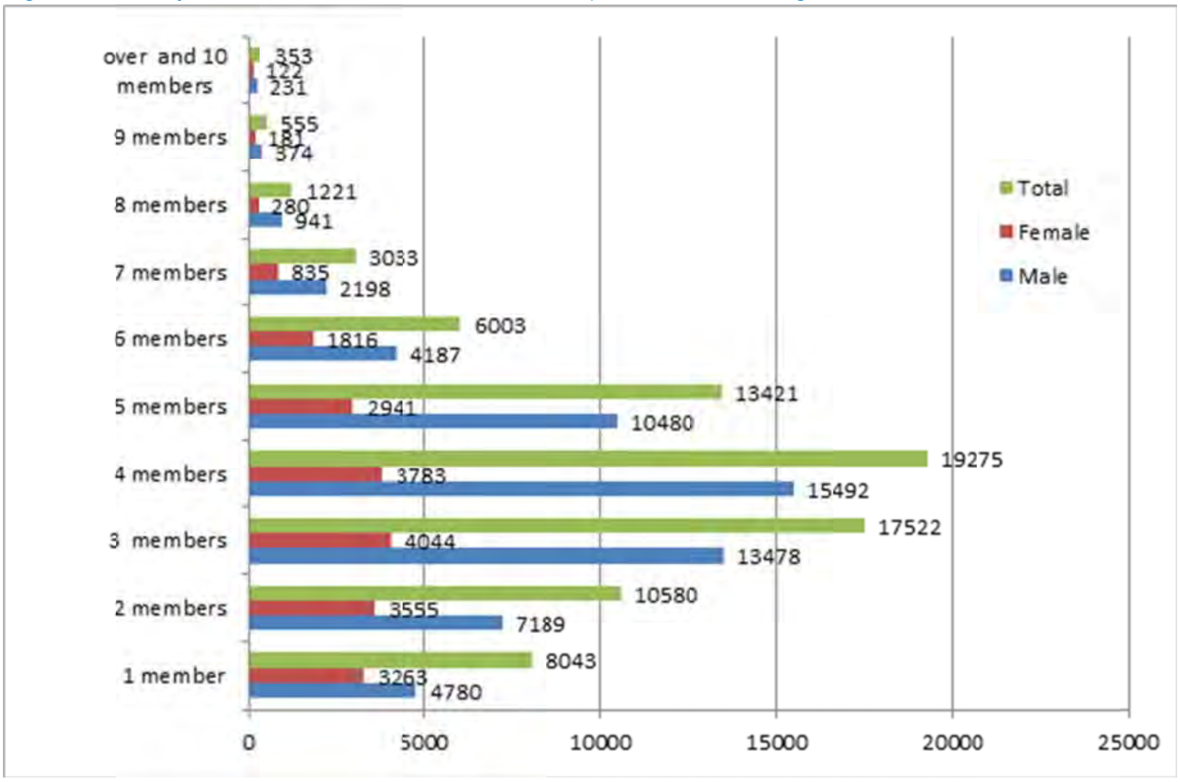
Source: CIA World Factbook

36 UN Data Country Profile, https://data.un.org/CountryProfile.aspx?crName=MONGOLIA, retrieved February 2015 and CIA World Factbook, https://www.cia.gov/library/publications/the-world-factbook/geos/mg.html, retrieved February 2015

The majority of the population lives in urban areas (68.5%) while 40% of the total population lives in Ulaanbaatar (1.18m), the capital of Mongolia, the proposed location of the Project and the wider area of influence of the social impact assessment. The overall rate of urbanisation in Mongolia is 2.81% (annual rate of change)[37]. Rural to urban migration is primarily undertaken by nomads who have found it more and more challenging to lead traditional lifestyles. As a result of this rapid urbanisation there has been an increase in informal ger[38] settlements across Ulaanbaatar. Approximately 25% of Ulaanbaatar's population resides in gers and these communities make up 45.1% of Ulaanbaatar's poor households.

The Bayanzurkh District where the Project site is located is the largest and most populated of the districts in Ulaanbaatar covering an area of 1,244 sq. km and having 304,300 residents (24.8%). the average household size in Bayanzurkh District is between three and four persons and the majority of households have male heads as shown in Figure 17.3.

Figure 17.3: Bayanzurkh District: number of members per household and gender of household head, 2013



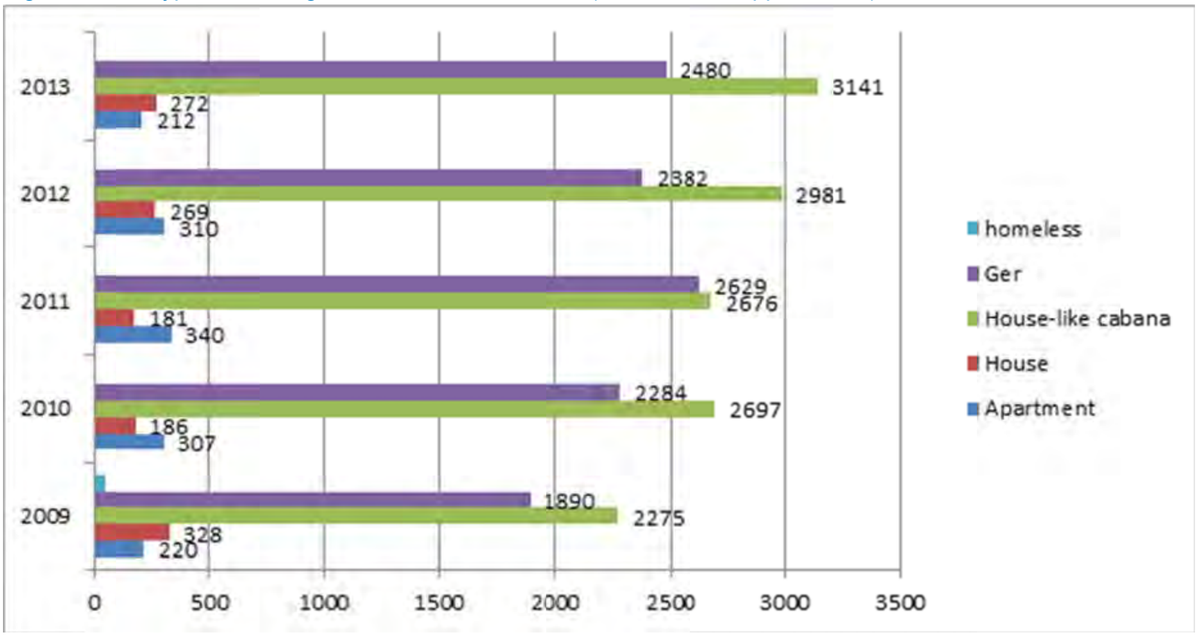
Source: Ulaanbaatar and Bayanzurkh District statistics book, 2009-13

37 CIA World Factbook, https://www.cia.gov/library/publications/the-world-factbook/geos/mg.html, retrieved February 2015

38 Ger – the traditional, circular Mongolian house can be assembled in a matter of hours from wooden frames, felt insulation, and exterior cloth. Ger settlement refers to parts of Ulaanbaatar where many households continue to live in gers. In these areas, poverty incidence is high and access to urban services is limited (UNDP Humand Development Report, 2011).

Khoroo 11, the local area of influence, has one of the lowest populations in the Bayanzurkh District at 6,113 persons. The population of Khoroo 11 increased from 4,761 in 2009 to 6,113 in 2013. During the same period, the number of households increased from 1,294 and 1,980. The average household size in the Khoroo is 3.1 persons. The gender ratio is 48.8% male and 51.1% female. The age structure in Khoroo 11 broadly reflects the national age structure. Most people in Khoroo 11, approximately 3,141, live in a House-like cabana whilst 2,480 live in gers. The change in types of housing over five years is shown in Figure 17.4 below which shows that the number of homeless people has been decreasing, but the number of people living in Gers – some of the most vulnerable community members – has been increasing.

Figure 17.4: Type of housing in Khoroo 11 2009-2013 (numbers are approximate)



Source: Ulaanbaatar and Bayanzurkh District statistics book, 2009-13

17.4.3 Local residential and community land-use

The site comprising the Project's immediate area of influence (IAI) was owned by the GoM prior it was transferred to the Ministry of Energy for the purposes of the Project. Prior to the site being allocated for use by the Project, at least part of it was used by residential property developers Lux Property to construct the 'Happy Valley Complex' on a plot of land adjacent to, and partly overlapping with, the site. A number of housing blocks of the 'Happy Valley Complex' were under construction (outside the site boundaries) but development has now ceased as the Government is in the process of revoking the land rights of Lux Property. None of the housing blocks were inhabited and the issue is not considered to fall under the involuntary resettlement standards that the Project is following; hence it is not addressed within this assessment.

The IAI is currently used both permanently and seasonally as residential land (as shown in Figure 17.5 and Figure 17.6 below) and contains approximately 35 households. The residences within the IAI can be broadly divided into categories of those who currently live on the boundary of the proposed site, and those that live nearby and as such are likely to also be significantly affected. These people have then been further divided into four categories as detailed in Table 17.3 below, and the locations of each are shown on Figure 2.2.

Figure 17.5: Permanent structure within the IAI

Source: Mott MacDonald

Figure 17.6: Ger home of seasonal users within the IAI

Source: Mott MacDonald

Table 17.3: Overview of site and immediate area of influence residences

Location	Category of site and neighbouring residences	Estimated number of affected households	Details
On site	Site boundary residences	6	Two of these households are understood to have legal land titles whereas the others two are untitled residents. Only one of the households is understood to be currently residing on the site.
Off site	'Site neighbouring residences'	25-30	Immediately adjacent the western border of the site. The majority are residences but it is thought that there are at least two businesses that will need to relocate also[39]
	'Laydown area residences'	5	The proposed location is to the north of the site across the Bagakhangai – Nalaikh Road, therefore not immediately adjacent to the Project site.
	'Potential Borrow' pit neighbouring residences	Unknown	The exact location for the borrow pit is currently unknown. One of the site selection criteria recommended as part of this ESIA is to avoid locations that has nearby social receptors.
	Ash disposal site	0	No households have been identified on the

[39] To be verified through the household surveys in progress in October 2015 to inform the resettlement action plan being produced for the Project.

Location	Category of site and neighbouring residences	Estimated number of affected households	Details
			proposed site.
	Total:	35-40 residence	

Local people use the IAI to graze horses and cattle, for collection of water from the river and for access to a road leading south west away from the Project site and through the protected area which borders the site (see Figure 17.7 and Figure 17.8). They also use the area to collect cattle dung (left by the seasonal herders – as discussed below – and other cattle holders) which is used for household fuel.

Figure 17.7: Cattle grazing on the Project site

Source: Mott MacDonald, August 2014

Figure 17.8: Local woman collecting water from Project site

Source: Mott MacDonald, August 2014

It is understood that four families of seasonal migratory herders were using the site in the summer of 2015[40] for grazing cattle. These families are new to the area and the summer of 2015 was the first time that most of them had used this area, and the longest that the other families had been coming was for the last two years. They are attracted to the site because of the abundant water supply. It is understood that these families have permanent residences in other areas of Ulaanbaatar and they spend the winter in these areas.

The precise nature of the site land use and the contribution it makes to the livelihoods or permanent residents and seasonal herders is being determined through the Resettlement surveys which are in progress as of October 2015.

[40] As determined through Resettlement Plan household surveys undertaken in June 2015

17.4.4 Economy, employment, education and skills

Mongolia is a lower middle income country that has become one of the fastest growing countries in the world. GDP growth which is estimated at 11.8% is sixth fastest in the world.[37] This growth has primarily been driven through development of mineral resources such as copper, gold and coal. Although Ulaanbaatar accounts for 40% of the country's population it only makes up 34.9% of total employees and accounts for 62.7% of total GDP. Between 2007 and 2010, Ulaanbaatar's GDP grew at a slightly faster rate than that of Mongolia as a whole even though the total number of employees decreased. These indicators imply that labour productivity in Ulaanbaatar has been increasing at a faster rate than nationally.[41] Rates of unemployment in Ulaanbaatar generally decreased between 2009 and 2012 however the labour force participation rate remained largely the same, ranging from 52.8% to 53.9% as shown in Table 17.4 below.

Table 17.4: Employment and unemployment in Ulaanbaatar, 2009-2013

Indicators	2009	2010	2011	2012
Labour Force Participation Rate	52.9%	52.8%	53.9%	53.5%
Rate of employment	86.0%	91.3%	94.4%	92.9%
Rate of unemployment	14.0%	8.7%	5.6%	7.1%

Source: Ulaanbaatar and Bayanzurkh District statistics book, 2009-13

Average monthly incomes in Ulaanbaatar have been increasing rapidly in recent years as shown in Table 17.5, more than doubling in the period between 2008 and 2012. As of 2012, the average total family income consisted of salary (54.3%), pensions/allowances (17.3%), household businesses (15.3%), other monetary income (9.5%), money/goods received from others (3.2%) and subsistence farming (0.3%). The average monthly expenditure has also increased rapidly, matching incomes.

Table 17.5: Average monthly income and expenditure per household in Ulaanbaatar

Types of income	2008	2009	2010	2011	2012
Average income per household	425,327	487,093	529,302	697,554	983,912
1. Monetary income -Total	416,015	475,803	514,069	676,393	948,855
a. Wages and salaries	255,089	292,858	325,901	428,609	534,713
b. Pensions and allowances	68,761	74,915	70,061	122,679	169,977
c. Income from household businesses	53,068	66,051	62,059	63,841	150,483
d. Other	39,097	41,979	56,048	61,264	93,682
2. Received from others	8,962	11,187	13,895	19,724	31,699
3. Foodstuff, which consumed from private farm or enterprise	350	103	1,338	1,437	3,358
National average income per household	363,594	402,525	448,027	573,541	819,996
Difference of National and Ulaanbaatar	61,733	84,568	81,275	124,013	163,915

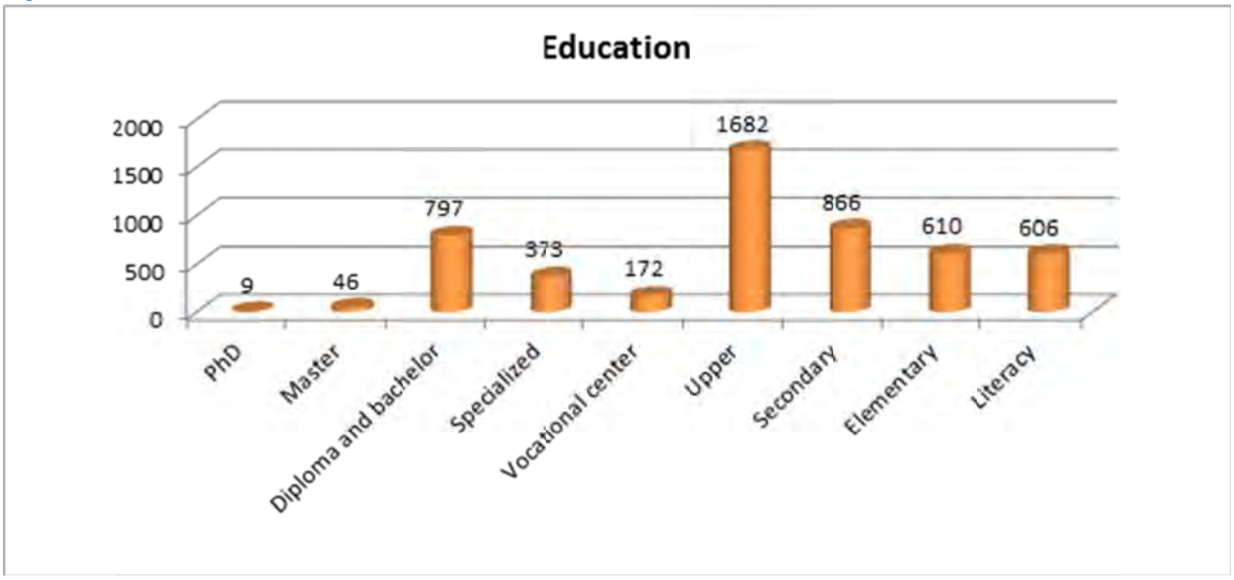
41 United Nations Development Program Mongolia Human Development Report 2011 (UNDP HDR, 2011).

Types of income	2008	2009	2010	2011	2012
average income per household					
Expenditure	**2008**	**2009**	**2010**	**2011**	**2012**
Average expenditure per household	464,134	499,212	534,882	672,535	957,902

Source: Ulaanbaatar and Bayanzurkh District statistics book, 2009-13

Partly as a consequence of the socialist period, formal educational levels in Mongolia are high: 97.4% of the population aged 15 and over is literate (96.8% amongst men and 97.9% amongst women) and the number of years of education a child can expect to receive is 15 years (14 years for males and 16 for females)[37]. Educational attainment in Khoroo 11 is shown in Figure 17.9 below. Secondary school number 88 and elementary school number 62 are located approximately 4.5 km from the Project site.

Figure 17.9: Educational attainment in Khoroo 11, 2011



Source: Ulaanbaatar and Bayanzurkh District statistics book, 2009-13

17.4.5 Access to electricity, heating and water

Coal-fired power plants provide the majority of power generation for Mongolia. There are seven main coal-fired power plants in Mongolia with a total installed capacity of 836.3MW; however, the actual available power capacity is only 615MW. Mongolia's daily peak electricity demand was 695MW back in 2009, but as of 2015 it is only able to produce and maintain only 615 MW so there is a shortfall of approximately 80 MW on a daily basis during peak season. The CES electricity grid reaches approximately 79% of the population and covers 60% of the country, including Ulaanbaatar and the surrounding 14 aimags. The power supply of Ulaanbaatar is managed by centralised and non-centralised power systems. It is recorded that there are approximately 3,300 (1.1%) households without electricity and that this number as a proportion of the City's total population is decreasing.

Approximately 55% of households are connected to Ulaanbaatar's central heating system provided primarily by CHP plants, although this percentage is decreasing as the population grows. It is estimated that an additional heating demand of 970 Gcal/hr is needed for Ulaanbaatar by 2020. The result of the heating shortage is that the percentage of households heating their own premises using coal fired stoves is increasing. On the periphery of the City in the ger districts there are estimated to be between 80,000 and 100,000 households using individual stoves for heating and cooking. The households in the ger districts consume approximately 0.4 million tons of coal per year. This results in significant localised air pollution and health problems as discussed further in section 17.4.6 below.

In urban areas of Mongolia 94.8% of the population benefits from an improved drinking water source whereas in rural areas the percentage is lower at 61.2%. Approximately 65.3% of the urban population has improved sanitation facilities compared with 35.4% of the rural population[42].

17.4.6 Health

Life expectancy in Mongolia is improving but still remains relatively low at 68.98 years and there is a disparity between life expectancy for males which is 64.72 years and for females which is 73.45 years37. The main causes of mortality in Mongolia are non-communicable diseases such as cardiovascular diseases and cancers and external causes (injuries and poisonings). Respiratory and digestive system diseases are primary causes of morbidity, along with external causes in urban areas, and urinary tract diseases in rural settings[43]. Mongolia has the fourth highest number of deaths of children under five caused by outdoor air pollution at 19 per 100,000[44].

Health conditions resulting from air pollution a major issue in Ulaanbaatar, particularly in the winter due to pollution from outdated combined CHP plants, HOB boilers and household stoves burning coal, and in the spring from sandstorms.

National expenditure on healthcare is 5.3% of GDP, ranked at 129th in the world. In general, Ulaanbaatar is better served than other areas of Mongolia in terms of health services and more than half of Mongolia's physicians are in Ulaanbaatar (4,565/7,497).The main health centre of Bayanzurkh District is located in Microdistrict 15 of Khoroo 7 which 15.6 km away from the Project site.

17.4.7 Ethnicity, religion and language

Mongolia is a largely homogenous country in terms of ethnic groups with the majority of its residents belonging to the Mongol (mostly Khalkha) ethnic group (81.9%) followed by Kazakhs as the second most populous ethnic group (3.8%) and then Dorvod (also called Durbet) 2.7%37. Despite this homogeneity the

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42 An improved drinking water source is defined as a type of drinking water facility or water delivery point where the drinking water source is protected from external contamination. An improved sanitation facility is defined as one that hygienically separates human excreta from human contact. Data from CIA World Factbook.

43 Health Service Delivery Profile Mongolia 2012, http://www.wpro.who.int/health_services/service_delivery_profile_mongolia.pdf, retrieved February 2015

44 UNDP Human Development Report 2014, http://hdr.undp.org/en/data, retrieved February 2015

government recognised 29 separate ethnic groups in Census 2010, up from 27 in Census 2000. The Kazakh speaking Muslim minority are concentrated mainly in the northwest corner of Mongolia in the province of Bayan-Olgiy. The Dorvod/Durbet are primarily located in western Mongolia near the Russian border. Many of the Dorvod/Durbet are nomads who move their horses, cattle and sheep around with the seasons but some have become settled farmers. The Dorvod/Durbet, Bayad, Buryat and Dariganga Mongols have distinct cultures and languages or dialects.

In addition to the Kazakhs there are some other small groups of Turkic-speaking minorities in the western and northern parts of Mongolia such as the Uyghurs, Uzbeks, Tuvinians, Urianhais and Hotons. Mongolia's smallest minorities are the indigenous Tuvinian-speaking Tsaatan (also known as Dukha) reindeer herders, numbering 200, who reside in northern Mongolia in the Sayan Mountains around Lake Hovsgol and the Tungusic-speaking Evenk people, also known as Hamnigan Buryats or Khamnigan, numbering approximately 500 people.

Ethnicity of project affected people in the immediate area of influence is being determined through ongoing resettlement related surveys but scoping activity to date along with feedback from initial consultations indicate that no vulnerable ethnic minority groups will be adversely or beneficially affected. Field research findings to date show the intermittent presence of one herder family that has used the area for two months only over two consecutive years but its members do not possess a distinct language, nor practice distinct customs or hold collective attachment to the land. More data on the ethnicity of the people within the IAI will be available following the completion of the socioeconomic surveys that are in progress in October 2015.

Just over half (53.%) of Mongolians practice Buddhism, 38.6% have state that they have no religion, 3% are Muslim, 2.2% Christian, 2.9% Shamanist and 0.4% are 'other' religions37. The official and most widely spoken language is Mongol (90%). Other languages spoken across the country, but primarily in the west, are Kazakh, Turkic and Russia. English is taught in secondary schools and is likely to become the country's second most spoken language. The main language spoken in Bayanzurkh District and Khoroo 11 is Khalka Mongol.

17.4.8 Governance

Mongolia is a parliamentary republic with a directly elected president. The deputies in the national assembly, the State Great Khural, are also voted for by the people. The State Great Khural chooses the prime minister who in turn selects the cabinet in collaboration with the president. The first Ulaanbaatar City council, known as the Temporary Hural and comprised of 45 members, was elected in 1924. Afterwards, the city council was renamed several times and finally named the present-day Ulaanbaatar Citizens' Representatives Hural in 1992. In 1989, the city council of Ulaanbaatar was separated from the executive government. The current Ulaanbaatar Citizens' Representatives Hural (City Council) consists of 45 members, 11 members of the Presidium, the chairperson, the secretary, and the staff members of the office. Each Khoroo has its own Governor, Chairman of Citizens' Representative, Office Manager, Social Manager, Social Welfare Office and Registration Officer.

17.4.9 Gender relations

As noted by the ADB. 2010 Mongolia: Country Gender Assessment, the gender dimensions of development in Mongolia are complex. In general, performance against several key Millennium Development Goal (MDG) indicators has improved. Notably, Mongolia has already reached the targets for MDG 4 on child mortality and one of the targets for MDG 5 on maternal health. However, there has been regression in some other targets, such as the proportion of seats held by women in the national parliament.

Despite solid economic growth, women remain at a disadvantage in the formal labour market. While the share of women working in the non-agriculture sector rose slightly from 51.1% in 2003 to 53.0% in 2007, wage gaps persist despite women's higher educational levels. Women's skills do not adequately match the requirements of the workplace. Moreover, National Statistical Office (NSO) data shows that female unemployment in 2008 was 37.7% higher than that of males, a significant surge from 18% higher in 2004.

The Parliament of Mongolia approved the Law on the Promotion of Gender Equality in February 2011, a decade after the concept of the law was first initiated. The law provides a legal definition for concepts such as gender equality, gender stereotypes, gender discrimination, sexual harassment, gender-based violence, and the rationale for gender quotas. It guarantees equal rights for men and women in employment and a minimum quota for the civil service, prevention of sexual harassment in the workplace, monitoring measures to ensure that employers report on the implementation of the law. Under the law, the value of unpaid labour in household work, family business, child-care, or care for elderly, shall be considered as his or her contribution to social wealth and the family economy. The proposed 30% quota for women as candidates for Parliament and local elections and the composition of election committee members was removed from the original draft of the law. Low numbers of women's representation in local and national politics is one of the main reasons Mongolia will fall well behind the majority of countries in the world in achieving this MDG target." The quota will be further discussed as a part of the proposed amendment to the Election Law.

There have been a number of positive regulatory and judicial steps towards combating gender-based violence. However, domestic violence remains prevalent, with only 40 domestic violence cases prosecuted since the adoption of the Law on Domestic Violence. Other than assistance provided by women's nongovernment organizations, there is very little support for female victims of domestic violence. Sound efforts have been made to improve women's health resulting in the attainment of the MDG target for maternal mortality (per 100,000 live births), which dropped to from 109.5 in 2002 to 45.5 in 2010. Mongolia is on track to achieve MDG targets for the reduction of infant and child mortality. However, there is a limited availability of good quality health care services, especially in rural areas. Women in low-income brackets are most likely to die from birth and pregnancy-related complications. At the same time, health problems caused by urban air pollution, poor nutrition and food safety are increasing. It will be important to ensure women's involvement in design and implementation of development activities through active engagement of women's grassroots associations and groups. As seen in several of the Japan Fund for Poverty Reduction pilot programs, women can be fundamental agents of change to improve environmental conditions.

Considerable progress has been registered in overcoming gender disparities in the education system. From 2001-2010 gender disparity improved in education: the girl:boy ratio in primary education of 1.01 in 2000 dropped to 0.97 in 2008, and the ratio in secondary education dropped from 1.2 to 1.08 over the same period. However, poverty continues to keep more boys out of school than girls, particularly in rural areas, due to an increase in direct costs of education and more opportunities for boys to enter the informal economy or artisanal mining, which also raises concerns about child labour.[45]

Within the Local Area of Influence, the gender dimension of poverty trends is reflected in relation to the increasing numbers of female headed households within the Bayanzurk district, as discussed in more detail in 17.4.10 below. Additional primary sex disaggregated data on the locally affected communities is being obtained in October 2015 through the household surveys that are being undertaken to inform the resettlement planning that is being carried out for the Project. This will also include focus group discussions with resettlement affected women. This baseline section will be updated with this data and further analysis of local gender relations once available.

17.4.10 Poverty and vulnerable groups

When considering poverty in Mongolia as a whole, the ADB's Country Partnership Strategy: Mongolia 2012–2016[46] notes that although a decade of strong economic growth has substantially boosted average incomes, a large segment of Mongolia's population continues to live below the poverty line. An estimated 39.3% of the population is living below the poverty line in 2010, with nomadic families, households headed by women, and recent urban migrants registering a high poverty incidence. Inequality is severe between the urban and rural areas, especially in the western part of Mongolia. This is reflected in poor and unequal quality access to basic social services in underserved suburban and rural areas, as well as unequal access to information, decent urban housing, and infrastructure. Inequality is rising over time, with the Gini coefficient increasing from 0.33 in 2002–2003 to 0.36 in 2007–2008. Over time, poverty incidence has fallen more rapidly in urban areas than in rural areas. Interpreting income poverty figures is complicated by the large degree of economic informality and the strong incentives that households have to underestimate income and expenditures.

Good progress has been made in reducing non-income poverty:

- Maternal and infant mortality rates have steadily fallen since 1990
- There is near universal literacy
- Primary and secondary school gross enrolment is over 90% of the required cohort

Mongolia is well on-track to meet most of its Millennium Development Goal commitments, although the growth slowdown in 2009 and the 2010 dzud have resulted in job and livestock losses and cutbacks in spending on infrastructure and social services.

[45] This summary is based on ADB. 2010. Mongolia: Country Gender Assessment. Ulaanbaatar.

[46] The summary there is based on Richard Marshall et al. 2009. Mongolia Country Poverty Assessment. Ulaanbaatar; and World Bank. 2009. Poverty Profile in Mongolia. Washington, DC.

The 2006 participatory poverty assessment identified a number of factors that contribute to poverty and vulnerability. These included high prices of basic staples, lack of access to credit, remoteness, and limited access to clean water, transport, power, and markets. The key causes of poverty included loss of livestock due to severe weather, illness-related financial stress, and natural or economic disasters. Other factors that were identified as contributing to poverty include a poor work ethic and alcoholism. The most vulnerable are perceived to be those who have lost all assets, the disabled, the elderly, orphans, the homeless, and single-parent households. According to the 2009 participatory poverty assessment update, the major factors contributing to poverty are debt and the lack of education, employment, social networks for assistance, and registration for migrants.

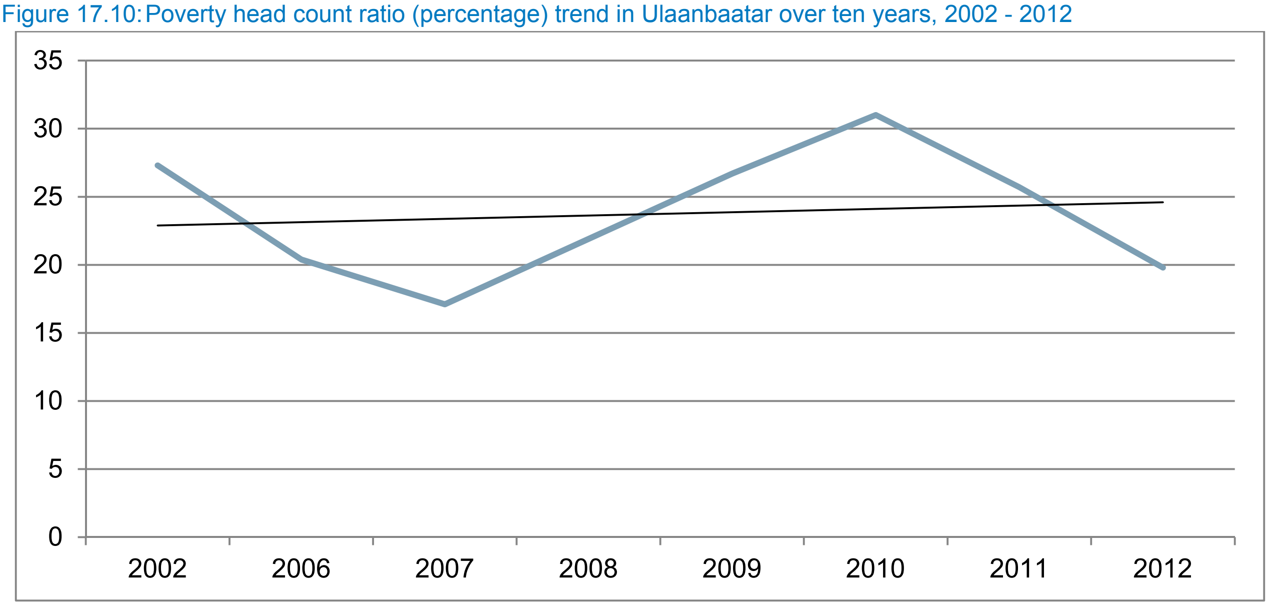
When considering the LAI, Table 17.6 and Figure 17.10 below show that over the ten years between 2002 and 2012 poverty in Ulaanbaatar fluctuated. In 2012 the poverty headcount ratio was 19.9 percent, 7.5 percent lower than in 2002. However it had previously increased to 31 percent in 2010 and over that ten year period as a whole here is a slight linear growth trend, as shown by the line in Figure 17.10.

Table 17.6: Poverty trends in Ulaanbaatar over ten years, 2002 - 2012

	2002	2006	2007	2008	2009	2010	2011	2012
Poverty headcount ratio (percent)	27.3	20.4	17.1	21.9	26.7	31	25.7	19.8
Poverty gap ratio (percent)	8.1	5.1	4.6	6.3	6.4	8.5	6.6	5.2
Share of poorest quintile in national consumption	7.3	6.3	6.4	6.8	0	7.8	7.6	7.3

Source: Ulaanbaatar Statistics website 2015: http://ubstat.mn/StatTable=36

Figure 17.10: Poverty head count ratio (percentage) trend in Ulaanbaatar over ten years, 2002 - 2012



Source: Ulaanbaatar Statistics website 2015: http://ubstat.mn/StatTable=

Within Ulaanbaatar, there are concentrations of the most vulnerable people - the asset-less, the disabled, the elderly, female headed-parent households and recent economic migrants – in pockets around the outskirts of the city. One such area is the Bayanzurkh district where the project is located. In relation to female headed households, this concentration has become more pronounced over the past 20 years. This is exemplified by the fact that between 1992 and 1994, out of the total number of single women with children under 16 in Ulaanbaatar, the Bayanzurkh district increased its share from 18.3% to 29.1% when compared to other districts in the city, as shown in Table 17.7 below.

Table 17.7: Number of single women with children under 16 in Ulaanbaatar district and as a whole

District	1992		2002		2012		2013		2014	
	No.	%	No.	%	No.	%	No.	%	No.	%
Baganuur	84	1.1%	1,112	7.1%	343	2.5%	344	2.6%	432	3.4%
Bagakhangai	19	0.2%	99	0.6%	83	0.6%	84	0.6%	100	0.8%
Bayangol	1,378	17.8%	2,420	15.5%	1,317	9.8%	913	7.0%	790	6.1%
Bayanzurkh	**1,418**	**18.3%**	**2,693**	**17.3%**	**3,787**	**28.0%**	**4,075**	**31.3%**	**3,745**	**29.1%**
Nalaikh	194	2.5%	702	4.5%	326	2.4%	508	3.9%	432	3.4%
Songinokhairkhan	1,998	25.8%	2,736	17.5%	2,072	15.3%	2,574	19.8%	2,701	21.0%
Sukhbaatar	1,104	14.3%	1,690	10.8%	1,426	10.6%	1,374	10.5%	1,542	12.0%
Khan-Uul	857	11.1%	1,970	12.6%	2,037	15.1%	1,620	12.4%	1,277	9.9%
Chingeltei	686	8.9%	2,170	13.9%	2,111	15.6%	1,533	11.8%	1,839	14.3%
Ulaanbaatar	7,738	100.0%	15,592	100.0%	13,502	100.0%	13,025	100.0%	12,858	100.0%

Source: Ulaanbaatar Statistics website 2015: http://ubstat.mn/

During October 2015 primary data on the vulnerability and poverty incidence of Khoroo 11 within the local and immediate areas of influence of the Project is being collected through the household socioeconomic surveys that re being undertaken as part of the resettlement planning process. This baseline section will be updated with this information once available.

17.5 Assessment of project impacts and risks

17.5.1 Overview

This section identifies and assesses the construction and operational phase significant impacts for the construction and operational phases of the Project. Significant impacts have been identified in relation to land acquisition and resettlement, employment generation and the benefits of the contribution to electricity and district heating supply. Potential project-risks are also discussed in relation to occupational and community health, safety and security, labour rights, and population influx. As detailed earlier in section 17.1.1, the various environmental impacts (air quality, noise, dust, traffic) from construction impacts are assessed in their respective chapters and are not covered here also to avoid double counting of impacts.

17.5.2 Construction phase impacts

17.5.2.1 Land acquisition and resettlement

The Project will result in physical and economic displacement[47] impacts on local people residing in and using land in the project's immediate area of influence (IAI). Specifically, the site neighbouring and site boundary residents identified in baseline section 17.4.3 will be physically displaced and required to permanently relocate. It is thought that this is approximately 30 households and businesses, but the exact number will be determined through the household detailed measurement (DMS) and socioeconomic surveys that are in progress in October 2015 to inform the resettlement planning (RP) process. The surveys and consultation activities are being used to gather quantitative and qualitative data about the vulnerability of the affected people and the magnitude of losses and livelihood impacts they may face (the RP is discussed further in section 17.6.1). The assessment below is preliminary and qualitative and will be updated once the surveys are complete.

The most vulnerable and sensitive of the resettlement affected households will be those below the poverty line, female headed households, the elderly and disabled. These households will be entitled to a vulnerability allowance as part of the RP compensation entitlements.

At least two businesses are known to be currently operating within the site neighbouring residences. The RP surveys will also identify the number and nature of other commercial or business structures affected by the Project; therefore losing their income generating abilities. The income and number of employees of these businesses will be determined when quantifying impacts related to loss of earning.

Consideration has been given to the economic displacement impacts related to potential loss of access to priority ecosystem services used by local people on a subsistence and monetary basis, namely: agricultural grazing land used by seasonal herders, and riverine resources used by local people as water for drinking and other domestic purposes. The assessment approach used is based on the World Resources Institute's guidance[48] according to criteria considered in Table 17.8 below.

Table 17.8: Assessment of identified priority ecosystem services assessment

Identification criteria	Agricultural services: grazing land	Riverine services: water fish,
1) *Whether the Project will change the quality or quantity of the service?*	Yes, it is thought that some grazing land informally used local residents and communities will be used for the project. This land also provides a free fuel source to some households in form of dung.	A section of the Khuliin river that is currently used by local people for part of the year to collect water for domestic purposes including drinking water will be closed during construction. Socio-economic surveys undertaken by Mott MacDonald in June / July

[47] Physical displacement can be considered as relocation or loss of shelter, and economic displacement as loss of assets or access to assets that leads to loss of income sources or other means of livelihood, and/or restrictions on land use.

[48] 'Weaving Ecosystem Services into Impact Assessment', World Resources Institute, October 2013

Identification criteria	Agricultural services: grazing land	Riverine services: water fish,
		2015 identified that the nearby communities did not use the Khuliin River for fishing due to the ephemernal nature of the watercourse i.e. the lack of summer flows and permanent surface water.
2) *If yes, whether the change will affect users significantly, for example by tipping it over a threshold or making demand outstrip supply, or changing perceptions about availability?*	No. Only a relatively small amount of land will be affected and there is alternative land of the same quality nearby. Alternative land will be provided through the RP that is being developed as part of the Project	The impact on users is not thought to be significant as there are alternative access points that local people can use, and no one is understood to depend on the river for their livelihood. The users will be relocated to a resettlement site with the same or improved access to drinking water
3) *If yes, is the service important for livelihoods?*	NA	NA
Priority ecosystem service significantly adversely affected?	**No**	**No**
4) *If yes, are affordable and viable alternatives available to mitigate the losses?*	NA	NA

Source: Mott MacDonald

In conclusion, no priority ecosystem services used to support people's livelihoods are thought to be significantly adversely affected. This will be verified following the completion of the socioeconomic surveys that are in progress in October 2015.

The resettlement affected people are considered to have high sensitivity due to the levels of poverty in the area, and the secondary data suggest that some of the affected households may be female headed, and therefore more vulnerable. This will be verified by the socioeconomic surveys in progress in October 2015. Despite the high sensitivity, displacement is likely to directly affect relatively few people (the ADB defines this as less than 200 people) and impacts are not expected to be highly complex. Also the government has some capacity to manage land acquisition and resettlement. As such, the magnitude of impact is considered to be minor, meaning this is an adverse impact of moderate magnitude, and is therefore considered significant, but it can and will be mitigated through the RP process being followed, as discussed further in section 17.6.1.

17.5.2.2 Construction phase short term employment generation

Temporary employment generation will result from the construction of the project components and associated facilities. Construction phase employment is expected to peak at approximately 3,100 workers at the 26th month of the Project, expected in early 2018. Most of the job opportunities will be skilled and managerial roles, and due to the lack of skills in the local labour pool, the majority of these will go to foreign workers, primarily from China where the EPC contractor originates from. The EPC contractor estimates that approximately 550 jobs (approximately 20%) will be provided for unskilled workers at peak construction and the intention is that majority of these will go to local workers. Unskilled jobs will include labourers and the provision of services for workers such as food and refreshments, cleaning of accommodation, sanitation and hygiene.

A key social effect will be the provision of an income source for workers and their families contributing to their wellbeing and enhancing their quality of life. Whereas migrant workers will tend to send remittances to their families thereby injecting money into other localities, the local jobs will contribute to poverty reduction. This is particularly the case if potentially vulnerable local people are employed, such as those displaced by the Project. Although the construction jobs will be temporary, the skills and experience gained will benefit future job prospects as workers are likely to develop new and or enhance existing skills. Construction activities will provide temporary but greater livelihood security. Indirect socio-economic benefits will result from workers earnings being spent on local goods and services.

Local jobseekers are considered to have high sensitivity due to the poverty levels and high demand for employment. The magnitude of the magnitude is considered to be minor due to the relatively low number of jobs that will be available to local workers and the temporary nature of the impact. As such, construction phase employment is considered to be **moderate beneficial**, and therefore significant.

17.5.3 Operational phase impacts

17.5.3.1 Employment generation

The operational phase is expected to generate fewer direct employment opportunities than the construction phase with the number of skilled jobs to perform maintenance and operation of the power station estimated at approximately 340. Some roles such as office staff may be performed by the same personnel as in the construction phase, so the actual number of new jobs created may be slightly lower. These will be mainly permanent jobs and approximately 330 of the roles are expected to be filled by Mongolians with only 10 expatriates expected. Many of the positions will be skilled roles and it is not known at this stage how many will be available to local community members with limited skills sets.

The majority of the job seekers that will benefit are likely to have some existing skills and therefore more livelihood opportunities than the construction workforce. However, their sensitivity is not low because most of them are Mongolian, and there is a shortage of job opportunities in the country. As such, the potential operational workers are considered to have medium sensitivity. The impact magnitude is considered to be minor due to the relatively low number of jobs, but this magnitude may be increased if workers are given the opportunity to acquire and develop new skills through the skills development component of the local content strategy, as discussed in section 17.6.3. According to these categorisations, the impact of operational employment – without the application of skills development activities - is considered to be a **minor beneficial** impact, and therefore not significant.

17.5.3.2 Contribution to electricity and district heating supply

The Project will be capable of generating 463.5MW gross of electricity in condensing mode through 3 x 154.5MWe generation units or whilst operating in combined heat and power mode, 587MW of thermal energy for district heating and 426MWe gross of electricity. This will contribute to meeting demand and addressing the shortfalls identified in the baseline section 17.4.5 and discussed in Chapter 3 which presents the need for the Project.

This will contribute to macroeconomic stability through increased national energy security, national income from energy sales, and the provision of the necessary framework for industrial development. Greater reliability in electricity power supplies to the industrial and commercial sector will facilitate direct and indirect beneficial effects for the wider economy. Benefits of large, medium and small-scale enterprise and business development include the creation of jobs and potentially widening of new and existing service industries. This is expected to increase gross domestic product (GDP) per capita and improve econometric indicators of poverty. At the national scale, a more reliable energy supply is expected to facilitate greater industrial production and attract foreign direct investment (FDI). This investment would contribute revenue to the national budget as a result of the direct taxation of industrial activities.

The provision of reliable and efficiently-priced electricity supply would also provide undoubted benefits to residential households acting as a significant contributor to improved levels of well-being. In general terms it would provide the opportunity for refrigeration, contributing to hygiene and sanitation improvements, as well enabling school children to complete their studies in the evening. It would also enable the establishment of more cottage industries and household scale cooperatives, and provides the opportunity for socio-cultural activities and recreational benefits in the evenings.

Specifically, increasing the electricity supply coverage and improving reliability aims to contribute to the following planning objectives:
- Construction of apartment buildings and related service constructions within existing apartment housing districts.
- Providing electricity to ever expanding ger areas on the outskirts of the city in the short term
- Ger areas to be replaced by new apartment building districts which by 2020 will need 166.8MW of new power.

In summary, increased electricity provision will be an important contributor to indirectly improving the ger population’s well-being through facilitating their movement into apartments.

In addition to the benefits from electricity, the Project will result in the provision of additional district heating (see Chapter 2, Figure 2.9) which is expected to result in a reduction in the use of old boilers and household coal stoves. This will in turn reduce localised atmospheric levels of PM_{10} and oxides of Nitrogen, which over the longer term should contribute to improved health through a reduced rate of respiratory infections and other air quality related illnesses. This will particularly be the case in the outskirts of Ulaanbaatar in the ger communities where the project would be located and where traditional stove use is high and air quality exceed national air quality standards.

In conclusion, the sensitivity of the population of the wider area of influence is medium due to the high demand for power and heating across the city and lack of connectivity in the poorer ger areas. The magnitude of the impact of contributing to the overall supply is considered moderate therefore this is considered a beneficial impact of **moderate significance**, and therefore is evaluated as significant.

17.5.4 Potential risks

17.5.4.1 Overview

Whereas the previous sections discussed social impacts that are considered highly likely to occur, this section discusses potential social risks that could occur but are less likely. The Project will take a precautionary approach to avoid and mitigate risks through appropriate social management measures.

17.5.4.2 Occupational health and safety and labour rights

Site preparation, construction and operational activities pose the following main occupational health and safety (OHS) risks to workers:

- Exposure to physical hazards from use of heavy equipment
- Trip and fall hazards
- Exposure to dust, noise and vibrations
- Falling objects
- Exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery
- Working at height, with live power equipment and lines
- Exposure to electro-magnetic fields (EMFs)

The use of temporary workers' accommodation poses potential risks to the health, safety, security and therefore wellbeing of construction workers if not managed appropriately. Health and safety issues associated with the use of temporary accommodation sites include those relating to sanitation, disease, fire, cultural alienation, sleeping space, quality and quantity of food, personal safety and security, temperature control and recreation, amongst others.

There are risks to workers' wellbeing through delayed payment of wages, potential for forced or child labour and people working without contracts and other safeguards. Similarly, there is the risk of adverse occupational health and safety impacts related to personal accident or injury on any construction site. Some of the OHS risks which could arise during the construction phase of the Project, and are typical to projects of this type of facility include: exposure to physical hazards from use of heavy equipment and cranes; falling from height; foundation pits/trenches; trip hazards; exposure to dust and noise; falling objects; electrocution risks. Risks specific to the Project location include exposure to extremes of climate and hazards associated with working on or near water.

Whilst workers on the Project, particularly sub-contracted construction workers, are vulnerable to risks to their health safety and wellbeing on a daily basis, the Mongolian regulatory standards provide some protection. Appropriate planning and execution of health and safety management planning, workforce management measures and accommodation management in line with the IFC PS2 and EHS guidelines will be undertaken by the Consortium to reduce the risks as far as possible.

17.5.4.3 Community health, safety and security

There are a number of activities in the construction phase which if not mitigated could cause risks to local communities. For example, Project truck and passenger vehicle movements will increase existing traffic volumes and may result in road safety risks, especially in areas where there are pedestrians and cyclists on the road. For further discussion of traffic impacts see Chapter 13.

There could be a health and safety risk to the local community posed by the existence of construction sites and possible presence of armed security guards. Access to construction sites by community members presents health and safety risks similar to those described in section 17.5.2 above and the presence of the construction workforce presents a risk of spread of sexually transmitted infections and increased pregnancies amongst local women. These risks are addressed in the ESMMP presented in Volume IV of this ESIA.

During operations there will be increased rail movement and there is the risk of an industrial accident (fire or explosion) which could affect communities living close to the power plant. The siting of the coal delivery and storage areas has been planned considering the proximity of nearby communities and is in the best possible location on the Project site, taking into account prevailing winds.

Air quality and noise impacts are discussed in chapters 7 and 8.

17.5.4.4 Population influx

There is a risk of population influx to the area as people may come in search of economic opportunities from the construction phase. The extent of migration is usually determined by Project characteristics and a number of factors which have been given consideration in Table 17.9 below.

Table 17.9: Key factors leading to high rates of influx and adverse social effects

Influx factor	Analysis
Scale of project: larger projects attract more migrants	This Project has a multi-year construction period and a substantial construction workforce which could be attractive to migrants.
Area's capacity to meet project needs/population density of project area	The Project is located in Ulaanbaatar, the capital city of Mongolia. As such the peri-urban area has better service provision and capacity to cope with population influx than some of the more remote rural areas of the country
Opportunities for compensation and benefits speculation	This Project has opportunities for compensation through the RP, which could attract some migrants, most likely family members of people already in the are. However, the resettlement is relatively small and will not be widely known about.
Conclusion:	Overall, the Project is expected to attract some opportunistic economic migrants or 'camp followers' during the construction phase, but this is not thought to be a significant risk or something that will be difficult to manage for local government authorities.

Source: Mott MacDonald based on IFC 2009 guidance on IFC Handbook Project-Induced In-Migration.

17.6 Mitigation and enhancement measures

17.6.1 Resettlement plan

The responsibility for resettlement lies with the government which will provide land for the Project unencumbered. The concessionaire is responsible for meeting commitments to its lenders that include ensuring resettlement is carried out to lender standards. Any gaps between national requirements and those of the lenders are the responsibility of the concessionaire. As such, the concessionaire is in the process of working with government to ensure it can implement an RP designed by the concessionaire to meet lender standards.

The RP being prepared will provide a detailed and quantified assessment of physical and economic displacement, as well as communal losses (for instance community infrastructure) based on primary survey data. It will specify compensation and livelihood restoration measures in accordance with an agreed entitlements matrix. The overarching aim of the RP will be to ensure that resettlement affected peoples standard of living, security of tenure and livelihoods is at least restored, or where possible improved, so that resettlement is used as a development opportunity.

17.6.2 Stakeholder engagement plan and grievance management

A SEP has been produced as part of the Project's environmental and social management system. The SEP will need to be implemented for the construction and operational phases of the Project. The objective of the SEP is to manage stakeholder and community relations, expectation, and grievances through consultation and disclosure mechanisms as well as to attain and maintain broad community support. The guiding principles of the SEP are that throughout the lifetime of the Project, stakeholder engagement will be well planned and based on principles of respectful and meaningful dialogue.

The SEP is a management tool using a culturally appropriate approach to information disclosure and consultation. The SEP coordinates, guides and maximises the full value of the engagement processes for the Project. Participation of stakeholders, in particular those who are directly affected, is considered essential to realising the full benefits of the Project. The SEP includes identification and analysis of stakeholders including vulnerable groups. Planned stakeholder engagement activities, responsibilities and timelines are proposed, including disclosure and consultation activities

The SEP includes a community grievance mechanism with grievance reporting and resolution procedures and roles and responsibilities of Project community liaison officers (CLOs) in terms of grievance management. The contact details of the CLOs will be disclosed to stakeholders, especially project affected communities prior to construction commencing.

The SEP is a live document that will be updated on an ongoing basis, so that it remains relevant and commensurate with the impacts and risks of the Project.

17.6.3 Local content strategy

The ESMMP will include a framework for a local content strategy to be developed and implemented during construction and operations to help promote the participation of national companies, local businesses and local workers in the service and equipment procurement opportunities.

The ESMMP will present a local procurement menu of options that will include: unbundling procurement requests into smaller work packages; providing tender documentation in local languages and free of charge; providing longer deadlines to assist small and medium enterprise response; using serial contracts or framework agreements; setting aside contracts or specific work packages that are only directed to local companies; providing price preference as part of the tender evaluation; and requesting tenders in local currency.

The local employment measures will include the requirement for a local employment policy, whereby job opportunities are disclosed locally to project affected peoples, with priority in recruitment to resettlement affected people. The strategy will include the means by which local people hired on a short term basis during construction can obtain permanent contracts on the Project during the operational phase.

In addition to maximising job opportunities for local people, the local content strategy will need to facilitate skills development of the local workforce. The overarching aim should be to provide longer-term benefits to local people beyond the lifetime of the Project, therefore enhancing their future employability. All training will be free of charge to participants. During the construction phase this will primarily achieved by on-the-job training by the EPC contractor with workers being provided with certificates which they can use to evidence their upskilling and qualifications obtained to future potential employers.

In the operations phase, when the majority of workers are expected to be local, the consortium will explore opportunities to partner with Vocational Education and Training (VET) providers.[49] Options to provide a mix of classroom based and on-the-job training trade skills training will be explored. This would be longer term than the construction upskilling and would run over a number of years for full time employees.

17.6.4 Labour rights safeguard measures

A number of construction and operations labour rights safeguard measures will be designed and implemented at start of project construction to avoid inappropriate and unfair working conditions. The ESMP will provide a framework for these measures including:

- Occupational health and safety plan (discussed in section 17.6.5).
- Appropriate human resources policies: to be developed in accordance with ILO core labour standards, the labour codes of Mongolia and IFC PS2.
- Workers' code of conduct: designed to govern the behaviour of workers employed by the Consortium and all its contractors and subcontractors during the construction of the Project.

[49] This can include technical and trade colleges that over vocational qualifications and apprenticeships.

- Worker grievance mechanism: designed to address labour grievances appropriately for all workers on the project on a timely basis.
- Workers accommodation plan: aligned with the requirements set out in the guidance note by IFC and EBRD on workers' accommodation: processes and standards (2009).
- Appropriate labour monitoring (of the EPC contractor and sub-contractors) arrangements, key performance indicators (KPIs) and reporting measures will also be explained in the ESMMP.

17.6.5 Occupational health and safety plan

Occupational Health and Safety (OHS) is required to identify preventative and protective measures to protect the health and safety of workers on-site. EPC contractors and the Consortium's Health and Safety Plans should be developed separately (not part of the CESMP). The Consortium will review Contractor's OHS Plan and procedures to ensure compliance with the Consortium's ESMS and health and safety requirements, and contractual clauses (which includes a commitment to implementation of the ESMMP). The plan should be prepared and read in accordance with the Emergency Preparedness and Response Plan.

Mitigation measures will include the following:
- Proper use of personal protective equipment (PPE) by all workers
- Contractor to have an appropriately equipped first aid room and staff to address workers' health and manage community health interactions
- Site safety awareness training
- Monitoring and reporting of accidents, injuries, lost-time incidents, near misses and community interactions on health issues
- Worker accommodation monitoring
- Tool box talks on hygiene and sanitation at least every six months
- Good housekeeping on site
- Control and quality assurance of drinking water
- Pest and vector control activities

The plan will cross reference the workers code of conduct.

17.6.6 Community health and safety plan

A community health and safety plan will be developed to safeguard local community members and the public. It will include but not be limited to measures to address:
- Appropriate signage and fencing
- A site registry system to prevent unauthorised access to the public
- Safety exclusion zones
- A traffic management measures
- Health screening for nearby residents
- A safety awareness campaign
-

The plan will cross reference with other relevant management plans such as the OHS plan, traffic management and stakeholder engagement plans. Local health care and emergency services will be consulted in the development of the plan,

17.6.7 Site security plan

A site security plan has been developed to manage security arrangements and safeguard the human rights and wellbeing of members of the public and local communities when encountering security providers. The policy makes a commitment to comply with national law and Project's approach is underpinned by the principles of proportionality and good international practice. The plan includes provisions for:

- Responsible hiring
- Training
- Means of security and equipment
- Use of force and weapons
- Access and incidence logging
- Community grievance mechanism (summary of that presented in the SEP)
- Use of government security

The policy also provides contract details of the Project management and specifies monitoring measures.

17.7 Residual impacts

The social impacts and mitigation and management measures are discussed above are summarised in Table 17.10 below. This also presents the conclusions on residual significance after the application of mitigation and benefit enhancement measures. All of the residual impacts for social and community are beneficial. No adverse residual impacts have been identified.

Table 17.10: Summary of social impacts and mitigation / enhancement measures

Activity	Potential Impacts	Sensitivity	Magnitude	Impact Significance	Mitigation or Enhancement	Residual Impacts
Construction						
Land clearance and construction activities [50]	Physical and economic displacement of households and businesses	High	Minor	Moderate adverse	RP, including livelihood restoration measures such as preferential employment for displaced peoples SEP and community grievance mechanism (this is a cross-cutting measure relevant to all impacts)	Minor beneficial Resettlement will be used as a development opportunity providing displaced people with improved housing, basic services, utilities and livelihoods.
Recruitment of construction workforce	Employment generation for local communities	High	Minor	Moderate beneficial	Local Content Strategy including local employment policy and skills development programmes Stakeholder engagement plan to specify means for disclosure of employment opportunities	Major beneficial Efforts will be made to employ local people (especially those displaced) providing upskilling so their roles can continue through to the operational phase.
Operation						
Recruitment of operational workforce	Employment generation	Medium	Minor	Minor adverse	Same as construction employment [51]	Moderate beneficial If highly sensitive local people can be provided with jobs and with qualifications
Generation of electricity and district water heating	Provision of essential social services for region and contribution to economic development and health benefits from reduced household stove usage	Medium	Moderate	Moderate beneficial		Moderate beneficial

[50] Nb. Environmental impacts (such as noise, vibration, dust, etc.) from construction have been addressed within the relevant chapters and not covered here to avoid double counting of impacts.

[51] Nb. Skills development in operations phase will look into options for partnership with local VET provider to provide classroom based training and qualifications.

18 Assessment of Associated Facilities

18.1 Overview

As discussed in Chapter 2, a number of associated facilities will be required to enable or support the Project, but do not form part of the Project responsibilities of the Consortium. A high level assessment has been undertaken in the following sub-sections to identify the main potential environmental and social impacts associated with the development and operation of these items of infrastructure. It should be noted that the design and routing arrangements have not yet been finalised for the associated facilities. Once this is undertaken by the various respective parties, separate detailed assessments will be required for the development of these facilities under the Mongolian environmental assessment process, and any separate requirements in terms of international financing. It is important to note that the area of influence has primarily been based on the impacts associated with the power plant itself. However, as far as reasonably practical and for the purposes of this ESIA consideration of the potential locations of the associated facilities has been taken into account in the defined spatial scope for each environmental and social aspect.

18.2 General construction

General construction activities of the associated facilities are likely to generate a number of nuisance impacts for nearby sensitive receptors, including a reduction in air quality from dust emissions and noise and vibration impacts from site clearance, earthmoving, construction traffic, ground and foundation works including piling and the construction of structures. Best practice construction techniques will need to be employed which accord with those specified in Chapters 7 and 8.

18.3 Transmission line

A 220kV transmission line will connect the Project to the CES network. It is likely that this above ground linear structure will have an impact on ecology and biodiversity as a result of its construction, in particular resulting in habitat loss and fragmentation. Biodiversity surveys will be required to identify any critical habitats as well as notable flora and where appropriate native plant species should be used for habitat restoration.

The operation of the transmission line brings the risk of bird collisions - particularly where the route is perpendicular to the line of flight - and increases the risk of electrocution of bird species. Prior to construction, a detailed collision risk assessment may need to be conducted to inform the route selection of the transmission line and the location and type of mitigation. The design of the towers should also be assessed with respect to potential electrocution risk and if necessary retrofitted with mitigation measures to eliminate the risk of electrocution to perching birds.

The presence of additional infrastructure (both during construction and operation) will have an adverse impact on local landscape features, visual amenity of the area and the setting of Bogd Khan National Park. The route selection for the transmission line has included criteria that the transmission line is outside of the national park. During construction, best practice construction techniques will need to be employed to minimise the impact on the landscape and visual amenity of the area (including minimising vegetation removal).

For the construction and operation of the transmission line there will be the need for the MoE to acquire or lease land both permanently and on a temporary basis. This is likely to result in some minor economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as agricultural or other land used for businesses and livelihoods is used for tower construction and corridors. It may also result in physical displacement (loss of housing or shelter requiring relocation of residents) if the route would pass through densely populated areas and communities. During the design phase, the route of the transmission line should be selected to avoid and minimise displacement as far as possible. Prior to construction, any displacement impacts will need to be appropriately mitigated and managed according to national legislation and applicable international guidelines for resettlement and livelihood restoration planning.

Once operational, the transmission and distribution of electricity is expected to provide significant socio-economic benefits to the city, region and country, as outlined in Chapter 17.

18.4 District heating pipeline

The route of the district heating pipeline has been designed to minimise adverse impacts and at stage is not anticipated to result in any private land take or displacement (physical or economic).

During construction, however, it is expected that there will be a significant impact on landscape character and visual amenity of the area. A corridor of approximately 50m on each side will be temporarily affected by construction activities, including the presence of machinery, machinery compounds, a large number of construction workers and construction traffic. Best practice construction techniques will need to be utilised to avoid landscape and visual impacts on sensitive receptors and, where possible, land occupation should be limited to the minimum necessary for the completion of the works. The presence of the over ground heating pipe will have localised adverse effects during its operational life; however, to minimise the impact, it is recommended that the structure should be painted in colours of the surrounding landscape.

Once operational the district heating pipeline is expected to provide significant socio-economic benefits to communities and the city, as discussed in Chapter 17.

18.5 Railway spurs and stabling

Permanent noise impacts associated with introduction of new railway sidings (from the passage of individual trains into the sidings) may have specific impulsive characteristics due to the interaction of trains wheels and track-work (switches and crossings). This will also become a feature of passing trains on the main line moving over the modified track and may also generate vibration. Furthermore, trains waiting to join the main line may generate noise impacts when idling. Ger receptors situated close to the track on the south east side of the track may be affected due to their close proximity to the existing railway.

The assessment within this ESIA has considered noise from train movements as a contributor to the operational noise of the project but this is based on an averaged noise level corresponding with the expected frequency of train movements. The intermittent noise impacts are expected to occur over short intervals but the levels of noise may have the potential to cause disturbance. Specific measures to mitigate permanent noise impacts should be considered, including careful siting of switches and crossings to maximise the distance between the receptors and these sources of noise. Signals should be sited so that trains do not idle close to noise sensitive receptors, and trackside barriers should be used, if necessary.

As identified in Chapter 9, modelling identified that there was a flood risk posed to the existing structures in the vicinity of the site, including the Ulaanbaatar Railways Bridge over the Khuliin River. This structure is not likely to have been designed to standards required for critical infrastructure such as a power plant. As such, in more extreme events (e.g. 1 in 200 year return period) there is a risk of overtopping and/or structural failure and this could increase the impact of floods at the site if water impounded behind these structures is suddenly released when these structures fail. This will need to be addressed in the feasibility study to be undertaken for the rail connection to the Project.

The ger community to the south east of the Project site is likely to impacted by physical and economic displacement as a result of the track realignment and construction and operation of the new railway spurs and sidings. The exact number of houses and nature of impacts will be determined through the resettlement planning household survey activities and will be mitigated through appropriate compensation, relocation and livelihood restoration activities, to be undertaken by Ulaanbaatar Railways.

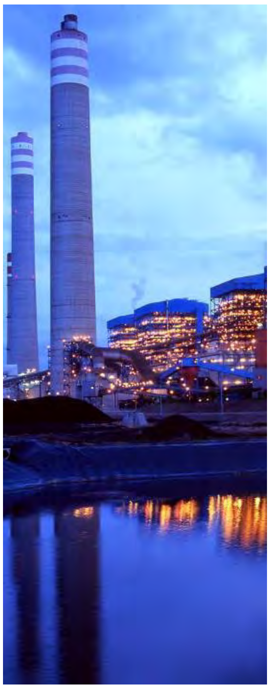
18.6 Pipelines and GIS switchgear

No key impacts have been identified for the raw water supply pipeline, the wastewater discharge pipeline or the GIS switchyard and substation beyond the nuisance impacts (dust and noise) associated with general construction activities (identified in Section 18.2).

18.7 Cumulative impacts

During the construction phase of the Project, there is the potential for significant adverse cumulative impacts related to the construction of the associated facilities. Development of these facilities will be undertaken throughout the construction period of the Project and it is likely that there will be major adverse impacts to the road network, including noise nuisance, congestion and delays, as a result of plant and vehicle movements and materials deliveries. The associated facilities will need to be assessed in accordance with national legislation and applicable international standards and guidelines. Management of these impacts will be the responsibility of the developer in collaboration with the Consortium.

Cumulative nuisance impacts (dust and noise) are also expected during the construction phase as a result of construction activities; however, these are expected to reduce significantly away from the Project site.



CHP5 Combined Heat & Power Plant

Volume IV - Environmental and Social Management & Monitoring Plan

October 2015

CHP5 Consortium

ENERGY FOR TOMORROW

Mott MacDonald

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Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
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B	01/09/15	N Court T Streather A Chakravartty	A Day	A Day	Working draft
C	23/09/15	T Streather	L Jones	L. Jones	Revised working draft
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G	26 October 2015	N. Court	L. Jones	A. Day	Final
H	29 October 2015	L. Jones	L Jones	M. O'Brien	Final for draft ESIA disclosure

Information class: Standard

Contents

1 Introduction

1.1 Overview

The primary objective of an Environmental and Social Management and Monitoring Plan (ESMMP) is to safeguard the environment, site staff and the local population from site activity which may cause harm or nuisance. This ESMMP is intended to provide a framework to ensure transparent and effective monitoring, prevention, minimisation, mitigation, compensation and off-setting measures to address the environmental and social impacts associated with the CHP5 Project. The mitigation measures described within this ESMMP will be applied to the CHP5 Project and its associated infrastructure, hereafter referred to as "the Project".

This document will need to form the basis of the environmental and social protection measures implemented by ENGIE, Sojitz, Posco Energy and Newcom (together the "**Consortium**") and the supporting construction contractors that will be employed. The implementation of the ESMMP ensures that environmental, health and safety (EHS) and social performance is in accordance with international standards (including the Asian Development Bank's Safeguard Policy Statement (ADB SPS). Equator Principles (EPs), the International Finance Corporation's Performance Standards (IFC PSs), the World Bank (WB)/IFC Environmental, Health and Safety Guidelines (EHS Guidelines), the European Bank for Reconstruction and Development (EBRD) Performance Requirements, and the Japanese Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Considerations (2012)) and best practice.

This document constitutes Volume IV of the Environmental and Social Impact Assessment (ESIA) process which has been undertaken by Mott MacDonald. The ESIA comprises four volumes including this volume, organised as follows:

- Volume I: Non-Technical Summary
- Volume II: Environmental and Social Impact Assessment
- Volume III: Technical Appendices
- **Volume IV: Environmental and Social Management and Monitoring Plan (this volume)**

Where relevant this volume consolidates and builds on the mitigation and monitoring requirements identified in the ESIA (Volume II) and establishes a framework under which the Engineering Procurement and Construction (EPC) contractor should develop their mitigation and management plans. The Consortium and EPC contractor will be required to develop standalone mitigation and monitoring plans, implementing the requirements contained within this document as a minimum.

1.2 Development of the ESMMP

This document is an overarching framework for environmental and social management. The EPC contractor will be required to transpose the measures and principles of this framework document in to a Construction Environmental and Social Management Plan (CESMP) prior to any site preparation / construction activities taking place. The CESMP details environmental control steps necessary to reduce environmental and social impacts through the entire construction phase of the Project, identifying as a minimum:

- A description of the works
- Regulatory requirements
- Site organisation and management
- Roles and responsibilities
- Review, reporting and auditing procedures
- Environmental and social risks and impacts
- Mitigation and protection measures
- Monitoring requirements
- Training requirements
- Emergency response plans
- Method statements (where applicable)

The development of the CESMP will be prepared prior to site preparation and construction works, and will be supported by the following:

- **Policies** – overarching system of principles to guide the Project's environmental and social performance.
- **Plans** – additional, more detailed plans prepared by contractors related to specific aspects and areas which are impacted by their scope of works (i.e. Waste Management Plan).
- **Procedures** – more specific work instructions developed by the Consortium, in collaboration with construction contractors, to support the implementation of the plans.

The Consortium will be responsible for oversight of the EPC contractor during the construction phase. The Consortium will be responsible for ensuring the Project complies with mitigation measures outlined within this document for the operational phase.

1.3 Structure of ESMMP

Section 2 outlines the institutional arrangements through which the ESMMP will be implemented and the relationship and responsibilities between the Consortium and the EPC contractor. Where relevant, a number of capacity building measures have been identified to ensure that the institutional arrangements are appropriate and qualified for the allocated tasks.

Section 3 provides an outline on the various site-specific EHS management and monitoring plans to be implemented as part of the ESMMP by the Consortium and its EPC contractor. The sub-plans are intended to ensure that the various mitigation measures / activities identified through the ESIA process are incorporated by the Project in a structured way. Mitigation measures are presented for each sub-plan, together with monitoring measures and key performance indicators (KPIs) where applicable. In addition, relevant international standards and best practice guidelines have been identified.

Section 4 of the ESMMP provides an overview of monitoring and reporting requirements associated with the activities and commitments contained within the ESMMP documentation. The monitoring and reporting requirements include a "***management of change***" capacity to the ESMMP reflecting that it is intended to be a live document subject to regular review and update as the Project evolves.

2 Implementation and Institutional Arrangements

2.1 Overview

Responsibilities for implementation of identified mitigation or management actions are outlined in the ESMMP and fall to the Consortium and/or the EPC contractor. It will be the responsibility of the Consortium and their Owners Engineer (OE) to oversee and monitor the implementation of relevant ESMMP elements by the EPC contractor and sub-contractors that may be employed. The Consortium through the OE will monitor, audit and assess the compliance of the EPC contractor's implementation of the relevant aspects of this ESMMP during the construction phase and ensure that corrective actions are taken when necessary to maintain EHS performance in line with international standards and Good International Industry Practice (GIIP).

The EPC contractor will be required to transpose the measures and principles of this framework document into a Construction ESMMP (CESMP), while the Consortium will be required to transpose the measures and principles of this framework document into an Operational ESMMP (OESMP).

2.2 Roles and Responsibilities

2.2.1 The Consortium's Role

The Consortium will have the overall responsibility for the compliance of the Project during the construction and operational phases with the mitigation measures outlined within this ESMMP. The contractors (including the EPC contractor) will be required to meet the specific requirements outlined within this ESMMP for the construction phase; this is to be implemented through the agreements between the Consortium and the contractors, for example, by adding specific provisions to such agreements or annexing this ESMMP to such agreements. Whichever route is chosen, the contractor agreements should ensure compliance with this ESMMP and appropriate international requirements.

The Consortium is to monitor its performance and that of all contractors on a regular basis and will undertake the following throughout the duration of the construction period:

- Review contractor documents (for example, associated sub-management plans, procedures, and mechanisms for reporting, record keeping and auditing) against the requirements of this ESMMP
- Undertake regular audits
- Continuously check records
- Set up a contractor reporting structure
- Conduct regular meetings where Environment Health and Safety (EHS) is an agenda item

During the construction phase, the Consortium should closely monitor all reports received from the contractors to monitor compliance. Mitigation measures described for the operational phase will be implemented by the Consortium using the proposed system described in this document.

2.2.2 The EPC contractor or Engineering Procurement and Construction Management (EPCM) contractor role

It will be the responsibility of the EPC contractor or EPCM contractor to implement the construction phase mitigation measures outlined within this document through a dedicated CESMP and to ensure compliance of any construction contractors in meeting the requirements within it. The EPC contractor or EPCM contractor will be required to undertake regular monitoring and inspections of the construction contractors and the Project site and will be required to keep up to date records as prescribed in this ESMMP and report regularly to the Consortium.

2.2.3 Owners Engineer (OE)

The role of the Owners Engineer is to supervise construction, including acting as the representative of the Consortium, managing all environmental and social aspects of the Project.

2.2.4 Lenders Environmental and Social Consultant

The Lenders Environmental and Social Consultant (LESC) will periodically undertake checks during the construction and operational phase to ensure compliance of the Project with this ESMMP. The Consortium and the contractor will be required to make available all records of monitoring and meetings during any construction monitoring visits that the LESC may undertake.

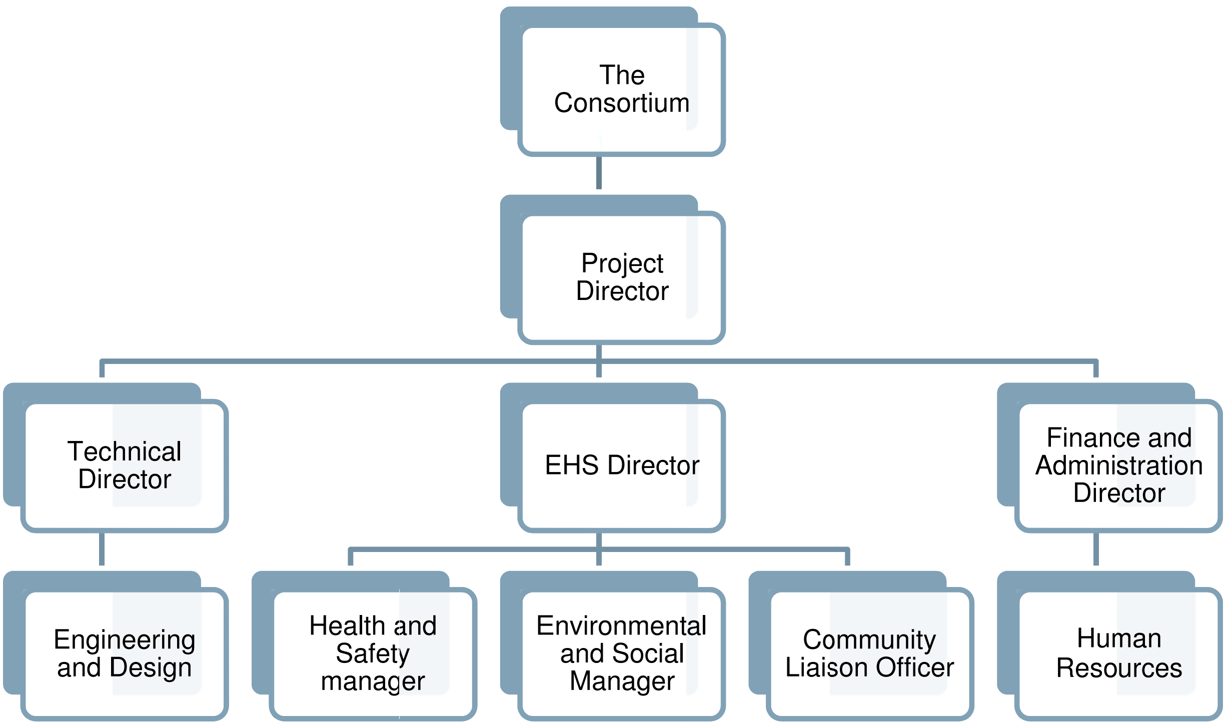
2.3 Construction EHS Management

2.3.1 The Consortium Environmental, Health and Safety (EHS) Management

The Consortium has not yet finalised its formal EHS and social policies and systems along with many of the other management systems that will need to be in place for the commencement of construction and into operation. However, it is the Consortium's intention to develop a comprehensive EHS Department to oversee and manage all EHS issues during the construction and operational phases.

A preliminary staffing structure of the EHS department is under development but consists of the key roles as set out in Figure 2.1 and in Table 2.1. The Consortium's personnel key roles and responsibilities will be set out in procedures created as part of the EHS management system, including organisational and individual working procedures.

Figure 2.1: Preliminary EHS Organogram



Source: Mott MacDonald

Table 2.1: The Consortium's EHS Department - Key Roles and Responsibilities

Role	Number	Responsibility	Location	Construction	Operation
EHS Director	1	Policy, overall responsibility, government liaison	Head Office with regular visits to site	✓	✓
Environment and Social Manager	1	Compliance reporting on environmental and social issues to the Deputy Detector	Head Office with regular visits to site	✓	✓
Health and Safety Manager	1	Compliance reporting on Health and Safety issues to the Deputy Director	Head Office with regular visits to site	✓	✓
Community Liaison Officer	1	Management and monitoring of social issues and performance	Head Office with regular visits to site	✓	✓
Support staff	to be defined	Community liaison, environmental reporting and monitoring	On site	✓	✓

It should be noted that there will also be a number of support staff, including environmental officers and engineers and technicians, social specialists and administrative staff. Whilst some evolution of the department structure, staff numbers and responsibilities will change as the Project moves through construction into operation the overall structure and roles and responsibilities will be defined during its inception and modifications implemented as required.

2.3.2 Contractor EHS Management

The EPC contractor or EPCM contractor will be required to adhere to the principles of ISO 14001:2004[1] and OHSAS 18001:2007[2] or equivalent if not already accredited. These standards place strong emphasis on the need for continuous improvement of the EHS management systems and resultant EHS management performance.

The appointed EPC contractor or EPCM contractor will be required to agree (see under paragraph 2.2.1 hereof) to the following actions:

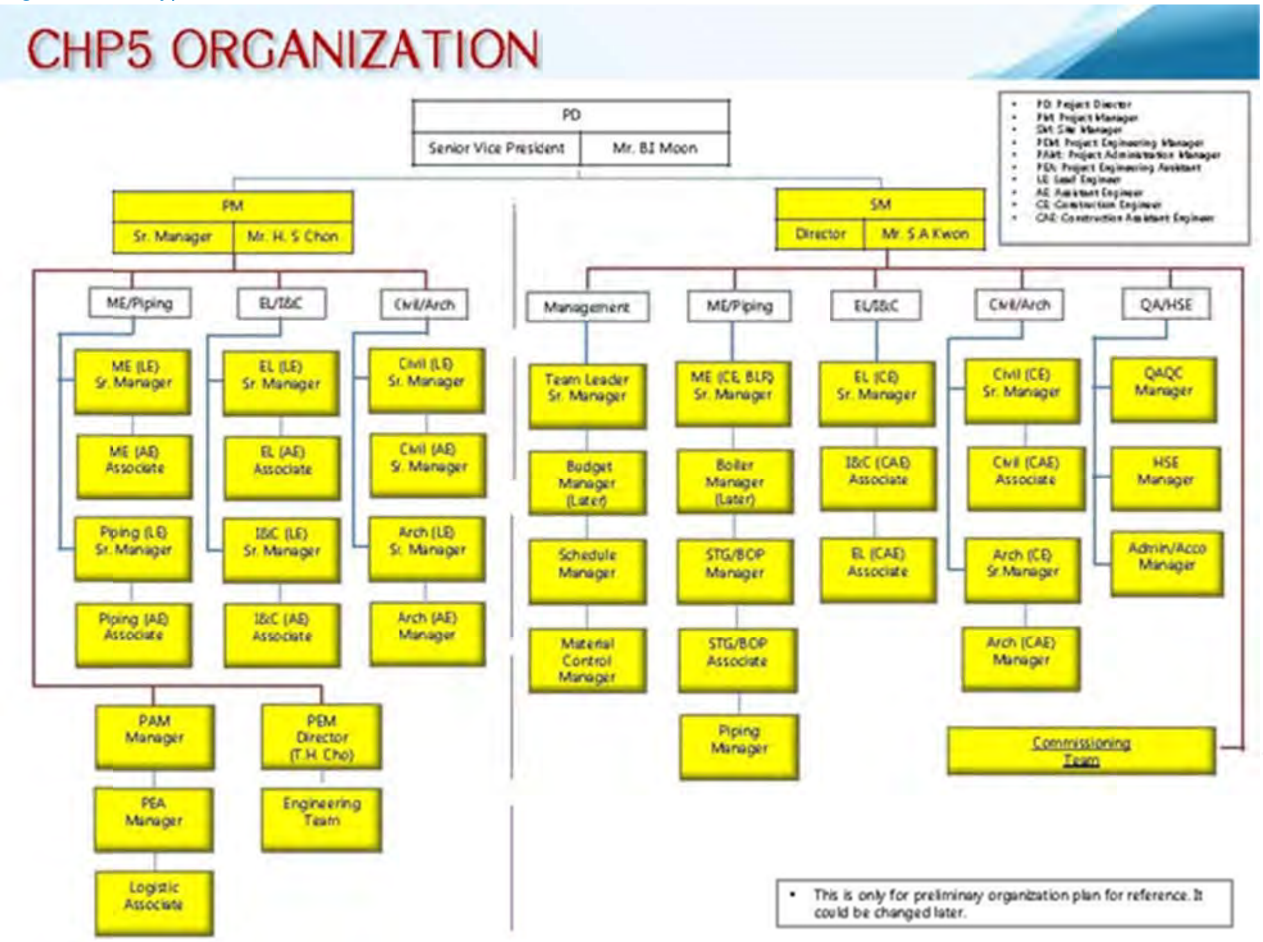
- Develop a project specific CESMP (refer to Section 3.2).
- Elaborate other parallel sub plans (refer to Chapter 3).
- Implement the requirements of the mitigation activities in the CESMP via the above plans.
- Provide a construction site layout plan that identifies key activity areas in line with the relevant requirements and Exhibits to the EPC contract.
- Produce detailed method statements relating to key activities that include specific reference to requirements of the plans contained herein during the Project progression.
- Provide all training necessary to oversee and implement ESMMP requirements prior to and throughout construction as appropriate.
- Be responsible for producing comprehensive suite of EHS management and coordination procedures
- Identify a full time person on site with dedicated EHS responsibilities to oversee works on site.

The EPC contractor or EPCM contractor will be required to be responsible for sub-contractor(s)' performance, including sub-contractor(s) adherence to the requirements of the CESMP. All sub-contractor(s) will be required to have dedicated environmental and social staff to implement the CESMP and to monitor and manage this on an on-going basis. The sub-contractor(s) staff will be required to liaise closely with the EPC contractor or EPCM contractor EHS staff including the provision of monthly reports and participation in weekly construction review meetings, for example. A typical construction Contractor EHS staffing structure that could be expected for this Project is set out in Figure 2.2 and Table 2.2.

[1] ISO 14001:2004 http://www.iso.org/iso/home/standards/management-standards/iso14000.htm

[2] OHSAS 18001:2007 http://www.bsigroup.com/en-GB/ohsas-18001-occupational-health-and-safety/

Figure 2.2: Typical EPC/EPCM Structure



Source: Mott MacDonald

Table 2.2: Typical Contractor EHS Staffing

Role	Number	Responsibility	Comment
Project Director	1	Overall responsibility for EHS performance of Project contracted works, including sub-contractor(s).	-
Construction Site Manager	1	Responsible for practical implementation of EHS requirements at site and for onsite EHS performance.	-
EHS Managers	1	Monitoring and reporting of project EHS performance. EHS regulatory interface.	-
Contractor Environmental and Social Officer	1*	Management and monitoring of CESMP plans implementation and	*Number of officers may vary depending on level

Role	Number	Responsibility	Comment
		environmental issues and performance	of construction activity
Health and Safety Officer	1	Management and monitoring of CESMP plans implementation and report health and safety issues to the EHS Manager	-

2.3.2.1 Environmental/Social Officer

The EPC contractor or EPCM contractor will be required to nominate a person be appointed to take the primary responsibility for day-to-day implementation of the CESMP and parallel management plans. The formal job description would be generally in accordance with the elements provided below.

The nominated person will carry out the following responsibilities:

- Take prime responsibility for practical implementation of the environmental management
- Oversee and ensure the implementation of the CESMP and parallel management plans (with support from the EPC contractor or EPCM contractor Construction Site Manager, detailed below) and ensure all sub-contractor(s) are in compliance with the CESMP requirements
- Review and report performance to the EPC contractor or EPCM contractor Construction Site Manager and the Consortium
- Review sub–contractor(s) environmental protection/mitigation measures to ensure compliance with the CESMP
- Report on a daily basis any CESMP non-compliances to the EPC contractor or EPCM contractor Construction Manager
- Carry out regular environmental awareness sessions and assist personnel in applying environmental standards on site
- Conduct regular audits / inspections to check that committed impact mitigation measures are being implemented
- Act as the first point of contact on environmental matters for the EPC contractor or EPCM contractor, for the government authorities, other external bodies and the general public.

There are certain criteria that the EPC contractor or EPCM contractor environmental officer will be required to have knowledge and experience in, including:

- An understanding of the international standard techniques of environmental management
- Familiarity with local environmental legislation and the likely developments in this field
- Practical operation of environmental monitoring techniques
- Ability to summarise environmental data in order to produce concise and conclusive reports
- Hold the confidence to enforce strict, but pragmatic, environmental control procedures and to motivate the construction staff to a high level of environmental awareness
- Minimum of five years practical experience on construction sites.

2.3.2.2 EPC contractor or EPCM contractor Construction Site Manager

The EPC contractor or EPCM contractor Construction Site Manager will need to work to co-ordinate efforts based on inputs from the Environment Officer(s) and assist in the allocation of staff with the skills for applying the CESMP on site. It is envisaged that the Construction Manager will:

- Ensure that the Environment Officer is adequately qualified to understand and implement the CESMP
- Nominate personnel to assist the Environment Officer as required
- Be responsible for communications with the Consortium with regard to environmental issues and non-compliances.

2.4 Operational EHS Management

The proposed organisational structure for the operational phase will be largely similar to that proposed for the construction phase as shown in Section 2.3.1; however, as the Project nears operation it is possible that this structure may be adapted to best meet the requirements of the Project.

3 Policies, Plans and Procedures

3.1 Overview

Table 3.1 summarises the key policies, plans and procedures required for the Project for both the construction and operational phases, which were determined through the ESIA process, and identifies the impacts they are designed to address. Table 3.1 also provides an implementation schedule detailing the timings in which policies, plans or procedures should be implemented.

Sections 3.2 to 3.25 elaborate on all the relevant plans or procedures identified in Table 3.1, which must be adhered to during construction and operation of the Project. The plans and procedures identified are "framework" documents only and will need to be developed further by the Consortium and/or EPC contractor prior to construction/operation. These framework mitigation measures have been developed in line with the international lenders guidelines and GIIP.

Table 3.1: Commitments of Policies, Plans and Procedures

Policy, Plan, Procedure	Objective / Content	Impacts	Implementation
Environmental			
CESMP	To implement mitigation activities relevant to the construction phase of the Project and to avoid, mitigate and minimise EHS impacts during the construction phase. EPC contractor will be required to adopt a CESMP which will strictly follow and comply with the general WB/IFC EHS Guidelines during construction activities at all sites as well as incorporate specific mitigation as identified through the ESIA process. It is recommended that subcontractors are issued with the full CESMP prepared by the EPC contractor prior to site preparation and construction activities commencing.	Construction related impacts mitigated by the management plans detailed below	Prior to any site preparation and construction works
OESMP	Intended to guide the development of the programs by which the Consortium's project company will ensure operational activities are carried out in a way that meets the goals of the Consortium's Environmental & Social principles/policies.	Operation related impacts mitigated by the management plans detailed below	Prior to operation commencing
Traffic Management Plan (TMP)	To define the requirements that should be implemented to mitigate any potential negative risks to the environment, workers or the community resulting from construction traffic. The TMP will advise and inform site contractors and external suppliers of equipment and materials of access and entry points along with other key information such tipping areas and wash-out areas. Intended to compliment and work alongside relevant CESMP. The TMP will be classed as "live" and therefore be subjected to updates as required.	Increase in general traffic (cars and trucks) volumes and abnormal load vehicles Nuisance (dust, noise and vibration) arising as a result of traffic Driver delay, pedestrian delay, severance, pedestrian amenity/ fear and intimidation Community road safety Improve transport infrastructure to handle the Project traffic movements and loads	Prior to any site preparation and construction works
Site Waste Management Plan (SWMP)	Identify measures for minimisation of waste and safe disposal of construction wastes	Non-hazardous waste generated as a result of general construction activities, including concrete offcuts, scrap ferrous and no ferrous metals, packaging materials (plastics, cardboard, pallets) Hazardous waste generated from general construction activities including fluorescent tubes, batteries, solvents and medical waste from camps. Contaminated material generated from fuel spills and leaks.	Prior to any site preparation and construction works Prior to operation
Ash Management Plan (AMP)	To guide the means by which the EPC contractor and the Consortium will reuse or dispose of ash generated during operation. Also outlines	Fly ash is classified as hazardous and bottom ash can be hazardous or non-hazardous.	Prior to operation

Policy, Plan, Procedure	Objective / Content	Impacts	Implementation
	control measures regarding storage, transport and monitoring.	Both these waste streams are produced during coal burning. Hazardous waste, if improperly managed will cause deterioration of air quality and pose a risk to human health. Non-hazardous ash must be handled, used, stored and disposed of according to the SWMP. Contamination of the ground and/or water environment	
Noise and Vibration Control Plan (NVCP)	To guide the means by which the EPC contractor will control noise and vibration caused by construction, traffic, operations, and other activities to ensure noise does not exceed applicable standards at the site boundary and beyond. Single or separate Plans shall be developed for the construction and operational phases.	Noise impacts as a result of site preparation excavation and foundations, construction. Noise impacts (nuisance) as a result of site traffic movements to and from site, including abnormal loads. Significant effects are likely at the peak of the construction period	Prior to any site preparation and construction works
Air Quality Management Plan (AQMP)	To manage dust and other pollutants during construction and operational phase of the project by using appropriate monitoring and mitigation measures. The AQMP will apply for the duration of both Project construction and operational phases. Refer to Appendix A of this ESMMP.	Deterioration of air quality as a result of: Site preparation; land clearing; quarrying; road construction; spoil deposition; general construction activities; operation Traffic and vehicle movements on site roads Transportation of spoil to disposal sites Construction traffic and machinery	Prior to any site preparation and construction works Prior to operation
Dust Monitoring and Action Plan (DMAP)	To define the minimum requirements that should be implemented to mitigate any potential negative risks that dust, PM10 and PM2.5 may cause to the nearest identified sensitive receptors located to the north-west and south-east of the proposed Project site prior to the operation of the Project.	Deterioration of air quality caused by dust, PM10 and PM2.5 as a result of operations at the identified sensitive receptors	Prior to operation
Water Quality Management Plan (WQMP)	To guide the means by which the EPC contractor (during construction) and the Consortium (during operation) will ensure that the Project and its activities do not cause unacceptable contamination or impacts to water resources and that process and potable water meet applicable standards.	Pollution caused by the discharge of industrial process water (effluent) to a water resource Pollution caused by the discharge of sewage to a water resource Sedimentation as a result of excavation, spoil disposal, vegetation clearance Deterioration of groundwater quality due to spillages	Prior to any site preparation and construction works Prior to operation
Spill Prevention and Response Plan (SPRP)	To define the requirements and procedures to be followed by EPC contractor (construction) and Consortium (operation) as well as the prevention and response to land-based spills.	Pollution caused by improper materials storage Contaminated material generated from fuel	Prior to any site preparation and construction works

Policy, Plan, Procedure	Objective / Content	Impacts	Implementation
		spills and leaks	Prior to operation
Materials Handling and Storage Plan (MHSP)	To define the requirements and procedures to be followed by EPC contractor (construction) and Consortium (operation) during the handling and storage of chemicals, lubricants, solvents, oil and fuel throughout the Project.	Pollution caused by improper materials storage Contaminated material generated from fuel spills and leaks	Prior to any site preparation and construction works Prior to operation
Borrow Pit and Spoil Management Plan (BPSMP), including Blasting and Explosives Management Plan (BEMP) if applicable	To define the requirements that should be implemented by EPC contractor during construction to manage monitor any potential negative risk and impacts to the environment, workers or the community resulting from the excavation, handling, transportation and disposal of spoil at the Project site and at the borrow pit location.	Dust as a result of excavation and transportation of earthen materials	Prior to any use of the Borrow Pit
	A BEMP is a risk control plan used in explosive blasting. It aims to ensure blasts do not harm people in the area and limit damage to the environment. A BEMP is the recommended method for planning safe use of explosives.	Risk of blasting activities resulting in accidents, injuries, or noise and vibration that cause damage or result in a nuisance	Prior to any use of the Borrow Pit
Chance Finds Procedure	Project-specific procedure that outlines what will happen if previously unknown cultural heritage resources, particularly archaeological resources, are encountered during project construction or operation.	Damage to unrecorded archaeological and cultural heritage features	Prior to any site preparation and construction works
Habitat Removal and Restoration Plan (HRRP)	The HRRP will set out the minimum requirements in relation to the clearance and restoration of natural habitats, and the removal, storage and reinstatement of soil. Guide the means by which the EPC contractor will minimise the project's area of disturbance, create a stable landscape, and restore land and vegetation of areas disturbed by construction activities. A key objective of the rehabilitation and landscaping works is to, where possible; restore disturbed land and vegetation so they are at least equivalent to their pre-existing condition, with self-sustaining vegetation and minimal visual disturbance.	Visual impact and loss of amenity Sedimentation and erosion Habitat removal	Prior to any site preparation and construction works To be implemented throughout the construction phase Objectives and demonstration of implementation to be evidenced prior to operation
Health and Safety			
Occupational Health and Safety (OHS) Plan	Plan to implement a safe working environment, procedures and culture during the construction phase. Further policies / procedures to be developed if need identified through site audits.	OHS risks, including: Exposure to physical hazards from use of heavy equipment Trip and fall hazards Exposure to dust, noise and vibrations Falling objects Exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery	Prior to construction Prior to operation

Policy, Plan, Procedure	Objective / Content	Impacts	Implementation
		Working at height, with live power equipment and lines	
Site Security Management Plan (SSMP)	To ensure that the Project protects the health, safety and security of people and communities within the area of influence from any negative impacts related to the Project	The plant as a security target Influx of workers and interaction with communities	Prior to any site preparation and construction works and maintain throughout operational phase
Emergency Preparedness and Response Plan (EPRP)	Preparation of the EPRP is a requirement of IFC PS1 to cover potential emergencies during the construction, operation and decommissioning of the Project. The EPRP will form part of the wider suite of plans to be implemented by the EPC contractor (construction) and the Consortium's EHS department (operation).	Accidental and emergency situations during construction Accidental and emergency situations during operation	Prior to any site preparation and construction works Prior to operation
Community and labour			
Resettlement Plan (RP)	Ensure that resettlement affected people's standard of living, security of tenure and livelihoods is at least restored or improved, so that resettlement is used as a development opportunity.	Land acquisition with physical displacement Land acquisition with economic displacement Severance affecting nomadic activities	Prior to construction
Stakeholder Engagement Plan (SEP)	Describes the means by which the Project will ensure continuous engagement with affected people and other interested parties. Updated when there are significant changes to the Project, such as change in phase or identification of new stakeholders.	Broad community support Project awareness in the community Information disclosure	Prior to construction and maintain throughout the operational phase
Community Grievance Mechanism	Formalised process by which grievances can be raised by the local community and staff during construction and operation and to allow structured investigation by the Consortium to review the validity, responsibility and response / action. The community grievance mechanism is outlined in the Project SEP.	Ensure community welfare Broad community support	Prior to construction and maintain throughout the operational phase
Local Content Strategy	Overarching objective of sharing the Project's socioeconomic benefits with the locally affected workers and businesses. The strategy will consist of three strands containing policies and actions to promote and maximise opportunities for: Local recruitment policy: to create more employment opportunities for local people. Skills development: to facilitate livelihood restoration/diversification of displaced people and the improve employability of local people after construction. Local procurement: to provide business opportunities for local small, medium sized enterprises and to stimulate local economic growth.	Employment generation Procurement of good and services Physical and economic displacement of local people, resulting in livelihood impacts Population influx	Strategy to be developed prior to and during construction with certain requirements passed down to EPC; Consortium to assume longer term ownership in operations.
Influx Management Strategy	Avoid and mitigate the effects of project-induced migration in partnership with civil society. Linked closely to CIP	Project induced in-migration	Prior to construction and maintain throughout the operational phase

Policy, Plan, Procedure	Objective / Content	Impacts	Implementation
Human Resources Policy	Equity in local employment benefits / minimise social conflict. Prohibit the use of child and forced labour / promote non-discrimination and equal opportunities. Special measures to promote equal employment opportunities across ethnicities and women.	Improve employment benefits and rights in line with GIIP	Prior to construction and maintain throughout the operational phase
Worker Grievance Mechanism	Formalised process by which grievances can be raised by the workforce during construction and operation and to allow structured investigation by the Consortium to review the validity, responsibility and response / action.	Improvement of workers' rights and welfare	Prior to construction and maintain throughout the operational phase
Workers' Code of Conduct	To provide a minimum standard of conduct that is expected from all workers.	Ensure worker and community welfare	Prior to construction
Worker Accommodation Plan (WAP)	To ensure that all Project accommodation areas are designed, constructed and maintained as healthy, clean and pleasant locations for workers to live in.	Hygiene, safety and security risks Cultural conflict risks between the host community and the migrant labour force	Prior to construction of the worker accommodation. Maintained throughout the Project lifecycle

3.2 Construction and Operational Environmental and Social Management Plans

An overarching CESMP will be prepared in accordance with the requirements of the IFC PS1, the ADB environmental safeguards and the EBRD PR1. It will provide guidance on EHS management approach to be adopted by the EPC contractor and sub-contractors for all activities undertaken throughout the construction phase of the Project (which shall be overseen by the Consortium).

The CESMP details the control steps necessary to reduce EHS impacts through the entire construction phase of the Project, identifying as a minimum:

- A description of the works
- Regulatory requirements
- Site organisation and management
- Roles and responsibilities
- Review, reporting and auditing procedures
- Mitigation and protection measures
- Monitoring requirements
- Training requirements
- Emergency response plans
- Method statements (where applicable)

The CESMP will be supplemented by various separate sub-plans and procedures (detailed in the following sections) which will be developed to address key EHS aspects identified during the ESIA process which will detail control procedures and define associated responsibilities for implementation by the contractors (which shall be overseen by the Consortium).

The EPC contractor will develop the CESMP; the Consortium will review and approve the document. The EPC contractor will comply with, and implement, the CESMP, although the Consortium is ultimately responsible for its implementation in accordance with international requirements.

Similarly for the operational phase, an overarching OESMP will be prepared prior to operation of the Project in accordance with IFC PS, ADB environmental safeguards and EBRD PR1. The structure and objectives of the report will largely be the same as the CESMP. The Consortium will be responsible for ensuring the Project complies with mitigation measures outlined within this document for the operational phase.

3.3 Traffic Management Plan

Due to the significant quantities of materials to be transported to and from the Project site, the ESIA has identified that a Construction TMP (CTMP) will be required for this Project. The CTMP should be prepared in line with national legislation and international guidelines where applicable.

The measures outlined below are required to ensure that all relevant policies and standards are met by the Project. These measures should be developed further by the contractor when developing the CTMP:

- Concrete mixing plant located at construction site limiting traffic movements associated with concrete delivery to site access roads
- Construction of worker accommodation on site to reduce light vehicle movements relating to travel to/ from the site
- Provision of bus/minibus services for personnel living in nearby settlements
- Repair to damaged road surfaces and other road infrastructure
- Road maintenance fund to cover damage caused by project related activities during the construction phase
- Regular inspection and maintenance of roads used by the Project
- Driver training for HGV drivers and a refresher course every six months for Project drivers
- Speed restrictions for project traffic travelling through communities (to be agreed with the local transport authority)
- Pedestrian awareness programme along the main site access routes
- Schedule deliveries and road movements to avoid peak periods
- Temporary signage, to include signs in each direction along the Bagakhangai – Nalaikh Road, where the road is a single carriageway, about the dangers of overtaking
- Details of abnormal load escort proposals
- Community liaison scheme to facilitate a formal communication channel between EPC contractor and community
- Schedule rail use in collaboration with network operator
- Use of rail for delivery of equipment to be utilised where possible
- Utilise low emissions vehicles for the transportation of materials (wherever practicable)
- Workers should be informed and reminded of road safety via toolbox talks and staff notice boards

The following monitoring provisions should be included as part of the CTMP:

- The Consortium to review contractors CESMP and CTMP to ensure continuity with commitment in this ESMMP
- Daily vehicle checks
- Reporting on monitoring and KPIs to be provided to the local transport authority, for example:
  - Number of complaints relating to traffic and transport
  - Reporting of accidents and statistics by contractor to the Consortium
- Monthly monitoring / review meetings to be held between the Consortium / EPC contractor and local transport authority
- Six monthly road condition reports.

Traffic management KPIs include:

- Speed limit of vehicles, traffic congestion on main roads near project sites
- Truck conditions and maintenance
- Vehicular accident records
- Vehicle safety signals (flares, warning lights, reflectors), fuelling procedures, loading / off-loading procedures
- Driver training records

- Log of maintenance activities.

3.4 Site Waste Management

3.4.1 Construction Site Waste Management Plan (SWMP)

A SWMP should be developed in accordance with the IFC PS3, IFC General EHS Guidelines: Environmental, section 1.6 on “Waste Management”, ADB SPS Annex 1 (environment), EBRD PR3 and the European Waste Catalogue (EWC).

Various waste streams are anticipated during the construction phase, such as spoil, concrete, timber and domestic waste. Spoil is the most significant waste stream during the construction phase and as such a dedicated Spoil Management Plan will be developed. During the construction phase, the EPC contractor will apply the following general waste management requirements to all site activities:

Material use

- Best practice waste management begins with waste prevention and minimisation, re-using materials on site wherever possible; the most significant opportunity in the construction phase is with respect to excavated spoil
- Instituting good housekeeping and operating practices, including inventory control to reduce the amount of waste resulting from materials that are out-of-date, off-specification, contaminated, damaged, or excess to plant needs
- Instituting procurement measures that recognise opportunities such as ordering the correct amount of materials to be delivered when needed, reducing the amount of packaging used by suppliers and establishing a take back system with suppliers
- Seeking ways to reduce raw material consumption through efficiency audits in the operational phase
- Substituting raw materials or inputs with less hazardous or toxic materials wherever economically and technically feasible

Segregation

- Wastes will be appropriately segregated in designated storage areas, such that hazardous and non-hazardous wastes are not mixed and to allow for recycling and reuse where appropriate
- Hazardous waste (such as oils, lubricants, batteries, chemicals and medical waste) will be segregated from other waste types to avoid cross contamination

Storage

- All wastes generated shall be correctly identified and stored pending collection/transfer for reuse, recovery, recycling or disposal in an environmentally sound manner
- The waste storage areas will be located on areas of impermeable hard standing to prevent leaching of any contaminants should spillage or leakage occur
- All skips to have a suitable cover

- Liquid wastes/oil/chemicals to be stored in tanks or drums located in bunded areas which can hold 110% of the capacity of the largest tank or drum or, for multiple drum storage, 25% of the total volume of material stored
- Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from site
- Store hazardous waste in closed containers away from direct sunlight, wind and rain in designated storage areas
- Provide adequate ventilation where volatile wastes are stored
- Provide readily available information on chemical compatibility to workers including labelling each container, demarcation of the area (e.g. on a facility map/site plan)
- No underground storage tanks or underground piping of hazardous waste to be included in the Project design

Handling

- Handling and storage shall be carried out by trained staff
- Spill response equipment will be made available and maintained in areas where hazardous wastes may be spilt and an appropriate number of site personnel will be trained in spill response techniques
- Prepare and implement spill response and emergency response plans to address any accidental release and leakage
- Each waste shipment will be assigned a unique waste consignment number. The EPC contractor Site Manager is responsible for ensuring that a register is kept at site recording all waste shipments leaving the site and their disposal destination
- A Waste Transfer Note will accompany all waste consignments from the construction site to the disposal destination

Disposal

- Offsite waste treatment or disposal facilities used will be appropriately permitted, or if not available based on the most suitable site on consultation with the Ministry of Environment and Green Development (MEGD)
- The EPC contractor Site Manager will not release the waste if there is concern about the standard of transport or destination of the waste
- Disposal of any medical waste must be undertaken at licensed facilities

Monitoring and inspection related to waste management during construction activities will be conducted for the duration of the Project construction phase, and as a minimum will include

- Records of waste volumes generated by the site and indicate the final disposal option for each waste stream
- Records of consignment and waste transfer notes
- Weekly site walkover inspection to monitor effectiveness of the SWMP
- Quarterly audit of waste management practices

The Consortium will be required to develop an operational SWMP prior to the operation of the Plant, in line with IFC Performance Standard 3: Pollution Prevention and Resource Efficiency and IFC General EHS Guidelines: Environmental, section 1.6 “Waste Management”.

The SWMP will contain:

- The establishment of a waste management hierarchy philosophy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes
- A map showing the location of waste storage associated with the Project
- A description of each waste generated by the operation of the facility, the appropriate handling methodology, the correct approach for storage and the correct route for removal/disposal off site
- Staff training requirements with respect to waste handling procedures
- Waste generation data collection for each waste stream by volume, according to the EWC. This will include the proportion of each waste stream going for reuse, recycling or disposal; any unusual waste volumes will be investigated
- Any waste monitoring as deemed to be necessary
- An audit schedule which details the frequency of waste management audits and those responsible for undertaking them
- A section related to continuous improvement and corrective actions where audit findings can be recorded and incorporated into the waste management procedure; this will also highlight any new and feasible reuse or recycling opportunities which may arise over time
- A mechanism by which to routinely track waste consignments from the originating location to the final waste treatment and disposal location
- The correct procedure for reporting any environmental incidents related to waste
- The specific regulatory reporting requirements as they relate to waste

Coal handling, disposal and use

The use of Best Available Techniques (BAT) should be in place for the unloading, storage and handling of coal:

- The use of loading and unloading equipment that minimises the height of fuel drop to the stockpile, to reduce the generation of fugitive dust
- Grassing over long-term storage areas of coal to prevent fugitive emission of dust and fuel loss caused by oxidation in contact with the oxygen of air
- Direct transfer of lignite via belt conveyors or trains to the on-site coal storage area
- Placing transfer conveyors in safe, open areas aboveground so that damage from vehicles and other equipment can be prevented.
- The use of cleaning devices for conveyor belts to minimise the generation of fugitive dust
- Rationalising transport systems to minimise the generation and transport of dust within the site
- The use of good design and construction practices and adequate maintenance.
- Coal storage must be on sealed surfaces with drainage, drain collection and water treatment for settling out
- The collection of surface run-off (rainwater) from coal storage area that washes fuel particles away and treating this collected stream (settling out) before discharge.
- Survey storage areas for coal with automatic systems, to detect fires, caused by self-ignition and to identify risk points
- Enclosed conveyors, pneumatic transfer systems and silos with well designed, robust extraction and filtration equipment on delivery and conveyor transfer points to prevent the emission of dust.

In addition, the EPC Contractor (during construction) and the Consortium (during operation) will commit to:

- Keeping waste carriers' licences on site.
- Complete in full all transfer and consignment notes related to waste uplifts, including an accurate description of the waste and be signed by the producer and carrier before waste leaves the site

3.4.2 Monitoring

Monitoring and inspection related to waste management during construction and operation will be conducted for the duration of the Project and as a minimum should include:

- Records of waste volumes generated by the site and indicate the final disposal option for each waste stream
- Records of consignment and waste transfer notes
- Weekly site walkover inspection to monitor effectiveness of the SWMP
- Quarterly audit of waste management practices

3.5 Ash Management Plan

The AMP will be produced prior to operations commencing and will include the following:

- Quantitative balance of ash generation
- Disposal, utilisation and reuse quantities/locations
- Cell structure and their protocol within site
- Size of ash disposal site
- Information on leachate collection and drainage
- Ash transportation arrangement (open and closed tank trucks depending on wet/dry ash) and expected number
- Access/security arrangements

Monitoring of groundwater, noise and leachate must be undertaken during operations to ensure negative effects are continuously kept to a minimum. If monitoring activities find that ash management on site is insufficient, the plan will be reviewed and amended as necessary.

3.6 Noise and Vibration Control Plan

The EPC contractor will be required to implement a NVCP in accordance with IFC PS3, IFC General EHS Guidelines: Environmental, section 1.7 on "Noise", ADB SPS Annex 1 (environment), EBRD PR3.

The plan will include the following measures:

- Planning activities in consultation with local communities so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance
- Using noise control devices, such as exhaust mufflers for combustion engines
- Avoiding or minimising project transportation through community areas
- Unnecessary revving of engines will be avoided and equipment will be switched off when not in use
- Internal haul routes will be kept well maintained

- Configuration of haul routes to be no less than 15 metres from sensitive receptors
- Plant and vehicles will be sequentially started up rather than all together
- Use of effective exhaust silence systems or acoustic engine covers as appropriate
- Plant will always be used in accordance with manufacturers' instructions
- Care will be taken to keep site equipment away from noise-sensitive areas
- Where possible, loading and unloading will also be carried out away from such areas
- Regular and effective maintenance by trained personnel will be undertaken to keep plant and equipment working to manufacturers specifications
- Screening e.g. noise barriers and bunds will be used as appropriate. Temporary screening to be used at sensitive parts of the site perimeter
- The use of temporary screening at sensitive parts of the site perimeter
- Procedures for handling noise and vibration complaints
- Advance notification of at least 24hrs to all sensitive receptors during critical phases of construction

It is considered that the effects due to construction traffic can be managed and adequately mitigated with measures such as:

- Maintenance of vehicles to ensure silencers are fitted and vehicles comply with emission standards
- Avoid queuing vehicles on the access road or at the site access points
- Restrict movements to avoid sensitive times of the day
- Adherence to speed limits
- Avoid unnecessary revving of engines and use of horns
- Minimising discontinuities in the profile of the haul routes to avoid body slap and rattle noise

Construction noise and vibration levels shall be monitored and assessed:

- Generally as set out in ISO 1996 'Acoustics –Description, measurement and assessment of environmental noise – Part 2: Determination of environmental noise levels' (2007)
- At monthly intervals throughout construction, but not at pre-arranged times
- As and when required, during critical phases of construction, i.e. when possible exceeding of the Project noise criteria is anticipated
- In response to reasonable noise complaints being received
- At locations representative of sensitive receptors in the vicinity of the site.

3.7 Air Quality Management Plan

A framework air quality management plan (AQMP) has been prepared and is included in Appendix A.

3.8 Water use and quality management plan

The EPC contractor will be required to prepare a water quality management plan prior to construction, in line with IFC PS3 and the WB/IFC General EHS Guidelines, ADB SPS Annex 1 (environment) and EBRD PR3.

There are mitigation measures that will be incorporated in the Project design and these can be seen in Volume II of the ESIA. The following sections provide an overview of measures that will be undertaken by the EPC contractor during construction and the Consortium during operation:

3.8.1 Construction phase

This section contains mitigation measures that will be exclusively applied to the construction phase.

Channel morphology and sediment transport

- Construction of a temporary diversion channel for the Khulin River in the first 3 months of the schedule prior to construction of the permanent diversion channel
- Implementation of temporary roads and drainage system as part of site preparation at the beginning of construction.
- Appropriate sequencing of temporary diversions and implementation of flood mitigation measures to ensure that channel connectivity is maintained throughout the construction period.

Surface water quality

- Reduce the amount of sediment generated via stockpile coverings, erosion control blankets, paving expose areas, wetting down of exposed areas etc.
- Reduce the amount of sediment that leaves site via sediment collection traps, silt fences and good site housekeeping
- Test water quality from effluent treatment systems discharges prior to commencement of operation
- Landscaping to avoid steep slopes in the site area and in the vicinity of the flood mitigation measures
- Where feasible, reinstatement of disturbed ground with vegetation cover

Water resources

- Avoid water wastage through procurement of water efficient equipment and fittings

Groundwater contamination

- Use best practice construction methodology

3.8.2 Construction and operational phase

This section contains mitigation measures that will be applied during both the construction and operational phases.

Surface water quality

- Undertake surface water quality monitoring prior to commencement of construction activities.
- Avoid water wastage
- Undertake the appropriate storage, use and disposal of chemicals and wastes on site, including use of drip trays and designated, concrete work areas, to avoid possible discharges to local watercourses;
- Using spill kits on site and training staff in their use to avoid the discharge of chemicals and wastes to local watercourses

Water resources

- Minimise water usage in construction processes through best practice and use of water efficient technologies
- Raise awareness of water usage with employees

Groundwater contamination

- Development of a SPRP in accordance with local, IFC and EHS guidance.

Flood risk – downstream

The principle mechanism to mitigate against the slightly reduced flood response time available, as a result of the required diversion and channelization of the watercourses (refer to Volume I, Chapter 10), for the downstream communities is through the development of a simple flood warning system, such as emergency sirens. This should be undertaken in conjunction with National Agency for Meteorology and Environment Monitoring of Mongolia (NAMEM). Proposed areas to be covered by a warning area can be seen in Appendix B.

3.8.3 Operational phase

This section contains mitigation measures that will be exclusively applied to the operational phase.

Channel morphology and sediment transport

- Removal of sediment deposited in the channel to ensure the diversion channel provides the required standard of protection
- Since the flood relief channel interferes with the natural processes of erosion and deposition it is recommended that any removed material is re-deposited at the downstream end of the diversion channel in order to mimic the natural transport processes
- The channels, structures and erosion protection measures should be inspected annually following the summer in order to
  - identify any damaged areas in need of repair
  - identify any signs of river meandering or realignment that might affect the integrity of the flood mitigation measures or encourage alternative flood flow routes.

Flood risk – on site

- Clear deposited material from the channels to ensure that their design capacity is maintained.
- Review the channel performance following any major flood event.
- Liaise with MEGD to implement development controls in the catchment to prevent increased flood risk to the site.

3.8.4 Monitoring

Construction

- Monitor water quality upstream and downstream of the site during construction to identify potential issues
- Monitoring and prompt repairing of leaks
- Undertake a routine monitoring programme, during construction, to provide early warning of impacts to groundwater such that these can be managed before they become significant

Operation

- Monitor areas of soil erosion within the site and around the flood mitigation measures and where possible reinstate disturbed ground with vegetation or provide other mitigation to prevent erosion.
- Monitor water quality upstream and downstream of the site to identify potential issues and recommend mitigation as required in order to prevent contamination / discharges to the local watercourses.
- Monitoring and prompt repairing of leaks
- Undertake baseline surveys of groundwater quality, and maintain an ongoing monitoring programme, during operation, to provide early warning of impacts to groundwater such that these can be managed before they become significant.
- In accordance with the site EMP, on-going monitoring and maintenance of the drainage system will be undertaken.
- Monitor and inspect the diversion channels and flood mitigation structures to ensure that they remain well maintained.

3.9 Spill Prevention and Response Plan

A spill prevention and response plan must be prepared in line with the requirements of IFC PS3, IFC General EHS Guidelines Section 1.7 “hazardous materials management”, ADB SPS Annex 1 (environment) and EBRD PR3.

The following spill prevention measures will be undertaken by the EPC contractor EHS Manager, with assistance as necessary from the EPC contractor Environmental Officer:

- Establish a complete inventory of hazardous materials (chemicals, oils and fuels) stored on-site so that in the event of a spill, information is available on volumes present
- Maintain copies of Material Safety Data Sheets (MSDS) for all hazardous materials held on-site so that in the event of a spill information is available on potential risks, both to nearby receptors and the health and safety of construction workers
- Ensure the appropriate storage and transfer requirements are in place at site
- Undertake regular inspections of equipment and facilities to check for leaks or faulty equipment. This includes checking for dents and rust

The Contractor will ensure that appropriate spill response equipment is located at the following locations:

- At all fuel and chemical storage facilities
- At re-fuelling points

As a minimum, the following spill response equipment will be held and maintained by the EPC contractor on site such that it can be deployed to the spill scene:

- Absorbent pads
- Dry granular absorbent
- Appropriate Personal Protective Equipment (PPE)
- Chemical resistant storage drums
- Sandbags
- Shovels made or coated with polyethylene (non-sparking material)
- Corrosion resistant pump
- Hoses
- Warning tape, traffic cones or temporary barricade fencing

The type of response to be mounted in a spill event is determined by the size of the spill and an internationally recognised three tier system will be adopted.

Splashes, drips and spills

- Response to splashes, drips and spills from leaking plant, vehicles and equipment will be immediate and will be undertaken by the EPC contractor's personnel involved in the incident. All site personnel will be trained in response and clean-up procedures for Tier 1 spills
- EPC contractor's personnel will place wastes generated as a result of the spill clean-up in a clearly labelled containers for storage
- The EPC contractor Environmental Officer will complete a Spill Incident Report using a Spill Incident Report sheet and submit this to the EPC contractor EHS Expert

Large bulk fuel or liquid chemical storage tank spills

- In the event of a large bulk fuel or liquid chemical storage tanks spill, attendant personnel will immediately notify the EPC contractor EHS Expert and EPC contractor Environmental Officer using the site emergency notification procedures
- On the advice received from the EPC contractor EHS Expert, the EPC contractor Site Manager will determine the necessity or otherwise of initiating additional spill response including:
  - Enlisting spill response teams for other contractors onsite
  - Emergency Services (firefighting team, ambulance, police)
- The tier 2 response team will place solid and liquid wastes generated during clean-up in suitable containers
- A Spill Incident Report sheet will be completed

Monitoring and inspection related to spill prevention and response during construction activities will be conducted for the duration of the Project, including weekly walkovers and refuelling compliance checks.

3.10 Materials Handling and Storage Plan

The ESIA has identified that a Construction MHSP will be required for the Project. The plan will be prepared by the EPC contractor in line with national legislation, guidelines and GIIP.

The plan will identify storage areas to be established during the construction phase and will require these to be specifically designed giving due consideration to the following requirements:

- Located away from sensitive receptors
- Not at risk from theft or vandalism
- Protection from the elements
- Easily accessible in a safe manner
- Well ventilated
- Unlikely to be damaged
- Bunded and with spill kits provided close by (as necessary for hazardous liquids)

The construction and operational procedures will include reference to the control measures in order to minimise the likelihood of incidents associated with materials storage, handling and use. This will include the following:

- Identification of the necessary bunding and spill kit requirements
- Details of the correct procedure for handling and storing any hazardous materials
- A map showing the material storage locations
- Vehicle and equipment fuelling to only be undertaken in designated areas on impermeable surfaces with adequate spill protection in place
- Training requirements (as necessary) with respect to materials handling procedures, use of PPE, spill procedures and emergency response procedures
- The correct procedure for reporting any environmental incidents related to spills/leakages

3.11 Borrow Pit and Spoil Management

Borrow pit site selection

A borrow pit site will need to be identified and assessed by the EPC contractor in accordance with the EPC Contract, national legislation and international guidelines. All necessary permits will need to be obtained prior to construction. Environmental and social criteria should be given due consideration in the borrow pit selection process to ensure that the borrow pit:

- Is not located in protected areas designated by the host country’s laws or international treaties
- Does not encompass protected habitats of endangered species designated by the host country's laws or international treaties
- Does not create any adverse impact on sensitive surface and groundwater resources
- Is not in an area of flood risk
- Is located no closer than 500m from sensitive human receptors (nuisance impacts) unless all adverse impacts to such receptors are satisfactory mitigated, regular consultation with the receptors will be conducted and results will be reported.
- Will not result in physical or economic displacement
- Does not create any adverse impact on archaeological, historical, cultural, and religious heritage sites
- Is not located far from the Project site
- Has adequate road links from material transportation

Borrow pit site layout

- Unnecessarily high steep faces should be avoided both to avoid reinstatement problems and to reduce visual impact on the local landscape during pit operation.
- Restoration of land used for borrow pits should be considered right from the start of excavation. The pit lay out should be designed to enable easy reinstatement.

3.11.1 The Borrow Pit and Spoil Management Plan

The ESIA has identified that a BPSMP will be required for this Project. The Plan will be prepared by the EPC contractor in accordance with national legislation, the IFC PS and ADB SPS, and the World Bank EHS Guidelines for Mining (2007) for the construction phase of the Project. The Plan will apply the following general practices:

Borrow pit operation

- Implement drainage channels where appropriate to prevent water pooling or flooding of the pit
- Pits and quarries will not be excavated below the water table
- Limit sediment movement using silt fences or straw bails
- Machinery and equipment used on the site will be serviced on a routine maintenance schedule to minimise emissions and noise impacts on nearby sensitive receptors
- Re-vegetate slopes to prevent erosion and wind borne emissions
- Follow the BEMP during blasting activities (refer to section 3.11.2)

Storage

- Topsoil will be segregated from sub-soil and covered to prevent dust / wind borne emissions
- The EPC contractor will ensure that all temporary spoil waste disposal sites adjacent to excavation areas are engineered such that they allow for the sorting and grading of spoil, removal of excess waters through filtration, and are covered to prevent dust emissions
- The EPC contractor will ensure that spoil wastes will not be mixed or contaminated with any other type of waste generated on site
- Topsoil and overburden stockpiles should be located where they will not interfere with pit operations

Disposal design requirements

- Create non-engineered slope profiles which can be integrated into the natural topography
- Spoil areas to be progressively exposed as needed to avoid vegetation removal of large areas without drainage and erosion measures in place.
- The EPC contractor will develop specific method statement and risk assessment for the spoil disposal site.
- Where practicable, topsoil will be reused on site upon re-instatement and landscaping of cut / excavated areas.

Borrow pit closure

- Dismantle and remove all buildings and related infrastructure
- Remove all hazardous waste and explosives

- Re-grade as necessary to establish safe slopes and restore the natural drainage to the area
- Test soils and remediate land as appropriate.

The following monitoring requirements will be required during construction:
- Daily inspections by the site manager
- Routine inspections by the EPC contractor environmental officer on a weekly to fortnightly basis
- Record volumes of spoil generated for spoil production and stockpiling daily and report monthly

3.11.2 Blasting and Explosives Management Plan (BEMP)

The BEMP will be prepared by the EPC contractor if applicable in accordance with the EPC Contract and the following international guidance (World Bank Group General EHS Guidelines and World Bank Group EHS Guidelines for Mining) and CSAIL frameworks (CSAIL FM-05) as well as national legislation.

Key principle of the BEMP will be to avoid blasting where possible. Clear reasons and need for blasting and use of explosives must be demonstrated over and above use of mechanical removal. In the even blasting is required the procedures outlined in the BEMP will be implemented. Permits for the purchase and transport of explosives will also need to be obtained.

The BEMP will meet the following requirements:
- Explain the objectives of the blast
- Identify hazards and risks, including control and/or mitigation
- Identify site-specific requirements
- Use of low energy explosives for blasting areas of low overburden
- Control the blast process from design to initiation and in the event of a misfire
- Comply with the approval/contract specifications
- Ensure safety of the public, site personnel and surrounding properties
- Implement a review process to ensure that the objectives are met

Mitigation measures for blasting include the following:
- Identification and documentation of risks through appropriate risk assessment
- Develop and maintain safe blasting procedures
- Security arrangements in place, such as access to authorised persons only and secured area with guarded gate
- Ensure shot firers are licensed
- Train personnel in explosives products and blast design
- Develop and implement procedures to check training and competency
- Set up exclusion zones
- Use appropriate firing method and types of explosives
- Use low energy explosives for blasting in areas of low overburden
- Scheduling of traditional drilling/blasting during the drier months to avoid overloading of the sediment transport capacity of the river.
- Pre-construction building condition survey of identified at risk buildings

- Use of temporary noise barriers and deflectors where appropriate
- Blasting should only take place during the day time

As regards monitoring, a BEMP will be prepared by the shot firer before every blast and after consulting those involved in the blast. Records will be kept on environmental conditions of the blast, details of fly rock, incidents or complaints, results and any proposed modification to the blast plan or future blasts.

3.12 Chance Finds Procedure

A ‘chance finds procedure’ in line with IFC PS8, the World Bank’s Physical Cultural Resources Policy Guidebook and GIIP will be developed and implemented for all groundworks during construction. The Consortium will consult with the relevant authorities to ensure that the procedure is acceptable to them and that it complies with local and national regulations.

If any unexpected finds are encountered during earthworks or excavation works the following mitigation approaches will be employed by the Project:
- Work will be immediately stopped in the area
- The find(s) will be demarked and protected via fencing / blocking off and the site manager and Project Environmental Officer will be contacted
- The cultural authority will be informed in order to seek guidance and specialist advice for management of the find(s) and how best to proceed, given its nature and extent
- All finds will be recorded

The Contractor Environmental Officer will submit a Chance Find Report to the Consortium’s EHS Officer within one day of the find. This will record as a minimum the following information:
- Date and time of the discovery
- Location of the discovery
- Description / photo of the Physical Cultural Resources
- Estimated weight and dimensions of the find
- Temporary protection that has been implemented (if any)

The Chance Find Report will be submitted to any other concerned parties as agreed with the Mongolian Academy of Sciences, Institute of Archaeology, and in accordance with national legislation.

3.13 Habitat Removal and Restoration Plan (HRRP)

A HRRP will be produced by the EPC contractor and reviewed by a qualified ecologist before the start of construction.

HRRP is likely to include the following practices:
- All construction and operational working areas will be kept to the minimum to reduce habitat loss and degradation.

- Additional habitat clearance required outside of the Project footprint will be restored on-site (if the impact is temporary) or recreated off-site through new planting using native species that do not require special irrigation measures.
- Plant 10 or more seedling and saplings for each harvested tree[3].
- Compensation for any losses to animals should be twice their ecological and economic value[4]
- All species used in the habitat restoration will be native. No introduction of non-native plant species will be allowed.
- Spoil deposit sites will be also planted with native vegetation and measures to control soil erosion will be implemented.
- Store soils carefully to protect fertility for reuse at the end of the Project construction
- Where possible, minimise vegetation removed and protect vegetation to be retained during the construction of the new roads
- Utilise pollution prevention through the correct implementation of best practice measures to minimise habitat loss and degradation

To ensure the habitats restored on-site or created off site are established successfully, they will be maintained and monitored for at least five years after construction by the Consortium. It is proposed that the National Park authority will be consulted to confirm and agree the proposed mitigation measures.

3.14 Occupational Health and Safety Plan

An OHS Plan is required to identify preventative and protective measures to protect the health and safety of workers on-site. The OHS Plan will be produced in line with the following national and international requirements:
- Labour code of Mongolia
- IFC PS2 – Labour and Working Conditions
- World Bank Group / IFC EHS Guidelines
- Workers' Code of Conduct

EPC contractors and the Consortium's Health and Safety Plans should be developed separately (not part of the CESMP). The Consortium will review the Contractor's OHS Plan and procedures to ensure compliance with the Consortium's ESMS and health and safety requirements, and contractual clauses (including commitment to this ESMMP). The OHS Plan should be prepared and read in accordance with the EPRP.

Mitigation measures will include the following:
- Proper use of personal protective equipment (PPE) by all workers, PPE use in workers' code of conduct
- Contractor to have an appropriately equipped and staffed first aid room accessible to Contractor and Owner staff during the Construction period

[3] Refer to Mongolian Law on Forest (2012)

[4] The Mongolian Law on Environmental Protection (2012)

- Site safety awareness training
- Monitoring and reporting of accidents, injuries, lost-time incidents, near misses and community interactions on health issues
- Worker accommodation monitoring
- Tool box talks on hygiene and sanitation at least every six months
- Good housekeeping on site
- Control and quality assurance of drinking water
- Pest and vector control activities

Monitoring of the OHS plans and procedures will be undertaken monthly and a progress report produced quarterly.

KPIs to ensure the successful implementation of the Plan include:
- Monthly monitoring and reporting of accidents, injuries, lost-time incidents, near misses and community interactions on health issues
- First aid room use statistics
- OHS target accident rate of zero
- Monthly summaries of toolbox talk topics and coverage

3.15 Site Security Plan

A site security plan has been prepared and is included in Appendix C.

3.16 Emergency Preparedness and Response Plan

An EPRP is relevant to both the construction and operational phases of the Project. The EPRP is to provide an organisational structure so that each scheme can effectively prepare for both external and internal disasters that can potentially negatively affect the Project. The EPRP will be prepared in accordance with IFC PS1 and GIIP.

Responsibility for developing the EPRP for the construction phase lies with the Contractor. Ultimately, in the preparation of the EPRP, the following process will need to be followed;
- Perform HAZOP analysis for all three schemes and this should cover the construction and operational phases of the Project. Completion of the HAZOP should be undertaken in a workshop or series of workshops and include inputs from all relevant stakeholders (such as the Consortium, the EPC contractors, local communities, municipalities and local emergency services representatives as applicable).
- Document the perceived level of risk (in a risk register) and the appropriate mitigation measures which are required to reduce risks to acceptable levels. All mitigation measures should have responsibilities and timeframes attached to them.
- Inform potentially affected communities of significant hazards giving explanations to aid understanding;
- Prepare the EPRP (see below for the proposed structure).
- Summarise and disclose the EPRP in a culturally appropriate manner.

The EPRP will as a minimum:

- Identify and evaluate emergencies
- Determine preventative action
- Highlight trigger events and measures to implement plan

3.17 Resettlement Plan

A Resettlement Plan (RP) has been prepared which is designed to ensure that resettlement affected people's standard of living; security of tenure and livelihoods is at least restored or improved, so that resettlement is used as a development opportunity. The RP has been developed in line with the requirements of ADB's Safeguard Requirement 2 on Involuntary Resettlement and IFC PS5 and related guidance notes.

The Consortium has responsibility for implementing the RP. Monitoring requirements will include:

- Regular internal monitoring reports based on RP
- Audit compliance with RP
- Resettlement completion report

3.18 Stakeholder Engagement Plan

A Stakeholder Engagement Plan (SEP) has been prepared which is designed to manage stakeholder and community relations, expectation, and grievances through consultation and disclosure mechanisms. The SEP has been developed in line with national legislation, ADB's Safeguard Requirement 1 on Environment, IFC PS1, 2 and 5 and related guidance and the Workers' Code of Conduct.

The Consortium has overall responsibility for ensuring meaningful consultation and broad community support throughout the Project lifecycle. The EPC contractor will lead on stakeholder engagement activities during construction for project performance whereas the Consortium will lead during operations.

Monitoring of the SEP includes:

- Consultation logs
- Grievance logs
- Annual updating of SEP
- Six monthly community liaison and stakeholder engagement reports by EPC contractor during construction
- Annual sustainability reporting by the Consortium during operation

3.19 Community Grievance Mechanism

A community grievance mechanism has been prepared and is included in the SEP.

3.20 Local Content Strategy

Overview

The Consortium will develop a 'local content' strategy with the overarching objective of sharing the Project's socioeconomic benefits with the locally affected workers and businesses. The strategy will consist of three strands containing measures to promote and maximise opportunities for:

- Local employment
- Skills development
- Local procurement

An outline strategy for the lifetime of the Project will be developed prior to construction commencing. Responsibilities for implementation of the plan during construction are passed down to the EPC contractor. Thereafter, implementation responsibilities will be assumed by the Consortium during the operational phase of the Project. The three strands of the strategy are discussed below.

Local Recruitment Measures

In order to provide employment opportunities for local people the Consortium will develop and implement a local policy and actions. This will aim to match the existing local skills base with the specific roles required for the Project. As a minimum, the policy will seek to provide unskilled or low skilled jobs to local jobseekers.

During the construction phase the EPC contractor's recruitment team will be required to:

- Work alongside local employment offices to develop a profile of the local skills base according to local job-seekers profiles, so that synergies with Project needs and opportunities for local recruitment can be identified.
- Disclose employment opportunities to local Project affected communities in a timely manner and actively seek applicants from these areas and nearby larger settlements.
- Provide preferential hiring of people who have been physically and economically displaced by the Project to contribute to the livelihood restoration plans that are to be developed.
- Regularly and on an ongoing basis report the labour profile to the consortium with workers disaggregated by nationality/place of origin, skills level and gender.

The strategy should include the means by which local people hired on a short term basis during construction can obtain permanent contracts on the Project during the operational phase. This should especially be the case for resettlement affected and economically displaced people.

The Consortium will be required to monitor the performance of the EPC and monitoring KPIs for local recruitment will include:

- A skills map of local job seekers, according to information provided by government employment offices and job applicants
- Evidence of disclosed recruitment and procurement policies, including recruitment fairs

- Percentage of local (as defined) and Mongolian employees, vis-à-vis foreign and non-local, disaggregated by different roles and level of seniority
- Statistics on number of resettlement and economically displacement affected people hired

In the event that 'non-local'[5] people are hired for low skilled (e.g. driver, cleaner, security) or unskilled roles (e.g. labourers) – especially in cases where workers from outside of Mongolia are employed - a clear and reasoned justification will need to be provided. Examples of such justification may include issues related to language, with regards to health and safety management; or, the skills-supply quality not matching the project requirements.

Skills Development Measures

In addition to providing jobs to local people, the Local Content Strategy should have the objective of facilitating skills development of the local workforce. The overarching aim should be to provide longer-term benefits to local people beyond the lifetime of the Project, therefore enhancing their future employability. All training will be free of charge to participants.

During construction, the EPC contractor will provide on-the-job training to certain of the unskilled or low skilled local workers hired. Such workers will then be provided with certificates which they can use to evidence their upskilling and qualifications obtained to future potential employers. The key beneficiaries of this training should be the physically and economically displaced people employed by the Project.

In the operations phase, when the majority of workers are expected to be local, the consortium will explore opportunities to partner with Vocational Education and Training (VET) providers.[6] A programme to provide a mix of classroom based and on-the-job training trade skills training. This would be longer term than the construction upskilling running over a number of years for full time employees.

Monitoring KPIs in relation to upskilling of the workforce during construction will include:
- Provided training and issued skills certifications
- Records of training for local residents (name, type of training, etc.)
- Skills development reports will be required.

In the operational phase, the number of trainees starting and completing courses and training course evaluations should be used as KPIs.

Local Procurement Measures

The aim of this strand of the Local Content Strategy will be to give opportunities to local small and medium enterprises (SMEs)[7]. Options that will be considered in the strategy include:

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[5] The plan will include a clear definition of what is meant by the term "local"

[6] This can include technical and trade colleges that over vocational qualifications and apprenticeships.

[7] Guidance available at http://www.engineersagainstpoverty.org/documentdownload.axd?documentresourceid=23

- Unbundling procurement requests into smaller work packages to facilitate access to SMEs
- Providing tender documentation in local languages and free of charge
- Providing longer deadlines to assist SME response
- Using serial contracts or framework agreements
- Requesting tenders in local currency

KPIs of the Local Content Strategy include:
- Analysis of which products and services can best be addressed by local and national companies[8] and development and maintenance of a database of manufacturers, consultants, companies and contractors who can provide goods and services.[9]
- Distributing a brochure that provides basic information on the Project, a summary of the main local content commitments, and contact information for local Small and Medium Enterprises (SMEs) and interested parties to register their capabilities or get more information on prequalification activities.
- EPC contractor to have a designated staff member to liaise with local companies and implement the local content strategy.

Monitoring requirements of the local procurement strategy include:
- Six monthly reports on construction contracts. with relevant data such as analysis of country of origin of company, size of contract, type of service, one off or routine.
- Annual operational reports on contracts as above.

3.21 Influx Management Strategy

An influx management strategy will be developed by the Consortium which aims to avoid and mitigate the negative effects of project-induced migration. The influx management strategy will include consideration of the following measures, which may be undertaken in consultation and in partnership with regional government (key stakeholders will be spatial planners) and civil society:
- Ring-fencing community investment funds for spatial planning and to support local initiatives to address greater demand for social and community services and infrastructure.
- Supporting counselling services in response to known existing problems to raise awareness and target services to the community, for example in relation to marital relationships, alcohol and drugs.
- Combat HIV/AIDS through coordination with the Ministry of Health and civil society with activities that are consistent with national policies, treatment guidelines and outreach approaches.[10]
- Supporting financial management through providing financial management seminars to workers

The strategy should refer to and be closely aligned with the CIP.

Monitoring requirements will include:

[8] The EPC contractor should begin local content efforts by focusing on goods and services where there is low risk and local and national companies can provide goods and services on a routine and internationally competitive basis.

[9] At a minimum the database needs to be alphabetical by company and include the company's location, contact, main activities and category of services

[10] Understanding how anti-retrovirals may affect workers' ability to carry out construction and operation tasks will be important.

- Population and census data for the Area of Influence (AoI)
- Yearly project induced in-migration strategy evaluation report with

3.22 Human Resources Policy

To avoid inappropriate and unfair employment conditions, a Human Resources (HR) Policy will be developed by the EPC contractor (prior to and during construction) and the Consortium (prior to and during operation), in line with labour codes of Mongolia, IFC PS2 and the Project Workers' Code of Conduct. Reference should also be made to the WAP.

The Consortium and EPC contractor's HR Policy and Procedures will require as a minimum:
- Project workers with contract of employment
- Job descriptions for all roles
- Payment of wages and bonuses on time
- Labour grievance mechanism
- HR files and systems with: applications showing non-discrimination and equal opportunity; signed contracts with working conditions and benefits defined; leave requests; timekeeping records; payment records; other relevant information
- At end of contracts workers provided with a summary of service and training activities

Monitoring of labour rights will be undertaken by the Consortium, EPC contractor and third party, as follows:
- Monthly reporting by all Project employers on labour statistics including profile, hours worked and lost, overtime use, labour incidents.
- Quarterly labour rights monitoring reports by EPC contractor during construction
- Labour rights monitoring reports by the Consortium and third party
- Six monthly toolbox talks on labour rights

3.23 Workers' Code of Conduct

The Code of Conduct will be designed to govern the behaviour of workers employed by the Consortium and all its contractors and subcontractors during the construction of the Project. It should include a signed declaration form.

The code of conduct includes general onsite requirements and requirements driving to and from the site:

General Responsibilities (including but not limited to):
- All workers must work towards maintaining good relations with each other and with the communities near to the Project
- Workers will respect the cultural norms of the local community
- All workers are forbidden to possess or consume alcohol during working hours
- The use of drugs or medicines must be authorized by the physician on site
- Workers must use the designated access routes between the site and accommodation

- All workers are forbidden to smoke except in specified areas
- All workers must comply with the occupational health and safety plan at all times
- All workers must wear personal protective equipment appropriate to the task they are undertaking

Driving to, from and on and the construction site (including):
- Vehicles must always be driven in accordance with the TMP
- Vehicles must not use routes other than those designated in the TMP
- Project drivers are not authorised to carry passengers other than Project workers
- The Project's designated speed limits must not be exceeded
- Drivers will adhere to dust suppression measures outlined in the Project's CESMP.

The Code of Conduct will be reviewed annually, taking into consideration any relevant complaints by communities or by workers against other workers.

3.24 Worker Grievance Mechanism

A labour grievance mechanism has been developed as part of the Workers' Code of Conduct and in line with IFC PS2. The mechanism addresses labour grievances appropriately and on a timely basis to avoid negative labour incidents.

KPIs to measure the effectiveness of the labour grievance mechanism include:
- Distribution and employee knowledge of labour grievance mechanism
- Labour grievance mechanism log
- Number, type and resolution timeframe of labour grievances
- No lost time because of labour strikes, disputes or incidents

It will be a requirement of the grievance mechanism that the following is undertaken:
- Six monthly toolbox talks on labour grievance mechanism
- Six monthly summary of use of labour grievance mechanism

3.25 Workers Accommodation Plan

The WAP describes the minimum national legislative requirements plus the applicable international and Project requirements relevant to the facility standards and management of labour accommodation. Specifically the plan will be aligned with the requirements set out in the guidance note by IFC and EBRD on workers' accommodation: processes and standards (2009).

Prior to the construction works, the Consortium, the EPC contractor and any other appointed contractors responsible for providing worker's accommodation will commit to measures at a minimum including the following:
- Practice for charging for accommodation
- Provision of minimum amounts of space for each worker
- Provision of sanitary, laundry and cooking facilities and potable water

- Location of accommodation in relation to the workplace
- Any health, fire, safety or other hazards or disturbances and local facilities
- Provision of first aid and medical facilities
- Heating and ventilation
- Workers freedom of movement to and from the employer-provided accommodation will not be unduly restricted
- Sharing and implementing the Workers' Code of Conduct.

Monitoring requirements of the WAP will comprise quarterly labour accommodation inspections until regular identification of no problems. Labour inspections can then be scheduled bi-annually.

4 Reporting Requirements

4.1 Introduction

Effective reporting is essential for rendering an ESMMP of practical value. Routine independent auditing provides the necessary impetus for continual improvement. Without these two fundamental elements, such systems simply become data collecting exercises. Performance monitoring, reporting and auditing should be carried out to ensure compliance with the requirements of this ESIA and ESMMP. The following provides an outline approach which is aligned to the requirements of ISO 14001. The final scope and format of all reports proposed herein will be agreed with the lender prior to them being required and produced.

4.2 Adaptive Management

The ESMMP and plans contained herein will adopt an “adaptive management” approach throughout the life cycle of the Project. The creation of the plans at the outset is a fluid process with the management objectives and performance indicators tailored to the current design and objectives of the project. The ESMMP utilises to the extent possible existing project knowledge to fully address the actual environmental and social impacts of the Project at the time and allow flexibility in environmental and social management decisions made on the project.

To ensure adaptive management of the ESMMP the following actions will need to be implemented:

- The ESMMP will be reviewed and amended in accordance with the Project as it evolves. The EPC contractor system should allow for a process of review and revision of relevant plans (in accordance with the requirements of ISO14001). Key information about any changes to Project description will be regularly reviewed (monthly) and site visits undertaken by Consortium staff to identify the true impacts of the Project.
- Evaluation of the effectiveness of measures included in the ESMMP need to be undertaken on a regular basis as the Project evolves through construction, operation and decommissioning. Evaluation will be undertaken through on-going communication with the contractors, construction sub-contractors, stakeholders and lenders supplemented by site audits and monitoring data review to identify weaknesses and / or gaps in the management plans. The ESMMP will be changed and / or updated accordingly to ensure appropriate, robust and effective environmental and social management commensurate to the scale of the Project through its lifetime.

4.3 Monitoring and Reporting

4.3.1 EPC contractor or EPCM contractor Monthly Internal Reports

The EPC contractor or EPCM contractor will undertake on a daily basis, compliance monitoring of the construction sub-contractors environmental and social activities as per the IFC Environmental, Health, and Safety guidelines and the approved EPC contractor or EPCM contractor CESMP and sub plans.

The EPC contractor or EPCM contractor Environment Officer will be required to prepare a monthly report for issue to the Consortium's EHS Director. These reports should normally be no more than one or two pages in length, to summarise the following:

- Progress in implementing their CESMP and parallel management plans
- Findings of the monitoring programmes, with emphasis on any breaches of the control standards, action levels or standards of general site management
- Outstanding Non-Compliance Reports (NCRs)
- Summary of any complaints by external bodies and actions taken/to be taken
- Relevant changes or possible changes in legislation, regulations and international practices.

Any breaches of the acceptable standards specified by law/construction permits and/or this ESIA should be reported to the Consortium, using a NCR Form. The EPC contractor will promptly address and/or correct any NCRs, in consultation with the Consortium.

4.3.2 The Consortium's Monitoring of Construction Activities

The Consortium will undertake on a weekly basis compliance monitoring of the EPC contractor or EPCM contractor environmental and social activities as per the WB/IFC EHS guidelines and the approved EPC contractor or EPCM contractor CESMP and sub plans. Internal audits will be undertaken within two months of commencement of construction and thereafter every three months focussing on the performance of the implementation of the EPC contractor or EPCM contractor CESMP. The Consortium will also audit the workers' accommodation camps on a three monthly basis.

Any breaches of the acceptable standards specified by law/construction permits and/or this ESMMP through the Consortium monitoring of the EPC contractor or EPCM contractor will be reported using a NCR Form.

A copy of each completed NCR (whether prepared by the EPC contractor or EPCM contractor or the Consortium) should be held on file by the Consortium's EHS department, to be replaced by the reply copy when it is received. A record of corrective actions should also be made and tracked to their completion.

4.3.3 The Consortium's Monitoring of Operational Activities

The environmental and social impacts that will occur during the operation phase have been assessed through the ESIA. Impacts will be managed and monitored through the commitments outlined in this ESMMP. The Consortium's EHS Director will prepare annual reports for issue to the lenders summarising progress against implementation of the Consortium's ESMMP obligations throughout the operations phase. This will include full reporting of monitoring results where relevant.

Adherence to the OHS plan and procedures will be taken seriously and audited frequently. A warning system for violations and non-compliance will be established and implemented for the monitoring system to be effective.

Regular monitoring of the Project performance grievance mechanism and stakeholder engagement will take place.

4.3.4 The Consortium's External Reporting for Regulatory Compliance

A register of all necessary external stakeholder reporting requirements under Mongolian Legislation and for regulatory compliance purposes should be developed where appropriate. The frequency of reporting, the required reporting format and the person(s) responsible for producing the report (along with any necessary specialist service providers/constructors required to assist for data collection or interpretation purposes) is to be noted in the register.

The Consortium will ensure that all the necessary reports are produced and submitted in a timely fashion in order to achieve on-going regulatory compliance throughout the life of the Project. Meeting regulatory reporting requirements is to also form part of the scope for any internal audits and management reviews.

4.4 Annual Independent Audits and Lenders Reviews

4.4.1 Independent Monitoring

The Equator Principles and EBRD require that all 'Category A' Projects such as this Project require an independent environmental and/or social expert to verify project monitoring information.

The IFC PS guidance notes state that Projects require an independent environmental and/or social expert to verify project monitoring information.

During the construction phase and as a minimum, throughout the first three years of operation, arrangements should be made by the Consortium for an industrial environmental management specialist to carry out an independent annual audit of the existing practices against the requirements of the ESMMP. The key objectives of the audit should be as follows:

- Report on the practical implementation of the ESMMP and progress since the last visit
- Establish feasible improvement objectives for completion before the next visit.

These audits should be used to re-examine the continued appropriateness of the ESMMP and to provide advice on any up-dates required. Attention should be given to lessons learnt in the light of experience. In particular, consideration should be given to the monitoring programmes in place to determine whether their purpose has been served and they can therefore be terminated or reduced in frequency.

Monitoring of social issues will be important, especially with regards to worker management, workers' terms and conditions, occupational health and safety and grievances. External monitoring will need to verify that the Project commitments to worker's rights are implemented, in particular with regards to:

- Use of child labour
- Payment of minimum wages and overtime
- Not taking any action to prevent employees from exercising their right of association and their right to organise and bargain collectively
- Ensuring no workers are charged fees to gain employment on the Project
- Implementation of plans, procedures and training for occupational health and safety
- Non-discrimination and equal opportunity
- Use of the labour grievance mechanism
- The existence of human resource policies, job descriptions, written contracts
- Provision of information to labour force regarding rights and working conditions
- Employee training activities.

Annual monitoring reports of the independent advisor will be made available for public disclosure on the Project's website and lenders website.

4.4.2 Monitoring by Lenders

Representatives of the lenders will be involved in regular field visits to monitor the Project's progress in implementing environmental and social measures. Prior notice will be provided to the Project before field visits. The Consortium's staff will provide further information of specific local environmental and social activities and help to coordinate interviews with contractors and construction sub-contractor representatives, community representatives, and Mongolian Government representatives, if required by the lenders.

Appendices

Appendix A. Air Quality Management Plan

  

Appendix A

Air Quality Management Plan

October 2015

CHP5 Consortium

Appendix A

Air Quality Management Plan

October 2015

CHP5 Consortium

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Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
A	September 2015	A Chakravartty	M O'Brien	A Day	First draft
B	September 2015	Chris Mills	N Court	A Day	Working draft
C	October 2015	Chris Mills	M. O'Brien	L. Jones	Updated to reflect Client Comments

Contents

1 Air Quality Management Plan

1.1 Purpose of this Plan

The purpose of the Air Quality Management Plan (AQMP) is to manage dust and other pollutants during both the construction phase and operation phases of the Project by using appropriate monitoring and mitigation measures as identified within the ESIA. The AQMP will apply for the duration of the project construction and operation phases (no decommissioning activities are considered in this AQMP).

The AQMP provides the following
- Construction and operational dust mitigation measures as specified in the ESIA
- A framework plan outlining the requirements to monitor emissions from the stack
- Two framework plans outlining the requirements for the monitoring of ambient air quality as specified below
  a. to assess impacts associated with coal handling within the site boundary
  b. to assess impacts associated with emissions from the stack

1.2 Responsibilities

The EPC Contractor is responsible for implementing the AQMP during the construction phase (i.e. incorporating construction mitigations).

The Consortium is responsible for implementing the AQMP during the operation phase (i.e. monitoring emissions from the stack and undertaking ambient monitoring). No construction or operational work shall be carried out prior to the formal approval of the AQMP. Prior to implementation, the monitoring plans shall be approved by the Lenders or their representatives.

1.3 Legislation/ guidelines

The AQMP will be implemented in line with the Mongolian Ambient Air Quality Standards stated in MNS 4585:2007 and the IFC EHS Guideline's and emission limit values applicable to the Project identified within the ESIA. Relevant Mongolian Ambient Air Quality Standards are presented in Table 1.1) and Section 3.2.1 presents the relevant emission limit values

Table 1.1: Summary of Applicable Ambient Air Quality Standards and Guidelines (µg/m³)

Pollutant	Averaging Period	Concentration
Nitrogen Dioxide (NO_2)	20 Minute	85
	24 hour	40
	Annual	30
Sulphur Dioxide (SO_2)	10 Minute	500
	20 Minute	450
	24 hour	20
	Annual	10
Particulate Matter (PM_{10})	24 hour	100

Pollutant	Averaging Period	Concentration
	Annual	50
Particulate Matter ($PM_{2.5}$)	24 hour	50
	Annual	25
Carbon Monoxide (CO)	30 Minute	60,000
	1 hour	30,000
	Running 8 Hour Mean	10,000

2 Construction and Operational Mitigation measures

The following broad mitigation measures are required to minimise impacts on air quality:

- Construction Phase
  - Minimise dust from material handling sources, such as conveyors and bins, by using covers and/or control equipment such as water suppression
  - Minimise dust from open sources, including storage piles and borrow pits, by using control measures such as installing enclosures, covers, or increasing the moisture content
  - Dust suppression techniques will be implemented, such as applying water or non-toxic chemicals to minimise particulate emissions from vehicle movements
  - Emissions from mobile sources will be managed as per the EHS Guidelines for Air Emissions and Ambient Air Quality as below:
    - Regardless of the size or type of vehicle, fleet owners /operators should implement the manufacturer recommended engine maintenance programs
    - Drivers should be instructed on the benefits of driving practices that reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits
    - Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas
  - Exposed surfaces of stockpiled materials such as excavated material arising during construction will be covered or vegetated
  - No open burning of solid waste material will be allowed.
- Operational Phase
  - Use of loading and unloading equipment to minimise the height of coal drop to the stockpile
  - Use of water spray systems and/or polymer coatings to reduce the formation of fugitive dust from coal storage (e.g. on stockpiles) as feasible depending on the coal quality requirements
  - Use of cleaning devices for conveyor belts to minimise the generation of fugitive dust
  - Use of enclosed conveyors with well designed, robust extraction and filtration equipment on conveyor transfer points to prevent emission of dust
  - Use of wind fences in open storage of coal or profiling
  - Limit use of machinery on and around the coal yard during windy conditions
  - Compliance with stack emission limits

3 Stack Emissions Monitoring

3.1 Overview

In accordance with the IFC EHS Guidelines, continuous emission monitors will be installed for the following pollutants:

- Particulate Matter (PM)
- Sulphur Dioxide (SO_2)
- Oxides of Nitrogen (NO_x)

Annual stack emissions testing will also be carried out to take direct measurement of emissions from the stack for the following pollutants:

- Particulate Matter (PM)
- Sulphur Dioxide (SO_2)
- Oxides of Nitrogen (NO_x)
- Heavy Metals

3.2 Technique and Standards

The techniques and standards that will be used for stack emissions monitoring are set out in Table 3.1. In order to provide reasonable flexibility during the implementation of the programme, the specification of the equipment to be used is described below rather than identifying specific manufacturers. Where other equipment is available that can be proven to provide the same level of data quality and meet the programme objectives this can be used.

Table 3.1: Monitoring technique and standards

Data Collection Method	Pollutant	Technique
Continuous	NO_X	EU / US EPA approved
Continuous	SO_2	
Continuous	PM	
Indicative	PM, SO_2, NO_x and Heavy Metals	

3.2.1 Legislation / Guidelines

The AQMP will comply with the following Emission Limit Values (ELV) (shown in Table 3.2) in accordance with IFC EHS guidelines for Thermal Power Plants.

Table 3.2: Summary of Applicable Emission Limit Values (mg/Nm³)

Pollutant	Degraded airshed (DA)(a) (b)
NO_x	200
SO_2	400
Particulate Matter	30

Source: [a] An airshed is considered to be degraded if nationally legislated air quality standards.

[b] In accordance with the IFC EHS Thermal Power Plants guidance emission levels should be evaluated on a one hour average basis and be achieved 95% of annual operating hours.

3.2.2 Analysis, Reporting and Actions

3.2.2.1 Continuous Emission Monitoring

A yearly report need to be produced based on the preceding calendar year data, detailing the following information:

- Compliance of the monitoring data against ELVs and detail of any breaches
- Details of any investigation or remedial action taken as a result of an exceedence
- Discussion of any salient quality assurance issues
- Copy of the calibration report (if applicable).

The reports will be reviewed by the Project Environmental Manager and a copy will need to be stored at the Project site.

3.2.2.2 Annual Emission Testing

Annual stack emissions testing will be carried out by a competent contractor and any test results will be reviewed by the Project Environmental Manager. Where emission test are found to be above ELVs, this will be reported immediately to the Project Environmental Manager. An investigation into the cause of the exceedence(s) will be carried out by the Environmental Manager and appropriate remedial action taken if emissions from the Project area are found to be the cause. Any such event will be logged appropriately and a copy will be stored in the project site detailing the cause and remedial action taken to resolve the issue.

4 Ambient Air Quality Monitoring

4.1 Monitoring of Ambient Impacts Associated with Coal Handling - Dust Monitoring and Action Plan (DMAP)

4.1.1 Overview

The purpose of the Dust Monitoring and Action Plan (DMAP) is to establish a monitoring protocol for dust at the nearest identified sensitive receptors located to the north and south east of the proposed Project site as a result of the coal handling activities. Dust is a generic term which usually refers to particulate matter in the size range 1-75 microns. Larger particles in this fraction can cause loss of amenity and/or nuisance and smaller particles (PM_{10} and $PM_{2.5}$) can cause health effects.

4.1.2 Schedule

In order to provide sufficient data on existing ambient pollutant concentrations, the monitoring will commence six months prior to the start of operation. The effectiveness of the DMAP shall be reviewed annually. After continuous operation of the Project for three calendar years, the monitoring could be simplified or reduced if monitored concentrations are found to be below 75% of the relevant standards and no significant dust, PM_{10} or $PM_{2.5}$ impacts are reported. As a maximum, the monitoring will cease upon the decommissioning of the Project.

4.1.3 Data Collection Methods

Only continuous automatic monitoring methods shall be used (i.e. not periodic) due to the short term national standards and the potential for unexpected short term releases of pollutants in ambient air.

In order to provide reasonable flexibility during implementation, the specification of the equipment to be used is described below rather than identifying specific manufacturers. Where other equipment is available that can be proven to provide the same level of data quality and meet the monitoring objectives this can be used.

4.1.4 Technique and Standards

The techniques and standards that will be used for the monitoring of dust include Total Suspended Particulate (TSP), PM_{10} and $PM_{2.5}$ and are set out in Table 4.1.

Table 4.1: Monitoring technique and standards

Pollutant	Technique	Data Collection Method	Sample Interval
TSP, PM_{10}, $PM_{2.5}$	Tapered element oscillating microbalance (TEOM) with Filter Dynamics Measurement System (FDMS) or Beta attenuation monitors (BAM) or Optical Detection	Continuous	1 hour

Pollutant	Technique	Data Collection Method	Sample Interval
	Monitors		

4.1.5 Monitoring station enclosure arrangement

The continuous analysers will require a weatherproof appropriate sitting arrangement with a continuous electrical power supply in accordance with the chosen manufacturer's specifications.

4.1.6 Data storage and security

All monitoring devices shall be equipped with appropriate communication systems in order to ensure that monitoring data can be downloaded, reviewed and archived at a central location.

All monitoring instruments shall be equipped with data logging capacity to store data for a minimum period of three months. This is to ensure secure monitoring data should the communications systems suffer temporary failure.

4.1.7 Monitoring Location

The proposed area of dust monitoring is presented in Figure 4.1. The identified areas for the monitoring locations are approximate and the final location will depend on the availability of electrical supply and site security measures. The chosen locations should be situated in areas where air circulates freely, are away from location emission sources and the air inlets are at heights which represent relevant population exposure.

Figure 4.1: Dust monitoring location

4.1.8 Quality Assurance/Quality Control

Calibration of the continuous analysers shall be carried out in accordance with the manufacturer's instructions and following reliable and traceable calibration standards.

4.1.9 Analysis, Reporting and Actions

Data from the continuous analysers will be checked on a daily basis by a site representative.

Based on the initial six months monitoring prior to operation a trigger level will need to be agreed, with an alert system put in place to inform the site Environment Manager when the level has been exceeded. A record shall be kept for any such event of exceedances of trigger levels detailing the actual TSP, PM_{10} and $PM_{2.5}$ levels recorded, the activity that was occurring on site and the actions taken to stop the exceedence and prevent re-occurrence. A review of existing mitigation measures followed by additional mitigation measures, or modification may be required to prevent any re-occurrences if the exceedance occurs when normal coal handling activities are taking place.

4.1.10 Performance measurement/ KPI's

The performance measurements for the DMAP are set out in Table 4.2:

Table 4.2: Dust monitoring performance measures

Objective	Activity	Project stage	Action	Standards	Monitoring / KPI	Implementation Route / Plan
To ensure the health and safety of the community and reduce potential nuisance	Continuous monitoring of TSP, PM_{10} and $PM_{2.5}$	Operation	Monitor dust and take remedial action when trigger levels exceed	IFC EHS General Guidelines on Air Emissions and Ambient Air Quality and Mongolian Ambient Air Quality Standards stated in MNS 4585:2007	• The monitoring concentration shall not exceed the trigger levels. • No complaints or dust impacts at receptors	Operator

4.2 Monitoring of Ambient Impacts Associated with Stack Emissions

4.2.1 Overview

The introduction of an Ambient Air Quality Monitoring Programme is in accordance with the IFC EHS Guidelines which recommend that monitoring programmes should be determined based on the findings of the ESIA. In addition, the IFC Performance Standards note that monitoring should be carried out to alert operators to significant impacts on ambient conditions that may indicate problems with the plant processes or pollution control equipment that could require corrective action. The IFC EHS Guidelines require that if predicted project impacts are greater than 25% of relevant short term ambient standards typically a minimum of two continuous ambient air quality monitoring stations are required to be installed in the vicinity of the plant. The ESIA identified the impacts are greater than 25% and therefore the following monitoring is proposed as a minimum in accordance with IFC EHS guidance:

- Continuously monitor ambient concentrations of NO_x and NO_2
- Continuously monitor ambient concentrations of SO_2
- Continuously monitor ambient concentrations of PM_{10}
- Continuously monitor ambient concentrations of $PM_{2.5}$

In addition to the air quality analysers a meteorological station will also be installed to assist with data interpretation.

Although an existing air quality and meteorological monitoring station is located in the study area (known as 'UB-08' (see Figure 4.2), its location is not suitable for the purpose of monitoring project impacts as it is located too close to the site.

4.2.2 Schedule

In order to provide sufficient data on existing ambient pollutant concentrations, the monitoring programme will commence as soon as is practicable, in 2016. The effectiveness of the ambient air quality monitoring programme shall be reviewed annually. After continuous operation of the Project for three calendar years the monitoring programme could be simplified or reduced if monitored concentrations are found to be below 75% of the relevant standards. As a maximum the monitoring programme will cease upon the decommissioning of the project.

4.2.3 Data Collection Methods

There are a number of methods available for the monitoring of NO_x, SO_2, PM_{10} and $PM_{2.5}$ in ambient air. For this Programme, a mixture of continuous automatic monitoring methods shall be used (i.e. not periodic) due to the short term national standards and the potential for unexpected short term releases of pollutants in ambient air and passive samplers as these provide a cost effective simple way of improving monitoring coverage

In addition, continuous automatic analysers allow the availability of near real-time data on pollutant concentrations to facilitate early detection and warning which is important for potential short term pollution episodes.

4.2.4 Technique and Standards

The techniques and standards that will be used for the monitoring of NO_X, PM and SO_2 are set out in Table 4.3. In order to provide reasonable flexibility during the implementation of the programme, the specification of the equipment to be used is described below rather than identifying specific manufacturers. Where other equipment is available that can be proven to provide the same level of data quality and meet the Programme objectives this can be used.

Table 4.3: Monitoring technique and standards

Pollutant	Technique	Data Collection Method	Minimum Sample Interval
NO, NO_2 and NO_X	Chemiluminescence, diffusion tubes	Continuous, passive	20 minutes, monthly average
SO_2	Ultra-violet technique or the Pararose Aniline technique, diffusion tubes	Continuous, passive	10 minutes, monthly average
PM_{10} and $PM_{2.5}$	Tapered element oscillating microbalance (TEOM) with Filter Dynamics	Continuous	1 hour

Pollutant	Technique	Data Collection Method	Minimum Sample Interval
	Measurement System (FDMS) or Beta attenuation monitors (BAM)		
Meteorological station	Comply with international standards and guidance such as US EPA - Meteorological Monitoring Guidance for Regulatory Modelling Applications	Continuous	15 min

4.2.5 Monitoring station enclosure arrangement

The continuous analysers will require as a minimum:

- Secure enclosure
- Concrete base
- Weatherproof housing with air conditioning
- Continuous electrical power supply

The passive diffusion tubes will require a solid structure to be attached to with cable ties.

4.2.6 Data storage and security

All monitoring devices shall be equipped with appropriate communication systems in order to ensure that monitoring data can be downloaded, reviewed and archived at a central location.

All monitoring instruments shall be equipped with data logging capacity to store data for a minimum period of three months. This is to ensure secure monitoring data should the communications systems suffer temporary failure.

4.2.7 Monitoring Location

The proposed locations of the continuous air quality analysers and meteorological station are presented in Figure 4.2. These approximate locations are considered to be representative and comply with IFC EHS guidelines. It is expected that the monitoring station 1 and the meteorological monitor would be enclosed within the same housing; however, provided they are close to each other (and within the approximate area identified in Figure 4.2) this is not a necessity.

The identified location of the monitoring location 1 (and meteorological monitor) is within the existing Khonhor settlement. This is considered to be the most appropriate location as, although modelling results indicate that the Project will have greater impact of NO_2 annual mean process contribution farther east of the Khonhor settlement, no sensitive receptors are present at that location; therefore, the proposed location is considered to be representative.

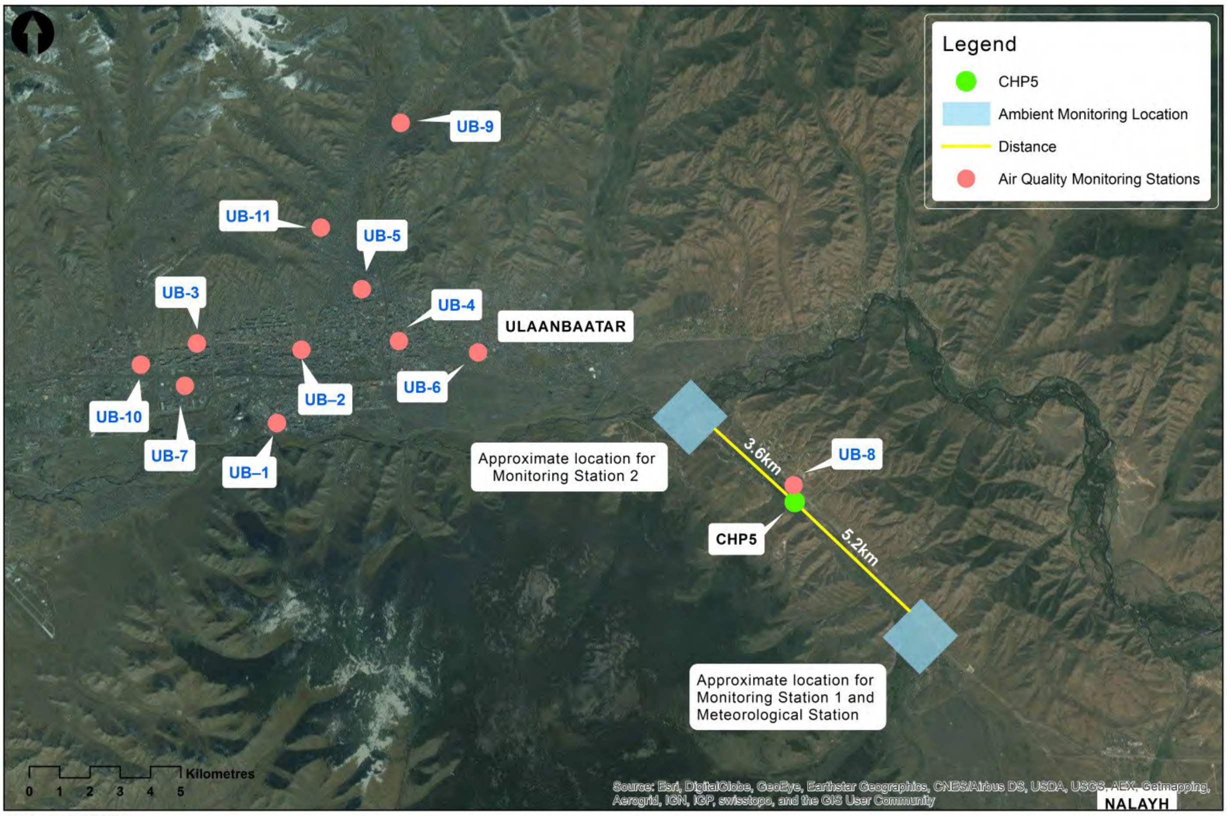
The proposed location for monitoring station 2 has been identified as a background location because when the wind blows from the predominant direction (i.e. from north-west) this monitor will represent the pollution originating from Ulaanbaatar.

Notwithstanding these proposals, the monitoring equipment will need to be installed in accordance with the manufacturer's instructions and be consistent with micro siting principles described below:

- The continuous analyser inlet heights shall be between 1 metre and 3 metres from the ground
- Monitoring sites shall be open to the sky, with no overhanging structures or buildings
- Monitoring sites shall not be within 50 metres of non-project related combustion sources.

In addition to the continuous monitoring site locations, up to eight additional sites will be selected for diffusion tubes to monitor for NO_2 and SO_2. Two of these sites will be co-located with the proposed continuous analysers and the other 6 will be sited in suitable locations spread across the study area but at locations where there is relevant population exposure.

Figure 4.2: Proposed continuous air quality monitoring locations



4.2.8 Quality Assurance/Quality Control

Calibration of the continuous analysers shall be carried out in accordance with the manufacturer's instructions and following reliable and traceable calibration standards.

4.2.9 Analysis, Reporting and Actions

4.2.9.1 Normal Reporting

Every quarter a report will need to be produced based on the preceding calendar months' data, detailing the following information:

- Validated monitoring data from the continuous analysers and data capture rates
- Summary data for comparison with the national air quality standards
- Summary meteorological data for the preceding month
- Discussion of any salient quality assurance issues
- Copy of the calibration report (if applicable)
- Details of any investigation or remedial action taken as a result of an exceedence.

In all cases the target data capture rate for an averaging period should be over 75%. In the event that data capture rates are below this level, this should be noted in the monthly report including the steps taken to remedy any recurring causes.

The reports will be reviewed by the Project Environmental Manager and a copy will be stored at the Project site.

4.2.9.2 Action in the Event of an Exceedance

Data from the continuous analysers will be checked on a daily basis by a site representative. Where concentrations are found to be above national standards, or contribute significantly to ambient concentrations, this will be reported immediately to the Project Environmental Manager. An investigation into the cause of the exceedence(s) will be carried out by the Environmental Manager and appropriate remedial action taken if emissions from the Project area are found to be the cause. Any such event will be logged appropriately and a copy will be stored in the project site detailing the cause and remedial action taken to resolve the issue.

5 Performance measurement / KPIs

The performance measurements for the AQMP are set out in Table 5.1:

Table 5.1: Performance Measurement / KPIs

Objective	Activity	Project stage	Action	Standards	Monitoring / KPI	Implementation Route / Plan
Construction and Operational Mitigation measures						
Minimise dust emissions	Site preparation, construction and site vehicle movement	Construction	• Minimising dust from material handling sources, such as conveyors and bins, by using covers and/or control equipment (i.e. water suppression) • Minimising dust from open sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content. • Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements.	IFC EHS Guidelines and Mongolian Ambient Air Quality standards	• Daily visual checks of construction areas. • Maintenance of record of violations where observed and disciplinary action imposed on contractor. • No complaints.	EPC Contractors.
Minimise construction machinery / vehicle emissions	Construction traffic and machinery	Construction	• Manage emissions from mobile sources as per IFC EHS guidelines for Air Emissions and Ambient Air Quality • Locate generators away from receptors (workers' camps and residents)	IFC EHS General Guidelines on Air Emissions and Ambient Air Quality	• Undertake visual checks. • Contractor to maintain servicing records for all machinery. • Environmental Manager to review Contractors servicing records at beginning of contract and thereafter on 6 months basis for longer term contracts lasting more than 6	EPC Contractors.

Objective	Activity	Project stage	Action	Standards	Monitoring / KPI	Implementation Route / Plan
					months	
Stack Emissions Monitoring						
To ensure the health and safety of the community	Continuous stack emission monitoring	Operation	Install and operate Continuous Emissions Monitors and carry out periodic stack emissions monitoring	Project stack ELVs	No breaches of ELVs	EPC contractor and Operator
Monitoring of Ambient Impacts Associated with Coal Handling						
To ensure the health and safety of the community and reduce potential nuisance	Continuous monitoring of TSP, PM_{10} and $PM_{2.5}$	6 months prior to operation and reviewed annually	Monitor dust and take remedial action when trigger levels exceed	IFC EHS General Guidelines on Air Emissions and Ambient Air Quality and Mongolian Ambient Air Quality Standards stated in MNS 4585:2007	• The monitoring concentration shall not exceed the trigger levels. • No complaints or dust impacts at receptors	Operator
Monitoring of Ambient Impacts Associated with Stack Emissions						
To ensure the health and safety of the community	Ambient air quality monitoring	Commencing in 2016 and reviewed after 3 years of operation	Set up and carry out ambient air quality monitoring and meteorological monitoring	IFC EHS General Guidelines on Air Emissions and Ambient Air Quality and Mongolian Ambient Air Quality Standards stated in MNS 4585:2007	Project does not contribute significantly to ambient concentrations or cause exceedances of Mongolian Ambient Air Quality standards	EPC contractor and Operator

Appendix B. Proposed Areas Covered by Flood Warning System

Legend

Watercourses

CHP5 Site Boundary

Proposed Flood Warning Areas

Notes

Hatched areas do not correspond to flooded areas but relate to the approximate valley area containing the communities at risk of flooding. This marked area is indicative only and not definitive as flood risk may extend outside this area, particularly in the area close to the confluence with the Tuul River.

Implementation of a flood warning system for the Khulin Valley such as emergency sirens would need to cover all marked areas.

Data Sources

Site Watercourses - Digitised from satellite imagery and observations from site visit
Satellite Imagery - Pleiades 0.5m resolution, dated 24 August 2013

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Project Title

CHP5 ESIA

Drawing Title

Figure 10.11 Proposed Areas Covered by Flood Warning System

Scale 1:20,000	MM Project No. 330177	Status INF

GIS File

Figure 10.11 Proposed Areas Covered by Flood Warning System.mxd

Drawing Number MMD-331930-C-DR-0012	Rev P1

Appendix C. Site Security Plan

In the event that the EPC Contractor is responsible for site security, the EPC Contractor shall manage security of the site(s) and shall carry out a Security Risk Assessment to determine the specific security measures necessary. The EPC Contractor shall ensure the security provisions put in place address the following:

- Control and record access/egress of all personnel and vehicles to/from site
- Control and record access/egress of all visitors to/from site
- Restrict access of all unauthorised persons and vehicle to the site
- Surveillance of persons and vehicles on site
- Physical protection of the site assets
- Ensure no unauthorised items are bought onto site
- Ensure no unauthorised items are removed from site
- Perform searches of vehicles and individuals as required
- Ensure all persons accessing the site comply with minimum PPE requirements, including the drivers and delivery vehicles
- Security patrols on site and on external site areas to check for any fire, flooding, environmental spills, breaches to perimeter fence security and for the security of site offices, buildings, and storage compounds
- Monitor for irregularities and suspicious behaviour
- Manning of telephones outside normal working hours, including calling in alarms in response to fires or other emergency
- Directing of emergency vehicles, for example fire engines and/or ambulances responding to emergency calls
- Assisting to secure any restricted area on site. For example an accident scene
- Outside normal working hours security patrols will check that safety equipment (telephone, fire hydrants and fire extinguishers) are operational and accessible
- Ensure all access/egress and designated walkways are clear and accessible
- Enforcement of parking restrictions, where applicable
- Controlling the speed of incoming and outgoing vehicles
- Enhance site safety provisions through defined health and safety checks
- Provide safe, controlled and monitored site evacuation
- Liaise with stakeholders, police and local authorities

The EPC Contractor shall define the security measures put in place in a written Site Security Plan which shall be continually monitored and reviewed, subject to revision as necessary throughout the various phases of the construction.

The EPC Contractor must keep an up to date register with identification information for the workforce on site. If subcontractors are used the register must also include details of the sub-contract workforce. The register should include the worker name, site pass number, start date on site and the company they work for.

Workers from a country outside the country where the construction work is taking place shall hold a 'work permit' or 'work card' as required by that country, before starting works and throughout the duration of their work on site.

If such a 'work permit' or 'work card' is not available, the EPC Contractor shall refuse the respective workers access to the site or expel them from the site until the relevant formalities have been duly completed.

All site access pass passes shall include a unique worker number and a ‘passport style’ photograph of the worker. A register of all workers who hold personal access passes will be kept by the EPC Contractor. Authorisation of personnel shall be managed to ensure that access is permitted only to workers with the necessary competence to undertake their work that have passed through the necessary level security screening and have undertaken the site induction process.

The site access pass shall also act as a training record of various skills and competencies, such that by looking at a workers site access pass it shall be clear what training has been received. This gives an immediate indication to supervisors and the client whether a person has received training in various working procedures on site.

Access to site must only be given to persons, vehicles and goods whose presence is required for strictly work-related reasons, and then only for as long as necessary for carrying out the work.

No person younger than 14 years old shall be permitted on site, not even for a simple visit, unless company policy and agreements with local authorities or corporate social responsibility foster restricted visits to students or similar visiting groups.

The access roads to the site must always be kept clear, to permit entrance and exit by personnel, visitors and the emergency services (such as an ambulance or fire tender).

Photography, filming or the making of videos, including on a mobile phone, PDA or other similar device, is only authorised on written permission from the consortium.

The site security arrangements provided by the EPC Contractor shall provide protection to the public, visitors and third parties as well as workers. Security procedures shall include the associated on-site checking and surveillance to ensure that, in the event of unauthorised or unsupervised access out of working hours, there are no residual safety hazards.

The nature and extent of security measures required depends on the location and nature of the site. Site specific requirements shall take account of the following:

- Remote locations or close proximity to conurbations and the relevant risks of each.
- Ease of access and the nature of the risks from persons and the means of entry which can be employed.
- Risks of protesters, terrorism and use of weapons by those seeking to gain access.

The site security plan will take account of the nature and location of the specific site and enable determination of the demarcation and control measures which are necessary. This shall include:

- Site demarcation by suitable perimeter fencing including appropriate warning/advising signs and anti-climbing measures (fences, barriers, bollards, gates etc.).
- Security lighting
- Boundary surveillance by CCTV, intruder detection systems and patrols
- Access and egress control at specific manned points and access control systems which provide monitoring and recording

Security provision shall provide particular control and monitoring measures of vehicle access to site and management of safe access for deliveries and drivers who do not work on the site and are infrequent visitors who do not undertake the site induction. This shall include security surveillance and checking prior to site access and supervised operations within the site security cordon.

The security plan shall include incident and visitor logging. All security incidents shall be investigated and any findings and recommendations must be implemented.

The security plan shall ensure that regular formal supervision is undertaken by a competent person to ascertain the status of the fencing and any damage or dislocation of the fence shall be remedied promptly.

At the end of each work shift, there must be a management plan that ensures:

- Excavations and openings are adequately covered or fenced
- The unauthorised use of ladders is prevented
- All plant is immobilised to prevent unauthorised use
- Flammable and hazardous substances are locked in secure storage areas
- All fences and barriers are secure and access gates locked

The security plan shall detail the communications channels for use in emergency and the need to avoid lone working particularly outside the site working hours.

Authorised private vehicles shall only park in designated parking areas. Private vehicles will not be permitted to enter into the construction areas, unless prior approval has been obtained from the EPC Contractor / consortium.

All visitors and delivery drivers to the site will book in and out at security and will follow instructions given by security.

The EPC Contractor shall put systems in place to control the removal of surplus or redundant materials, plant or equipment. The EPC Contractor security arrangements shall include performing checks on all vehicles and individuals leaving the site and those removing surplus or redundant materials, plant or equipment must have the necessary written authorisation before being allowed to leave site.

In order to prevent the bringing on to site of illegal or unauthorised substances and limit site access to authorised individuals only, the EPC Contractor shall perform checks on vehicles, individuals and their belongings when entering site.

The EPC Contractor shall perform random searches as a deterrent or targeted on the basis of specific intelligence.

EPC Contractor must brief their staff and subcontractors on the possibility of being searched and ask for their cooperation with the security staff. The EPC Contractor should make it clear that failure to cooperate with security searches may result in individual(s) or the Subcontractor being excluded from site.

Security of the EPC Contractor and subcontractor(s) materials, tools, plant and equipment is the responsibility of the Contractor. EPC Contractor will bear all liability for damage to and loss of any materials, plant or property brought on site by the EPC Contractor or subcontractors. All lost materials, tools, plant and equipment must be immediately reported to the consortium.

The EPC Contractor shall ensure site security is in accordance with local laws, regulations, police guidelines and international guidelines, taking into consideration that local laws and police guidelines will prevail.