Vol. 4: Draft Environmental and Social Impact Assessment

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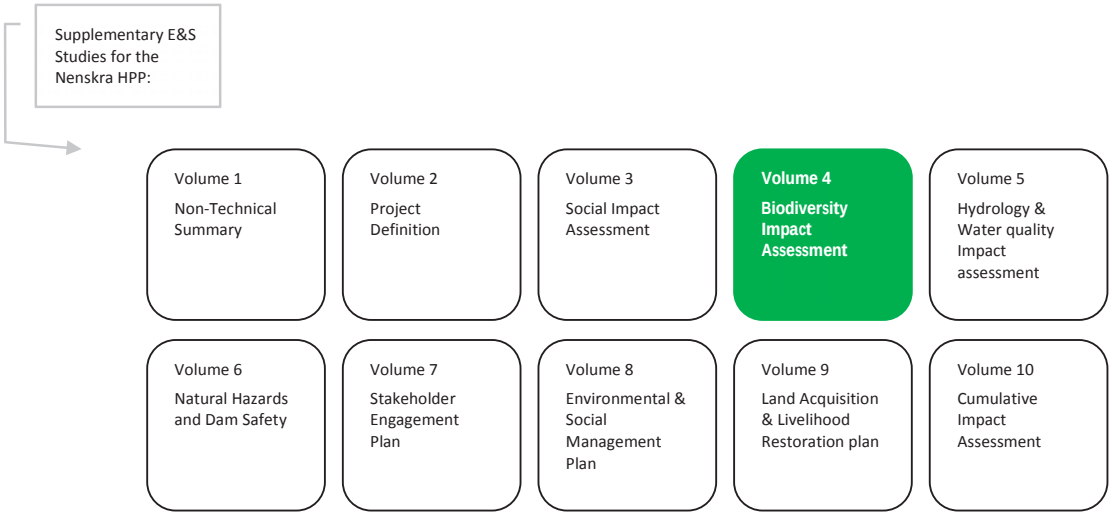
Prepared by SLR Consulting France SAS

JSC Nenskra Hydro

Nenskra Hydropower Project

Supplementary Environmental & Social Studies

Volume 4
Biodiversity Impact Assessment



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Acronyms

AA	Association Agreement between Georgia and the European Union.
AAF	Average Annual Flow
ADB	Asian Development Bank
APA	Agency of Protected Area
BHD	Birds and Habitat EU Directives
CH	Critical Habitat
CHA	Critical Habitat Assessment
CHAA	Critical Habitat Area of Analysis
CORINE	Coordination of information on the environment
CSR	Corporate Social Responsibility
Dbh	Diameter at Breast Height
DMU	Discrete Management Unit
EBRD	European Bank for Reconstruction and Development
ECAs	Export Credit Agencies
EF	Environmental Flow
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EPC	Engineering-Procurement-Construction
E&S	Environmental & Social
ESAP	Environmental & Social Action Plan
ESIA	Environmental & Social Impact Assessment
ESMS	Environmental & Social Management System
EU	European Union
FS	Feasibility Study
FSL	Full Supply Level
GEL	Georgian Lari
GIP	Good Industry Practices
GSE	Georgian State Electrosystem
GHG	Greenhouse Gas
HEPP	Hydro Electric Power Plant
HS	Health & Safety
IFC	International Finance Cooperation
IUCN	International Union for Conservation of Nature
KfW	Kreditanstalt für Wiederaufbau (German Development Bank)
LALRP	Land Acquisition and Livelihood Restoration Plan
LESA	Lenders Environmental & Social Advisers
MCIEEM	Member of the Chartered Institute of Ecology and Environmental Management
MoENRP	Ministry of Environment Protection and Natural Resources
Mm3	Million cubic meter
mOL	Minimum Operating Level
MOL	Maximum Operating Level (=Full Supply Level)
NACHP	National Agency for Cultural Heritage Preservation of Georgia
NGO	Non-Governmental Organization

NTS	Non-Technical Summary
OECD	Organisation for Economic Co-operation and Development
OESA	Owners Environmental & Social Advisers
PA	Protected Area
PH	Powerhouse
PMF	Probable Maximum Flood
PRs	EBRD Performance Requirements
PS	IFC Performance Standards
SEP	Stakeholder Engagement Plan
SoW	Scope of Work
TL	Transmission Line
UNESCO	United Nations Educational, Scientific and Cultural Organization
WFD	EU Water Framework Directive

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Preamble

In August 2015, the final Environmental & Social Impact Assessment Report (ESIA) for the proposed Nenskra Hydroelectric Power Plant (HPP), located in the Svaneti Region was submitted to the Government of Georgia as part of the national environmental permitting process. The 2015 ESIA report had been prepared by Gamma Consulting Limited (Gamma) – a Georgian environmental consulting company. The ESIA was based on the findings of field investigations undertaken in 2011 and 2014. Public consultations meetings had been held in May 2015 and the Environmental Permit was awarded by the Environmental Authorities in October 2015.

In the present document, the ESIA submitted in 2015 is referred as the 2015 ESIA.

Since then, several International Financial Institutions (the Lenders) have been approached to invest into the Project. In compliance with their environmental and social policies, the Lenders have recommended that a number of additional environmental and social studies be undertaken to supplement the 2015 ESIA report.

This report n°901.8.6_ES Nenskra_Vol.4_Biodiversity is Volume n°4 of the Supplementary Environmental and Social Studies prepared by SLR Consulting and issued in 2017. It details the findings of the Biodiversity Impact Assessment which has been performed from August 2015 to June 2016 by SLR Consulting Ltd (SLR) on the proposed Nenskra HPP.

It must be read in conjunction with the other volumes of the Supplementary Environmental and Social Studies organised as follows:

- Volume 1: Non-Technical Summary
- Volume 2: Project Definition
- Volume 3: Social Impact Assessment
- **Volume 4: Biodiversity Impact Assessment (this volume)**.
- Volume 5: Hydrology and Water Quality Impact Assessment
- Volume 6: Natural Hazards & Dam Safety
- Volume 7: Stakeholder Engagement Plan
- Volume 8: Environmental & Social Management Plan
- Volume 9: Land Acquisition & Livelihood Restoration Plan
- Volume 10: Cumulative Impact Assessment

Summary

This report is the Biodiversity Impact Assessment issued in 2017 as part of the Supplementary Environmental and Social studies for the Nenskra HPP (the Project). The report contains the results of the investigations conducted from August 2015 to July 2016 in the project-affected area on the terrestrial biodiversity and the river fish habitats[1]. The aim of this Supplementary Biodiversity Impact Assessment is to address the areas where lack of information was identified during a gap analysis[2] conducted on behalf of the Lenders, of the 2015 ESIA.

The following receptors were targeted for survey:

- Flora, vegetation and habitats
- Mammals – brown bear, Eurasian lynx, bats (all species), otter and Caucasian squirrel
- Birds – all species
- Aquatic habitats and fish

This report contains the methodology, results and an impact assessment for each receptor in respect of the Project both during construction and during operation. In addition to this a Critical Habitat Assessment has been undertaken in accordance with the guidance notes provided by the various Lenders' organisations.

The flora, vegetation and habitats baseline surveys identified 12 broad scale habitats within the survey area (which covered an area larger than the Project area). The dominant habitat present was found to be mixed broadleaved and conifer woodland which made up 59.38% of the survey area. The survey area covered a total of 142.16km^2. The second most common habitat was broadleaved woodland which comprised 12.67% of the area surveyed. Conifer dominant woodland was found to cover only 4.95% of the area surveyed.

The more detailed floristic surveys identified 20 species of plant which are endemic to the Caucasus Mountains, listed on the Georgian Red List or covered by the CITES convention (Convention on International Trade in Endangered Species of Wild Flora and Fauna). One individual plant which was found, but requires further verification is *Paracynoglossum imeretinum*, which is an endemic species to Georgia, only recorded from 17 locations within Georgia. The habitat types identified during the detailed floristic surveys were categorised based on the European CORINE system. Of the habitats identified, two of habitats of potentially high sensitivity value were identified within the reservoir impoundment area. These are: beech forests with Colchic understory *Fageta fruticosa colchica* and dark coniferous forest without the understory *Piceeto-Abieta sine fruticosa*. Habitats of medium sensitivity value oak or oak-hornbeam forests (*Quercitum -Carpinion betuli*) were recorded. Habitats of a low likely sensitivity value were also recorded.

The mammal surveys undertaken in 2015 identified that brown bear *Ursus arctos* are present within the Nenskra valley. The 2016 surveys covered the whole of the Nenskra and Nakra watersheds and found signs of brown bear in both valleys. Signs of brown bear: prints, dung and camera trap photos, were found in a number of the Nenskra tributaries, both upstream and downstream of the proposed reservoir area. The number of brown bear signs suggests that there are between 6 and 10 bears present in the Nenskra valley. A single print considered

[1] Aquatic invertebrate surveys had been previously undertaken by Gamma during 2014, within the project area, so were not repeated during the supplementary studies.

[2] Mott MacDonald (2015) Nenskra 2018 MW Hydropower Project. Environmental and Social Gap Analysis – Lenders Technical Advisor, August 2015 – CONFIDENTIAL

potentially to be from the Eurasian lynx (*Lynx lynx)* was also recorded within the reservoir area in 2015, but no signs of lynx were recorded during the 2016 surveys. Bat surveys were also undertaken, they found that less bats use the reservoir area than the area surrounding Tita Village, however seven species of bat were identified within the reservoir area using bat call analysis. It is considered likely that comparatively less bats are roosting within the reservoir area than Tita, but suitable roosting habitat is present in the form of mature trees with lose bark and rot holes.

During the mammal surveys no signs of otter *Lutra lutra* were noted, however the habitats present within the survey area were considered to be suitable for this species. Caucasian squirrel *Sciurus anomalus* were noted during the 2016 surveys and were found to be relatively wide spread within the Nenskra valley. A single female wolf *Canis lupus* was recorded on remote camera, feeding on a carcass close to Tita village.

During the bird survey a number of records were made for wide spread and commonly occurring bird species. The surveys were undertaken during September, which is a month when bird migrations (from north to south) are occurring. The survey found that while small flocks of species such as griffon vulture *Gyps fulvus* did fly over the survey area, they did not stop and flew over at height. The surveys found that the Nenskra and Nakra valleys are only occasionally used as migratory flyways, the main flyways being situated to the west of the survey area (closer to the Black Sea) and to the east of the survey area. It was also concluded that the Project area does not lie within a protected site for birds, nor does it form part of the rich bird endemism sites which are present within Georgia.

The aquatic biodiversity survey had to rely on a habitat assessment and the examination of fish caught by local anglers as electro-fishing was not licenced in Georgia at the time of survey. The fish which were observed were considered to be brown trout *Salmo trutta*.

The river habitat assessment found that there are a number of habitats present on both the Nenskra and Nakra rivers. High flow areas are considered only to be suitable for adult fish, whereas the lower flow areas with gravels are likely to be suitable as spawning and nursery sites. No spawning areas were noted on the Nakra River up to 2 km upstream of the proposed Nakra water intake; however some areas, were considered suitable as nursery areas. On the Nenskra the potential spawning habitat was noted upstream of the proposed reservoir area. Downstream of this there are a variety of habitats, including nursery habitats. Local observations found that trout are caught by anglers on the Nenskra River.

The impact assessment predicts that as a result of the Project there will be some impacts regarding habitat loss. To compensate for this loss, the implementation of a Nenskra/Nakra watershed based Reforestation Management Plan is planned. For temporarily lost habitats a Revegetation and Management Plan will be implemented to enable targeted planting and management to restore areas, to similar habitats to those pre-construction where possible.

For mammal and bird species no significant impacts were predicted; however mitigation in the form of timing of vegetation removal to outside of the bird breeding season (birds between April and End of July) is planned. Nest boxes suitable for Boreal owl, and for bat species will also be erected. Monitoring for brown bear will also be undertaken; population estimates will be based on DNA analysis of brown bear dung.

As part of the Project an access track will be created from the dam area to the upstream end of the reservoir impoundment area. This would replace a track which already exists, but would be flooded. The new track would facilitate access to the upper Nenskra valley therefore mitigation would be implemented to control the access along the reservoir by-pass cattle track, to prevent use by vehicles (i.e. to prevent use by logging trucks). In the Nakra valley, the track which currently leads up to the weir location will be improved. This improved track is not anticipated to have any significant effect on the current rate of illegal logging in the valley.

However, as the weir and track will be located 760 metres from the boundary of the proposed Svaneti Protected Area, the Project will continue to negotiate with MoENRP to identify defined conservation project(s) to (part) fund, to aid in the creation of the proposed Svaneti Protected Area.

The Nenskra dam will prevent downstream migration of fish from the upper part of the valley to the lower Nenskra River, as no fish pass is proposed for the Nenskra dam. This is because the available technical solutions are considered to be inefficient for a 130 m high structure, with fluctuating reservoir levels. Since no suitable spawning areas were identified downstream of the dam on the Nenskra river itself, the altered migration pattern could reduce the brown trout population over time, post construction, in the Nenskra River downstream of the dam, as the only available spawning areas would be within the tributaries flowing in to this stretch of the Nenskra.

However, the fish impact assessment found that the change in river levels and flow velocity which will occur as a result of the dam could be of benefit to fish populations in some sections of the river. Downstream of the dam, close to the Tita bridge, a stretch of 2.2 km of the river could become a suitable area for nursery and spawning grounds. The expected increased sediment deposition downstream of the dam (due to a decrease in average flow rates) would likely contribute to the emergence of new spawning areas for the fish. It is however anticipated that sediment deposition would take time, in the order of about 10 years. As a mitigation measure, a River Channel Maintenance/Habitat Enhancement Management Plan will be prepared. The plan will be informed by the results of ongoing fish monitoring and a year one post dam construction repeat River Habitat Survey. The River Channel Maintenance/Habitat Enhancement Management Plan will deal with the management of a 2.2 km section of river close to the Tita Footbridge area. This section of river will be managed as a spawning/nursery ground for trout; management is likely to include engineering of the river bed to achieve enhancement. On the Nakra River, a natural/slot pass hybrid fish pass will be constructed for the weir and ongoing monitoring to assess its efficacy is planned.

For the Critical Habitats assessment a range of species and habitats were assessed against the published criteria for this assessment. Only one species present within the Project area was considered under Criteria 2 - Habitat of significant importance to endemic and/or restricted-range species – Tier 2. This is the plant species *Paracynoglossum imeretinum* which is of restricted range, only being found in Georgia. As only one specimen was identified in 2015, the habitat is not considered critical for this species as it is likely to sustain a population less than 1% of the global population. A further survey for this species has therefore been recommended; first of all to verify the identification of this species, and to more fully establish the extent of its range within the Project area. During the survey, donor sites will be searched for outside of the Project area. Once the survey data has been gathered, suitable mitigation will be implemented accordingly, to ensure no net loss of biodiversity.

All of the receptors assessed within this chapter have been subject to a Cumulative Assessment. This is presented separately in Volume 10 “Cumulative Impact Assessment”. As described above, the Government of Georgia has plans to create the Svaneti Protected Area; adjacent to, but outside of the Project Area. There are also plans to create an Emerald site. In February 2016 an application was made to the Bern Convention to change the candidate Emerald site boundaries. As of November 2016 these boundary changes have been implemented and the Project area is now wholly outside of the candidate Emerald site boundary. Although the Project area resides outside of the boundary of the candidate Emerald site, some species for which the Emerald Site has been designated, may range into the Project area, therefore an Appropriate Assessment screening exercise has been undertaken, in line with European Habitats Directive guidance. The Appropriate Assessment Screening Report is presented as an annex to this volume.

1 Introduction

1.1 Overview

This report is the Biodiversity Impact Assessment issued in 2017 as part of the Supplementary Environmental and Social studies for the Nenskra HPP Project (the Project). The investigations were conducted from August to November 2015 and additional surveys in May to June 2016 in the project-affected area. The investigations covered the terrestrial biodiversity and the river fish habitats.

The proposed Nenskra Hydropower Project is a greenfield high head hydropower project with an installed capacity of 280MW, located in the upper reaches of the Nenskra and Nakra valleys in the North Western part of Georgia in the Samegrelo-Zemo Svaneti Region (see Map 1-1).

The Project uses the available discharges from the Nenskra River and the adjacent Nakra River, developing a maximum available head of 725 m down to the powerhouse located approx. 17 km downstream of the dam.

The main Project components comprise a 130 m high, 870 m long asphalt face rock fill dam on the upper Nenskra River creating a live storage of about 176 million m^3 and a reservoir area at full supply level of 2.67 km^2. The Nakra River will be diverted into the Nenskra reservoir through a 12.25 km long transfer tunnel. The power waterway comprises a headrace tunnel of 15.1 km, a pressure shaft and underground penstock of 1,790 m long. The above-ground powerhouse is located on the left side of the Nenskra River and will house three vertical pelton turbines of 93 MW capacity each, for a total installed capacity of 280 MW. A 220 kV transmission line that connects the powerhouse switchyard to a new Khudoni Substation will have to be built.

The main construction period is planned to start in September 2017 and will last 4 years. Some early works began in October 2015 and will continue to September 2017: rehabilitation of access roads, construction of workers camps and technical installations. Power generation is planned to start end of 2020 if the conditions are favourable.

The Project is being developed by JSC Nenskra Hydro (JSCNH), whose main shareholders are K-water, a Korean government agency and Partnership Fund, an investment fund owned by the Government of Georgia. K-water and Partnership Fund are referred to as the Owners in this document.

1.2 Objectives

The aim of this biodiversity impact assessment is to address the areas where lack of information was identified during a gap analysis[3] conducted on behalf of the Lenders of the 2015 ESIA (Gamma Consulting 2015[4]). For a summary of the floristic baseline data, contained within the 2015 ESIA, refer to Annex 1 of this report (detailed Flora, Vegetation and Habitat Assessment Report). For a summary of the faunal species listed in the 2015 ESIA, please refer

[3] Mott MacDonald (2015) Nenskra 2018 MW Hydropower Project. Environmental and Social Gap Analysis – Lenders Technical Advisor, August 2015 – CONFIDENTIAL

[4] Gamma 2015 Nenskra JSC Project on the Construction and Operation of Nenskra HPP – Environmental and Social Impact Assessment Report.

to Table 1 in this report; however please note, the data provided in the 2015 ESIA, does not state whether each species was recorded in the field, or just anticipated to be present.

In order to fulfil this aim, the following objectives were set:

- Report the results of the field surveys undertaken in September/October 2015 and May / June 2016;
- For floristic habitats, map the habitat locations and extents, so that habitat loss can be assessed quantitatively;
- For fauna (terrestrial and aquatic) where appropriate, assess presence or likely absence of species and map habitat suitability for each target species;
- Based on the faunal and flora information gathered, undertake a critical habitats assessment, based on lender guidance (EBRD 2014[5], IFC 2012a[6], IFC 2013[7], IFC 2012b[8], ADB 2012[9]);
- Undertake an impact assessment of the key habitats and species identified both for this Project alone and also in-combination with other hydropower schemes in the area;
- Propose suitable outline mitigation and/ or compensation, where required in accordance with the mitigation hierarchy.
- Complete and present an Appropriate Assessment with regards to the candidate Svaneti Emerald site.

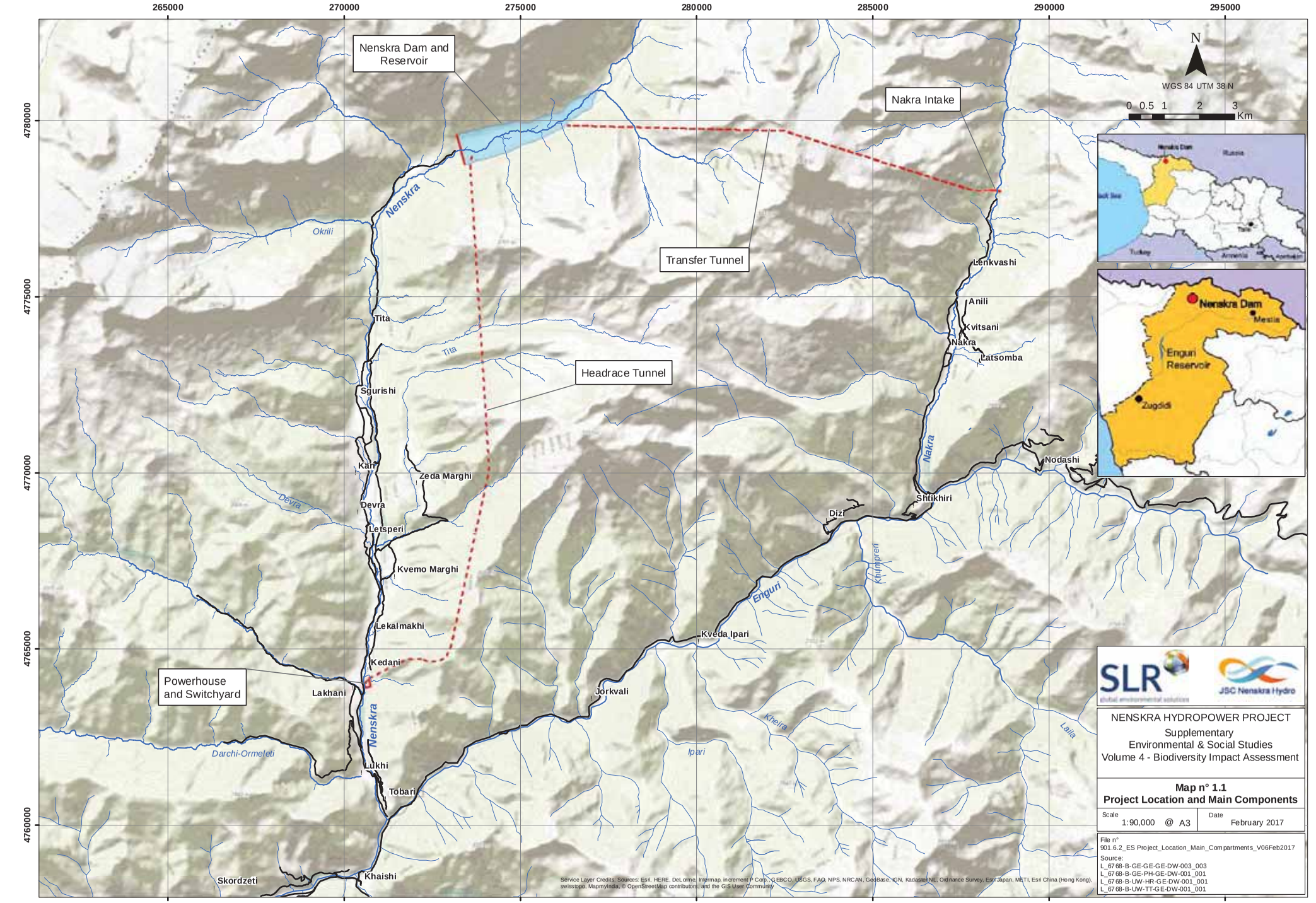
[5] EBRD (2014). Environmental and Social Policy. European Bank for Reconstruction and Development.

[6] IFC (2012a). Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. International Finance Corporation, World Bank Group.

[7] IFC (2013) Critical Habitat Assessment using IFC PS6 Criteria. World Bank Group.

[8] IFC (2012b). Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. International Finance Corporation, World Bank Group.

[9] ADB (2012) Environment Safeguards, A good practice sourcebook, draft working document. Asian Development Bank.



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NENSKRA HYDROPOWER PROJECT
Supplementary
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Map n° 1.1
Project Location and Main Components

Scale	Date
1:90,000 @ A3	February 2017

File n°
901.6.2_ES Project_Location_Main_Compartments_V06Feb2017

Source:
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1.3 General Methodology

1.3.1 Desk based study

A desk based review of all available information was undertaken. The data search included collating information from both national and international sources:

- Gamma Consulting (2015);
- International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species (http://www.iucnredlist.org);
- The Red List of Georgia[10];
- The Red List of Endemic Plants of the Caucasus Region (Soloman 2014[11]);
- Centre for Biodiversity Conservation and Research (www.nacres.org);
- Georgian Centre for the Conservation of Wildlife (http://gccw.bunebaprint.ge); and
- BirdLife International Data Zone (http://www.birdlife.org/datazone/home).

The desk study information has been collated and referred to in the results section where relevant. The data have not been reproduced as a separate report.

1.3.2 Study area

The study area has been defined separately for fauna and flora (see Section 2). The areas for each discipline take into account the potential "zone of influence" of the Project for each species being studied. The size of the zone of influence is dependent on the receptors subject to assessment. The zone of influence identifies the area over which that specific receptor may be subject to a biophysical change as a result of the Project/identified activities taking place. For the field surveys accessibility has also had to be taken into account as the Project area consists of steep-sided wooded valleys, with areas of rock fall, land slide and fast-flowing rivers.

Within this chapter, the term 'Project area' refers to the Project infrastructure (e.g. reservoir impoundment area, dam, new roads, powerhouse and penstock, Nakra water intake), located in both the Nenskra and Nakra Valley. The term 'reservoir area' has also been used. This refers specifically to the Nenskra valley, where the reservoir impoundment area, dam and new permanent access roads, etc. are to be located.

It is also worth noting, that although not directly part of this Project, a transmission line will be installed to connect the Nenskra power house, to a proposed new substation. GSE have stated that the Nenskra powerline section is part of the Northern Cluster and will comprise a 220 kV Line. At the time of writing the alignment of this line is not known as consultations and surveys as to the location of the new substation (within the Enguri valley) are ongoing. The vegetation surveys for this Project covered the area down to the confluence with the Enguri, but not beyond, so the powerline section was only partially surveyed.

[10] Red List of Georgia as issued by the President. The copy used here was translated from Georgian and is not publically available.

[11] Solomon J., Shulkina T., Schatz G.E. (2014) Red list of the Endemic Plants of the Caucasus. Missouri Botanical Garden Press.

1.3.3 Site investigations

In August 2015 a field reconnaissance survey was carried out by SLR, in conjunction with a representative from Gamma, in order to assess the area and to define a scope for further survey.

The scope for further survey was designed to enable the following to be completed in September and October 2015 within the survey window available prior to the onset of the winter snows:

- Prepare a large scale vegetation map covering both Nenskra and Nakra valleys;
- Prepare a map showing the vegetation habitat types present in the reservoir area;
- Identifying habitats and listing their sensitivity and conservation status (e.g. Annex 1 habitats);
- Undertake a survey across both watersheds for signs of protected mammal species. Protected species here are considered to be those listed on the Georgian Red List 2006; species of conservation importance according to the IUCN Red List and those listed on the EU Habitats Directive (Annex II and IV);
- Survey both the Nenskra and Nakra rivers habitats for their suitability to support fish species;
- Undertake a rapid assessment of the likely avifauna assemblage in the area.

In May/June 2016 further site investigations were commissioned and undertaken by SLR in conjunction with two representatives from Ilia University. The surveys were designed to search for Eurasian lynx and brown bear at a watershed level.

1.3.4 Floristic survey rationale

The detailed additional botanical survey was carried out within the Project area during September 2015. The methodology for the field works is set out in Section 2.1. The information gathered was then used to create the broad scale habitat map, as well as a more detailed map of the habitats to be lost within the reservoir area. The maps and associated data have been used herein to inform the Critical Habitats Assessment as well as the Impact Assessment.

Flora, Vegetation and Habitat Assessment Report (Annex 1) is a detailed document, which does not just provide the field survey results, it has also been written to bring together in one report, relevant legal aspects of Georgian law and a general overview of the survey area. All of the floristic l/vegetation/habitat survey information from the 2015 ESIA (surveys undertaken in 2011 and 2014) and the SLR update surveys in 2015 has been compiled together and are contained within the Flora, Vegetation and Habitat Assessment Report. The report also categorises all the habitat types present, based on the Natura 2000 or CORINE system. In addition and for the purposes of the assessment of significance of habitat loss, all of the habitat types have also been categorised according to a sensitivity assessment for the floristic and vegetation receptors based on the criteria recommended by Morris and Therivel (1995[12]).

1.3.5 Terrestrial species survey rationale

Within the timeframe available prior to the onset of the winter snows of 2015, it was not possible to survey for all faunal species present within the area. As a result the 2015 ESIA report was reviewed, species were also assessed in conjunction with the Georgian Red List in

[12] Morris P., Therivel R. Editors (1995) Methods of Environmental Impact Assessment. UBC Press.

order to gauge need for further survey. Table 1 below shows which species were considered for further survey, and which were ultimately surveyed for (see also Photo Sheet 1 and Photo Sheet 2[13]).

Table 1 - List of Georgian fauna Red List species which could occur in the Project area

Latin name	English name	IUCN Status	Georgian Status	European Status	Species Surveyed For in 2015
Barbastella barbastellus	Barbastelle	NT	VU	AII	Yes
Lutra lutra	European Otter	NT	VU	AII/AIV	Yes
Ursus arctos	Brown Bear	LC	**EN**	AII/AIV	Yes
Canis lupus	Wolf	LC	-	AII/AIV	No
Lynx lynx	Eurasian Lynx	LC	**CR**	AII/AIV	Yes
Sciurus anomalus	Caucasian Squirrel	LC	VU	AIV	Yes
Neophron percnopterus	Egyptian Vulture	**EN**	VU	AI	Yes
Gypaetus barbatus	Bearded Vulture	NT	VU	AI	Yes
Aegypius monachus	Cinereous Vulture	NT	**EN**	AI	Yes
Gyps fulvus	Eurasian Griffon Vulture	LC	VU	AI	Yes
Aquila chrysaetos	Golden Eagle	LC	VU	AI	Yes
Aquila heliaca	Eastern Imperial Eagle	VU	VU	AI	Yes
Aquila clanga	Greater Spotted Eagle	VU	VU	AI	Yes
Accipiter brevipes	Levant Sparrowhawk	LC	VU	AI	Yes
Falco biarmicus	Lanner Falcon	LC	VU	AI	Yes
Buteo rufinus	Long-legged Buzzard	LC	VU	AI	Yes
Buteo lagopus	Rough-legged Buzzard	LC	VU	-	Yes
Athene noctua	Little Owl	LC	VU	-	Yes
Vipera dinniki	Dinnik's viper	VU	VU	-	No
Vipera kaznakovi	Caucasian viper	**EN**	**EN**	-	No
Salmo fario (Salmo trutta morfa fario)	Brown trout	LC	VU	-	No

As per the threatened species categories used in IUCN Red Lists: LC – Least Concern, NT – Near Threatened, VU – Vulnerable, EN – Endangered, CR – Critically endangered. For the European status: AI – species is listed on Annex I of the EC Habitats Directive, or Annex 1 of the EC Birds Directive, AIV – species is listed on Annex IV of the EC Habitats Directive.

For some protected species such as brown bear, European otter (henceforth referred to as otter) and Eurasian lynx (henceforth referred to as lynx), where presence had been noted at some point in the past, surveys were undertaken in order to verify current presence, or likely absence within the Project area. For other protected species such as bats and Caucasian squirrel *Sciurus anomalus*, they were selected for further survey as currently available data on species and presence was considered to be limited.

A second survey for brown bear and lynx was undertaken in May/June 2016. This additional survey was undertaken to allow for the collection of further data, to inform the Critical Habitats Assessment in respect of these two species. The area of study was also increased to allow a Critical Habitats Assessment at a watershed level, see Map 2-5.

[13] The compiled photos have been taken from: the IUCN website www.iucn.org and from Pixbay www.pixbay.org which provides copyright free stock photos.

Although it was considered likely that wolf would be present in the wider Svaneti area, specific surveys for wolf were not undertaken. Wolf territories cover areas between 100 – 500 km^2 or range in density from one wolf per 12km^2 to one wolf[14] per 120km^2; therefore it was considered most practicable to record incidental signs to inform presence, rather than to specifically survey for this species.

Specific surveys for invertebrates were not undertaken as the data presented within the 2015 ESIA was considered to be relatively complete for this phylum.

Two species of Red List reptile occur in the Svaneti Region: The Caucasian viper or Dinnik's viper (*Vipera dinniki*) is described as inhabiting the upper-forest zone, stream borders, shrub forests, subalpine and alpine meadows, rocky scree, talus slopes and montane moraines of the Caucus Mountains[15], where they can use rocks to bask in the sun. The majority of these habitats are not considered to be present within the Project area, but are present elsewhere in the valley at higher altitudes, at least 500 metres from the Project area. Stream borders and in some areas rocky scree is present in the Project area, but in limited quantities. These isolated habitats are not considered suitable for this species as they tend to be surrounded by tall and sometimes dense mature forests, which would not provide a suitable habitat for this reptile species.

The second species, Caucasian Viper (*Vipera kaznakovi*) is described as occurring only up to an altitude of 900m with a fairly restricted range along the black sea and the foothills of the Caucus Mountains. For this reason, while it may have a presence in the Svaneti Region, it is not considered to be present within the Project area as the range map produced for this species (IUCN 2015[16]) shows likely absences this far north at the limits of its altitudinal range (apart from the powerhouse, the majority of the Project infrastructure will be above 900m altitude). Therefore these reptile species were not subject to further survey as they are not anticipated to be within the zone of influence of the Project.

1.3.6 River habitat survey rationale

The 2015 ESIA concluded that only one species of fish is present in the Nenskra and Nakra Rivers; this species was referred to as "spring trout". Based on this information, that only a single species was present, it was considered that further fish species surveys would not be undertaken; however a more detailed desk search to further validate the single species assessment would be carried out.

In order to undertake population estimation for this fish species, a survey method using electro-fishing would generally be employed, however, electro-fishing at the time of survey was banned in Georgia. As a result of this and given the available timeframe for the Supplementary Environmental and Social studies issued in 2017, it was decided that a river habitat survey and fisheries assessment approach would gather sufficient data for an Impact Assessment to be undertaken. Local anglers were also approached, so that their catch could be examined in order to determine the species of fish present. Further aquatic invertebrate surveys were not undertaken as the 2015 ESIA was considered to provide sufficient detail on the restricted range of species present in the low productivity glacial melt-water rivers and streams.

[14] Information taken from: Mech, L.D. & Boitani, L. (IUCN SSC Wolf Specialist Group). 2010. Canis lupus. The IUCN Red List of Threatened Species 2010: e.T3746A10049204. Downloaded on 06 July 2016.

[15] Orlov N.L., and Tuniyev B.S., (1990) Three species in the *Vipera kaznakowi* complex (Eurosiberian Group) in the Caucasus: Their present distribution, possible genesis and phylogeny. Asiatic herpetological Research vol 3. Pp 1-36.

[16] IUCN (2015) Information on the range of the Caucasian Viper. [Online] Available at: http://maps.iucnredlist.org/map.html?id=22990 [Accessed 14 November 2015]

1.3.7 Assessment of impacts

The assessment of impacts has been undertaken using the following guidelines:

- IFC (2012) International Finance Corporation's Guidance Note: Performance Standards on Environmental and Social Sustainability.
- CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester
- EIB (2013) Environmental and Social Handbook. European Investment Bank.

The initial action for any assessment of impacts is to determine which features should be subject to detailed assessment. The ecological receptors to be the subject of a more detailed assessment should be of sufficient value that impacts upon them may be significant in terms of either legislation or policy. The receptors should also be vulnerable to significant impacts arising from the development. Section 1.3.4, Section 1.3.5 and 1.3.6 above, detail the survey rationale, and Section 2 details the results of the field surveys. The species brought forward for further assessment are detailed in the assessment Sections 4 to 7. In line with guidance, the impacts have been assessed in the absence of mitigation. The assessment presented here has used the December 2016 'design freeze' of the Project scheme.

In this report, a significant impact, in ecological terms, is defined as an impact (whether negative or positive) on the integrity[17] of a defined site or ecosystem and/or the conservation status[18] of habitats or species within a given geographical area.

The approach adopted here aims to determine an impact to be significant or not on the basis of a discussion of the factors that characterise it, i.e. the ecological significance of an impact is not dependent on the value of the feature in question. For the purposes of this report, impacts have been characterised as significant, or non-significant.

The mitigation strategy is set out in Section 8. The residual effects are then set out in Table 24 and do take into account the mitigation, compensation and enhancements which have been proposed.

1.3.8 Interactions with the other E&S investigations

During September and October 2015 social impact investigations were undertaken in the Project area. As part of these investigations a questionnaire was put together in order to seek information from the local population. A number of questions asked related to wild animal sightings and number of stock kills as a result of wild animal attacks. For more information see the Volume 3 "Social Impact Assessment" issued in 2017 as part of the Supplementary Environmental & Social Studies[19]. The results of these surveys have been taken into account here, but could not be used as proof of current presence, as often location and timing information could not be supplied.

[17] Integrity is the coherence of ecological structure and function, across a site's whole area, that enables it to sustain a habitat, complex of habitats and/or the levels of populations of species.

[18] Conservation status for habitats is determined by the sum of the influences acting on the habitat and its typical species that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area. Conservation status for species is determined by the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area.

[19] SLR, Report n°901.8.7 , Volume 3 - Social Impact Assessment, 2017

In addition, this Volume also draws upon the information provided in Volume 5 “Downstream hydrology and water quality impact assessment” of the Supplementary Environmental and Social studies issued in 2017, particularly for the river habitat assessment.

Barbastella barbastellus
Barbastelle

Gypaetus barbatus
Bearded Vulture

Lutra lutra
European Otter

Aegypius monachus
Cinereous Vulture

Ursus arctos
Brown Bear

Gyps fulvus
Eurasian Griffon Vulture

Lynx lynx
Eurasian Lynx

Aquila chrysaetos
Golden Eagle

Sciurus anomalus
Caucasian Squirrel

Aquila heliaca
Eastern Imperial Eagle

Photo Sheet 1 - Georgian fauna Red List species which could occur in the Project area - 1

Neophron percnopterus
Egyptian Vulture

Aquila clanga
Greater Spotted Eagle

Accipiter brevipes
Levant Sparrowhawk

Buteo lagopus
Rough-legged Buzzard

Falco biarmicus
Lanner Falcon

Athene noctua
Little Owl

Buteo rufinus
Long-legged Buzzard

Vipera dinniki
Dinnik's viper

Salmo fario
Brown Trout

Vipera kaznakovi
Caucasian viper

Photo Sheet 2 - Georgian fauna Red List species which could occur in the Project area - 2

1.3.9 Survey limitations

For the floristic surveys, the seasonal limitation of only surveying in September 2015 could mean that some annual or ephemeral species may not have been recorded; however, this survey limitation is considered to be insignificant when combined with the floristic survey data gathered in June/July 2011 and August/September 2014.

For the fauna, a September survey window is considered to be an optimal time for undertaking presence/likely absence surveys, as this is a time when fauna (terrestrial and aquatic) will be actively foraging in order to build up fat reserves for the winter, or (for some avifauna) migrating through the Project area to warmer areas towards the south. It is therefore considered that a September survey period does not generally present a constraint to this biodiversity impact assessment.

To assess species such as brown bear and lynx, with large ranges and seasonal movements, information additional to just proven presence will be required. This data can only be gathered through a number of surveys over a range of seasons. It is therefore acknowledged that for the lynx and brown bear, while presence has been proven within the Project and surrounding area, and surveys have been undertaken in September 2015 and May/June 2016, there may still be some data gaps, such as location of hibernation sites and use of habitats in early spring and late summer. During the May/June 2016 surveys camera traps were used. Unfortunately due to the various social issues, these cameras could not be placed within the Project Area; therefore camera traps were placed in remote side valleys away from main thoroughfares used by the local population. For this study, the information gaps are not considered to be a significant limitation, as data has been gathered from two survey periods and local hunters provided information on the location of hibernation sites.

For the fish surveys, the inability to undertake electrofishing surveys (as at the time, they are illegal under Georgian law) did present a constraint to undertaking more detailed population estimates; however the river habitat survey (RHS) data gathered in 2015 has been used to make an informed assessment on the brown trout habitat usage. Side tributaries were not surveyed as part of the RHS due to time constraints i.e. the onset of winter. Fish survey data from one tributary (the Darachi-Ormaleti) was made available and the information used to inform this impact assessment, so too were visual observations made during the 2016 faunal surveys as 7 of the side tributaries were walked in May 2016. As a result of this, the lack of RHS survey data for the Nenskra tributaries is not considered to have significantly affected this Biodiversity Impact Assessment.

1.4 Structure of the report

The Biodiversity Impact Assessment Report is structured into the following main sections, including this Introduction section:

- Section 2 contains the Habitat Assessment. This section has been broken down into four sub sections to include the following topics:
  - Vegetation and habitat mapping – the results of the field surveys, broad scale mapping of the two valleys and a more detailed map of the floristic habitats which will be subject to loss or other direct impact;
  - Terrestrial faunal habitats – survey results and maps showing habitat suitability for the target faunal species considered. Avian fauna survey results have also been presented here, however maps have not been produced for the avi-fauna.
  - Aquatic Habitats – the results of the field surveys, including the life cycle of the fish found in the Nenskra/Nakra watersheds and a map showing the habitat unit classification for these watersheds.

  - Critical Habitat Assessment - this section assesses the habitats present and their ability to support protected species to assess whether they are “critical” as defined by the IFC guidance, which reflects the EBRD, the EIB and the ADB definitions.

- Section 3 sets out a description of the conservation initiatives which are being undertaken in the area, such as the proposed Svaneti Protected Area and candidate Svaneti Emerald site.
- Section 4 is the first of the Impact Assessment sections, looking at the potential impacts upon the flora, vegetation and habitats within the zone of influence of the Project. This section, and each of the subsequent impact assessments, include details of the issues and an impact analysis. The mitigation strategy and assessment of residual impacts is located in section 8. The cumulative impact assessment has been placed in Volume 10: Cumulative Impact Assessment.
- Section 5 presents the Impact Assessment on mammals.
- Section 6 presents the Impact Assessment on birds.
- Section 7 presents the Impact Assessment on river fish.
- Section 8 Mitigation contains information on the Mitigation Hierarchy and how this has been applied to this Project. Taking into account the results of the three preceding Impact Assessments (Mammals, birds and river fish); this section will provide information on the proposed mitigation strategy.
- Section 9 is the recap of the proposed mitigation measures presented in Sections 5 to 7 and is presented as a Summary table of impacts and commitments.

2 Habitat assessment

2.1 Vegetation mapping

2.1.1 Habitats of conservation concern

One of the main aims of the vegetation mapping was to provide relevant baseline data to identify if there are any habitats of conservation value which are likely to be affected by the proposed development and to quantify the resulting habitat loss or effect. Habitats of conservation concern are considered to be those habitats which contain viable populations of Georgian Red List (MENRPG 2006[20]), IUCN Red List floristic species, as well as those habitats and species listed in the EC Habitats Directive.

2.1.2 Habitat mapping methodology

A broad habitat mapping exercise of the Nenskra and Nakra Valleys was undertaken. The methodology used is described below.

2.1.2.1 Study area

For the broad habitat mapping, a corridor, 2km either side of the River Nenskra and the River Nakra was surveyed and mapped.

The 2km corridor/buffer distance used here, was chosen at the time as it is considered likely to be the distance beyond which the Project and associated activities are unlikely to exert an influence and also includes for the likely powerline corridor from the power house down towards the Enguri River. As of January 2017, it can now be confirmed that the 2km survey buffer does include all of the project components which lie above ground. The faunal aspect was taken into consideration as the broad habitat mapping has also been used in order to assess the floristic habitats for their ability to support protected faunal species too.

2.1.2.2 Field survey methodology

The broad habitat mapping was initially based on aerial photographs (to a resolution of 0.75 metres) of the Nenskra and Nakra valleys. Distinct vegetation types were marked out by hand onto the aerial imagery, to form “polygons” around distinct vegetation types. The minimum polygon size used was approximately four hectares. A site visit was then undertaken in order to ground truth and verify the vegetation types present. Each polygon was then marked with a symbol to identify it as one of the 12 habitat types listed in section 2.1.2.4. In 2016 the broad habitat mapping was expanded to cover both the Nenskra and Nakra watersheds; this mapping was ground truthed during a series of helicopter flights and ground based surveys, undertaken during the faunal surveys (May/June 2016). The watershed level mapping has been used in the Critical Habitats Assessment (Map 2.29).

The detailed floristic inventory lists were taken at 30 separate locations within both the Nenskra and Nakra Valleys. The species lists were collated on predesigned survey forms, allowing the surveyor to record the location, date, species and abundance of each species.

[20] MENRPG (2006) Ministry of Environment and Natural Resources Protection of Georgia. The Red List. [Online] Available from: http://moe.gov.ge/index.php?lang_id=ENG&sec_id=47 [Accessed 16th October 2015].

These are all contained in Annex 1. The results of the 2015 field surveys were then combined with those from 2014 and 2011, so that for all 65 points surveyed over these three years, a detailed inventory of habitat and vegetation types, as well as floristic species lists could be compiled. All of the habitat types have also been assigned a CORINE classification, allowing for assessment according to European Annex 1 Habitat Classifications, as well as each habitat being evaluated according to its sensitivity status.

2.1.2.3 Survey constraints

The habitat mapping was undertaken in early September (8th – 16th September 2015) which is a time of year when the majority of plants will be in evidence; however spring flowers may have died back by this time and may therefore not have been picked up within the species lists. It is however considered that this is unlikely to have presented a significant constraint to the broad habitat mapping or the detailed species inventories which were taken at 65 points (during three survey periods, 2011, 2014 and 2015) within the two valleys.

2.1.2.4 Habitat unit classification for the Nenskra and Nakra watersheds

The habitat classifications used for the broad habitat survey are listed below. These broad habitat types were decided upon following an initial site appraisal visit (August 2015) and in discussion with the Georgian botanists (Dr Mariam Kimeridze and Mr David Chelidze) who undertook the surveys. The habitat types have been derived from the "General Habitat Classes" used by the Bern Convention. For a summary of the methodology used please see Section 2.1.2.2, for full information on the survey methodology used, please refer to Annex 1 Flora, Vegetation and Habitat Assessment Report.

These are broad habitat types, the survey data is not detailed enough for the broad habitat types to be aligned to the EC Habitat Directive, Annex I habitat types. Annex 1 habitat types have instead been discussed in Section 2.1.4.

a) River or stream and associated river gravels
b) Farmland including grassland and crops
c) Residential areas including houses and gardens
d) Broadleaved woodland
e) Conifer dominated woodland
f) Mixed broadleaf and conifer woodland
g) Bracken (*Pteridium tauricum*) covered slopes
h) Landslide areas (mud slides, rock shoots and areas of eroded bare ground)
i) Scrub (areas of small trees or bushes)
j) Sub-alpine zone
k) Alpine zone
l) Bare rock

For the more detailed survey: the Flora, Vegetation and Habitat Assessment Report also contains detailed information on habitat type based on the CORINE system of habitat categorisation. The European CORINE (Moss 2008[21]) system is a programme which was established by the European Commission to create a harmonized geographical information

[21] Moss D (2008) EUNIS habitat classification – a guide for users. European Topic Centre on Biological Diversity.

system on the state of the environment in the European Community. The CORINE system does provide a sound basis for a Georgian based system of habitat type. Although Georgia is not part of the European Union, the Georgian scientific community has fully adopted the implementation of this process for describing and categorising habitats. A Scientific Working Group, set up by the Habitats Committee (established by Directive 92/43/EEC), expressed in May 1992 the need to prepare a manual for the interpretation of Annex I including habitat type classification. The results of the commission work were development of the two following points with the national experts:

- The interpretation work on Annex I should primarily focus on the priority habitat types.
- The CORINE classification (1991 version) provides a basis for a description of the Annex I habitat types; where the experts feel that it is not suitable, an operational scientific description should be produced from the contributions of the national experts.

As a result much work on this CORINE system has been undertaken in Georgia, with Georgian specific habitat categories being researched and added to the CORINE list.

2.1.3 Broad habitat map

The broad habitat maps show the Nenskra (Map 2-1 and Map 2-2) and Nakra (Map 2-3) valleys with regards to colour coded vegetation type. The broad habitat description set out below has been taken from The Flora, Vegetation and Habitat Assessment Report, Section 2: Overview of Flora and Vegetation of Nenskra-Nakra Catchment Area.

The Project territory covers botanical-geographical region of Nenskra-Nakra catchment area, which is located on the West part of Svaneti, in the western Caucasus Mountains. The annual amount of precipitation in the region, which has a strong impact on vegetation type, is 1200-1350 mm. Average annual temperature is 10-14 ^{o}C; annual temperature of the coldest month is 0.6^{o}C; average temperature of the warmest month is 20.9^{o}C.

The upper border of the forest belt is at 2000-2300m elevation in this region and is characterised by dark coniferous forests which dominate the vegetated-landscape of the Zemo Svaneti region. Evergreen undergrowth often containing relic species from the Tertiary period are represented by Cherry Laurel *Laurocerasus officinalis*, Rhododendron *Rhododendron ponticum* and Holly *Ilex colchica*. Cherry Laurel can be widespread in some valleys. A range of types of mixed deciduous forests dominate in the lower zones. Especially notable however, are Georgian oak *Quercus iberca* forests along Enguri River, near the confluence of Nenskra River, and also at the confluence of the Nakra River adjacent to Naki village.

Above 2300-2300 metres lies the sub-alpine zone which is characterised by low growing 'elfin' forests of spruce *Picea orientalis*, pine *Pinus sosnowskyi*, fir *Abies nordmanniana* and beech *Fagus orientalis* in dryer areas and by birch *Betula litwinowii*, beech and rowan *Sorbus caucasigena* in more moist areas. These areas can be floristically rich with regionally endemic birch species as well as the Pontic oak *Quercus pontica*.

The alpine zone is present above the sub-alpine zone (between about 2500 m and 3000 m). It is characterized by the dominance of short grass alpine meadows, which are often used (where accessible) for grazing stock in the summer months. Often the alpine meadows are located between areas of rhododendron and rock scree vegetation. It is also interesting to note that above the alpine zone is the sub-nivial zone, which is represented on high ridges and peaks above 3200 m elevation. Vegetation cover is represented by open cenoses and fragments of alpine meadows can be also found here. Vegetation of the Svaneti Caucasus, from Dolra valley to Tetnuldi, is dominated by rare subnival species to Svaneti documented by (Kimeridze 1985). Above this zone, rocky peaks with glaciers are present.

The Nenskra and Nakra river valleys both run roughly from north to south. The River Nenskra flows from the upstream point of the proposed reservoir impoundment area at 1305m above sea level, down to 590 metres where it joins the Enguri River, over a distance of about 17 km. The Nakra River is similarly steep, from the proposed weir location at 1530 m, falling to 885 metres over a distance of approximately 9 km where it also meets the Enguri River. The rivers tend to be narrow and fast flowing with large boulders in channel. However some less steep areas are present on the Nenskra River, where cobbles, gravels and even sand are present.

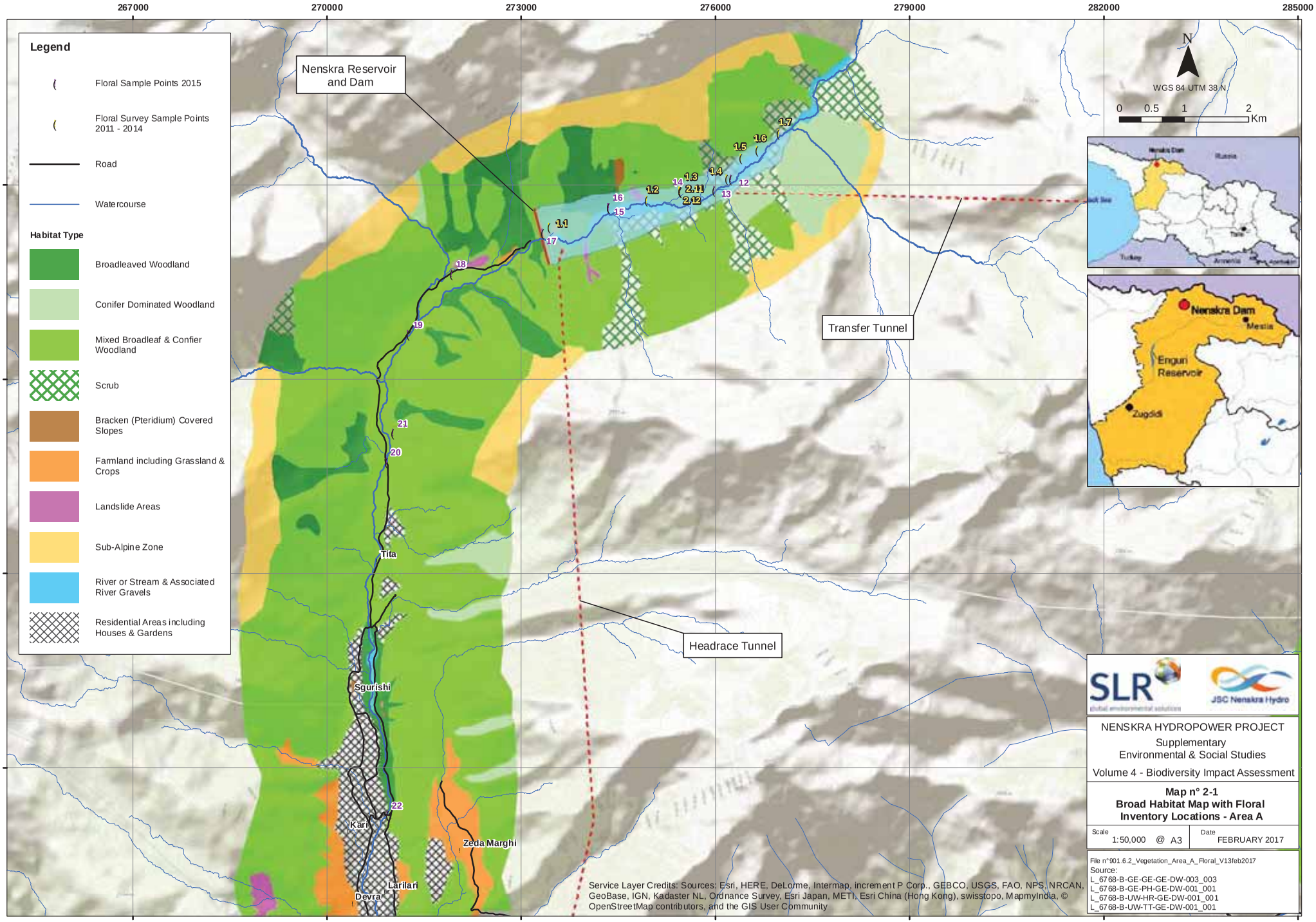
Both of the Nenskra and the Nakra valleys are predominantly covered with a mix of broadleaf and conifer woodland. Small urban conurbations and grazing areas are present in both valleys, generally below 1200 metres. It is due to the locations of these conurbations that logging in the area is occurring. As stated in Vol. 3 "Social Impact Assessment" issued in 2017 as part of the Supplementary Environmental & Social Studies,[22] the local residents cut wood for domestic uses such as firewood and construction materials. It is also estimated that about half of the households in the two valleys (Nakra and Nenskra) are also engaged in commercial logging for the cash income. The actual species of tree cut for logging depends on its ultimate use. Pine is mostly cut for domestic use; for export pine or hardwood is cut, depending on the current market conditions. As a result of this, the forests surrounding the conurbations tend to lack pine and can be described only as broadleaf woodland. On the steeper valley sides however, where access is difficult due to the terrain, these areas remain unlogged, so tend to contain areas dominated by pine, or mixed pine/broadleaf woodlands.

The broad habitat maps show that the Nenskra valley is predominantly wooded, with mixed broadleaf and conifer woodland being the most abundant habitat type. The sub-alpine areas are strongly related to altitude and do not appear to occur below 2000 m. Further south in the Nenskra valley, broadleaf woodland becomes dominant and the conifer woodland is restricted to the steeper more inaccessible areas of the valley sides. Within the Nakra valley, there are more areas of farmland and cropped land compared with the Nenskra valley. The dominant habitat type is still mixed broadleaf and conifer woodland, with areas of broadleaved woodland (especially dominant around the conurbations). In the south of the Nakra valley where the valley is particularly steep, there is a band of remaining conifer-dominated woodland. Table 2 is a summary of the percentage and area occurrence of each habitat within the Nenskra and Nakra valleys (see Photo Sheet 3 to Photo Sheet 5).

Table 2 - Total areas of habitat within the Nakra and Nenskra Valleys

Type	Description	Area ha	% of survey area
a	River or Stream & Associated River Gravels	73.90	0.52
b	Farmland including Grassland & Crops	740.04	5.21
c	Residential Areas including Houses & Gardens	730.61	5.14
d	Broadleaved Woodland	1800.95	12.67
e	Conifer Dominated Woodland	703.90	4.95
f	Mixed Broadleaf & Conifer Woodland	8441.03	59.38
g	Bracken (Pteridium) Covered Slopes	59.93	0.42
h	Landslide Areas	128.78	0.91
i	Scrub	525.09	3.69
j	Sub-Alpine Zone	1009.74	7.10
l	Bare Rock	1.42	0.01
	Grand Total - All Habitat	14215.41	100.00

[22] SLR, Nenskra HPP, Supplementary E&S studies, Volume 3 - Social Impact Assessment, 2017



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NENSKRA HYDROPOWER PROJECT

Supplementary Environmental & Social Studies

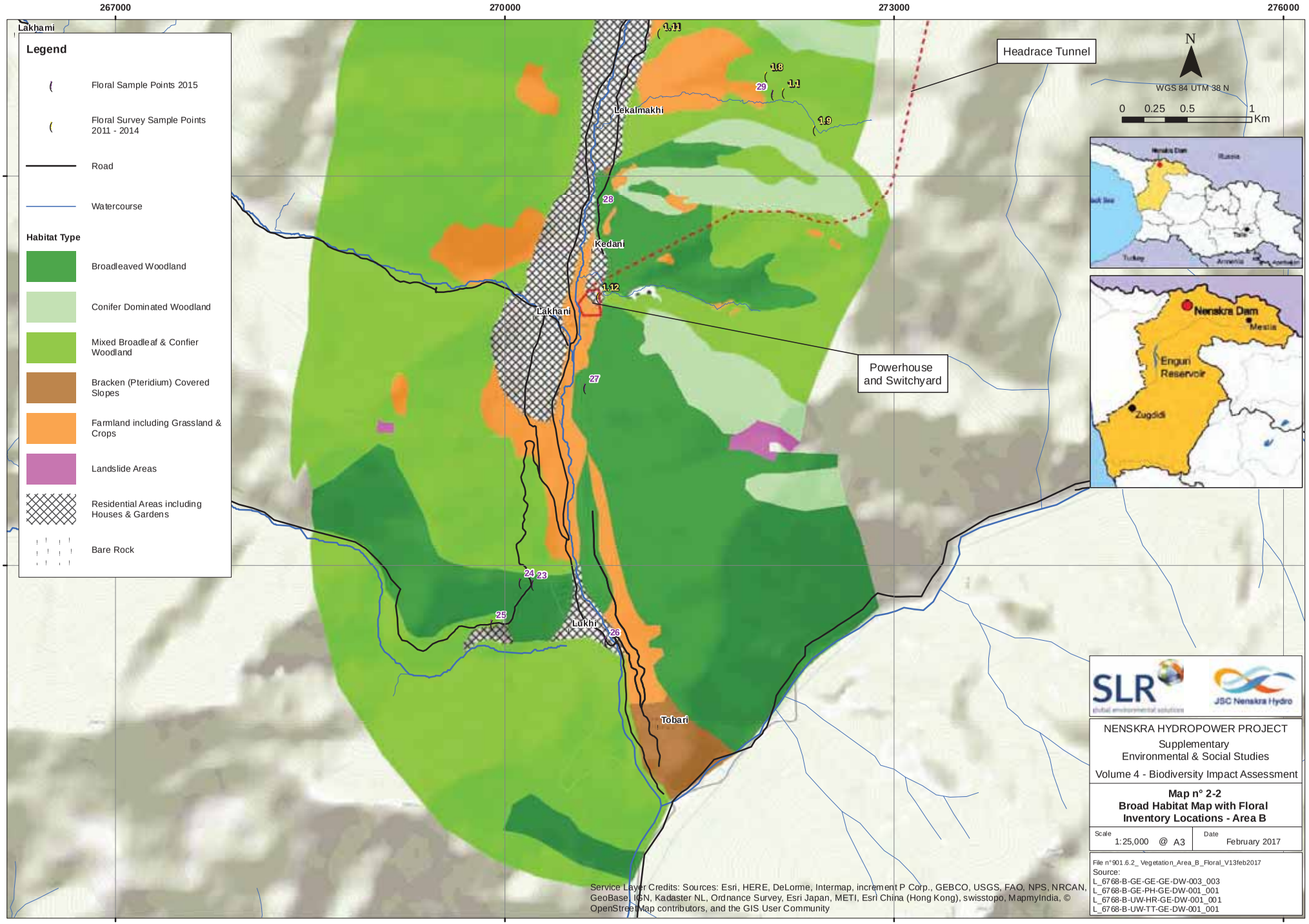
Volume 4 - Biodiversity Impact Assessment

Map n° 2-1
Broad Habitat Map with Floral Inventory Locations - Area A

Scale	Date
1:50,000 @ A3	FEBRUARY 2017

File n°901.6.2_Vegetation_Area_A_Floral_V13feb2017

Source:
L_6768-B-GE-GE-GE-DW-003_003
L_6768-B-GE-PH-GE-DW-001_001
L_6768-B-UW-HR-GE-DW-001_001
L_6768-B-UW-TT-GE-DW-001_001



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NENSKRA HYDROPOWER PROJECT

Supplementary Environmental & Social Studies

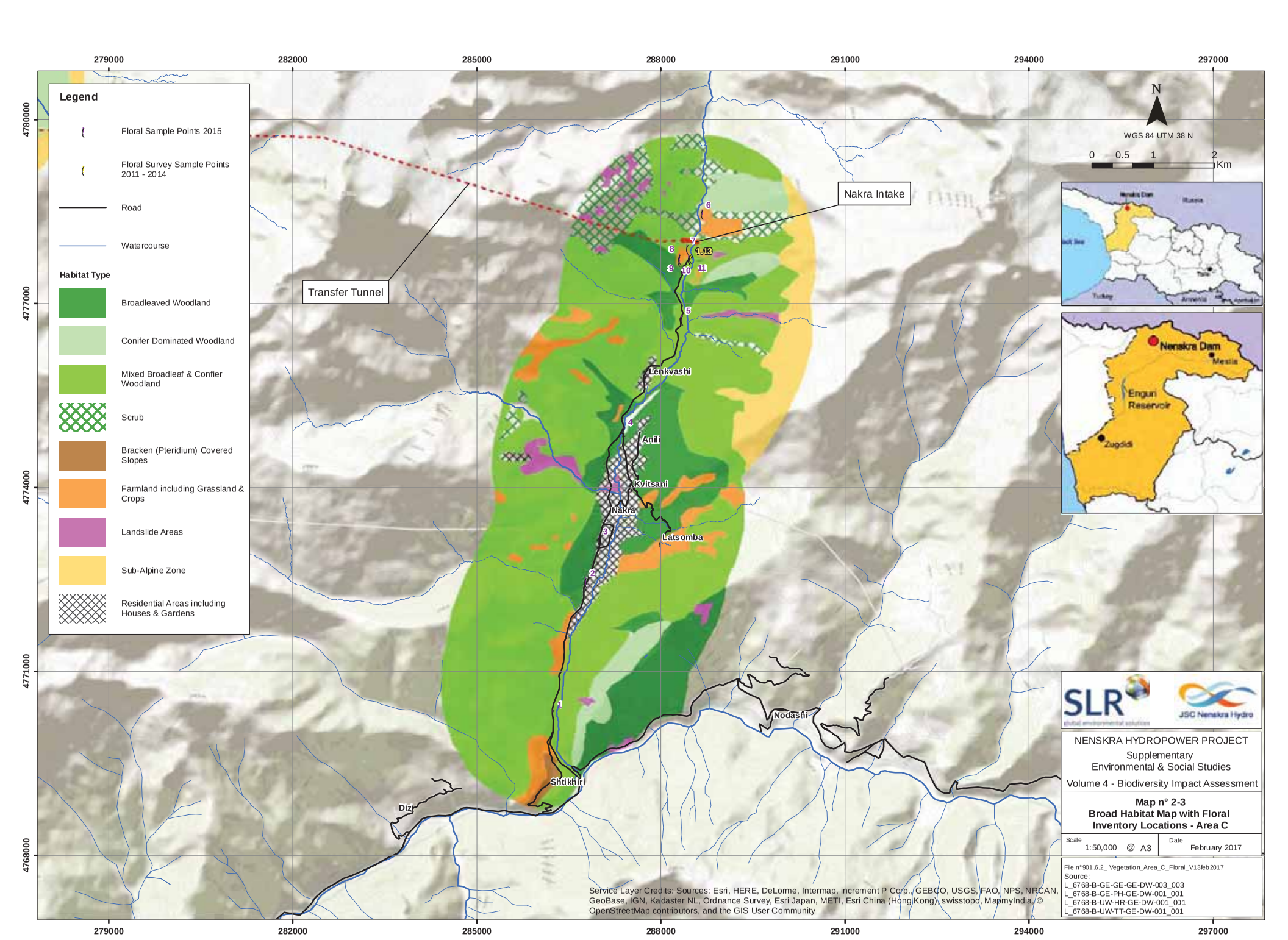
Volume 4 - Biodiversity Impact Assessment

Map n° 2-2
Broad Habitat Map with Floral Inventory Locations - Area B

Scale	Date
1:25,000 @ A3	February 2017

File n°901.6.2_ Vegetation_Area_B_Floral_V13feb2017

Source:
L_6768-B-GE-GE-GE-DW-003_003
L_6768-B-GE-PH-GE-DW-001_001
L_6768-B-UW-HR-GE-DW-001_001
L_6768-B-UW-TT-GE-DW-001_001



1	1 : *Conifer dominated woodland – Reservoir area (May 2016)*
2	2 : *Broadleaved woodland – Reservoir area (May 2016)*

Photo Sheet 3 - Main habitats - Conifer dominated and Broadleaved woodland

3	3 : *Mixed woodland- Nenskra valley (May 2016)*
4	4 : *Scrub – Nenskra upper valley (May 2016)*

Photo Sheet 4 - Main habitats - Mixed woodland and Scrub

5	5 : *Sub-alpine zone – Nakra/Nenskra pass (May 2016)*
6	6 : *Alpine zone- Nenskra valley (May 2016)*

Photo Sheet 5 - Main habitats - Sub-alpine zone and Alpine zone

7 : *Bracken – Kedani (September 2015)*

Photo Sheet 6 - Main habitats- Bracken

As can be seen in Table 2, the two most dominant habitat types are mixed broadleaf and conifer woodland, and broadleaf woodland. These broad habitat types cover a range of species compositions which are described in more detail in the section below. Essentially the broadleaf woodland close to the power house comprises mixed species deciduous forests containing species such as hornbeam *Carpinus caucasica,* ash *fraxinus excelsior*, hazel *Corylus avellana,* oak *Quercus imeretina and Q. hartwissiana*, sweet chestnut *Castanea sativa,* holly and cherry laurel. The broadleaf woodland within the reservoir area comprises species such as beech, chestnut, sycamore, maple *Acer laetum and A. campestre*, alder *Alnus barbata,* oak , willow , lime *Tilia begoniifolia* and elm *Ulmus glabra and U. elliptica*. Where the broadleaf woodland is mixed with conifer species the following species are found: Caucasian fir and Caucasian spruce. For more detail please see the next section or the Flora, Vegetation and Habitat Assessment Report in Annex 1.

2.1.4 Detailed floristic inventory and mapping

Annex 1 to this Volume, contains a detailed report entitled: Flora, Vegetation and Habitat Assessment Report. The report is the output from the 2015 surveys undertaken for this Project. The Flora, Vegetation and Habitat Assessment Report forms the basis for all of the survey information regarding flora contained within this biodiversity impact assessment. The detailed floristic inventory sheets for each location surveyed in 2015 are also contained within the Annex 1 Flora, Vegetation and Habitat Assessment Report. The detailed floristic inventory locations are shown as numbered dots on Map 2-1 - Map 2-3. The detailed floristic inventory lists all species and habitats identified during the 2015 surveys as well as the 2011 and 2014 survey data provided in the 2015 ESIA. For the 2015 surveys data on species inventory were recorded, such as conservation value, structural features, tree layer species, shrub layer species, herb layer species as well as the moss layer where appropriate. For each species the cover/abundance was also noted. Levels of disturbance to each habitat were recorded too.

Detailed floristic inventory locations 1 – 30 were surveyed in 2015 and were located to best represent infrastructure locations (reservoir area, powerhouse and penstock and the Nakra weir), areas where habitat losses will occur. The other 35 locations containing a decimal point were surveyed in June 2011 and August 2014. The data has been compiled together in order to provide a greater understanding of the habitat types and floristic species present in the area. The surveys were undertaken within the same areas as the broad habitat mapping survey. As a result of this, some of the detailed surveys are in fact located outside of the Project area (as defined in Section 2.1.2.2).

Table 3 shows all of the species which were identified during the surveys (2011, 2014 and 2015) which are Red List species and/or are subject to some form of protection e.g. Georgian Red List, or CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora), an international agreement between governments aiming at ensuring that international trade in specimens of wild animals and plants does not threaten their survival. Other information is given regarding the species' status e.g. endemism or rarity. This information has been taken from the Flora, Vegetation and Habitat Assessment Report in Annex 1. None of the named species are listed on the EC Habitats Directive. The photo plates contained within this volume have been presented in order to illustrate the habitats present. The photographs presented on the plates have been taken from the Flora, Vegetation and Habitat Assessment Report, or have been taken by the main author of this volume.

Following the 2015 site visit, all of the survey points were categorised according to the habitat type which they best represented. The Flora, Vegetation and Habitat Assessment Report in Annex 1 gives detail on the habitat types[23] and how they were identified[24]. These habitats

[23] Akhalkatsi, Maia (2012) Habitats of Georgia. Tbilisi. https://www.academia.edu/9088313/Habitats_of_Georgia

were then subject to a sensitivity assessment based on criteria such as species richness, naturalness and level of modification, human disturbance, rarity and geographical location of habitat (For more detail refer to the Flora, Vegetation and Habitat Assessment Report in Annex 1).

The habitat types listed in Table 4 have all been assessed has having a high or medium sensitivity[25] or is a habitat listed on Annex I of the EC Habitats Directive and which are located within the project area. The sensitivity assessments were undertaken according to the methodology set out in Morris and Therivel (1995[26]), see Annex 1 for more detail on the methodology used. Again the plot numbers have been shown on Map 2-1 and Map 2-3. High sensitivity habitats are those considered to have a high species richness and likely support endemic or threatened species, i.e. those included in the Georgian Red List, IUCN red list, or as an Annex 1 habitat[27]. These habitats are further described as being only slightly modified or natural habitats within which very little or no human disturbance has taken place.

The main high sensitivity habitat identified is the Beach forests with Colchic understory, found predominantly in the reservoir area. This habitat is described as being widespread in western Georgia and is found on the north western slopes of the Greater Caucasus and the Adjara-Imereti Range. This type of forest ranges from 200 metres above sea level and reaches up to about 2250 metres (Akhalkatsi 2015[28]). As a result of this broad altitudinal range, there are a number of sub types, of which three are described above. Of the forest habitat distributed in Georgia, beech forests make up 46.6% of the forested areas, which equates to 10,600km^2.

The other habitat identified as high sensitivity is Dark-coniferous forest *(Piceeta orientale-Abieta nordmanniana).* This habitat is less wide spread in Georgia, making up about 7.1% of forest cover, or about 1,615km^2 (Akhalkatsi 2015).

The Flora, Vegetation and Habitat Assessment Report (Annex 1), lists 27 plots (from the 65 surveyed over the three years of survey), as being of medium sensitivity. Of these, five plots are considered to occur within the footprint of the Project area, so are listed in the table below. These are habitats which are considered to be moderately modified habitats i.e. those which can still support characteristic species assemblages. Medium also describes habitats with a medium species diversity with few or rare or threatened species.

[24] Akhalkatsi, Maia and Kimeridze, Mariam (2012) *Implementation of the classification system of forest habitats in accordance with the 'Natura2000' standards in the Georgian Legislation*. In: 12th International Symposium on Legal Aspects of European Forest Sustainable Development , 31 May – 2 June 2010, Nikosia, Cyprus.

[25] Please note that depending on the condition of each habitat type, the same habitat may be variously classified as low, medium or high in different areas. An intact habitat may have a high sensitivity, and a logged, grazed version of the same habitat may have a low sensitivity due to its already degraded or modified nature.

[26] Peter Morris and Riki Therivel [eds.]. 1995. *Methods of environmental impact assessment*. London: UCL Press.

[27] The EC Annex I habitats, have been categorised according to the methodology set out on page 27 of the Detailed Flora, Vegetation and Habitat Assessment Report located in Annex 1. Please note that not all Annex I type habitats have been considered to be of high conservation value; the rationale for which is also described within the Detailed Flora, Vegetation and Habitat Assessment Report.

[28] Akhalkatsi M. (2015) Forest habitat restoration in Georgia, Caucasus Ecoregion. Published by Mtsignobari.

Table 3 - Plant species subject to legislation or protection

Species	Protection/status/geographic occurrence	Plot No.s	Notes
Castanea sativa	Georgian Red List Species - vulnerable (VU)	1, 3, 24, 28, 1.01, 2.20	Only limited individuals found. Largest number reported from plot 3, where 4 - 10% of the species present were *Castanea sativa.* Plot 3 lies outside of the project footprint in the Nakra Valley. This species is native to Europe and Asia Minor and is widely cultivated throughout the temperate world (PFAF 2012[29]).
Taxus baccata	Georgian Red List Species (VU)	1, possibly 1.10	Only one individual listed in plot one during the 2015 surveys. Recorded as an incidental in plot 1.10. This is a very widely occurring species, in much of Europe, western Asia and North Africa.
Atropa caucasica	Endemic to Caucasus	19, 20, 21 possibly 1.2	Only recorded as single individual plants at each survey point. This species is likely to represent *Atropa belladonna* subsp *caucasica.* Published information cannot be found on the distribution of this species, however during the mammal surveys it was noted as a single plant at least nine locations across the Project area.
Scabiosa correvoniana	Endemic to Caucasus	26	Only a few individuals of this species were noted at one survey point. This plant species is found throughout the Caucasus region.
Paracynoglossum imeretinum	Endemic to Georgia	16	Only one individual was noted at this location – species identification requires confirmation. Synonym to *cynoglossum imeretinum.* The IUCN database states that this species is listed as Vulnerable in view of the extent of occurrence (EOO) estimated to be 12,500 km2, its area of occupancy (AOO) estimated to be no more than 200 km^2, its existence at less than 10 locations and a continuing decline in at least the area, extent and quality of habitat, foothill shrub-lands on the Black Sea coastal area, inferred from actual scale and rates of grazing and land development for construction in the area..
Senecio pojarkovae	Endemic to Caucasus	3, 6, 16, 30, 2.13	Found in a number of locations with abundances ranging from rare to fairly common. This species was observed to widely occur throughout the Caucus region.
Euphorbia macroceras	Endemic to Caucasus	6, 7, 8, 9, 10, 11, 17,	Found at a number of locations in small numbers (less than 4% coverage of the survey area). This species is found in the Turkey, The Caucasus region and Iran (WCSP 2014[30]
Helleborus caucasicus	endemic to Caucasus	3, 23, 24, 30	Only a few individuals noted at each location. This species can be found in Greece, Turkey and the Caucasus (Hortopedia n.d[31].).
Digitalis ciliata	Endemic to Caucasus	6, 8, 24, 25, 27, 1.7, 1.8	Only a few individuals noted at each location. This species is native to the Caucasus area, where it can be found in meadows, pastures on the edge of forests. It is indigenous to mountainous terrain so can also be found on steep slopes.
Picea orientalis	Sub-endemic for the Caucasus,	24, 2.1, 2.4	According to the report, this species makes up no more than 10% of each area surveyed. The IUCN database

[29] PFAF (2012) Plants For A Future. [Online] Available at: http://www.pfaf.org [Accessed 17 November 2015]

[30] WCSP (2014) World Checklist of Selected Plant Families. Facilitated by the Royal Botanic Gardens, Kew. [Online] Available at: http://apps.kew.org/wcsp/ [Accessed 18 November 2011]

[31] Hortopedia (n.d.) Website containing information on a range of plant species. [Online] Available at: http://en.hortipedia.com/wiki/Main_Page [Accessed 17 November 2015]

Species	Protection/status/geographic occurrence	Plot No.s	Notes
	irradiated to Asia Minor		states that this species is listed as least concern in view of its wide distribution and presumed large population.
Abies nordmanniana	Sub-endemic for the Caucasus, irradiated in Asia Minor	11, 2.1, 2.9, 2.11, 2.19, 2.20, 2.21	The species has been recorded as comprising 50% or more of the tree cover at the following locations: 2.9, 2.19, 2.21. This species is described as being present in the Caucus mountains around the eastern Black Sea and northern Turkey. It grows in a band between about 900 – 2100 metres and is highly valued for its timber (Farjon 2010[32])
Pachyphragma macrophyllum	Representative of monotypic nemoral Colchic-Caucasian family; sub-endemic to Caucasus, irradiated to Assia Minor (Chaneti)	27	Only a few individuals recorded. The range for this species is described as West Asia to northeast Turkey to the west Caucasus (PFAF 2012).
Asarum ibericum	Sub-endemic for the Caucasus, irradiated to Asia Minor (Chaneti)	27	Few individuals noted. Research is being conducted to conclude if this is a subspecies of the commonly occurring *Asarum europaeum*. If A. *ibericum* is regarded as a sub species it wildly occurs across the Caucus Range (Jalas 1988[33]).
Ilex colchica	Tertiary relict flora species, irradiated to Balkans (Strandzha) and Asia Minor	2.11, 2.20	Few individuals noted at two survey locations.
Laurocerasus officinalis	Tertiary relict flora species	14, 19, 21, 2.12	Up to about 30% coverage of this species was noted at the survey points.
Quercus iberica	Rare plant species	1, 3, 23, 24, 25, 27	At location 23 this species was found to be quite abundant with up to 75% coverage.
Sorbus caucasigena c.f. *Sorbus caucasiana*	Rare plant species	19, 20, 21, 22, 1.1, 1.2, 2.1, 2.8	Small numbers of this species were identified at a number of points. This is possibly a subspecies of the widely occurring *Sorubs aucuparia*.
Cephalanthera rubra	CITES	2, 1.6, 2.16, 2.18, 2.21	Only found at one location in 2015.
Colchicum speciosum	CITES	10, 15, 16, 22, 26	Small clusters of individuals found at five separate recording points.
Cyclamen vernum	CITES	27, 2.17	Found at two locations.

[32] Farjon A. (2010) A handbook of the worlds conifers. Volume 1. Brill Leiden – Boston,

[33] Jalas J., Suominen J. (1988) Atlas Florae Europaeae. Distribution of Vascular Plants in Europe II, Cambridge University Press.

Table 4 - Floristic habitats sensitivity value and Annex I Habitat alignment

Plot number	Habitat type	Location	Sensitivity Value
1.1; 1.3; 1.5; 2.11; 2.12;	Habitats: 91FC-GE* Code of Georgia: Beech forests with Colchic understory (*Fageta fruticosa colchica*) Habitat sub-type: 91FC-GE-02 Beech forest with the understory (*Fageta ilicitoso-laurocerasosa*) of holly (*Ilex colchica*)	Reservoir area	High
1.2	Habitats: 9160GE Code of Georgia: - Oak or oak-hornbeam forests (*Quercitum -Carpinion betuli*) Habitat sub-type: 9160GE-03 Oak-hornbeam forest (*Quercetum-Carpinion betulii*)	Reservoir area	Medium
1.4	Habitats: 91FC-GE* Code of Georgia: Beech forests with Colchic understory (*Fageta fruticosa colchica*) Habitat sub-type: 91FC-GE-04 Beech forest with the typical understory (*Fageta magnovacciniosa*) of Caucasian blueberry (*Vaccinium arctostaphylos*)	Reservoir area	High
1.6	Habitats: 91SF-GE Code of Georgia: Beech forests without understory (*Fageta sine fruticosa*) Habitat sub-type: 91SF-GE 03 Beech forest with blackberry *(Rubus hirtus)* cover (*Fageta rubosa*)	Reservoir area	High
1.7; 6; 10; 11; 15; 16	Habitats:91E0* Code of Georgia: Alluvial forests Habitat sub-type: 91E0 *01. Floodplain forest	Reservoir area; Nakra weir	Low
12	Habitats: 91PA-GE Code of Georgia: Dark-coniferous forest *(Piceeta orientale-Abieta nordmanniana)* Habitat sub-type: 91PA-GE-01 Dark coniferous forest without the understory (*Piceeto-Abieta sine fruticosa*)	Reservoir area	High
13	Habitats: 9BC-GE* Code of Georgia: Colchic relic broad-leaved mixed forest Habitat sub-type: 9BC-GE-04 Beech – alder – chestnut – hornbeam forest (*Alnus barbata – Caprinus betulus – Fagus orientalis – Castanea sativea)*	Reservoir area	Low
14	Habitats: 91PA-GE Code of Georgia: Dark-coniferous forest (*Piceeta orientale-Abieta nordmanniana*) Habitat sub-type: 91PA-GE-02 Dark coniferous forest with Colchic understory (*Piceeto-Abieta fruticosa colchica*)	Reservoir area	Medium

Plot number	Habitat type	Location	Sensitivity Value
17	Habitats: 91FC-GE* Code of Georgia: Beech forests with Colchic understory (*Fageta fruticosa colchica*) Habitat sub-type: 91FC-GE -05 Beech forest with azalea *(Rhododendron luteum)* understory (*Fageta azaleoza*)	Reservoir area	Medium
19	Habitats: 91PA-GE Code of Georgia: Dark-coniferous forest *(Piceeta orientale-Abieta nordmanniana)* Habitat sub-type: 91PA-GE-01 Dark coniferous forest without the understory (*Piceeto-Abieta sine fruticosa*)	Access area	Medium
20	Habitats: 91PA-GE Code of Georgia: Dark-coniferous forest *(Piceeta orientale-Abieta nordmanniana*) Habitat sub-type: 91PA-GE-02 Dark coniferous forest with Colchic understory (*Piceeto-Abieta fruticosa colchica*)	Access area	Medium
21	Habitats: 91PA-GE Code of Georgia: Dark-coniferous forest *(Piceeta orientale-Abieta nordmanniana* Habitat sub-type: 91PA-GE-02 Dark coniferous forest with Colchic understory (*Piceeto-Abieta fruticosa colchica*)	Access area	High

* Indicates a habitat (or sub habitat type) which is considered to be equivalent to an Annex 1 habitat type.

1
2

1: *Beech forests with Colchic understory Fageta fruticosa colchica (High conservation value) Tita valley (May 2016)*

2: *Dark coniferous forest without the understory piceeto abieta sine fruticosa (High conservation value) - Nenskra upper valley (May 2016)*

Photo Sheet 7 - Illustration of high conservation value habitat

3	3 : *Dead layered beech forest mixed with Fir and Spruce (Medium conservation value) Nenskra valley (September 2015)*
4	4 : *Beech forest with chestnut, hornbeam and oak admixture (Medium conservation value) Nakra valley (September 2015)*

Photo Sheet 8 - Illustration of medium conservation value habitat

5	5 : *Oak forest (Low conservation value)- Ormeleti valley (September 2015)*
6	6 : *Alder forest with blackberry undergrowth(Low conservation value) Nenskra valley (September 2015)*

Photo Sheet 9 - Illustration of low conservation value habitat

2.2 Terrestrial faunal habitats

2.2.1 Species of concern

The following species were targeted for survey (see Section 1.3.5 for rationale); however, during the survey period, all mammal signs which were identifiable were logged.

- Brown Bear
- Bats (all species)
- Lynx
- Otter
- Caucasian squirrel
- Birds (all species)

2.2.2 Faunal biology

2.2.2.1 Bear

The brown bear is an opportunistic feeder, so has a varied omnivorous diet, which is likely to consist predominantly of berries and nuts (IUCN 2015[34]). Bears will also eat grasses, roots, insects, small mammals and if available large ungulates. The socioeconomic surveys performed for the Social Impact Assessment (see Volume 3 of the Supplementary E&S studies) showed that around one fifth of families questioned reported that within the last two years domestic stock had been killed or injured by a bear. The brown bear may be active during the day however it is considered mostly active during the early morning and evening.

Brown bears are subject to seasonal movements, generally in response to food aggregations such as autumnal berries, which in turn may cause bears to congregate in one specific area or valley during a short period when feeding occurs. In general though, the brown bears are considered to have quite a low density, with approximately 7- 12 bears per 1000km^2 (Chestin 1992[35]) to 13 bears per 1000km^2 (Lortkipanidze 2010[36]). Another study suggests that bears have large ranges from 200-2000km^2 for male bears and 100-1000km^2 for females (IUCN 2005) but that while typically solitary, they do tolerate the presence of other brown bears and do not tend to be territorial.

The mating season for brown bears is from May to July. After which time the fertilized egg(s) undergoes delayed development and does not implant in to the female's womb until about November. The young are then born between January and March while the female bear is still in hibernation. The litter of between one and four cubs is produced which are initially fed on their mother's milk. The cubs will often remain with their mother until the third or further year of their life, and will reach sexual maturity at about four to six years old.

Hibernation, or more accurately a period of torpor, for the brown bear in the Caucasus Mountains occurs throughout the winter, in a den which will either be in a cave, under boulders or dug into the earth. For the brown bears in the Svaneti Region, anecdotal evidence (from local hunters) suggests that the bears tend to create their hibernation dens above the valley floor on the sheltered side slopes, where snow will create a long lasting cover (as

[34] IUCN 2015 The IUCN Red List of Threatened Species – species specific information. [Online] Available from: http://www.iucnredlist.org/ [Accessed 16 Oct 2015].

[35] Chestin E., I. *Et al. (1992)* The Brown Bear *(Ursus arctos L.)* in the USSR: numbers, hunting and systematics. Ann. Zool. Fennici. 29 p.57-68

[36] Lortkipanidze (2010) Brown bear distribution and status in the South Caucasus. Ursus 21, 97-103

insulation) to the den underneath. This type of den location also seems to occur in other bear populations in mountainous areas such as the East Carpathian Region (Stofik 2014[37]) where a range of dens were built at higher altitudes, presumably where winter temperatures were more stable.

2.2.2.2 Bats

The group term 'bats' here encompasses a number of different species all with differing habitat and food requirements, however all of the bats described within this report are insectivorous bats which inhabit higher altitude forested land (above 1000 metres) and which hibernate over the winter months.

As stated in the Bats Conservation Plan for the Caucasus (Ed. Kandaurov 2008[38]) bat distribution by altitude depends on the air temperature and concentrations of flying insects. Generally most bats do not live higher than 1500 metres above sea level (asl). Some species such as greater horseshoe *Rhinolophus hipposideros*, Brandt's bat *Myotis brandtii*, Daubenton's bat *M. daubentonii*, Natterer's bat *M. nattereri*, noctule *Nyctalus noctula*, serotine *E.serotinus*, brown long-eared bat *Plecotus auritus*, Nathusius pipistrelle *Pipistrellus nathusii*, Geoffroy's bat *M. emarginatus*, Hypsugo's pipistrelle *Hypsugo savii* and occasionally barbastelle *Barbastella barbastellus* can be found as high as 1800 meters a.s.l. lesser mouse eared bat *Myotis blythii*, *whiskered bat M. mystacinus*, greater noctule bat *Nyctalus lasiopterus*, common pipistrelle *Pipistrellus pipistrellus*, parti-coloured bat *Vespertilio murinus*, brown long-eared bat, Brandt's bat, serotine and the European free-tailed bat *Tadarida teniotis* have been recorded at over 2000 meters a.s.l.

All of the bat species listed above are dependent on the availability of suitable roosts. Bats have to have suitable roosts for the following activities:

- Nursery roosts, where female bats give birth and nurture their offspring (May to July);
- Wintering roosts where bats hibernate in winter (November to March);
- Summer roosts used by males and non-breeding female bats;
- Transit roosts used for a limited time during migration or movements; and
- Rutting roosts used during the autumn mating season.

During the winter hibernation period, cave systems, where no sharp fluctuations of temperature occur, are of particular importance for hibernating. Such habitats are not present in the Project area. Caves can be used not only by year-round cave dwelling bats, but also by bats which roost in trees and buildings during the summer, for hibernation during the winter period. Due to the low temperatures experienced in the Project area during the winter, when snow can be present on the ground for 2 – 4 months, the bats present (during the warmer summer months), are likely to migrate south from the Project area, to over winter, with a proportion of the bats likely hibernating in cave systems within the limestone areas, more than 20km south of the Project area.

During the bat active season (March – November) bats will leave hibernation and disperse to their roosting areas. Bats are likely to use the Project area (specifically the reservoir area) only when the snows have melted and insect prey is available. During these active months, the bats will likely roost in trees, rock fissures and man-made structures such as herding huts, logging huts and houses. Maternity roosts are also likely to be present here too. The bats are likely to

[37] Storfik J., Saniga M. (2014) Dens and beds of the brown bear Ursus arctos in the East Carpathian region – Poloniny National Park. Folia Oecologica 39(2): 147 – 154.

[38] Yavruyan E., Rakhmatulina I., Bukhnikashvili A., Kandaurov A., Natradze I., and Gazaryan S. Authors (2008) Bats Conservation Plan for the Caucasus. Publishing House Universal.

remain in the area until temperatures drop, when they will migrate south, down the valley towards alternative foraging areas and ultimately a hibernation area for the winter.

2.2.2.3 Lynx

According to IUCN (2015[39]) the lynx occurs in a wide variety of environmental and climatic conditions. Throughout Europe and Siberia, it is primarily associated with forested areas which have good ungulate populations and which provide enough cover for hunting.

The home range size of the lynx varies widely from 100 to over 1,000 km² the size being dependent on the availability of prey. The lynx does not hibernate, remaining active throughout the year. Lynx may hunt during the day; however the Eurasian lynx is mainly nocturnal or crepuscular and spends the day sleeping in dense thickets or other places of concealment. It lives solitarily as an adult within its range; only coming together during the mating period January to April. The Lynx is the largest lynx species and the only one to primarily take ungulate prey, although they rely on smaller species where ungulates are less abundant (which is likely to be true in the Nenskra and Nakra valleys). Lynx kill ungulates ranging in size from the 15 kg to 220 kg, but show a preference for the smaller ungulate species, such as roe deer *Capreolus capreolus* and chamois *Rupicapra rupicapra*. Within the Nenskra and Nakra valleys if roe deer are still present then they are at very low populations, only one deer print was recorded during the 2015 survey period. Chamois and west Caucasian tur *Capra caucasica* are likely to be present but evidence suggests that they tend to occupy alpine and sub alpine meadows[40], so would not be present within the reservoir area. Occasionally, lynx also hunt foxes, hares, wild pigs, birds or domestic animals such as sheep and goats. In European Russia and western Siberia, where roe deer are absent, mountain hares and tetraonids (grouse) form the basic prey base. Lynx do not hibernate and are active throughout the year.

2.2.2.4 Otter

The otter lives in a wide variety of aquatic habitats, which for the Svaneti otter populations includes glacial melt-water rivers. Evidence has shown (Conroy 1998[41]) that in some locations such as the Himalayas and Alps, otter will ascend up to higher altitudes in the summer, when rivers are free of ice, but in colder months, otter will migrate downstream to lower altitudes where food items are more readily available. It is therefore considered likely that this also occurs in the Caucasus Mountains, where rivers and streams can remain frozen for a number of months each winter.

This predominantly nocturnal species establishes group home ranges within which each female otter has a core range, the size of which is determined by food abundance and shelter requirements (IUCN 2015[42]). Various studies have been undertaken in order to assess the range size for otter based on river length, results show that food availability is highly relevant, but that range size can vary from 10km to 50km of river length average per otter (Sulkava 2009[43]). Resident males have larger home ranges, which may include a number of female

[39] IUCN (2015). The IUCN Red List of Threatened Species 2015, Information on Lynx Lynx. [Online] Available from: http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T12519A50655266.en [Accessed 27 October 2015]

[40] Huffman B. (2006) Information on ungulate species. [Online] Available from: http://www.ultimateungulate.com/Artiodactyla/Capra_caucasica.html [Accessed 10 November 2015]

[41] Conroy, J, Melisch, R and Chanin, P (1998) The Distribution and Status of the Eurasian Otter (Lutra lutra) in Asia - a Preliminary Review. IUCN Otter Spec. Group Bull. 15(1): 15 - 30

[42] IUCN (2015). The IUCN Red List of Threatened Species 2015, Information on Otter *Lutra lutra*. [Online] Available from: http://www.iucnredlist.org/details/12419/0 [Accessed 27 October 2015]

[43] SUlkava R., Sulkava P (2009) Otter 9*Lutra lutra)* population in northernmost Finland. Estonian Journal of Ecology 58: 225-231.

ranges. Otter feed predominantly on fish. In the case of the otter in the Svaneti Region, this is likely to be brown or river trout *Salmo trutta/Salmo fario* (see Section 2.3). However a portion of their diet is also likely to consist of reptiles, amphibians, birds, small mammals and insects (Gorgadze 2013[44]).

Otter are largely solitary with adult associations tending only to take place during reproduction. The family group of the mother and offspring is the most important unit in otter society. Otter can breed at any time of year and after a gestation period of 63-65 days will give birth to between one and five kits (IUCN 2015).

2.2.2.5 Caucasian Squirrel

The Caucasian squirrel is a tree dwelling squirrel, which is found in a number of countries including Georgia, Armenia, Azerbaijan, Greece and Turkey. The Caucasian squirrel's natural habitat is broadleaf and mixed forests (Yigit 2009[45]). The Caucasian squirrel lives in areas as high as 2000 metres altitude. They make dreys in trees (nests) and their diet includes nuts (pine nuts, hazel nuts and acorns), seeds, tree shoots and buds[46].

2.2.2.6 Birds

The Georgian bird specialist Dr Alexander Abuladze who has visited this area to undertake bird surveys on a number of occasions (initial surveys in 1977, a number of visits in the 1980's and again surveys in this area during 2003, 2007 and 2015) writes in his report[47] (see Annex 2):

"On the basis of the author's own field observations carried out in previous years and analysis of all available information from several literature sources, unpublished reports and personal communications of Georgian zoologists, working in previous years within the limits of study area and other sources, a total of 129 bird species have been recorded within the limits of study area. These 129 bird species (50 – Non-Passerines and 79 - Passerines) are associated in 38 families that belong to 14 orders and form around 25% of Avifauna of South Caucasus and around 30% of Avifauna of Georgia."

The woodland and other habitats present in the Project area will be used by a range of bird species, some year round and others only seasonally, for activities such as breeding or stopovers on migration.

The Caucasus mountain range creates an east-west barrier to the twice yearly migration of birds on a predominantly north-south axis. The Caucasian mountains lie across one of the main Palaearctic-African flyways, connecting Europe with Africa (WOW n.d.[48]). As birds fly south from their breeding grounds in Russia and other northern European countries, they have to cross the Caucasus Mountains. The main routes over these mountains are well known. The Enguri river valley forms the migration route of numerous bird species as a secondary fly-way. The main fly-ways lie to the west - along the coast of the Black Sea and to the east along the

[44] Gorgadze (2013) Seasonal Diet of the Otter *(Lutra lutra)* On the Alazani River (Georgia). Hystrix, the Italian Journal of Mammalogy. Volume 24 (2): 157-160.

[45] Yigit, N., Kryštufek, B., Sozen, M., Bukhnikashvili, A. & Shenbrot, G. (2008). *Sciurus anomalus*. In: IUCN 2008. IUCN Red List of Threatened Species. Retrieved 6 January 2009.

[46] Nakanishi (2014) Information on the Caucasian squirrel. [Online] Available at: http://animaldiversity.org/accounts/Sciurus_anomalus/#D6B53CB3-4353-11E2-9EE4-002500F14F28 [Accessed 10 November 2015]

[47] The analyses of Avifauna are presented on the basis of the materials collected by the author in previous years, mostly in 1977, 1980's and later - in 2003 and 2007. See Annex 2.

[48] WOW (n.d.) Information on migratory birds and flyway conservation. [Online] Available at: http://wow.wetlands.org [Accessed 10 November 2015]

Rioni river valley. The Nakra and Nenskra valleys are linked to the Enguri river valley, so are used by a reduced number and range of species as minor fly-ways.

2.2.3 Faunal Habitat Mapping

2.2.3.1 Study area for faunal habitat mapping

For the faunal habitat mapping the broad habitat map shown in Section 2.1.3 has been used as a guide to habitat types. The original area covered by the floristic mapping is a corridor up to 2km from the river Nenskra where it joins the Enguri upstream to the confluence with the Dalri River. On the Nakra River the area surveyed is 2km upstream from the proposed diversion weir and includes the inlet channel where above ground works occur. The Nakra valley was also surveyed down to the confluence with the Enguri River. The 2015 faunal surveys were based on this area and aimed to search for species signs within this corridor where access could be gained.

"Map 2-4 - Mammal survey areas" shows the surveyor coverage, in relation to the Project area. The 2016 faunal surveys for brown bear and lynx were undertaken at a watershed level, so included a much larger area (see Map 2-5).

2.2.3.2 Field survey methodology

Initially the field survey period was limited; therefore the surveys were designed in order to maximise usage of the time available. Surveys were based on those used in published papers and European guidance and considered to be appropriate within a Georgian context. Examples include:

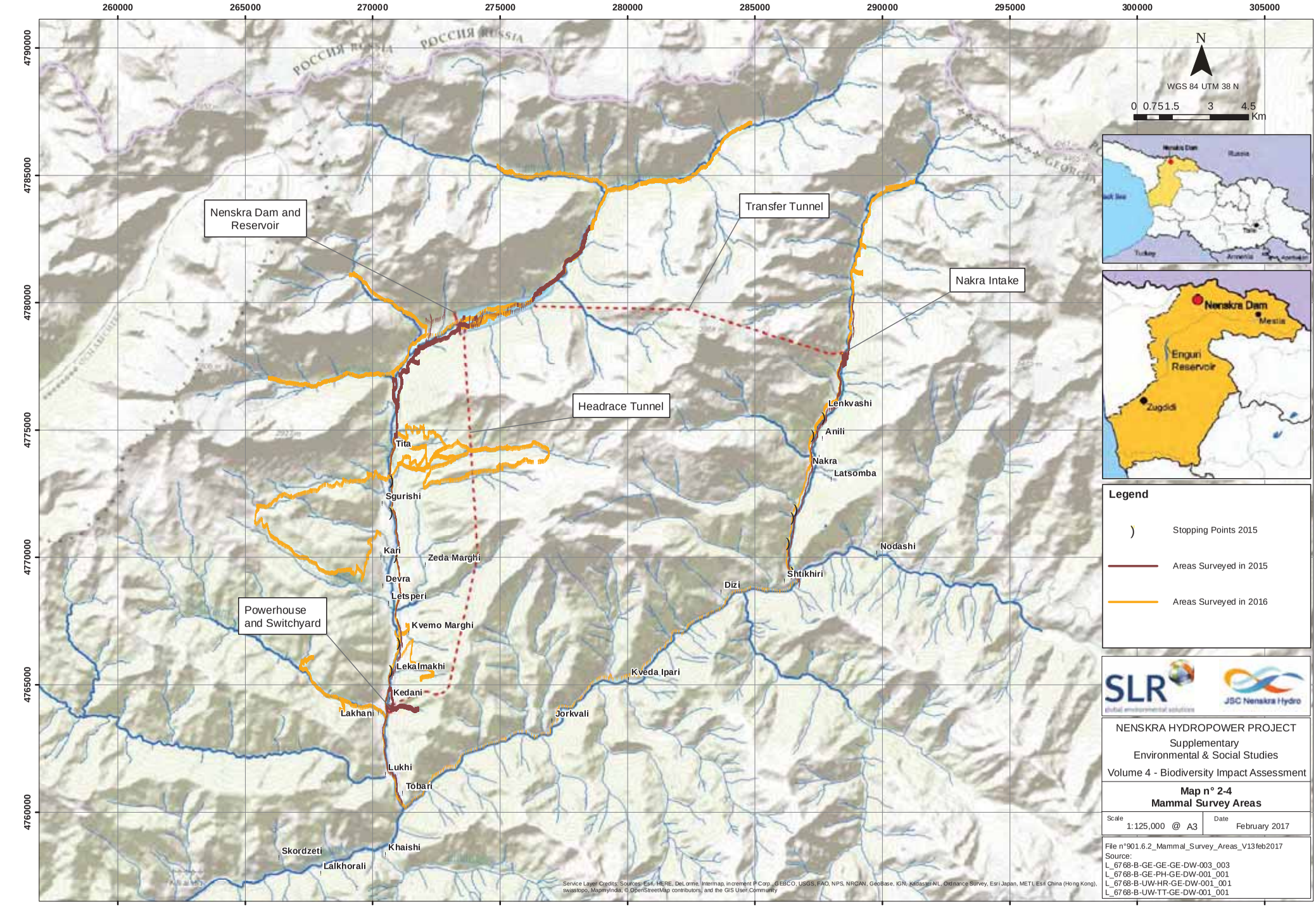
- Bat Conservation Trust (2012). Bat Surveys: Good Practice Guidelines, 2nd Edition. Bat Conservation Trust, London.
- Battersby (n.d.) Eurobats Publication Series No. 5. Guidelines for Surveillance and monitoring of European bat species.
- Chanin, P. (2003) Monitoring the Otter Lutra lutra. Conserving Natura 2000 Rivers Monitoring Series No. 10. English Nature: Peterborough
- Sidorovich V., Vorobej N. (2013) Mammal activity Signs: Atlas, identification keys and research methods. Published by Veche.

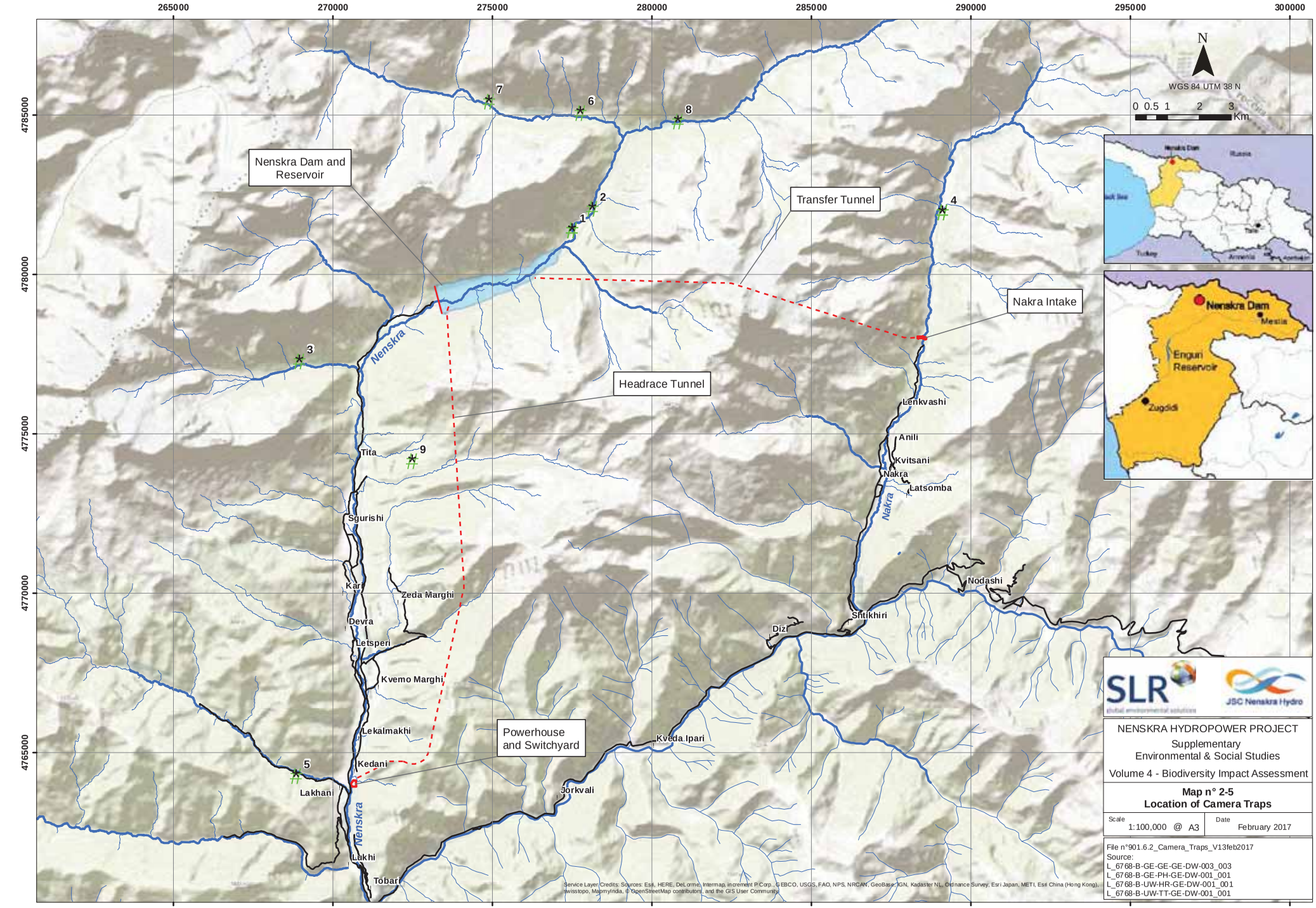
The surveys covered as much of the survey area as was practical and safe to do so and the findings are considered to be robust enough to support the impact assessment.

The initial field surveys for mammals were undertaken from the 15 – 24th September 2015 and were undertaken by Nicola Faulks CEnv MCIEEM (SLR) accompanied by at different times by two Georgian ecologists Andrei Kandaurov and Dr. Alexander Bukhnikashvili from the Institute of Zoology, Ilia State University, Georgia. The second tranche of field surveys for lynx and brown bear were undertaken from May 21st to June 5th 2016. Nicola Faulks was accompanied by Nicolas Glenat (SLR) and two PhD students from Ilia University, Georgia: Levan Ninua and Nika Paposhvili.

A. Bear

The 2015 brown bear surveys involved searching for signs such as scat, paw prints and feeding signs. The surveys targeted sandy and muddy areas (close to the river and on paths and tracks) to search for paw prints. In addition to this, paths and tracks were walked in order to search for bear scat.





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Map n° 2-5
Location of Camera Traps

Scale	Date
1:100,000 @ A3	February 2017

File n°901.6.2_Camera_Traps_V13feb2017
Source:
L_6768-B-GE-GE-GE-DW-003_003
L_6768-B-GE-PH-GE-DW-001_001
L_6768-B-UW-HR-GE-DW-001_001
L_6768-B-UW-TT-GE-DW-001_001

In addition to the walk over surveys one camera trap was placed out in the field. The intention had been to place out three camera traps, however due to human presence in the area, it was considered too high a risk for theft. The camera trap was placed in an area where previous bear activity had been noted. The camera trap was left in situ for a minimum of 5 days.

The 2016 surveys involved the use of a helicopter so that a much greater area could be accessed for survey. Surveys were undertaken in the upper Nenskra and Nakra watersheds, including tributaries of the Nenskra river across the whole valley. The surveys involved searching for signs of brown bear (prints, dung, scratch marks, fur etc.). In addition to this, nine camera traps were placed in the field and were initially left to record for ten days. At the time of writing two of the cameras remain in the field and will be collected and the data analysed in June 2017 (after the snows have melted). The camera trap locations were chosen as they represented locations close to previous brown bear signs, or were located in areas where potential brown bear food was noted. The locations of the camera traps are shown on Map 2-5 and lie outside of the project area in order to further identify if bear are using the upper part of the Nenskra valley, side tributaries and the Nakra valley.

B. Lynx

Lynx are very elusive creatures; however during the bear surveys (2015 and 2016), lynx scat and feeding remains were searched for. The main aim of the lynx survey was to understand the habitats present in the survey area and to ascertain if they may form part of a larger range for this elusive animal. The nine camera traps which were placed out in May 2016 were also located such that they may provide evidence of lynx presence. At the current time, two camera traps remain in situ in areas where lynx may be present.

C. Bats

Due to the time of year, and the short window during which surveys could be undertaken in 2015, the bat surveys were targeted specifically at understanding the use of the landscape by bats. Caves or other potential hibernation sites were searched for within the reservoir impoundment area.

Two bat detectors were located in the field (one within the reservoir area and one 5km down stream of this close to Tita). The aim of this exercise was to enable comparison of the bat activity recorded in the reservoir to that recorded further down the valley. The detectors remained in the field for a minimum of 6 nights. A third bat detector was used during a single car journey after sunset as a transect device. The bat detectors used, the Anabat Express, record each bat call and link each call series to a GPS location reference. This allows a map of species and locations to be produced for each car journey or transect if required.

The bat survey data was analysed initially using Kaleidoscope software (By Wildlife Acoustics). This software, when the parameters are set, will scan all of the Anabat generated files and will discard all files which do not contain bat calls. The software can then also be used to generate an identification of species for each of the remaining files. This species identification is still in development and is not 100% accurate, therefore once automated identification had been undertaken; each file was also manually checked for species identification and altered if considered appropriate.

During the 2015 site survey, the forest was also assessed for potential bat roost habitat. The methodology used involved walking transects 100m long and assessing all trees within five metres of that transect for bat roost potential. Tree species, size (height and thickness) and condition were recorded. Trees with a circumference of over 1m were considered as potential roost trees and were checked further for the presence of crevices and hollows. Only very old

alder *Alnus barbata* trees were taken into consideration on the banks of rivers since young and middle-aged trees of this species usually do not have hollows and/or crevices.

D. Otter

The otter surveys were undertaken on the Nakra and Nenskra rivers. The surveys aimed to identify otter activity by either direct observation or by secondary signs such as spraints or the identification of couches, lie-ups or footprints. Otter spraint, if found, would have been collected and examined in order to understand more about the otters and what they are eating.

E. Caucasian squirrel

During the 2015 survey period the habitats present within the Project area were appraised for their suitability to support this species; though no direct sightings were made. During the 2016 surveys, sightings were made and were recorded using a GPS unit and photographed were possible. No special survey requirements were made for this species; surveys were undertaken concurrently with the brown bear and otter surveys.

F. Incidental signs

During the 2015 and 2016 survey periods, signs of other mammals were noted and recorded (GPS and photograph). This included badger *meles meles* dung and prints, wild boar *Sus scrofa* wallowing holes and prints, hazel nuts eaten by edible dormouse *Glis glis* and other signs, such as marten *Martes spp.* scat. Many prints of mammals were also found and recorded. Finally in 2016 a foal carcass was found close to Tita village. The opportunity was taken to set up a camera trap so that any scavengers could be filmed. The results of the carcass camera trap are presented in the next section.

G. Birds

A site visit was undertaken by Georgian bird specialist Dr Alexander Abunadze on site between the 15-19th September 2015. September is a time when the north to south bird migration occurs. All species observed during the 5 day survey period were listed.

Observations were taken from random points using binoculars. Concurrent with this, the habitats present within the survey area were appraised for their likely use by avifauna for nesting and feeding.

The final bird study results presented in Annex 2 and used herein, comprise field data from a number of visits to a range of locations in and around the Svaneti area. Therefore the study area, which includes the wider area of the Nenskra and Nakra rivers will be referred to as the 'ornithological study area'. Specific breeding bird surveys were not conducted on the site, as it was considered following the receipt of the bird survey report (Annex 2) that sufficient information on bird presence and assemblage was available to undertake a robust impact assessment, without the need for breeding bird surveys.

2.2.3.3 Faunal habitat unit classification for the Nenskra and Nakra watersheds

The mapping has been based on the findings of the field surveys. The results are described below for each species along with the rationale for developing the faunal habitat classification scheme specific to each species.

A. Bear

The bear habitat map (Map 2-6) shows the location of the bear signs and estimated habitat suitability calculated from the 2015 and 2016 brown bear surveys.

Bear signs in the form of paw prints, scats, and feeding signs were noted across the reservoir area. These signs are located on Map 2-6 and illustrated on Photo Sheet 10 and Photo Sheet 11.

At one location, feeding signs were noted. Logs had been lifted and moved and claw marks were seen, where presumably the bears had been removing grubs to eat. The brown bear is an opportunistic feeder, so has a varied omnivorous diet, which is likely to consist predominantly of berries and nuts (IUCN 2015[49]). This was evidenced during the site survey by the large amount of cherry laurel *Laurocerasus officinalis/Prunus laurocerasus* berries recorded in the bear dung.

The habitats within the Project area were also appraised for their use as hibernation habitat by bears. Evidence taken from published articles (Wildpro 2015[50]) suggests that brown bears tend to hibernate in sites away from human disturbance and in areas which are unlikely to be affected by mid-winter thaws. Also evidence suggests that hibernation dens are often dug into the hillsides, so bears do not have to rely on boulder or cave dens. Published papers detailing information on the behaviour of the brown bear are limited; however evidence (IUCN 2015 and Pers. Comm. local hunters) would suggest that the bears in the Nenskra valley are likely to den outside of the areas subjected to logging, and possibly higher up the valley sides, close to the alpine zone in order to avoid freeze-thaw cycles through the winter period.

The brown bear habitat map (Map 2-6) has been colour coded to reflect a simple scale of habitat suitability for bear. Such suitability has been calculated for habitats in a number of European countries (Kusac 1998[51], Mertzanis n.d.[52], Martin j., *et al.* 2012[53], Koren M., *et al* 2011[54] . Important habitat variables identified are seasonal foods, cover, roads and fragmentation of habitats. The habitat map has therefore been drawn up to reflect the following:

- Good value habitat: forested areas where no, or low levels of logging/human impact have taken place.
- Moderate value habitat:
  - Areas where human disturbance irregularly occurs, but outweighed by presence of woodland habitat with food plants such as cherry laurel;
  - Areas where bears may forage when berries, grasses or other vegetation is in season, e.g. alpine meadows, but use would be subject to seasonal imitations;
  - Habitats suitable for brown bear, which are in proximity to sparse settlements, e.g. Tita village, where bears are known to frequent orchards to take fruit.
- Low value habitat: This category is represented by habitats in close proximity (about 1km) to high levels of human disturbance, or where logging is a regular occurrence.

[49] UCN 2015 The IUCN Red List of Threatened Species – species specific information. [Online] Available from: http://www.iucnredlist.org/ [Accessed 16 Oct 2015].

[50] Wildpro (2015) compendium of references for information on Ursus arctos hibernation. [Online] Available from: http://wildpro.twycrosszoo.org [Accessed 31 October 2015]

[51] Kusak J., Huber D. (1989) Brown bear habitat quality in Gorski Kotar, Croatia. Ursus 10:281-291

[52] Mertzanis G., *et al* (n.d.) Bear habitat suitability in relation to habitat types of European Interest in NE Pindos mountain range, Greece. Published in Sustainable Management and Development of Mountainous and Island Areas.

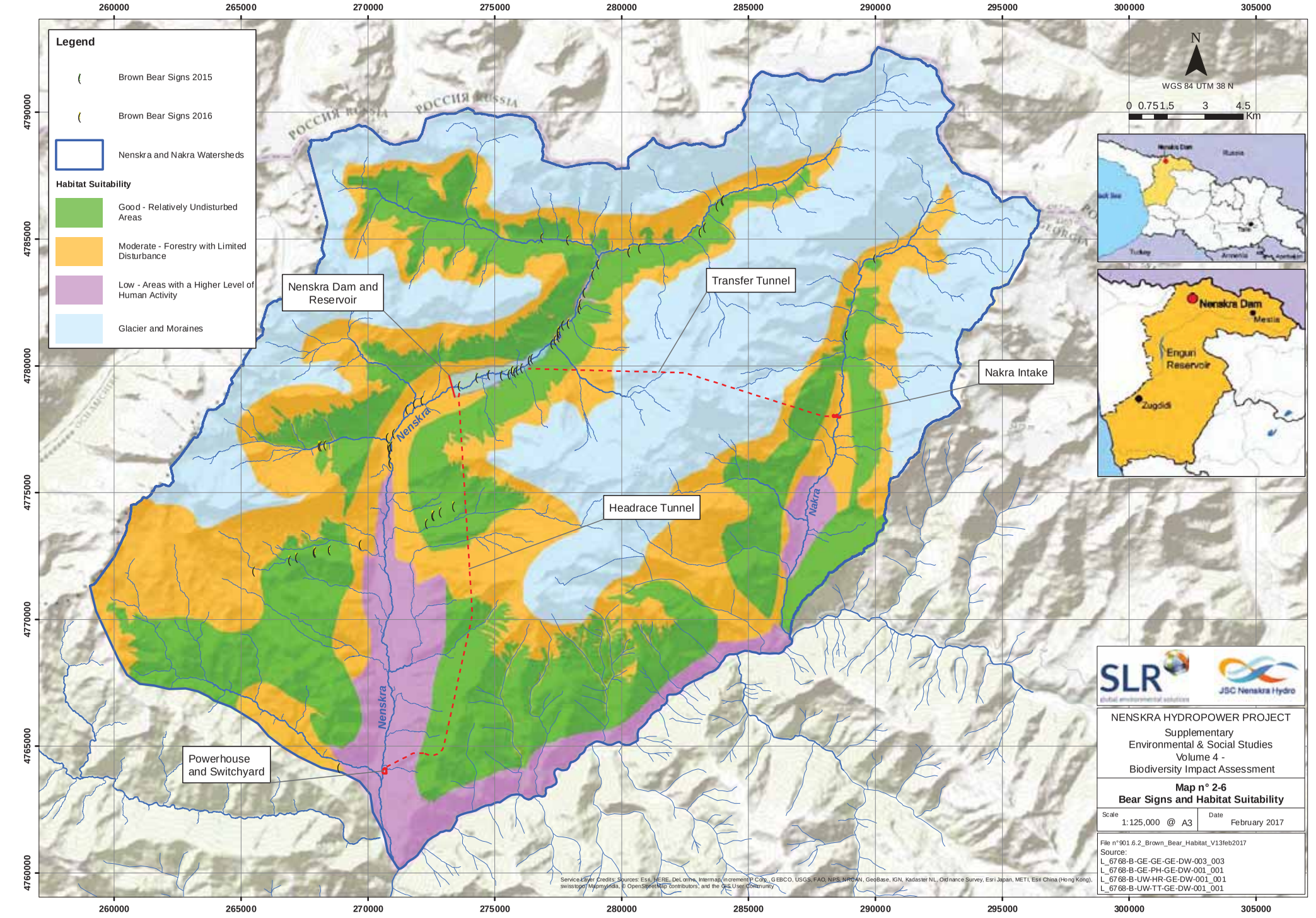
[53] Martin J., *et al* (2012) Brown bear habitat suitability in the Pyrenees: transferability across sites and linking scales to make the most of scarce data. Journal of Applied Ecology.

[54] Koren M., *et al* (2011) Habitat suitability modelling from non-point data The case study of brown bear habitat in Slovakia. Ecological Informatics, 6 (2011) 296-302.

The location of glacial and moraine areas has also been indicated on the habitat map. These areas are unlikely to be used frequently by brown bear, but may occasionally be used as movement corridors to gain access to adjacent valleys etc.

Low suitability habitat for bear has been mapped for areas with urban conurbation, roads and other activities which generate noise such as saw mills. It should be noted however, that brown bears can habituate to human presence, so brown bears can still move through areas categorised as low suitability, especially if food items, such as fruit trees or bee hives are present[55].

[55] Jerina K. *et al.*(2012) Factors affecting brown bear habituation to humans: a GPS telemetry study. Final Report. University of Ljubljana.



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Map n° 2-6
Bear Signs and Habitat Suitability

Scale	Date
1:125,000 @ A3	February 2017

File n°901.6.2_Brown_Bear_Habitat_V13feb2017
Source:
L_6768-B-GE-GE-GE-DW-003_003
L_6768-B-GE-PH-GE-DW-001_001
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L_6768-B-UW-TT-GE-DW-001_001

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

1	2
3	4
5	6

1 : *Bear print – Reservoir area (September 2015)*
2 : *Bear scratches– Tita valley (May 2016)*
3 : *Bear print – Downstream reservoir area (April 2016)*
4 : *Bear Print - Reservoir area (May 2016)*
5 : *Bear dung with laurel berries - Reservoir area (September 2015)*
6 : *Bear dung, old, near vehicle track in reservoir area (September 2015)*

Photo Sheet 10 - Signs of bear observed across the reservoir area in September 2015 and May 2016

1	1 : *Brown Bear – Okrili valley (May 2016)*
2	2 : *Brown Bear – Nenskra upper valley (May 2016)*

Photo Sheet 11 - Photos of bear in the Nenskra watershed in May 2016

B. Lynx

During the 2015 survey a potential lynx footprint was recorded within the project-affected area. A potential lynx marking on the base of a tree was also noted (shown on Map 2-7). Although only two potential signs of this species were noted during the survey (see Photo Sheet 12) it may indicate presence within the area. No signs of lynx were found during the 2016 survey period.

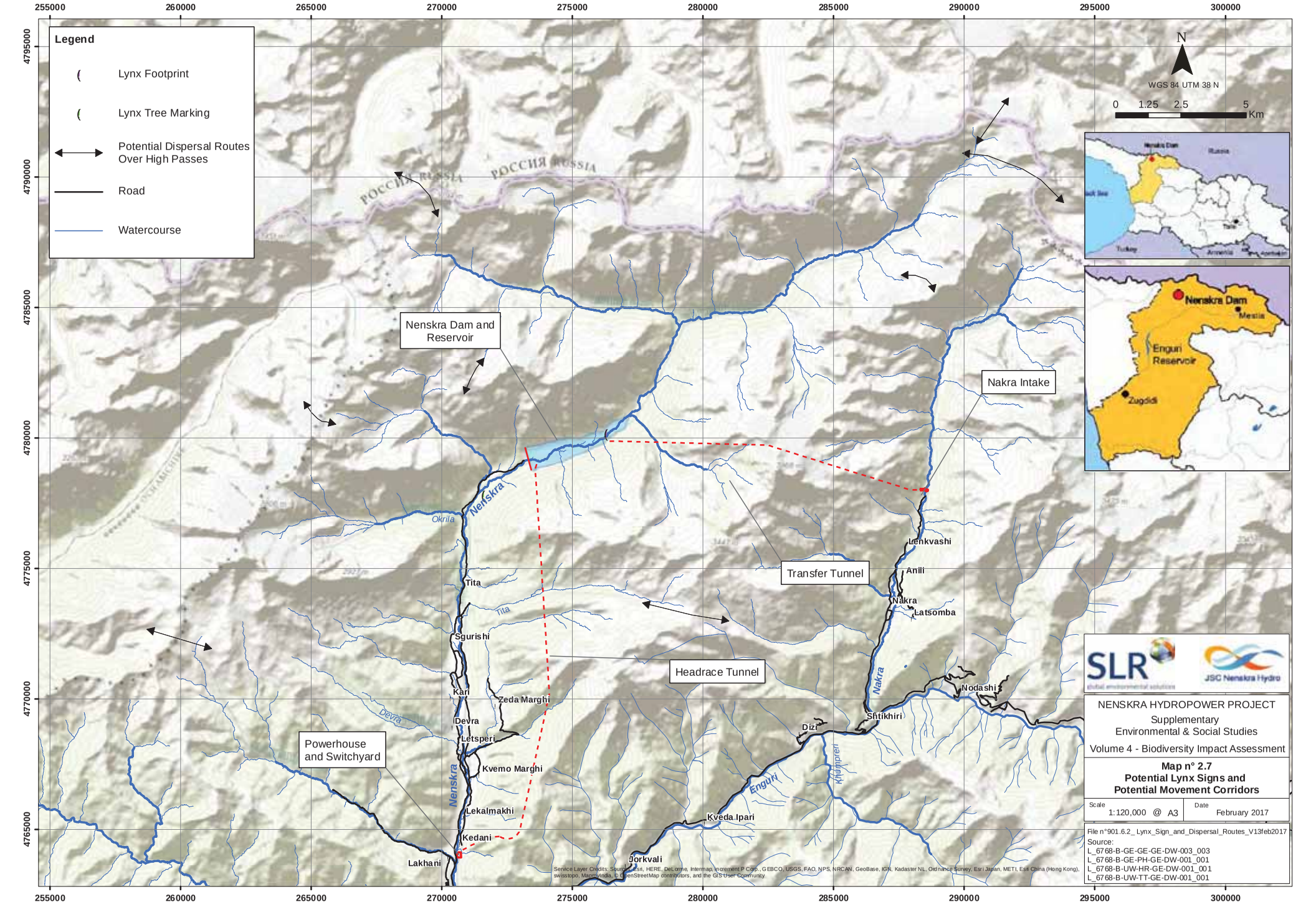
Photo Sheet 12 - Potential lynx footprint noted across the Project area in September 2015

Lynx are highly elusive animals, so finding signs is difficult. Lynx territories range in size depending upon terrain and food availability. It is difficult to determine the potential size of a lynx's territory as they can range from 100 – 1000km^2 (IUCN 2015[56]).

Little or no published data is available for lynx specifically within the Caucasus Mountains. The lynx's range size will vary according to food availability; a larger range will be occupied when prey items are less dense (Herfindal 2006[57]). Due to lack of published data, a habitat suitability map has therefore not been drawn up for lynx, however if the lynx's territory ranges from 100 – 1000km^2 then the lynx will need to cross from one watershed into the next. Map 2-7 has therefore been drawn up to indicate where these movement corridors may be. The areas indicated are all passes which exist across ridges allowing access to neighbouring watersheds.

[56] IUCN (2015). The IUCN Red List of Threatened Species 2015, Information on Lynx Lynx. [Online] Available from: http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T12519A50655266.en [Accessed 27 October 2015]

[57] Herfindal I., *et al.* (2006) Prey density, environmental productivity and home-range size in the Eurasian lynx (*Lynx lynx)* Journal of Zoology, Vol. 265, pp 63-71.



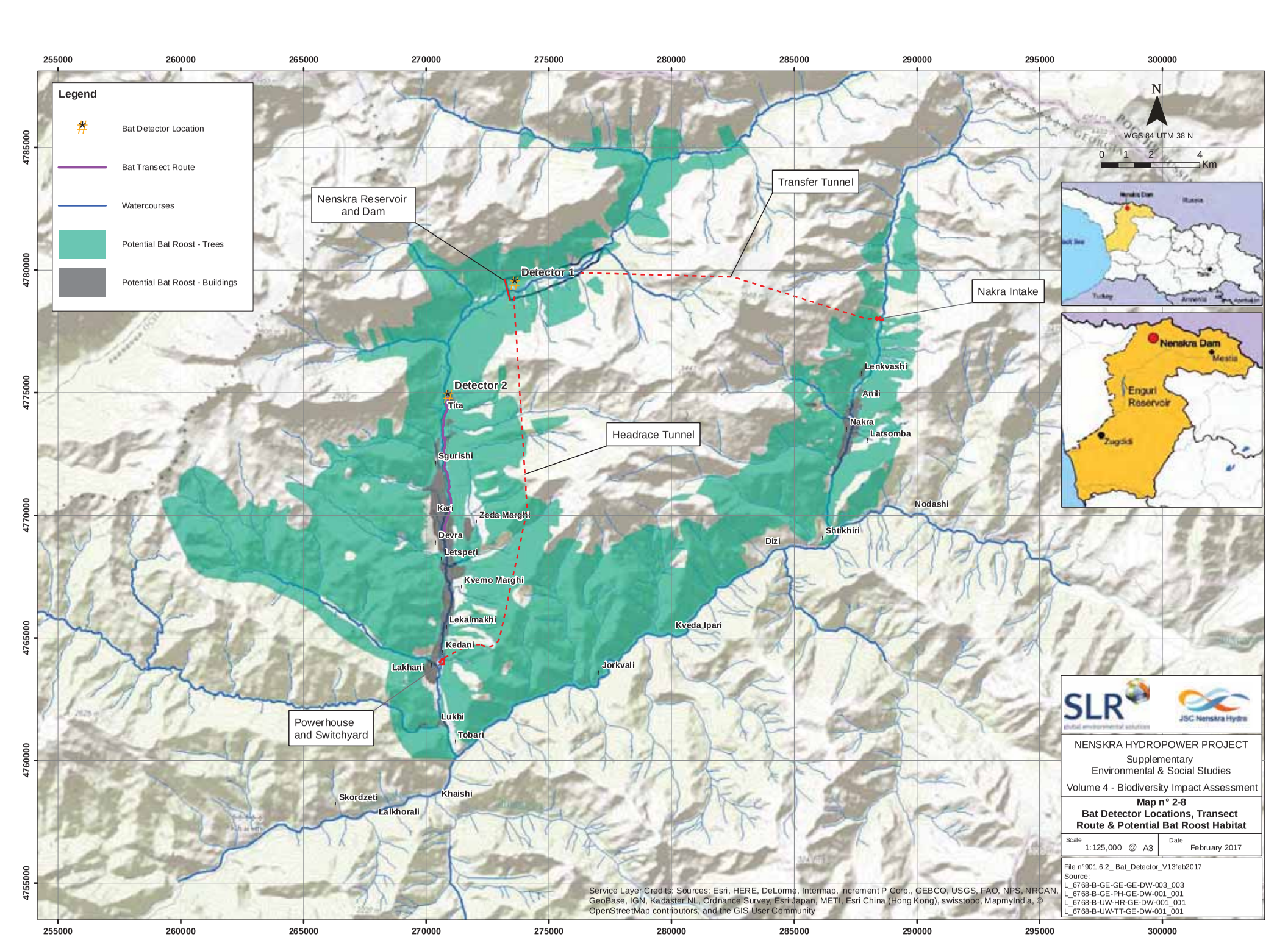
C. Bats

The bat surveys were undertaken using remote detectors within the reservoir area and Tita Village. A transect was also undertaken along the valley floor by car. The location used for recording in Tita Village was approximately 100 metres from the river, in a clearing between the trees, where stock could graze. In the reservoir basin, the device was partially hidden inside an old rotting tree, close to the woodland edge and a grazing area 250 metres from the river. Map 2-8 shows the locations of the bat detectors and the transect route. The species recorded during all survey types are shown in Table 5. The Nakra valley was not subject to a bat transect or static survey as the Project footprint was assessed to be minimal, with the majority of trees present with in the project footprint, found to be unsuitable for roosting bats.

Table 5 - List of bat species recorded during the surveys

Common	Latin	Abbrev.	Reservoir	Tita Village	Transect
Noctule	*Nyctalus noctula*	NYLO	Y	Y	-
Leisler's Bat	*Nyctalus leislerii*	NYLE	Y	Y	Y
Common Pipistrelle	*Pipistrellus pipistellus*	PIPI	Y	Y	Y
Soprano Pipistrelle	*Pipistrellus pygmeus*	PIPY	Y	Y	Y
Nathusius' Pipistrelle	*Pipistrellus Nathusii*	PINA	-	Y	Y
Savi's pipistrelle	*Hypsugo savii*	HYSA	-	YP	-
Kuhl's Pipistrelle	*Pipistrellus Kuhlii*	PIKU	-	Y	-
Brown Long Eared Bat	*Plecotus auritus*	PLAU	YP	YP	
Serotine Bat	*Eptesicus serotinus*	EPSE	Y	Y	Y
Whiskered Bat	*Myotis mystacinus*	MYMY	-	Y	-
Natterer's Bat	*Myotis nattereri*	MYNA	Y	Y	-
Barbastelle	*Barbastelle barbastellus*	BABA	-	Y	-
Greater horseshoe bat	*Rhynolopus ferrumequinum*	RHFE	-	Y	-
Parti coloured bat	*Vespertilio murinus*	VEMU		Y	

Y – yes present ; YP – Tentatively identified, i.e. the call parameters could not be definitively attributed to that species, but the species attributed is considered the most likely.



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Map n° 2-8

Bat Detector Locations, Transect Route & Potential Bat Roost Habitat

Scale	Date
1:125,000 @ A3	February 2017

File n°901.6.2_ Bat_Detector_V13feb2017

Source:
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During the bat surveys, more bat activity per-night was recorded at Tita Village than in the Reservoir area.

It is most likely that Tita, over the bat active season (March to October) is subject to higher average night time temperatures, therefore foraging opportunities may be greater as a result. It is also possible that the bats are using the houses in the area for roosting, this may explain why more foraging activity was recorded at Tita.

The bat roost habitat survey found the following:

- Mixed forest (conifer and deciduous) is present in both the Nenskra and Nakra valleys. On the north facing slopes of the river Nenskra there are more beech *Fagus orientalis* trees than maple *Acer spp*. Other tree species are present, but in low numbers. On the more south facing slopes of river Nenskra there are less Beech trees, forming a 50% mix with maple. Other trees species are represented in low numbers.
- During the transect walks (described in Section 2.2.3.2) the trees with bat roost potential were assessed; the trees identified only represent a sample of the trees present within the reservoir area. On the slopes next to river Nakra more than 65% of forest was represented by beech. On the right bank of the river Nakra 19 potential roost trees with hollows and crevices were counted and 10 trees on the left bank.

The right bank of the Nenskra river, is considered to be the drier, warmer side of the valley, where there is a higher number of maple compared with the left bank - 38.1% to 19.,1% accordingly. There are generally more crevices and hollows in maple trees, so there is considered likely to be more bat roost habitat available on the western bank of the river then on the eastern bank. Despite this availability of potential bat roost habitat, the remote recording results strongly suggest that the reservoir area is used by less bats for foraging, than at Tita village.

During the mammal survey suitable bat hibernation habitat was searched for. No caves were found within the area surveyed and the rock appears to be a hard igneous type rock, rather than the limestone type clast (known for providing cave systems) which is present further downstream on the Enguri river. The bats recorded within the Project area are species known to hibernate in caves (Kandaurov 2008[34]). It is therefore considered likely that the bats recorded in the Project area are likely to migrate to use hibernation areas downstream of the Nenskra River, where caves and consequently more stable temperatures will exist during the winter hibernation months.

D. Otter

Otter signs were searched for, but none were found.

The rivers are quite steep and in September 2015 they were fast flowing, with the levels rising throughout the day as the glaciers melted. Surveys were undertaken early in the morning where possible, so that footprints on sand and spraints on rock could be searched for; however none were found.

Otter diets are varied (Gorgadze 2013[58]), they eat a range of food prey, which are present in the Nenskra valley including: fish (trout), amphibians, reptiles and small mammals. Anecdotal evidence from one of the local hunters from Tita suggests that otter have been noted in the past around the area of the proposed reservoir, on one of the tributaries. This was considered to be a few years ago; however exact dates could not be given. The 2015 ESIA noted otter signs, in the area of Tita village (Pers. Com. 16/09/15 Alexander Bukhnikavshvili).

[58] Gorgadze (2013) Seasonal Diet of the Otter *(Lutra lutra)* On the Alazani River (Georgia). Hystrix, the Italian Journal of Mammalogy. Volume 24 (2): 157-160.

Map 2-9 shows the location of the otter signs noted in 2014 (2015 ESIA). Also shown on the map, are areas where relatively undisturbed areas, suitable for holt building are present. These areas are limited, and occupancy will be further limited by the availability of fish and other prey items. Photo Sheet 13 shows some of the habitat types surveyed on the Nenskra River.

E. Caucasian squirrel

During the 2015 surveys, signs of squirrel were noted, such as hazel nuts which had been eaten. However from these signs it was not possible to identify which species of squirrel was present. A red squirrel *Sciurus vulgaris* was recorded just south of the village of Tita. During the 2016 surveys Caucasian squirrel was recorded at a number of locations within the Nenskra valley. Suitable habitats and the 2016 record locations are shown on Map 2-10; suitable habitat has been determined as those areas with mixed and broadleaf woodland.

F. Incidental records

During the mammal surveys, signs of other mammals were also noted (see Photo Sheet 14 and Photo Sheet 15). These are shown on Map 2-11 and include badger *Meles meles*, a marten species *Martes sp.*, roe deer *Capreolus capreolus* and wild boar *Sus scrofa.*

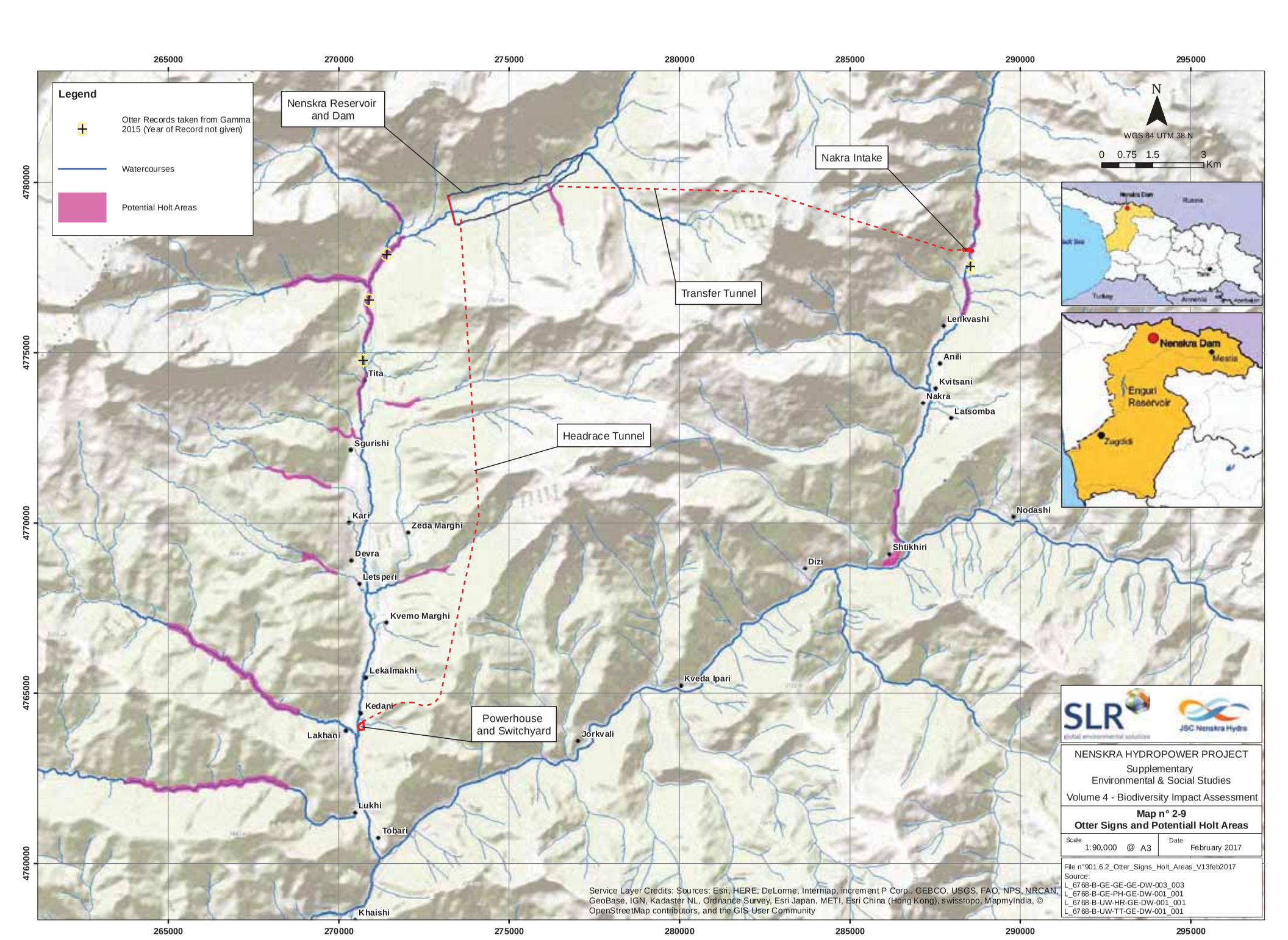
During the 2016 surveys a foal was killed close to Tita; on close examination it appeared to have been killed by a wolf. The foal carcass was left in situ and two camera traps set up to monitor activity throughout the following night. A lone female wolf *Canis lupus* was recorded feeding on the carcass. She then dragged the remains away from the camera. The following morning no remnants of the carcass were noted. Footprints of a single adult grey wolf were also noted in on the tracks above Tita village. These incidental records prove presence in the Nenskra Valley, but the fact that signs were only noted in 2016 and during none of the other survey periods, strongly suggests that while wolf are present they are present at a very low density and are likely have large territories. Wolf are of least concern on the IUCN red list, not on the Georgian Red List, but are a European Habitats Directive, Annex II/IV species; however in European countries/regions where the wolf population is stable e.g. Estonia, Greece and parts of Spain, Annex II does not apply. Similarly, Annex IV does not apply in portions of Greece and Spain, in Latvia, Lithuania, plant or Slovak populations, where populations of wolf are considered favourable[59]. It could therefore be argued, that if Georgia was part of the European Union, the favourable wolf population would be excluded here too. As a result of this, wolf has not been taken forward for the impact assessment Section 5, but has been included in the Critical Habitats assessment for completeness.

During the surveys of the upper Nenskra valley and the Dalari River, signs of Tur *Capra caucasica* were also noted.

[59] Although population data was difficult to collate for Georgia, Pilot *et al* (2014) Genetic variability of the grey wolf *Canis lupus* in the Caucasus in comparison with Europe and the Middle East, distinct or intermediary population. PLoS ONE 9(4): e93828. doi:10.1371/journal.pone.0093828 The research found that Caucasian wolves have a high genetic diversity compared to European wolves. It is this genetic diversity which suggests that there is a favourable population of grey wolf present in Georgia. Sillero-Zubiri, C., Hoffmann, M. & Macdonald, D.W. (2004). Canids: Foxes, Wolves, Jackals and Dogs: Status Survey and Conservation Action Plan. IUCN/SSC Canid Specialist Group, IUCN, Gland, Switzerland and Cambridge, UK – also provides information about wolf populations in countries surrounding Georgia, all of which are relatively healthy, but may be declining in areas e.g. Turkey).

1 : Sandy areas searched for otter (and other) footprints
2 : Suitable habitat for otter upstream of reservoir area
3 : Suitable otter habitat between Tita and the proposed dam location
4 : Eroded grazed banks adjacent to the power house area, not considered suitable forotter

Photo Sheet 13 – Habitat types surveyed for otter signs



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Map n° 2-9
Otter Signs and Potentiall Holt Areas

Scale	Date
1:90,000 @ A3	February 2017

File n°901.6.2_Otter_Signs_Holt_Areas_V13feb2017
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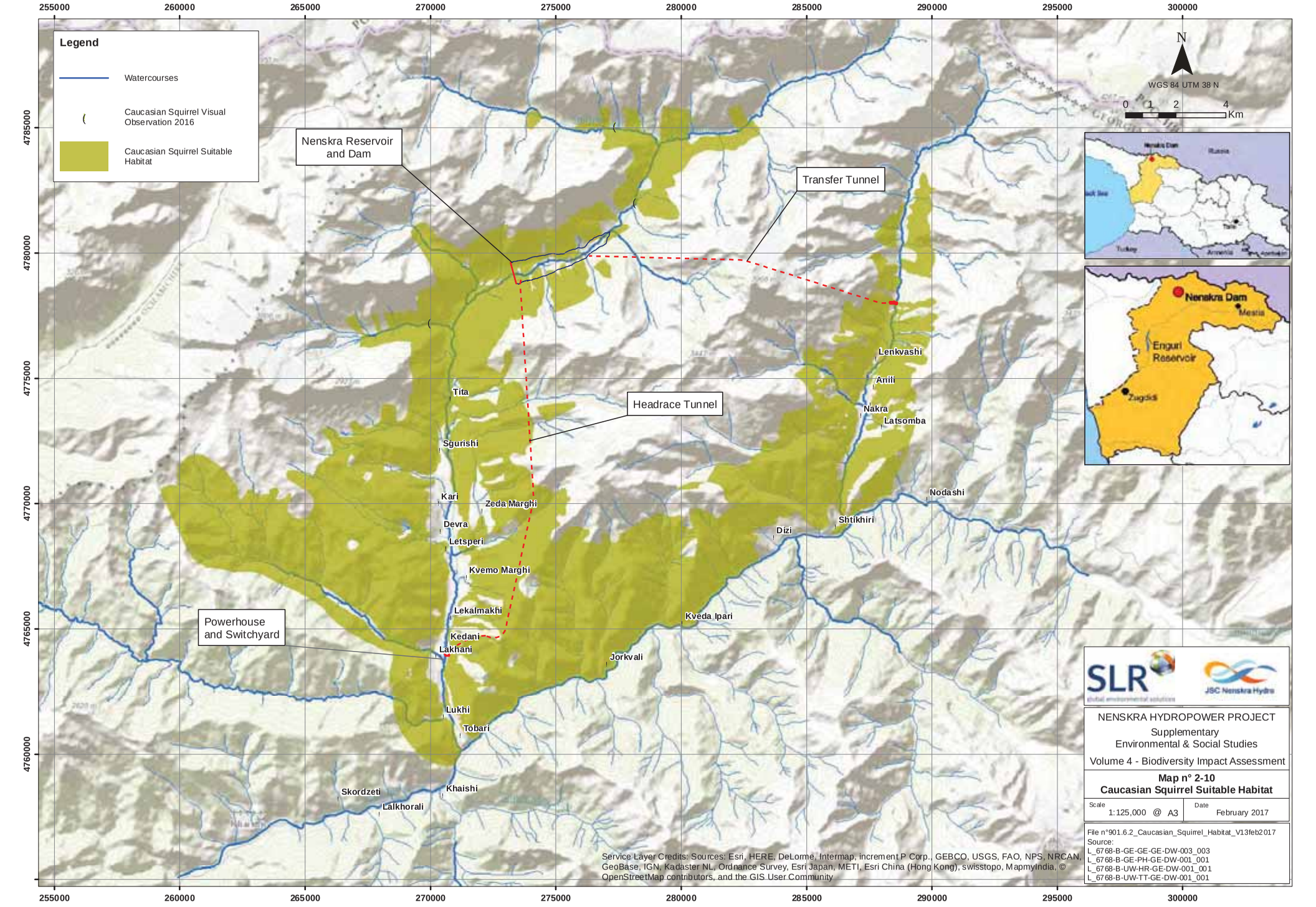

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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Map n° 2-10
Caucasian Squirrel Suitable Habitat

Scale	Date
1:125,000 @ A3	February 2017

File n°901.6.2_Caucasian_Squirrel_Habitat_V13feb2017
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L_6768-B-GE-PH-GE-DW-001_001
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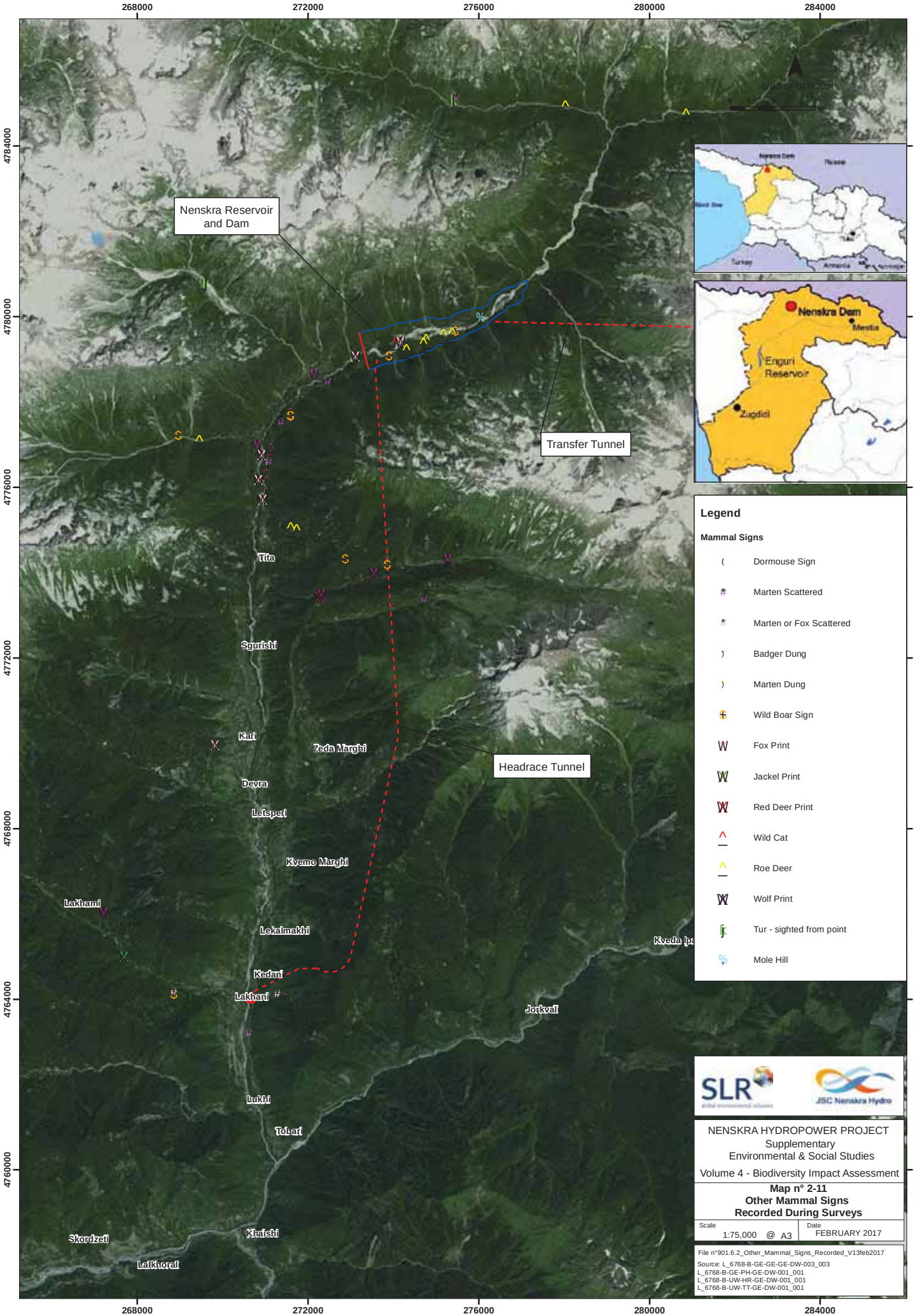


1	1 : *Red squirrel (melanic form)– Okrili valley (May 2016)*
2	2 : *Wolf – Tita, Nenskra valley (May 2016)*

Photo Sheet 14 - Incidental photos of other mammals observed in May 2016 in the Project area

1	2
3	4
5	6

1 : *Hazel nuts likely eaten by dormouse Glis glis – Reservoir area (September 2015)*
2 : *Badger dung – Reservoir area (September 2015)*
3 : *Wild boar rolling hole - Tita valley (May 2016)*
4 : *Burrowing mammal activity – Reservoir area (September 2015)*
5 : *Roe deer - Nenskra upper valley (May 2016)*
6 : *Red squirrel - Reservoir area (May 2016)*

Photo Sheet 15 - Incidental signs of other mammals observed in Sept. 2015 and May 2016 in the Project area

G. Birds

This section contains only a summary of the avian survey results. The avian survey report is presented in full in Annex 2 of this report. Based on the author's own unpublished materials collected during fieldwork carried out in previous years in the Project area, the presence of at least 121 bird species has been confirmed in the Project area and in adjacent areas. About 110 bird species are more-or-less regular elements of the avifauna and 10 – 12 species are occasional visitors.

The breeding of at least 70 species was confirmed by factual materials in the course of research for the study and three further species can be assumed to nest within the Project area (or "probably breeding species"). At least 30 species are year-round residents, or residents with local seasonal altitudinal movements. See Photo Sheet 16 thereafter.

Within the Project area, 75 bird species were recorded during seasonal passages. Of these, 33 species were assessed to be only present during seasonal passages – in spring and in autumn. The fauna of wintering birds includes at least of 48 species, about 30 species are regular winterers and the other 15-20 species should be considered as an irregular winter visitors.

The project area is assessed to be of low importance for bird species included in the national Red List (2006) of Georgia. 10 out of 35 bird species included in the Red List of Georgia (2006), or about 28% of bird species in the National Red List, were recorded within the limits of Project area. Nine species listed on the Annex 1 of the EC Birds Directive were also noted during the 2015 survey. However it should be noted that the majority of the IUCN and Georgian red list species recorded are rare visitors, passage visitors or non-breeding visitors. For more detailed data on these bird species please see Table 6 below.

Table 6 - Birds in national Red List & EC Birds Directive, recorded in Nenskra and Nakra valleys

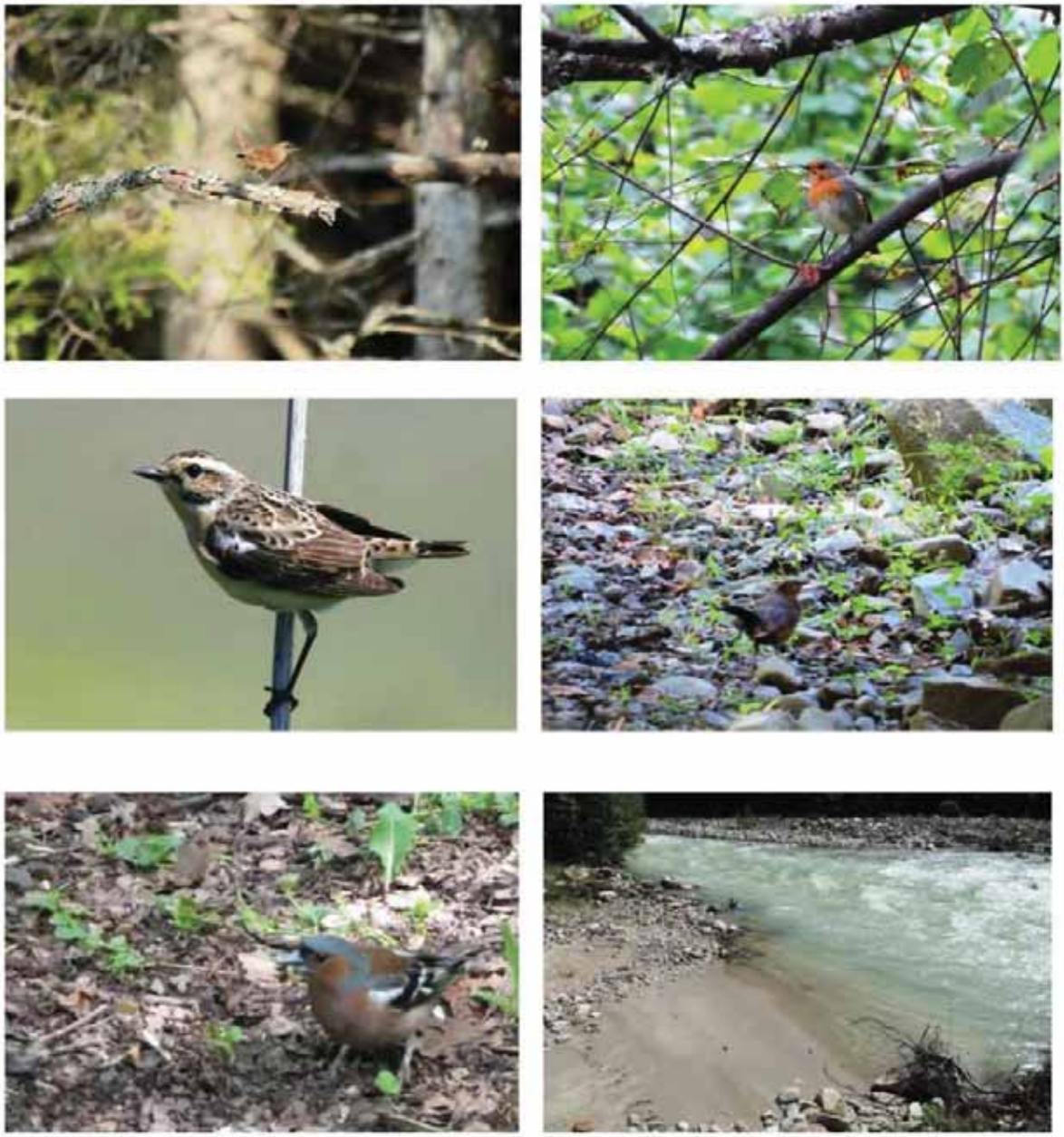
N	Bird species	IUCN Red List	Red List Georgia	EC Birds Directive Annex 1	Status of presence	Additional information
1	Bearded Vulture[60], *Gypaetus barbatus*	NT	VU	Yes	YR-V	Regular non breeding visitor in small numbers
2	Eurasian Griffon, *Gyps fulvus*	LC	VU	Yes	YR-V	Regular non-breeding visitor
3	Cinereous Vulture[61], *Aegypius monachus*	NT	EN	Yes	OV	Very rare occasional visitor, recorded by solitary individuals
4	Egyptian Vulture, *Neophron percnopterus*	EN	VU	Yes	PM	Regular, but rare passage visitor
5	Greater Spotted Eagle, *Aquila clanga*	VU	VU	Yes	PM	Irregular passage visitor in small numbers; more common in autumn
6	Golden Eagle, *Aquila chrysaetos*	LC	VU	Yes	YR-R	Rare year-round resident to area, nests in adjacent areas
7	Common Crane, *Grus grus*	LC	EN	Yes	OV	Occasional, irregular, in small numbers visitor
8	Boreal Owl,[62] *Aegolius funereus*	LC	VU	Yes	YR-R	More-or less common breeding year-round resident
9	Guldenstadt's Redstart,	LC	VU	-	YR-V	Occasional visitor, commonly

[60] Also known as Lammergeier.
[61] Also known as Black Vulture.
[62] Also known as Tengmalm's Owl.

N	Bird species	IUCN Red List	Red List Georgia	EC Birds Directive Annex 1	Status of presence	Additional information
	Phoenicurus erythrogaster					recorded in late autumn and winter, nests in higher located altitudinal belts in adjacent areas
10	Great Rosefinch, *Carpodactus rubicilla*	LC	EN	-	WV	Irregular, in small numbers visitor; nests in higher located altitudinal belts in adjacent areas
11	Honney Buzard *Pernis apivours*	LC	-	Yes	PM	Seasonal passage migrant. Large numbers migrate in spring and autumn. Seen at 200-300m height above ground level passing over the Project area.
12	Black Kite Milvus migrans	LC	-	Yes	PM,WV	During the September 2015 surveys this species was seen migrating southwards at 150 to 300 metres above the Project area. May be a very occasional winter visitor to the area.
13	Lesser Spotted Eagle Aquila chrysaetos	LC	-	Yes	PM	An uncommon species which can be seen migrating over the Project area during the spring and summer months.
14	Booted Eagle Hieraaetus pennatus	LC	-	Yes	PM	A rare species which can be seen migrating across the Project area during the spring and autumn.
15	Tawny pipit Anthus campestris	LC	-	Yes	PM	A relatively rare species in the area. A passage migrant, only seen passing over the Project area in spring and autumn.
16	Woodlark Lullula arborea	LC	-	Yes	SB,PM	Common and widespread in woodlands of all types both within and adjacent to the Project area.
17	Red-Backed Shrike Lanius collurio	LC	-	Yes	SB, PM	A common species both during the nesting season and as a passage migrant.

YR-R- year-round resident; IR-R- year-round visitor; SB – Summer breeder, not present at other times of the year; PM – passage migrant; OV – occasional visitor; WV – winter visitor.

IUCN Red List Categories: CR - Critically Endangered; EN - Endangered; VU – Vulnerable.



1	2
3	4
5	6

1 : Winter wren *Troglodytes troglodytes*
2 : European robin *Erithacus rubecula*
3 : Caspian whinchat *Saxicola rubertra*
4 : Eurasian blackbird *Turdus merula*
5 : *Chaffinch* Fringilla coelebs (male)
6 : Typical habitats of citrine wagtail *Motacilla citreola* and white wagtail *Motacilla alba*

Photo Sheet 16 - Birds observed in September 2015 in the Project area

2.2.4 Abundance and distribution of fauna within Nenskra and Nakra watersheds

2.2.4.1 Brown bear

The Nenskra and Nakra valleys comprises a range of habitats, from agricultural land adjacent to the rivers where stock is raised and some crops are planted, to logged forestry where conifer trees have been removed, to pristine forest, where no or very little man made activity/impacts have occurred. Bears need to eat large quantities of food in the autumn in order to fatten up for the winter hibernation period. As a result of this, they tend to congregate where food sources are present[63]. Where historical forestry operations have occurred, clearings often provide suitable areas for berry bearing species to grow, such as cherry laurel *Laurocerasus officinalis*.

In addition to this bears will also feed on beech nuts, beech trees being relatively abundant in the Project area, especially in the Nenskra Valley (as evidenced during the 2016 surveys). As a result of this, the number of bears considered to be present in the Nenskra valley, during the short autumn survey period may be greater in autumn than at other times of the year, as they may disperse to occupy other areas during the rest of the year. During the Spring (May/early June) 2016 surveys, fresh bear evidence was found in the upper Nenskra valley as well as the upper parts of the Dalari, and some of the smaller tributaries of the Nenskra (Map 2.6). At this time of year new shoots and grasses are starting to grow as the snow retreats. Feeding signs were noted in some areas too, where bears had been eating the newly emerged vegetation here.

Evidence recently collected in the Polish Tatras by GLOBE (2015[64]) has shown that a male bear (called Iwo) has undertaken a journey of 120km, the paper goes on to state that brown bears in central Europe have been recorded migrating up to 350km. Therefore long distance movement of bears temporarily into and out of the Nenskra valley cannot be discounted. The presence of the river Nenskra does not appear to be a barrier to the bear either, with signs that they cross the river where required to fully utilise both sides of the valley. The crossing of the river was evidenced by footprints which walked up to the river banks then disappeared, the assumption being that the bears then entered the water to cross the river.

Limited signs of bear were noted in the Nakra Valley (dung containing beach nuts found on the melting snow in the upper valley). It is therefore considered likely that bear are transiently present here, as confirmed by the social study questionnaire (See Volume 3 “Social Impact Assessment” issued in 2017 as part of the Supplementary Environmental & Social Studies[65]) where four households stated that they actively hunted brown bear.

From a comparison of the footprints found during the 2015, at least four bears were considered likely to be present in the Main Nenskra valley, an adult with a sub adult loosely following it (recorded in the reservoir area) and a female bear with a cub (recorded up stream of and outside of the Project area). During the 2016 surveys evidence of brown bear was recorded as footprints, dung and on camera traps. The amount of fresh evidence found in such a short space of time suggests that between 6 and 10 brown bears were likely to be present within the Nenskra watershed during the survey period. No fresh brown bear evidence was

[63] Chestin *et al.* (1992) The brown bear (*Ursus arctos L.)* in the USSR: numbers, hunting and systematics. Ann. Zool. Fennici 29:57-68

[64] GLOBE (2015) Information on the GLOBE brown bear GPS tagging survey. [Online] Available from: http://www.anp.hu/en/minden-amit-iworol-tudni-erdemes [Accessed 02 November 2015]

[65] SLR, Report n°901.8.7, Nenskra HPP, Supplementary E&S Studies, Vol. 3 “Social Impact Assessment”, 2017

found in the Nakra valley, though evidence in the form of old dung was noted; strongly suggesting that they do utilise this valley on a transient basis.

2.2.4.2 Lynx

Due to lack of information on the lynx in Georgia, determining populations has been difficult. One website found estimated the Georgian lynx population at 160 individuals[66]. The overall natural forested area of Georgia is 46% of the country's area[67] which equates to 32,142km^2. From this data it is not possible to accurately estimate the range size of the lynx in Georgia, but if the population is only 160, then possible range size could easily be larger than 100km^2 especially in areas where ungulate populations are low. Though it should be noted that prey species such as roe dear, tur and chamois were recorded in the Nenskra watershed, though at a very low density. Based on this information, it would be considered likely that there would be only a very low population present, possibly as low as one or two individual lynx within in the Nenskra and Nakra valleys, with the valley areas only forming part of the lynx's wider range.

2.2.4.3 Bats

Population estimates for bat species have not been made for the Project area. Fourteen bat species were recorded within the Project area (including Tita Village) using sonograms. Only seven bat species were recorded in the reservoir area. Comparatively it is assessed that bat populations within the reservoir area are likely to be smaller than those at lower altitudes possibly due to average lower nightly temperatures during the bat active season and consequently reduced prey (insect) density.

2.2.4.4 Otter

Otter often occupy long stretches of rivers/riparian habitats and males can have ranges in the order of 30km^2 with no overlap between male otters' ranges (Hogan 2012[68]). Therefore it is possible that during the survey period the otters were simply elsewhere in the watershed. Otters may also migrate up or down watersheds in response to food availability (Ruiz-Olmo 2001[69]) and or seasons (Conroy 1998[70]) which may also account for the lack of otter signs noted. It is therefore considered likely that otter are still present on the Nenskra river, but at a low density, with likely no more than one male and possibly up to two females.

Within the Nakra valley, no signs of otter were found either. The Nakra valley appears to be a smaller valley, with steeper sides and a faster flowing river. It is also likely that there are less fish in this river as the hydrological conditions are less suitable; therefore it may be less favourable for otter to inhabit this river. The occasional use by otter can however not be ruled out.

[66] CatSG (n.d.) Information on the European Lynx with country population estimated. [Online] Available from: www.catsg.org [Accessed 29 October 2015].

[67] No Author (2009) Fourth National Report to the United Nations Convention on Biological Diversity: Georgia. [Online] Available from: https://www.cbd.int/reports/nr4/default.shtml [Accessed 10 October 2015].

[68] Hogan, C. (2012). European otter. Retrieved from http://www.eoearth.org/view/article/169873

[69] Ruiz-Olmo J., *Et al.* (2001) The influence of fish abundance on the otter (*Lutra lutra)* populations in Iberian Mediterranean habitats. J. Zool. Lond. 254, 325-336

[70] Conroy, J, Melisch, R and Chanin, P (1998) The Distribution and Status of the Eurasian Otter (Lutra lutra) in Asia - a Preliminary Review. IUCN Otter Spec. Group Bull. 15(1): 15 - 30

2.2.4.5 Caucasian Squirrel

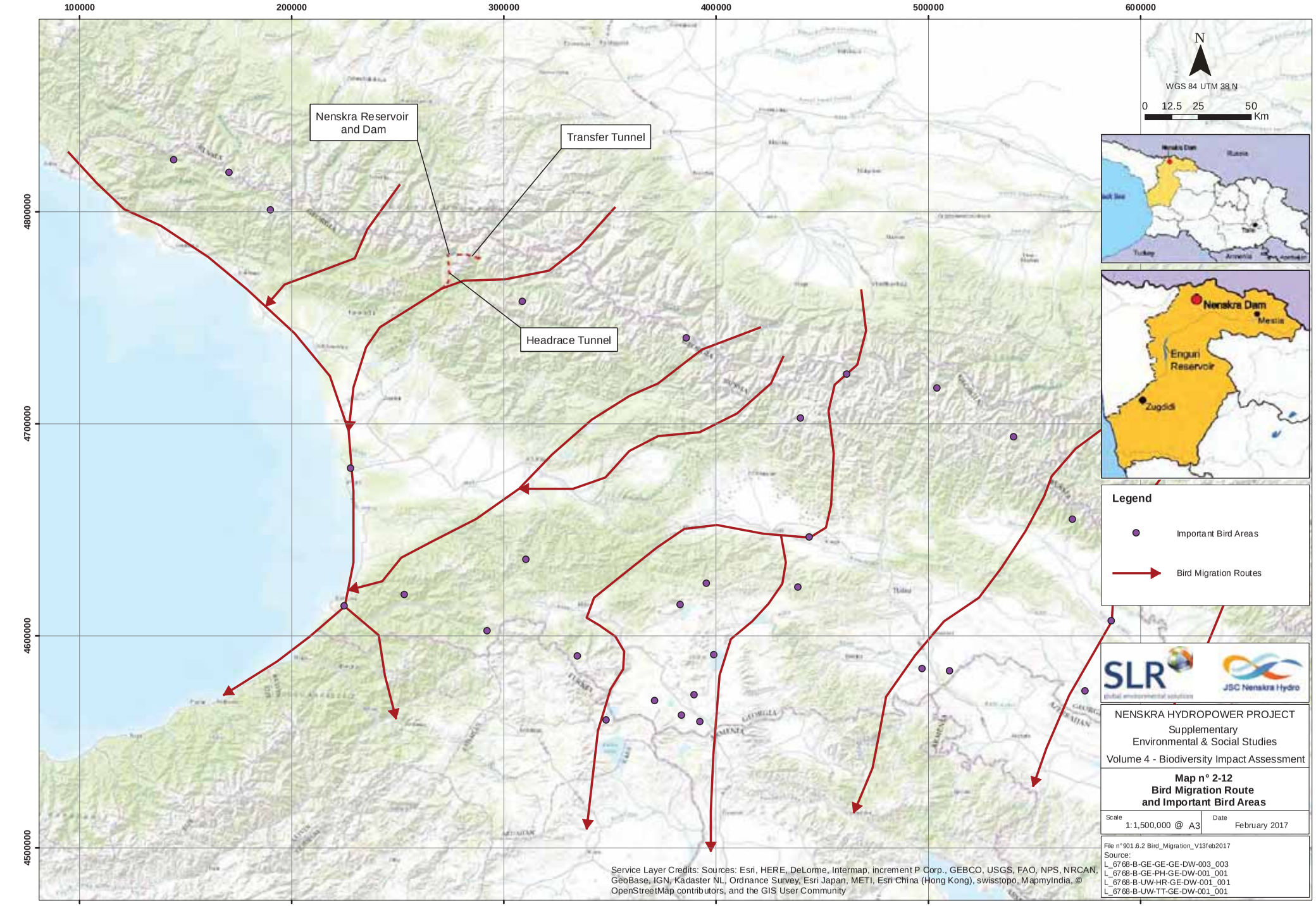
Population estimates have not been calculated for the Caucasian squirrel lack of published information on this species; however the sightings made during 2016 suggest that this species is quite wide spread across the Nenskra valley.

2.2.4.6 Birds

Based on the data collated, the ornithological importance of the two valleys is assessed to be low. The following points set out the reasons for this assessment:

- The avifauna present in the Project area is represented mainly by widely distributed, quite common and numerous bird species within the Great Caucasus and in this region of Georgia, Svaneti. The breeding avifauna of the study areas is represented by widespread and common species. The dominant group of breeding, migrating and wintering birds are small-sized passerines.
- Georgia is important to Western Palaearctic birds, as one of the main north - south migration routes (Map 2-12). The western part of Georgia, or the Black Sea basin, especially has an importance for a numerous bird species and as a stopover site on passage and as wintering grounds. But the Project area is located outside of the most important migratory fly-ways, “bottle-necks”, halting or resting sites and wintering grounds.
- The importance and value of the Project area increases during seasonal migrations, because the Enguri River valley forms the migration route of numerous bird species. But it is a secondary fly-way. The main fly-ways lie to the west – along the coast of the Black Sea and to the East – along the Rioni River valley. The importance of the Nenskra and Nakra river valleys for migrating birds is therefore low. In addition, it should be noted, the majority of transit migrants crossing the Project area usually do this without stopping. If they do stop it occurs occasionally and in very small numbers. Nevertheless, the ornithological importance of some parts of study areas during seasonal migrations may be classified as a medium, but only during peaks of autumn transit passage (in the first half of September) and only in the lower part of Nenskra river flood-land.
- Georgia is an important area for various wintering water-birds, birds of prey, passerines, some other birds. The significance of Georgian wintering grounds is greatly increased when unfavourable weather conditions take place in northward regions (Azov sea basin, south of Russia, Front-Caucasus area, northern Caucasus, lower Don River valley, etc.). But the Project area is located outside of the main wintering grounds, so the importance of the Project area as a wintering ground is classified as a low.
- It is noted that the proposed Svaneti protected area may be contiguous with the eastern extent of the Nakra valley, however species citations[71] for this proposed protected area are not publically available for review (See Section 3.1 for more information). The candidate Emerald site’s updated November 2016 boundary is located 760 metres to the west of the Nakra river, so none of the Project area is currently included within the candidate Emerald site. The candidate Emerald site does have a number of bird species for which it has been designated; see Annex 5 Appropriate Assessment Screening Report for more information. Although these two candidate/proposed designated areas are close too/within the Project area, neither has been designated solely for avifauna or bird assemblage.

[71] A citation may include a list of species which are present in the Proposed Protected Area and which are considered to be of conservation concern. It is these cited species which are a contributory reason for designation of that protected area.



2.3 River habitats

2.3.1 Species of concern

Previous catchment information ESIA 2015 report that the only fish species present within the Nenskra catchment is the brook/brown trout *Salmo trutta*. Initial observations of angler catch made during October 2015 at the reservoir site support this statement (Section 3.3.4). However, some desk based studies and literature searches[72] would suggest that *S. trutta* is not currently recorded as present in Georgia by the International Union for Conservation of Nature[73]. Furthermore, this report states that there have been no surveys to assess the health of the country's ichthyofauna, since 1991 with the exception of the sturgeon and the Black Sea salmon. The conservation status of the majority of fish species in Georgia is, therefore, unknown.

This does not preclude the fish species being *S. trutta*, given that the current European distribution map for this species includes Russia and its borders with Georgia[29]. There is the possibility that if *S. trutta* is a non-native species then the species could have been introduced to Georgia at some stage in the past[74].

Species of the Salmo genus, such as *S. trutta* are polymorphic and express a large variety of morphotypes throughout Europe. They exhibit marine, lake and river life history traits and their distribution and abundance depends upon habitat availability. The reasons for this are poorly understood but it is accepted that both environmental and genetic factors play a part.[28]

Fish surveys have been undertaken on a tributary of the Enguri, and Nenskra Rivers, Pers. Comm. (email 25/01/16 with Dr., Professor Sergey Afanasyev - Deputy Director of Institute of Hydrobiology of National Academy of Sciences), who stated: "following detailed survey, the specialists confirmed that only one species of fish was found to be present within the Darchi/ormeleti and Kasleti Rivers, this was brown trout *Salmo trutta morfa fario."*

As a result of this assessment, the fish found within the Project area are also considered to be *Salmo trutta morfa fario* and will henceforth be referred to as 'brown trout' within this report.

Within Georgia all riverine salmonids are protected by Presidential Decree[75] and 'The Commission of the Endangered Species' has been established to develop the new Red List of Georgia which has evaluated the status of each species according to IUCN criteria and categories. The final Red List is approved by the Presidential Decree and now provides the legislative base for the protection of the endangered species in Georgia[76]. The difficulty in evaluation for brown trout *Salmo turtta morfa fario* is that it not currently listed as occurring in Georgia, although experts do agree that further surveys are required to understand the species compositions in Georgia. That said, *Salmo fario* which is listed on the Georgian Red List, may be regarded as a synonym of *Salmo trutta fario*[77](or *Salmo trutta morfa fario)*, therefore, for the purposes of this report, the brown trout species present in the Project area is

[72] Kottelat, M. and J. Freyhof, (2007) Handbook of European freshwater fishes ISBN 978-2-8399-0298-4

[73] http://www.iucnredlist.org/details/19861/0`
http://eol.org/pages/206777/hierarchy_entries/60831388/overview

[74] Elliott, J.M. (1994). Quantitative Ecology and Brown Trout, Oxford University Press.

[75] Presidential Decree (#303, 02.05.06)

[76] Fourth National Report to the United Nations Convention on Biological Diversity: Georgia, page 25 - https://www.cbd.int/doc/world/ge/ge-nr-04-en.pdf
http://moe.gov.ge/index.php?lang_id=ENG&sec_id=49&album_id=10&info_id=#seegal
https://matsne.gov.ge/ka/document/view/97288

[77] Information taken from WoRMS: http://www.marinespecies.org/aphia.php?p=taxdetails&id=322541

considered to be synonymous with *Salmo fario*. It is therefore considered to be on the Georgian Red List as vulnerable, and on the IUCN Red List as least concern.

Photo Sheet 17 - Trout caught by local fisherman at the reservoir site in Oct. 2015

2.3.2 Trout biology

Brown trout primarily feed on invertebrates that live in water and include members of the river-fly families i.e. the mayfly (*Ephemeroptera sp.*), caddis flies (*Trichoptera sp.*) and stone flies (*Plecoptera sp.*). They will also eat freshwater shrimp (*Gammarus sp.*) as trout are opportunists and will feed on anything edible which also includes insects that drop into the river.

Brown trout will eat river-flies in the aquatic stage of their life (nymphs), as adult flies from the surface of the water and as they move between these life stages through the water column. The classic surface 'rings' that are the easiest way to spot a trout in the water, which are caused by the trout eating insects from the water surface. Trout will also feed on other small fish, and some become very large and feed almost exclusively on other fish.

Adult brown trout in rivers are territorial in their behaviour, and will protect their territories or 'lies'. Most trout will have a feeding lie, typically in an area where the river current acts as a conveyor belt for food so they can simply face upstream and catch invertebrates as they drift past, expending as little energy as possible. They will also have one or more resting lies, where they are safer from predators. Typically this will be under an undercut bank, tree root, rock or log. This territorial behaviour assists the estimation of trout densities in rivers.

2.3.2.1 Species life stages

Brown trout spawn in winter from October to January, with their eggs hatching in 6-8 weeks, depending on the water temperature (Figure 1 below). Once on the spawning grounds, brown trout lay their eggs in gravel pockets or 'redds' that have been excavated by the female fish. A 500g female trout will typically deposit around 800 eggs and the number of eggs that hatch varies enormously depending on quality of the water and gravel. This can be as low as 4%, or, at the top end, exceed 80% where conditions are excellent. When the eggs have been fertilised by the male the female then covers the fertilised eggs with gravel.

They hatch and become alevins that remain in the gravel for a further 4-6 weeks before the young trout will emerge from the gravel between mid-March and early May. Initially they feed on small crustaceans and insect larvae, and trout tend to continue with this insect based diet throughout their life, though larger specimens will eat fish and are termed 'Ferox Trout'.

A brown trout of less than one year old is called a parr and both trout fry and parr have similar habitat needs, e.g. plenty of cover to hide from each other and from predators. Parr can cope with deeper and faster water as they grow. In order to find their own territory, they will gradually drop downstream with the flow rather than fight their way up against the flow.

The brown trout found in the Project area will complete the whole of its life cycle in fresh water. Most populations do, however, undertake significant migrations within fresh water and may migrate into on-line lakes or reservoirs. The most common life-cycle pattern in European brown trout populations is the migration of juvenile fish from nursery areas, where they begin to feed, into areas where they may remain until becoming adults. Some other migration may also occur between feeding areas in the summer months. Maximum fish size is variable according to habitat and in alpine mountainous regions where food sources are limited trout are unlikely exceed 23 cm in length (Maitland 2007[78]).

[78] Maitland, P.S. (2007).Scotland freshwater fish, Trafford Publishing. ISBN 1-4251-1064-9

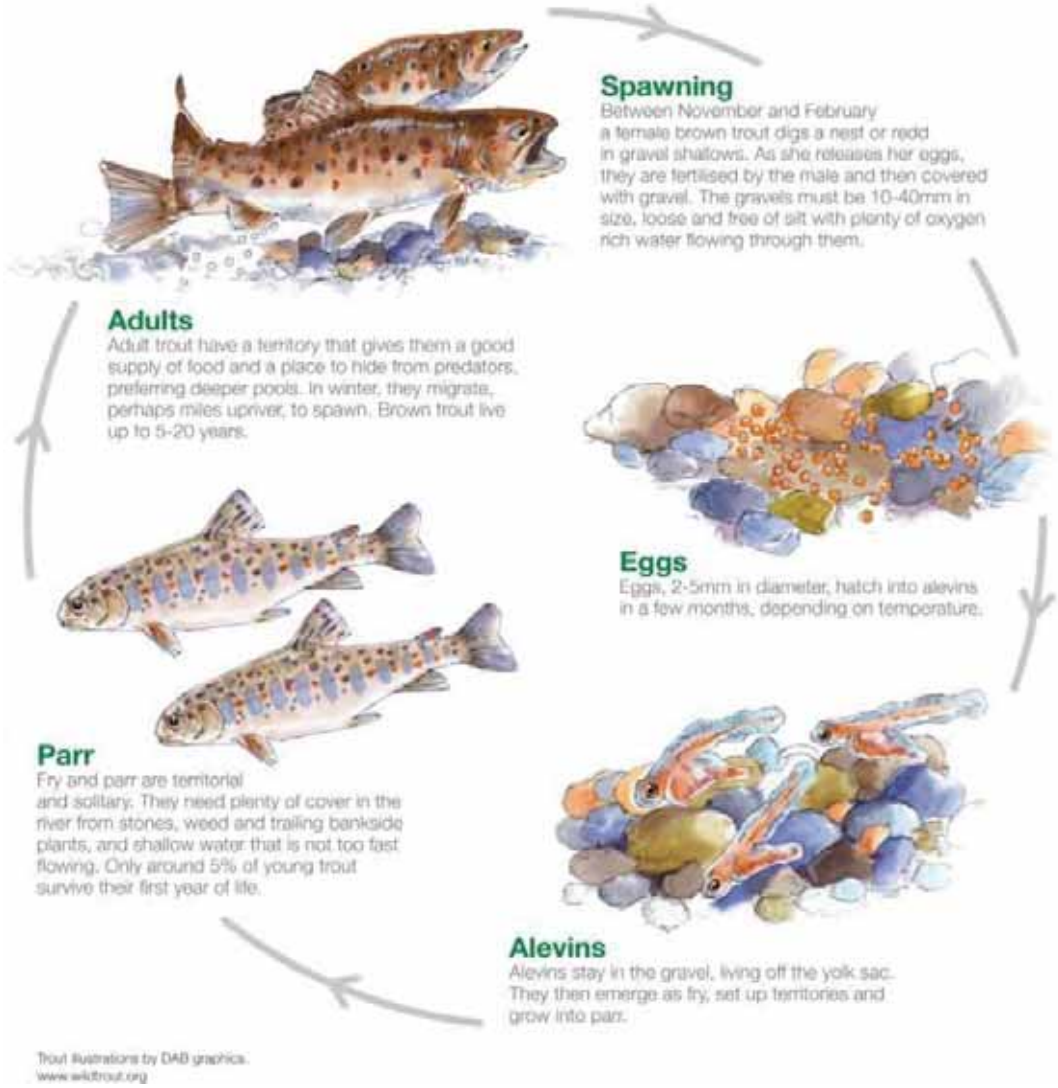


Figure 1 - Typical river trout life strategy diagram.
Reproduced by kind permission of The Wild Trout Trust, UK.

2.3.2.2 Timing and types of habitat use

It is very likely that the brown trout observed in the Nenskra reservoir area, are influenced by glacial derived river flow and temperatures. During the site survey in October 2015, the trout were in spawning condition, indicating that spawning occurs between October-November prior to any winter snowfall which would influence water temperature. The October-November period is also a time when the water is in optimum flow condition for spawning, with high oxygen levels. Channel gravels would also be loose and largely free from silt having been worked and cleaned by the higher summer river flows, which occur between May and September. The habitat and flow preferenda and critical months for trout within the Nenskra and Nakra rivers are outlined in Table 7below.

Table 7 - Nenskra Trout habitat preferenda and critical months

Life Stage	Key months	Habitat
Spawning	October – December	• Gravel between 10-75mm in diameter; • (Pea to golf-ball sized material); • Flow 15-95cm/sec; • Water depth 20-46cm; • Gravel depth 50-150mm; • Excess of fine material can clog spawning gravels.
Eggs	October - March	• Gravel between 10-75mm in diameter; • (Pea to golf-ball sized material); • Flow 15-95cm/sec; • Water depth 20-46cm; • Gravel depth 50-150mm.
Alevins	April-May	• Gravel between 8-70mm in diameter; • (Pea to golf-ball sized material); • Flow 0-40cm/sec; • Water depth 3-60cm; • Gravel depth 50-150mm;
Trout fry / Trout parr	April - June	• Gravel between 8-256mm in diameter; • (Pea to football sized material); • Flow 5-50cm/sec; • Water depth 25-60cm; • Gravel depth 50-150mm; • Habitat includes undercut banks, tree roots, big rocks, deeper slower water. Shallow water, often concentrated in stream margins.
Adults	All year	• Gravel between 8-256mm in diameter; • (Pea to football sized material); • Flow 6-70cm/sec.; • Water depth 20-120cm; • Habitat includes undercut banks, tree roots, or big rocks.

Optimal brown trout spawning habitat comprises gravel which is 5- 50mm in diameter, with spawning areas varying in size, from 50cm^2 to over 150cm^2 per female trout. Small trout generally create smaller redds in finer gravel, and big trout can create larger redds within much larger gravels.

Trout egg development in a river with a mean water temperature of 7.8^{o}C will hatch in 60 days, at 4.7^{o}C they will take 97 days and at 2^{o}C, 148 days to hatch[30]. It is likely that given the

lower river temperatures caused by the winter conditions within both the Nenskra and Nakra catchments that trout eggs spawned in October/November, would hatch in April (based upon a 2°C winter river temperature).

The newly hatched brown trout alevins will live in the gravel, feeding off the remaining yolk that is attached to their body for 14-30 days; again water temperature influences their rate of development. When young brown trout emerge from the gravel (likely to be early May here), they will move towards the light and start to feed on tiny insects in the water. The young brown trout will require shallow water of c. 1cm to 40cm depth that is not fast flowing, typically at velocities of between 5 and 50 cm/s.

During summer periods, when flow conditions within the Nenskra and Nakra catchments will be at their peak (May-September), juvenile and adult brown trout will be susceptible to being moved downstream as river velocities exceed maximum trout swimming speeds[79]. The evaluation and assessment of trout swimming speeds at key life stages was assessed utilising the SWIMMIT[80] model and will be discussed later within this report (Section 7.3.1.1).

It is also considered likely that it is due to the temperatures and flow conditions, as well as food type and limited productivity of these glacial rivers, that only one species of fish is present within the Nenskra and Nakra catchments. The brown trout which does inhabit these waters has adapted its lifecycle so that it can take advantage of the seasonal hydrological changes in the river system, as well as being able to swim against the flow rates.

2.3.3 Fish Habitat

2.3.3.1 Study area for the fish habitat mapping

The optimal field survey period for fishery assessments is during river low-flow periods which enable a visual habitat assessment to be undertaken. The optimum opportunity during the current survey period for such works was October 2015, when river water levels were low enough to assess the instream fisheries habitat and also target the period when the trout breed (late October-December) (Kottelat 2007[81]) and snow had not yet fallen.

The catchment based fisheries habitat was assessed via the Life Cycle Unit Method (LCUM) developed by Kennedy (1984[82]). Surveys were undertaken using the LCUM by walking suitable sections of river bank where conditions allowed. Detailed site and in-channel investigation of aquatic habitat was undertaken utilising the River Habitat Survey (RHS) methodology (Raven 1998[83]). The Nenskra and Nakra catchments were assessed using these methodologies between 6th -10th October 2015 and the surveys were undertaken by Steve Coates & Peter Glanville of SLR Consulting Ltd. The Nenskra was divided into the following areas within which the habitats were georeferenced, assessed and mapped in relation to LCUM:

- Nenskra sections (Map 2-13):
  - Upstream section – Nenskra River upstream from the dam to the confluence with the Dalari river;
  - Upper downstream section – the reach between the dam and the powerhouse; and

[79] EA R&D Swimming speeds and model

[80] SWIMIT, Version 3.1. Fish swimming speed and endurance program. Environment Agency, UK (2004)

[81] Kottelat, M. and Freyhof, J. (2007). Handbook of European freshwater fishes. ISBN 978-2-8399-0298-4

[82] Kennedy GJA (1984) Evaluation of techniques for classifying habitats for juvenile salmon (*Salmo salar* L.). Proceedings of the Atlantic Salmon Trust Workshop on Stock Enhancement.

[83] P.J. Raven, N.T.H. Holmes, F.H. Dawson, P.J.A. Fox, M. Everard, I.R. Fozzard and K.J. Rouen (1998). River Habitat Quality – the physical character of rivers and streams in the UK and the Isle of Man. Environment Agency, Bristol.

  - Lower downstream section – the reach of river which flows from the powerhouse to the Enguri.
- Nakra sections (Map 2-14)
  - Upstream – Nakra River upstream of the weir for 2.2km.
  - Downstream – the length of river below the weir to the confluence with the Enguri.

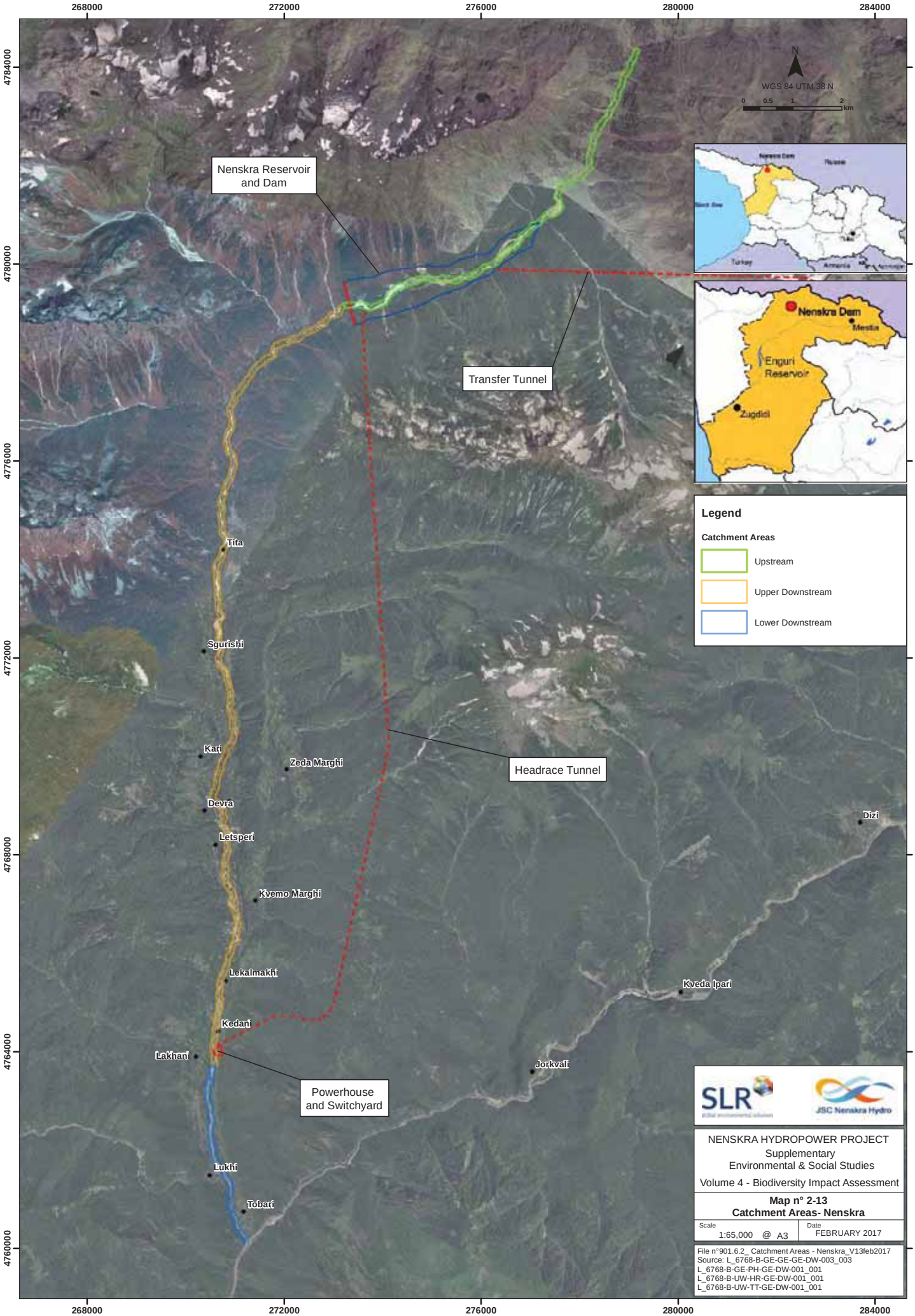
By utilising the LCUM assessment methodology the entire length of the Nenskra River between the Dalari branch of the upper Nenskra River to the River Enguri was evaluated and classified.

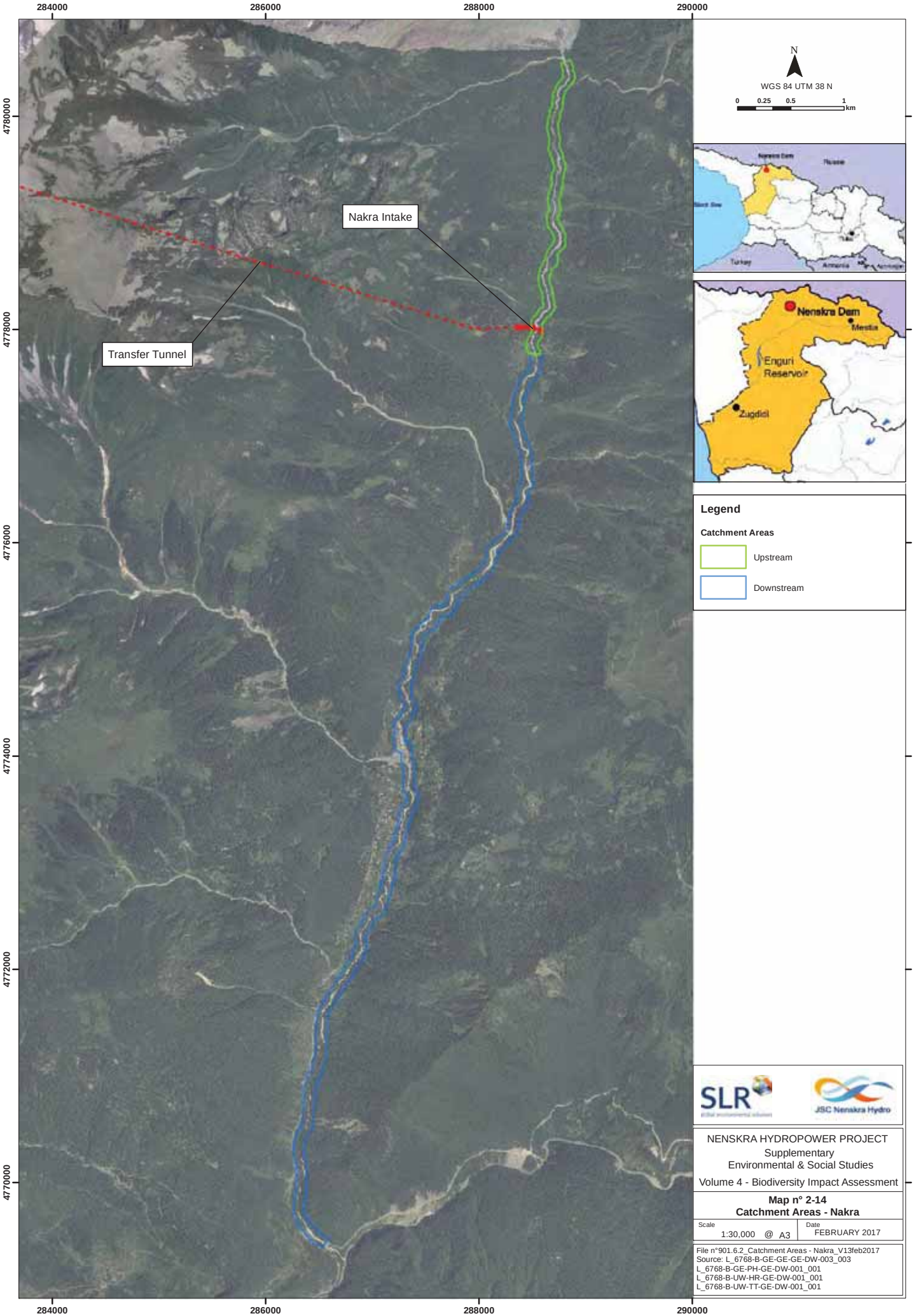
Access to the Nakra river channel was difficult due to the topography and vegetation along the river restricting access to it, therefore spot evaluations were made within reaches to validate the section of river. Using spot evaluations the survey team were able to assess the entire reach of Nakra channel from the River Enguri to the diversion weir, and from the weir to 2.2km upstream.

Detailed river habitat surveys were undertaken in conjunction with LCUM within the catchments. In total nine RHS sites were surveyed, seven within the Nenskra and two within the Nakra. The primary focus of these detailed river habitat surveys was directed at the following key infrastructure locations:-

- Upstream and downstream of the powerhouse;
- Upstream and downstream of the Nenskra Dam; and
- Upstream and downstream of the Nakra diversion weir.

The strategic RHS locations (Table 8 below) were determined in relation to the fish survey assessment and hydrological survey aspect. RHS were undertaken where conditions permitted. Sites which had poor access and high flow such as the confluence of the Nenskra and Nakra Rivers and the main River Enguri were not considered.





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Map n° 2-14
Catchment Areas - Nakra

Scale	Date
1:30,000 @ A3	FEBRUARY 2017

File n°901.6.2_Catchment Areas - Nakra_V13feb2017
Source: L_6768-B-GE-GE-GE-DW-003_003
L_6768-B-GE-PH-GE-DW-001_001
L_6768-B-UW-HR-GE-DW-001_001
L_6768-B-UW-TT-GE-DW-001_001

Table 8 – RHS/Flow Monitoring Locations

RHS Site	Flow ID	River	Easting UTM 38N	Northing UTM 38N
RHS 1	FL01	Nenskra downstream of Powerhouse	270411.472	4763041.864
RHS 2	N/A	Nenskra near the village Lakhani	271023.335	4766445.783
RHS 3	FL02	Nenskra upstream at Dam Site	273655.419	4779132.838
RHS 4	N/A	Nenskra End of Reservoir Site	277357.834	4781045.369
RHS 5	N/A	Nenskra upstream at Dam Site	273116.347	4779084.063
RHS 7	N/A	Nenskra upstream of Powerhouse	270723.359	4764554.609
RHS 8	N/A	Nakra upstream of diversion Weir Site	288537.417	4778020.926
RHS 9	FL06	Nakra downstream of diversion Weir Site	288433.452	4777557.259

2.3.3.2 Field survey methodology

A. Walkover surveys

Satellite and geodetic mapping was studied prior to undertaking the field visit. Key sites were identified on satellite maps and key areas within these sites noted and transferred to the field GPS.

LCUM assessment methodology is used for all life stages of trout (including spawning) and habitat assessment is graded in relation to substrate size/type, flow and water depth. It is used by fisheries professionals to provide a broad habitat type map which can cover large areas of rivers. A selected number of categorised salmonid requirements include holding areas for adults, nursery areas and spawning locations, for habitats are summarised below in Table 9.

The LCUM habitat surveys were undertaken at the key sites outlined in Table 8 Above. They were based upon generic reach assessments for trout and the spawning and habitat requirements, which are well understood, summarised in Table 10.

Table 9 – Brown trout spawning and habitat requirements

Life Stage	Trout Requirements
Eggs/alevins	Dependent upon fish size:- Golf-ball to tennis-ball substrate for large brown trout. Pea to golf-ball sized material for smaller trout
Fry (<1 year old)	Golf ball to tennis ball sized substrate, slow to medium flowing water, often concentrated in stream margins
Parr (≥1 year old)	Variety of substrate, undercut banks, tree roots, big rocks, deeper slower water.
Adults	Deeper areas sustained by flow but not too fast, undercut banks, tree roots, instream vegetation and large rocks

After Kennedy 1984

Table 10 – LCUM Habitat Classification

Habitat Type	Grade	Criteria
Nursery	1	Water depth 50-25mm; 0.5 – 8% gradient; Stable cobble/boulder substrate with at least 70% coverage of riverbed.
	2	Marginally outside Grade1 in a single criterion.
	3	Well outside Grade1 in one or more criteria.
Spawning	1	Flow 300-600 mm/sec; Water depth 150-700mm; Gravel size 30-80mm with at least 70% coverage of riverbed; Gravel depth 50-150mm; Near holding area; Nursery area downstream.
	2-3	Failing as for spawning habitat above.
Holding	1	Minimum depth 1m; Adequate instream/bankside cover; Stable banks and substrate; Spawning area nearby.
	2-3	Failing as for holding habitat above;
Unclassified		Unsuitable for fish – not classifiable as any of the 3 habitat types Typically shallow, silty substrate or 100% bedrock, channelized section or other engineered channel of low morphological status.

After Kennedy 1984

Within this alpine environment there are areas of the river which will freeze to riverbed level during the winter months. Other areas will remain free flowing due to depth, current and or being fed by comparatively warmer spring water (a number of springs are present along the banks of the Nenskra river). During the LCUM surveys, no differentiation was made between the holding habitats which would freeze and those which would not. However, a review of the survey data and persona communication with local fishermen concludes that there are likely to be pools within all holding areas, which will not totally freeze over and will be suitable for winter use by brown trout.

It should also be noted that, some of the habitats which could be used as marginal spawning habitat have been recorded as Class 1 Holding habitat; due to uncertainties regarding actual use. As a result, availability of spawning areas may have been under estimated. The assessment has been based on the published criteria; unless evidence of egg laden female brown trout proved otherwise. Where brown trout have limited access to good spawning habitat, it is considered likely that they would use marginal spawning habitat instead; which includes here, the Class 1 Holding habitat.

Walkover surveys were undertaken from the downstream section of river and key LCUM habitat characteristics were noted at 50m intervals along the river channel. If river sections were of a continuous river habitat, then reaches longer than 50m were also considered during the survey.

Detailed site LCUM maps were produced in association with RHS site map. This information will also include links between key fisheries habitat and RHS features and the assessment of environmental flow characteristics.

The RHS was carried out along standard 500m lengths of river channel with observations made in a consistent manner at ten equally spaced spot-checks along this length. Channel, flow, in-channel and bank-side vegetation and other features were recorded and additional

information on valley form and land-use within the river corridor was also noted to provide additional context to the RHS.

Standard RHS recording techniques were used to produce the detailed habitat maps and to describe the composition and structure of both aquatic and adjacent terrestrial habitats. Key sites for RHS assessment were chosen in conjunction with a judgement on the suitability of habitat for the key fish species and in order to support the assessment for the Justification of Environmental Flow (Section 7.3.1.1).

During the field surveys, a further appraisal was made of the likelihood of any Georgian Red List species being associated with the habitats present on the site and in the immediate surrounding area.

B. Flow Measurement Methodology

The locations of the flow monitoring stations for the River Nenskra are shown on Map 2-15 and the locations for the River Nakra are shown in Map 2-16.

The flow measurements were undertaken in the field using a Valeport Braystoke Model 001 flow meter for the measurement of open channel flows. The Model 001 has a 125 mm diameter impeller and is suitable for flow velocities of up to 10 m/s. The Velocity-Area method for open channel flow measurement was used for the field flow measurements. The flow measurements were undertaken in accordance with SLR's Standard Operation Procedure (SOP) 11005 for Stream Flow Gauging.

The six flow measurement locations were surveyed between the 6th and 9th of October 2015. The river flow measurements were undertaken at strategic ecological locations with the objective of obtaining data on flow volume (discharge) and flow velocity data, to support the fish survey element of this biodiversity study. The flow measurement locations are shown in Table 11below.

Table 11 – Flow Measurement Locations

Flow ID	River	Easting UTM 38N	Northing UTM 38N
FL01	Nenskra downstream of Powerhouse	270411.472	4763041.864
FL02	Nenskra at Dam Site	273655.419	4779132.838
FL03	Tskhvandin River (tributary of Nenskra)	271570.297	4778390.802
FL04	Okrili River (tributary of Nenskra)	270773.679	4776983.269
FL05	Nenskra at Tita Foot Bridge	270831.746	4771677.817
FL06	Nakra at Weir Site	288433.452	4777557.259

Two of the flow measurements were undertaken on the larger tributaries of the Nenskra River, the Memuli River and the Okrili River, which both join the Nenskra River between Tita Village and the proposed dam site. The flow measurements on these two tributaries were undertaken in support of the hydrology impact assessment performed by SLR as part of the Supplementary E&S studies issued in 2017 to provide baseline data (see Volume 5).

The river flow at a particular location in a catchment will depend on climatic conditions and also on catchment variables such as geology, gradient and the vegetation type and cover.

It is understood that during the warmer summer months, with longer daylight and increased solar radiation reaching the earth's surface in the Caucasus Mountains region, the flow in the River Nenskra and River Nakra varies on a diurnal basis depending on the rate of snow/ice melt from the catchment glaciers. At the time of the field survey in early October 2015, cooler

weather and rainfall meant that there was no discernible variation in daily flow as a result of snow/ice melt.

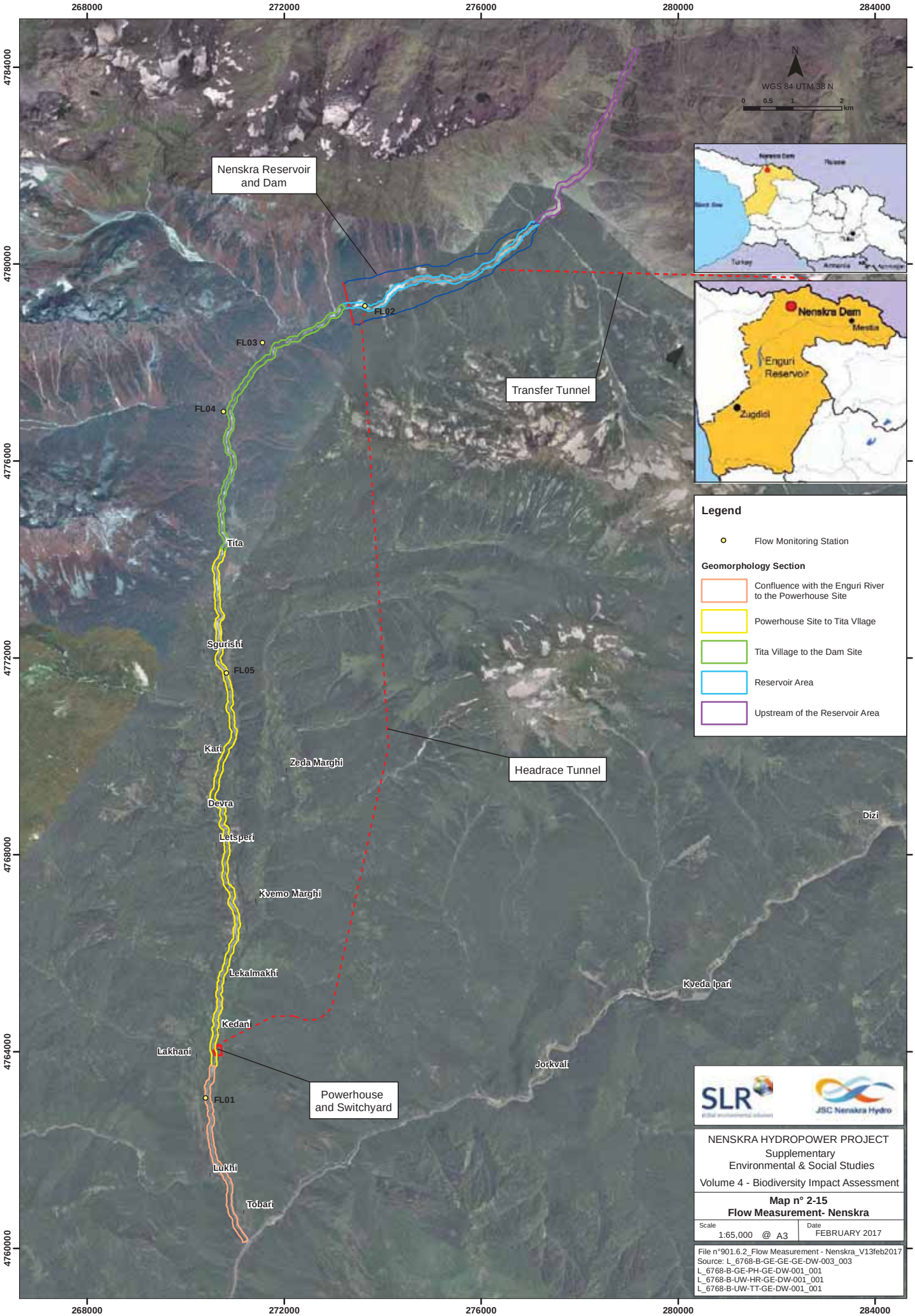
A number of difficulties were encountered during the flow measurements in the field; they were channel bed characteristics and flow velocities/volumes.

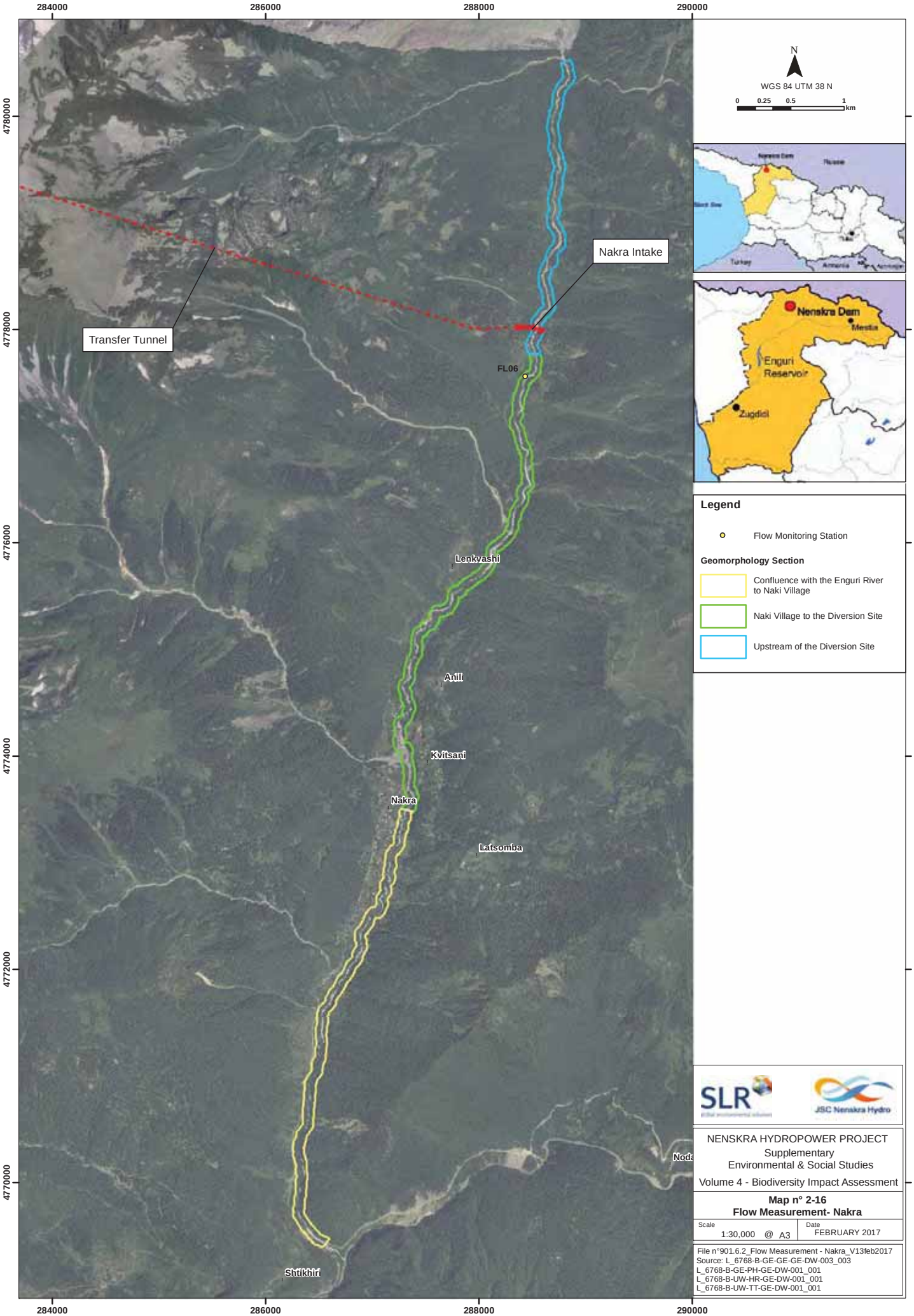
The channel bed along the majority of the Nenskra and Nakra rivers is characterised by large boulders which results in non-uniform flow across the channel, creating conditions which are not ideal for taking flow measurements. Only at the Dam Site area (flow location FL02) was the flow relatively uniform across the channel as the channel bed was comprised of gravels and cobbles.

In order to reduce the influence of boulders in the river bed on flow measurements, measurement locations were selected where there were fewer boulders present in the channel. Where it was not possible to find a section at the strategic ecological locations where no boulders were present, then the flow measurement sections/areas across the channel were adjusted to account for the presence of the boulders.

Flow velocities in the rivers were relatively high during the field survey and were at the upper end of a safe range for the person undertaking the flow measurement to enter the river. Flow measurements were only undertaken where it was safe to do so.

Extended heavy rainfall occurred in the catchments on the 7th October and the night of the 8th / 9th October which lasted c. 12 hours and six hours respectively. This rainfall resulted in increased flow in the rivers for flow measurements FL03, FL04, FL05 and FL06.





C. Flow Measurement Results

The full results of the river flow measurements are included in Annex 3 and summary results are shown in Table 12 below. Summary river velocity details are shown in Table 12below and Annex 4.

Initial observations are as follows.

- Flow measurements FL01 and FL02 may be considered comparable given their respective locations in the catchment and as there was no rainfall between when these two flow measurements were taken.
- FL03 and FL04 were measured after c. six hours of heavy rainfall. The tributary flow at these locations was in flood.
- Flow measurement FL05 was taken the day after the 12 hours of heavy rainfall in the catchment and the flow is significantly more than that recorded downstream at FL01, which was taken two days previously.
- One flow measurement (FL06) was taken on the Nakra at the weir site, as this is the strategic ecological location on the Nakra for the biodiversity study.
- The flow results are representative of the flow conditions at each location on the day and time the measurements were taken only.

Table 12 – Summary of Flow Measurements

Flow ID	Date	River	Easting UTM 38N	Northing UTM 38N	Q (m3/s)
FL01	06/10/2015	Nenskra below Powerhouse	270411.472	4763041.864	11.3
FL02	07/10/2015	Nenskra at Dam Site	273655.419	4779132.838	5.3
FL03	07/10/2015	Tskhvandin River (trib. of Nenskra)	271570.297	4778390.802	0.7
FL04	07/10/2015	Okrili River (trib. of Nenskra)	270773.679	4776983.269	3.2
FL05	08/10/2015	Nenskra at Tita	270831.746	4771677.817	14.1
FL06	09/10/2015	Nakra at Weir site	288433.452	4777557.259	1.8

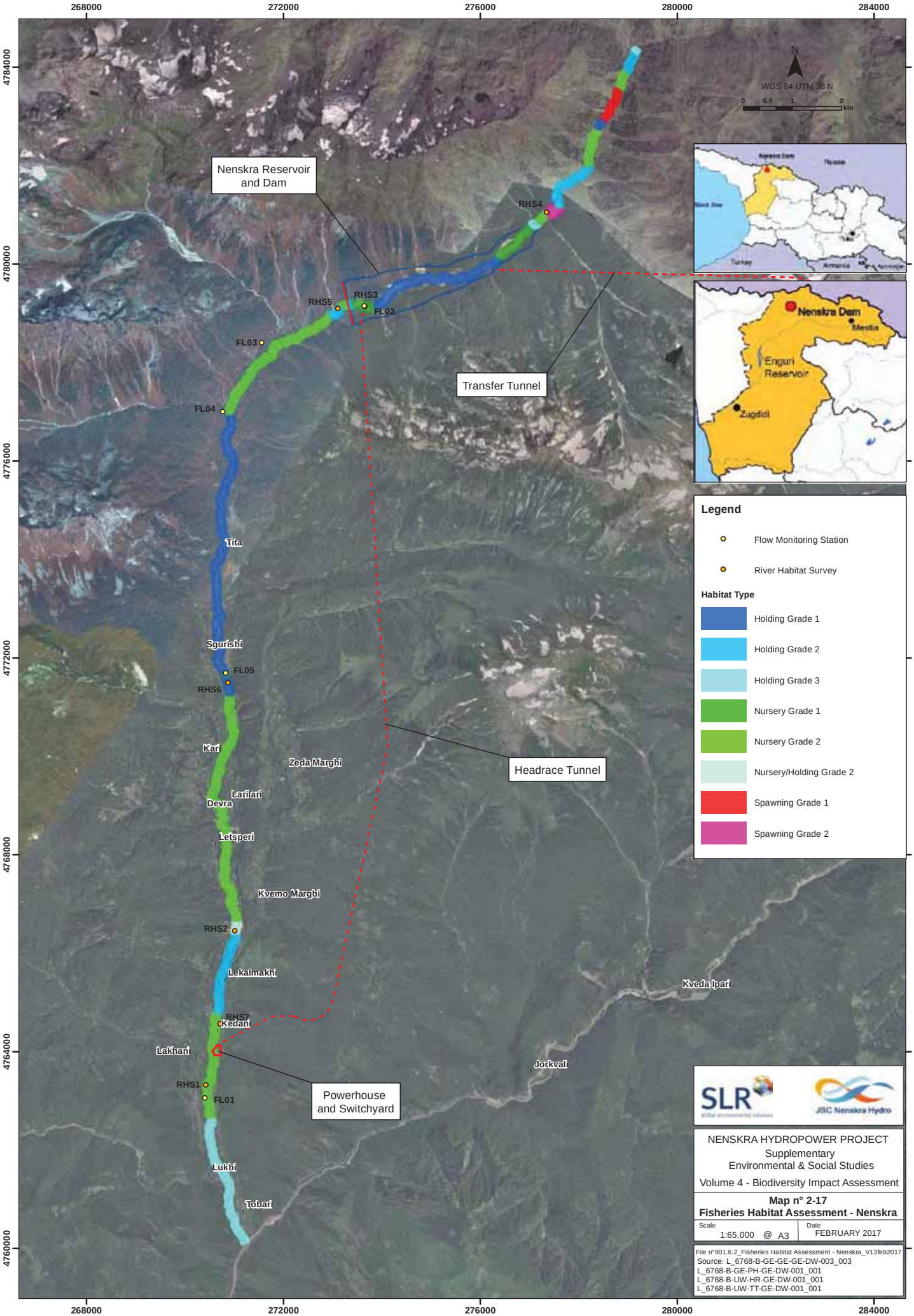
Table 13 – Summary of Recorded Flow Velocities (m/s) at Measurement Locations

Flow ID	Max. Velocity (m/s)	Min. Velocity (m/s)	Avg. Velocity (m/s)
FL01	1.11	0.48	0.85
FL02	0.98	0.66	0.86
FL03	0.78	0.28	0.59
FL04	2.06	1.08	1.57
FL05	1.00	0.57	0.78
FL06	0.65	0.41	0.50

The river velocity is critical for fish habitat and controls the age (size) of fish which can utilise particular reaches. River velocities and fish habitat are discussed within Section 7.3.1.4.

2.3.3.3 Fish habitat mapping of the Nenskra River

The results of the field surveys for both the geomorphology and RHS have been used to inform the habitat mapping. The habitat mapping follows the same boundaries as the geomorphology study. The results for the Nenskra River are shown on Map 2-17.



The river geomorphology along five broad fisheries habitat sections of the Nenskra River are described here. The five habitat sections along the River Nenskra are from:

- The confluence with the Enguri River to the powerhouse site;
- The powerhouse site to Tita village;
- Tita village to the dam site;
- The reservoir area; and
- Upstream of the reservoir area.

The characteristic river geomorphology of each broad habitat section is discussed thereafter in conjunction with the results of the fish habitat mapping as the two subjects are so inextricably linked. The geomorphology will always to a certain extent, dictate the fish habitat that is present.

A. Confluence with the Enguri River to the proposed powerhouse site

For the Geomorphology survey this section is divided into two reaches: upstream of the Enguri River to the first bridge and then from the bridge to the powerhouse site.

Upstream of the Enguri River, the Nenskra is confined to a narrow gorge. The channel morphology is characterised by very large boulders and a steep channel gradient; cascades and small waterfalls dominate this linear gorge section of the river. The river habitat observed along this narrow gorge section would limit the available refuge for adult fish and would also restrict migration upstream. There is very little habitat for juvenile fish and no suitable spawning areas within the section of river. As such, and at the time of survey this reach was classified under the LCUM as a 'Class 3 Holding Area'.

Upstream of the gorge reach the valley forms a U-shape with a wider valley floor and also a decrease in channel gradient; there are no cascades or small waterfalls along this reach. River sediments fill the valley floor and the channel is wider compared to the lower gorge section where it is constricted; where the channel opens out it offers greater in-stream habitat diversity for fish. One noticeable aspect of this reach is the absence of finer bedload and alluvium which is carried by the river indicating that smaller bedload material comprising medium gravels (<20mm diameter particle size) is transported by the river through this reach to the Enguri River.

The valley floor land use along this section is predominantly characterised by rough grazing and used by cattle.

Map 2-18 and Map 2-19 below illustrate the type of river bed met downstream and upstream of the proposed house through Stations RHS1 and RHS7. The location of these two stations in the Nenskra River is shown on Map 2-17.

270000 270500 271000

4764000 4763500 4763000 4762500

N

WGS 84 UTM 38 N

0 0.05 0.1 0.2 km

Penstock

Dry High Flow Channel

Flow Type

Boulder Bank Material

RHS1 End

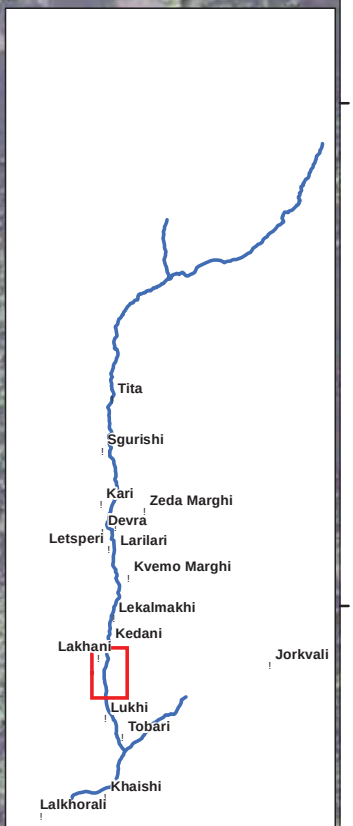
RHS1 Mid

RHS1 Start

Mid Channel Boulder Deposition

Channel Rock Feature

Adjacent Land Use Rough Pasture



Legend

- River Habitat Survey

Habitat Type

- Holding Grade 1
- Holding Grade 2
- Holding Grade 3
- Nursery Grade 1
- Nursery Grade 2
- Nursery/Holding Grade 2
- Spawning Grade 1
- Spawning Grade 2

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Map n° 2-18
River Habitat - RHS 1

Scale: 1:5,000 @ A3

Date: FEBRUARY 2017

File n°
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L_6768-B-GE-PH-GE-DW-001_001
L_6768-B-UW-HR-GE-DW-001_001
L_6768-B-UW-TT-GE-DW-001_001

Three Flow Types

Footbridge at Upstream End

Flow Type - Downstream View

Dry Back Channel - Upstream View

Boulder Banks

30m Wide Channel - Downstream View

RHS 7 Start

RHS7 Mid

RHS 7 End

HeadraceTunnel

270500

271000

4765500

4765000

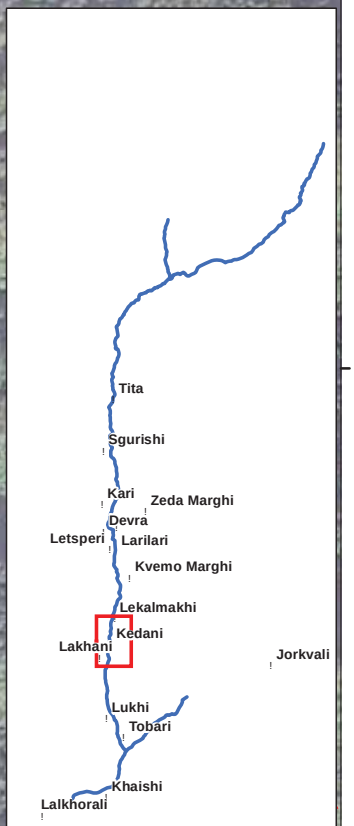
4764500

4764000

N

WGS 84 UTM 38 N

0 0.05 0.1 0.2 km



Legend

River Habitat Survey

Habitat Type

- Holding Grade 1
- Holding Grade 2
- Holding Grade 3
- Nursery Grade 1
- Nursery Grade 2
- Nursery/Holding Grade 2
- Spawning Grade 1
- Spawning Grade 2

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Map n° 2-19
River Habitat - RHS 7

Scale: 1:5,000 @ A3

Date: FEBRUARY 2017

File n°
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L_6768-B-GE-PH-GE-DW-001_001
L_6768-B-UW-HR-GE-DW-001_001
L_6768-B-UW-TT-GE-DW-001_001

B. Powerhouse to Tita village

The River Nenskra from the powerhouse area, through the villages Chuberi to Tita, is characterised by braided channel interspaced by step changes in channel gradients. Where the gradient is relatively low the channel is generally wider and can be braided into a number of channels. During lower flow conditions dry river channels can be observed within the river corridor, and these features are termed 'back-channels'. During summer peak flow conditions these back-channels will carry any additional river flow.

The river and back channels are comprised of coarse bedload with very large boulders present in the channel. The predominant bedload material is coarse sand, cobbles and small boulders with small areas of gravel and sand deposits interspaced within the larger boulders. Larger boulder sized material is visible in the bed of the channel however this material is probably not being transported by the current river flood flows and is inherited glacial meltwater derived material to the river channel which is being eroded in situ in the river channel.

Given the coarse size of the bed material along this section of river there are limited areas that can provide a suitable habitat for fish to spawn in this reach. This area is therefore assessed to be only suitable as a holding area for adults or as a juvenile nursery area.

The valley floor land use along this section is predominantly characterised by agriculture and residential with sawmills.

The river bed conditions met north of Lekalmakhi (Map 2-20) and close to Sgurishi 2km downstream of Tita (Map 2-21) are illustrated through Station RHS 2 and Station RHS6 (See Map 2-17 for the location of this station).

C. Tita to the proposed Nenskra dam site

This section of channel is relatively confined by the valley sides and glacial deposits, compared to the lower section through the villages, and the channel gradient is steeper. The river banks are characterised by forest vegetation and there are no areas of agriculture.

The predominant bed material is cobble to small boulder in size with only small areas of gravel and sand deposits interspaced within a boulder substrate. Given the large size of the bed material there are limited areas that will provide suitable habitat for fish to spawn in. The habitats are therefore considered to become predominantly a holding area for adult fish.

Map 2-22 below illustrates the type of river bed met at the proposed Dam site through Station RHS6. (See Map 2-17. for the location of this station).

270500 271000 271500

4767500 4767000 4766500 4766000

N

WGS 84 UTM 38 N

0 0.05 0.1 0.2 km

Left Bank Boulders

Bridge - Upstream View

Channel Boulders - Upstream View

RHS 2 Start

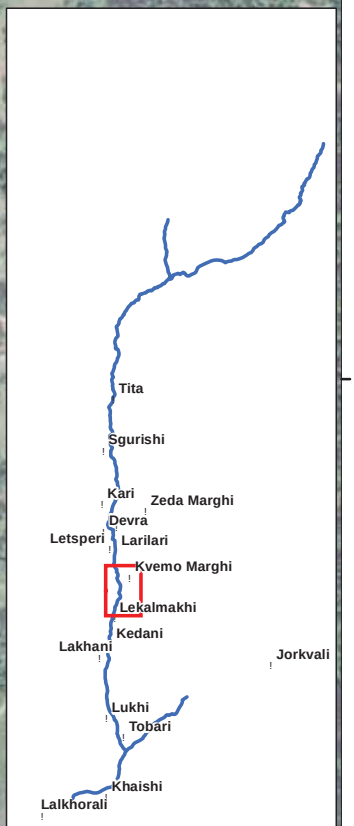
Area of Gravel deposition

RHS2 Mid

Braided Channel

RHS 2 End

Vegetated Bar - Upstream View



Legend

River Habitat Survey

Habitat Type

- Holding Grade 1
- Holding Grade 2
- Holding Grade 3
- Nursery Grade 1
- Nursery Grade 2
- Nursery/Holding Grade 2
- Spawning Grade 1
- Spawning Grade 2

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Map n° 2-20
River Habitat - RHS 2

Scale	Date
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File n°
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L_6768-B-UW-HR-GE-DW-001_001
L_6768-B-UW-TT-GE-DW-001_001

Good Fish Pool at Bridge

Bridge at Upstream End

Boulder Banks - Downstream View

Flow Measurement

Mature Island - Downstream View

Flow Types - Downstream View

270500 271000 271500

4772000 4771500 4771000 4770500

N

WGS 84 UTM 88 N

0 0.05 0.1 0.2 km

RHS 6 Start

RHS6 Mid

RHS 6 End

Tita
Sgurishi
Kari
Zeda Marghi
Devra
Letsperi
Larilari
Kvemo Marghi
Lekalmakhi
Kedani
Lakhani
Jorkvali
Lukhi
Tobari
Khaishi
Lalkhorali

Legend

River Habitat Survey

Habitat Type

- Holding Grade 1
- Holding Grade 2
- Holding Grade 3
- Nursery Grade 1
- Nursery Grade 2
- Nursery/Holding Grade 2
- Spawning Grade 1
- Spawning Grade 2

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Map n° 2-21
River Habitat - RHS 6

Scale: 1:5,000 @ A3

Date: FEBRUARY 2017

File n°
901.6.2_River Habitat RHS6_V13feb2017

Source:
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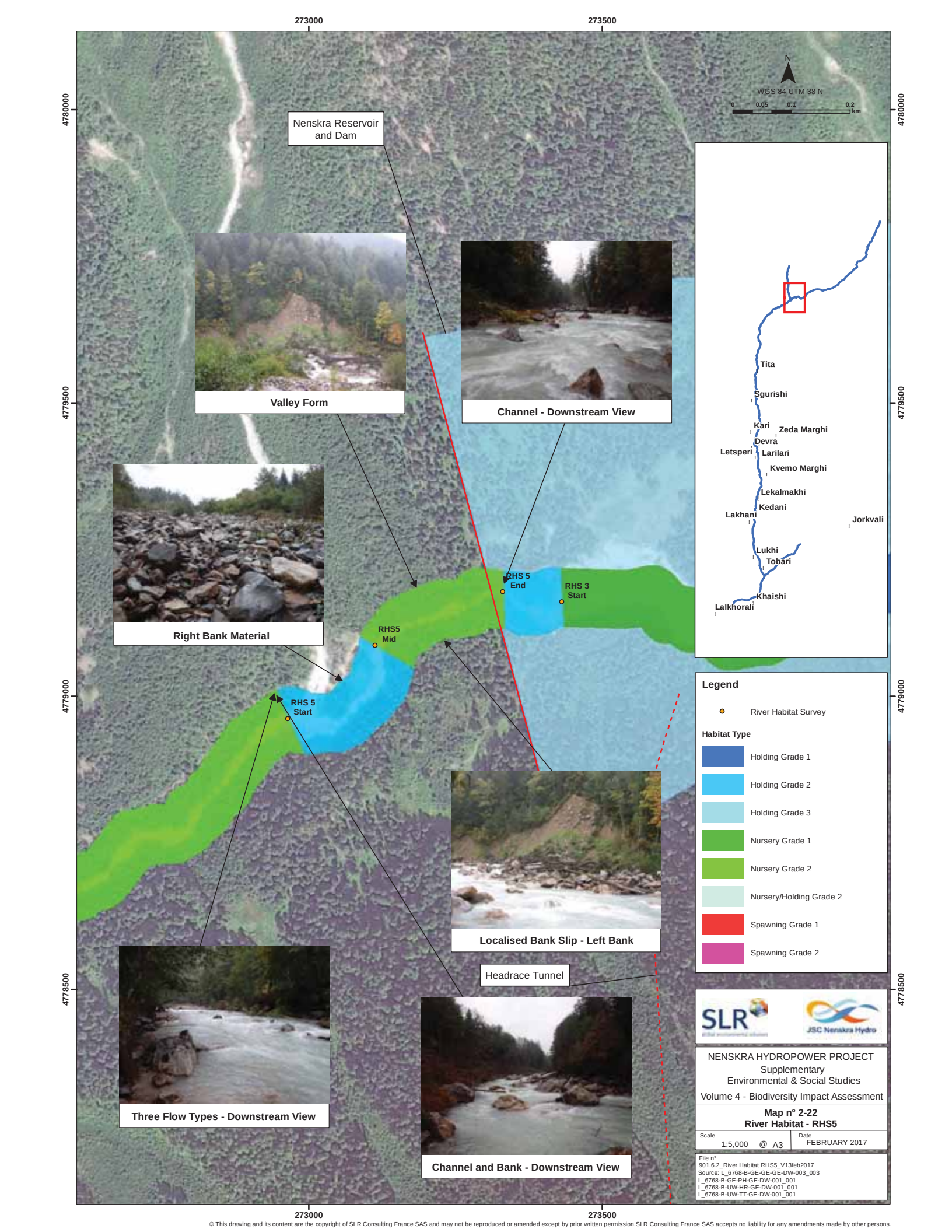
L_6768-B-UW-TT-GE-DW-001_001



D. Reservoir area

Above the proposed dam site within the reservoir area, there is a dramatic change in the valley and river morphology and river habitats. The valley form opens out into a wide U-shaped valley floor while the river channel has a lower gradient than immediately downstream of the dam site.

The reservoir area is characterised by an extensive flat area of gravel deposition, which will be beneath the proposed reservoir site and there is a reduction in the size of the bed load material compared to upstream and downstream with the substrate becoming predominantly cobble sized, interspaced by gravels and coarse sand.

The gravel deposition area is comprised of bedload material which is currently being transported by the river regime, and a topographic control on channel/valley floor gradient has resulted in the deposition of bedload material at this reach. The gravel materials on the valley floor have resulted in a braided channel system, which provides a wide diversity of fisheries habitat including tree debris, braided channels, gravels and meanders.

The reservoir area provides an excellent combination of LCUM Class 1 fish nursery and trout holding areas along with potential spawning areas identified.

Map 2-23 below illustrates the type of river bed met within the future Nenskra reservoir through Station RHS3. (See Map 2-17. for the location of this station).

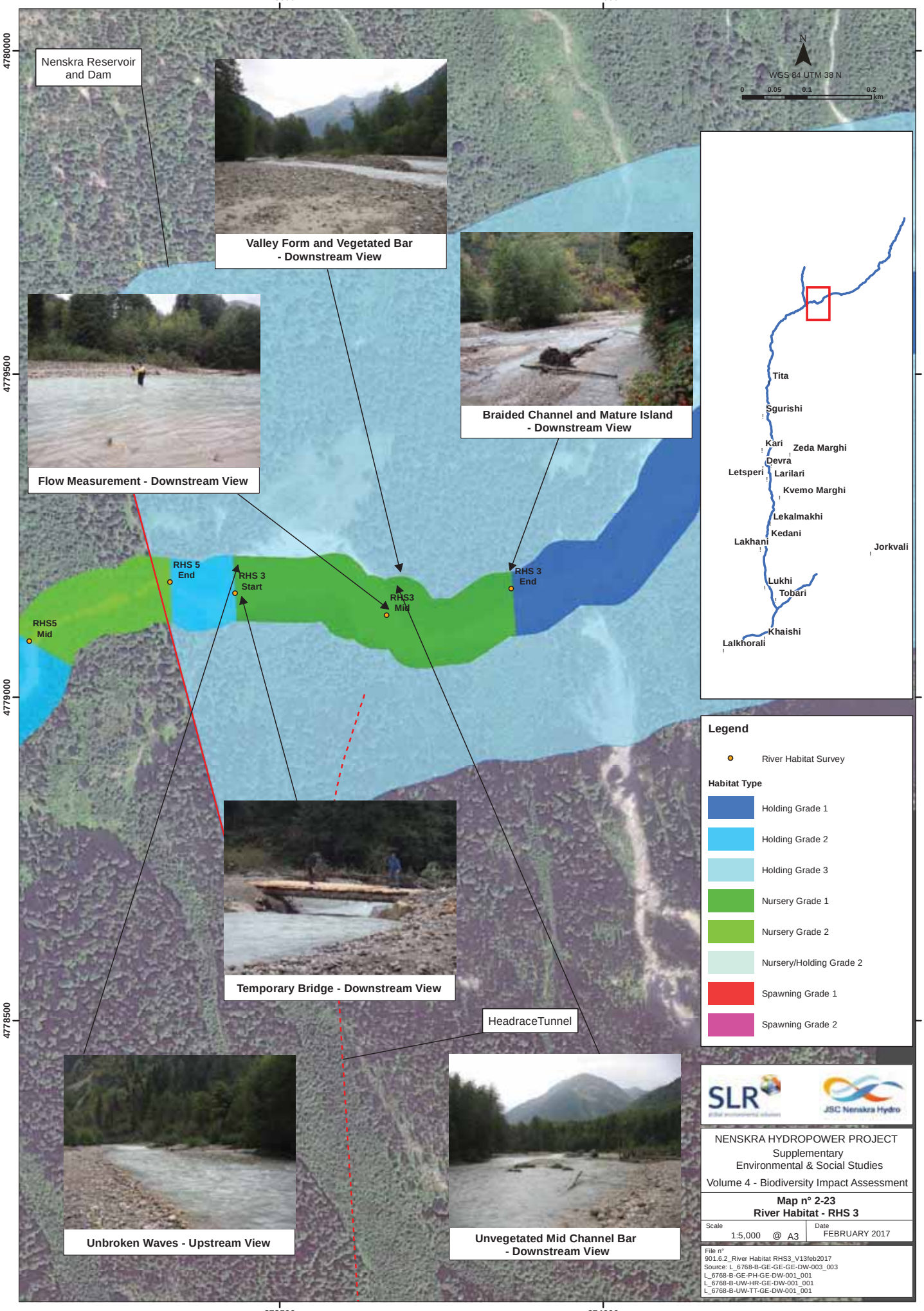
E. Upstream of the reservoir area

Upstream of the reservoir area the channel gradient increases again thus dictating the channel morphology and fisheries habitat. The channel morphology is similar to that downstream of the reservoir dam which is characterised by a steep gradient with coarse bedload and large boulders in the channel substrate. In general this section of river is of a lower grade to the reservoir area and only provides nursery and holding habitat. This reach of predominantly adult holding area (Class 2) continues, offering pool and shallow habitat for adult fish.

Upstream of the landslide area there is second gravel deposition area which offers at least 3000m^2 of pristine spawning within this section of river and includes associated trout nursey and holding areas. Throughout this reach the channel meanders through the valley floor and provides an excellent riffle and pool habitat (Class 1). The pristine gravel flat area at this site is comprised of bedload material which is being transported by the river. A topographic control on channel/valley floor gradient has resulted in the deposition of bedload material at this reach. The gravel materials on the valley floor have resulted in braided channel systems creating habitats suitable for spawning and nursery areas.

The final upstream section of the River Nenskra becomes more mountainous with vegetation along the channel banks and an increased channel gradient along with a narrowing of channel as the valley floor narrows. The dominant fisheries habitat in the upper section is associated with large boulders and is suitable as a holding area for adult fish only, with no suitable areas for spawning.

Map 2-24 below illustrates the type of river bed met upstream the future Nenskra reservoir through Station RHS4 (See Map 2-17. for the location of this station).



277000 277500 278000

4782000 4781500 4781000 4780500

N

WGS 84 UTM 38 N

0 0.05 0.1 0.2 km

Braided Channel - Downstream View

Upstream Nursery Area

Boulder Bank Material

Nenskra Reservoir

RHS 4 End

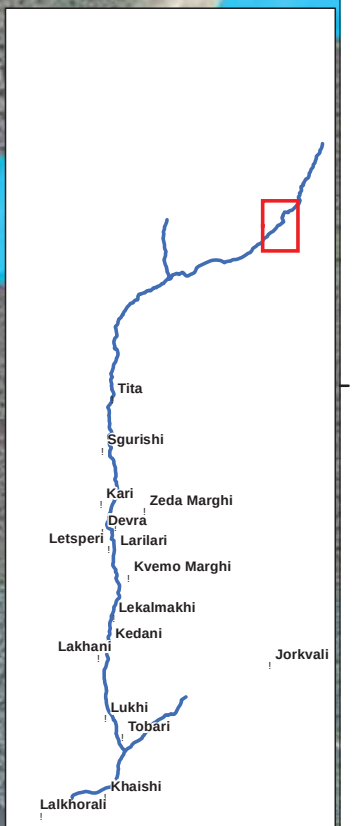
RHS4 Mid

RHS4 Start

Downstream Steeper Gradient

Downstream Holding Area

Three Flow Types - Downstream View



Legend

River Habitat Survey

Habitat Type

- Holding Grade 1
- Holding Grade 2
- Holding Grade 3
- Nursery Grade 1
- Nursery Grade 2
- Nursery/Holding Grade 2
- Spawning Grade 1
- Spawning Grade 2

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Map n° 2-24
River Habitat - RHS 4

Scale 1:5,000 @ A3

Date FEBRUARY 2017

File n°
901.6.2_River Habitat RHS4_V13feb2017
Source: L_6768-B-GE-GE-GE-DW-003_003
L_6768-B-GE-PH-GE-DW-001_001
L_6768-B-UW-HR-GE-DW-001_001
L_6768-B-UW-TT-GE-DW-001_001

2.3.3.4 Geomorphology and fish habitat mapping of the Nakra River

As for the Nenskra River, the results of the field surveys for both the geomorphology and RHS have been used to inform the habitat mapping along the Nakra River. The habitat mapping follows the same boundaries as the geomorphology study. The results for the Nakra River are shown on Map 2-25.

The river geomorphology along three broad fisheries habitat sections of the Nakra are described here. The three habitat sections along the River Nakra are from:

- The confluence with the Enguri River to Naki Village;
- From Naki village to the diversion site; and
- Upstream of the diversion site.

The characteristic river geomorphology of each broad habitat section is discussed thereafter in conjunction with the results of the fish habitat mapping.

A. Confluence with the Enguri to the village of Naki

Access to the lower sections of the river was constrained by a lack of suitable access but where it was possible then reaches were assessed via site spot checks aided by previously consulting satellite imagery. The lower Nakra from the confluence with the River Enguri is characterised by a narrow gorge with a steep channel gradient. Large boulders, steep channel gradient, cascades and small waterfalls dominate this linear gorge section upstream of the River Enguri. The lower section of the river channel does not provide suitable areas for trout to spawn and provides limited habitat for juvenile fish.

The channel morphology and habitat continues to be dominated by the steep gradient and is constrained by the valley sides with little or no valley floor present. Large instream boulders and cobbles provide the only habitat for trout. It is considered that this reach is only suitable as a holding area for adult fish with limited trout nursery areas, and no areas suitable for spawning.

B. Naki to the diversion weir

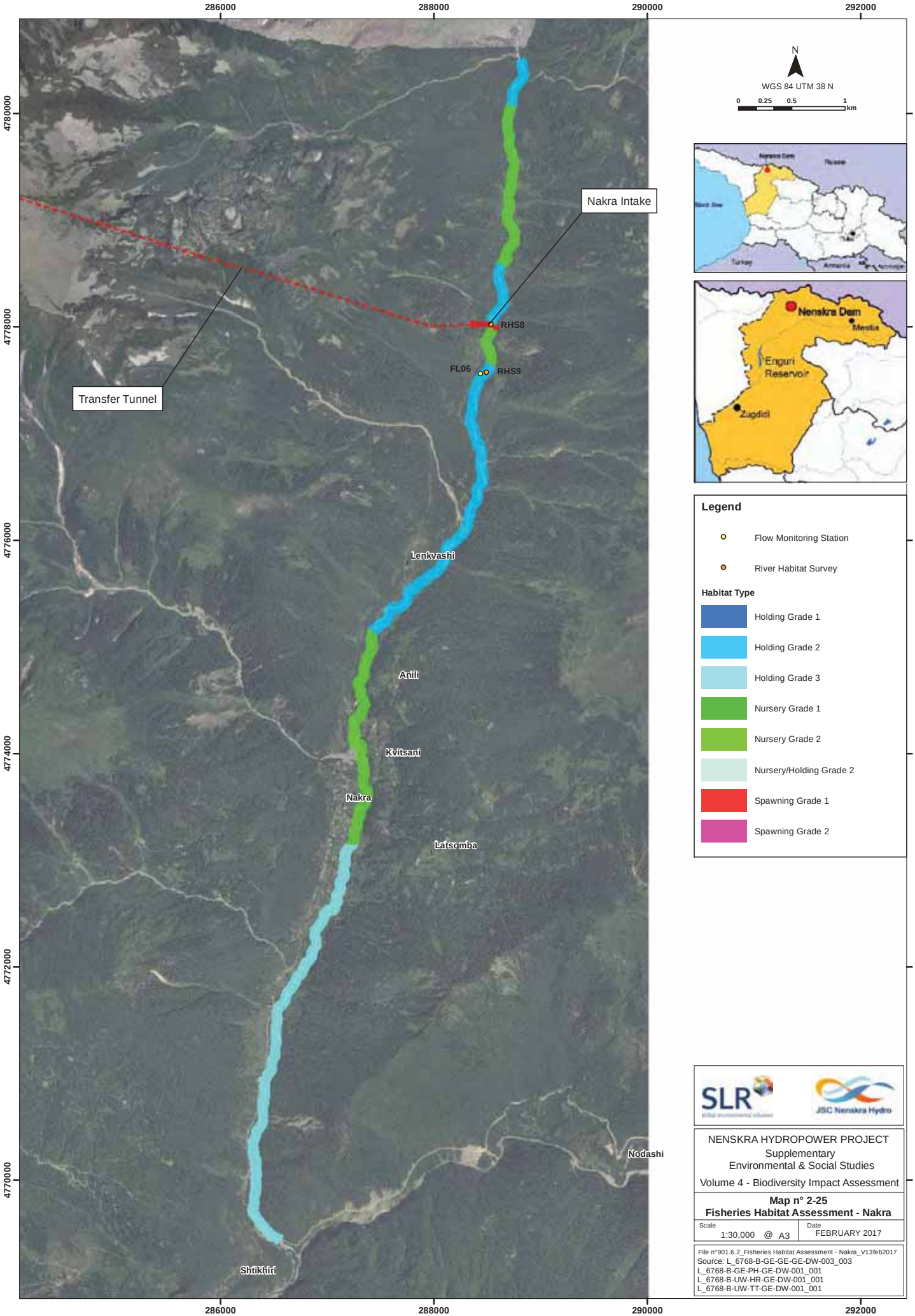
Above the village of Naki to the diversion weir site the River Nakra starts to flow through a wider valley floor and there is a slight reduction in channel gradient. This change provides more habitats for trout in relation to instream features such as fallen trees, cobble bars and pools for adult fish. No suitable areas of fish spawning were observed though the gradient becomes more favourable for spawning immediately below the diversion weir.

Map 2-26 below illustrates the type of river bed met immediately downstream of the proposed Nakra water intake through Station RHS8 (See Map 2-25 for the location of this station).

C. Upstream of the diversion weir

Above the proposed diversion weir the characteristics of the River Nakra are again dominated by a steeper channel gradient with the river flowing through a narrow ravine. Large boulders, timber debris dams and small falls make this section of river suitable only for adult fish. No suitable areas of trout spawning were observed with the channel offering limited potential to juvenile fish.

Map 2-27 below illustrates the type of river bed met immediately upstream of the proposed Nakra water intake through Station RHS9 (See Map 2-25 for the location of this station).



288000 288500 289000

4779000 4778500 4778000 4777500

N

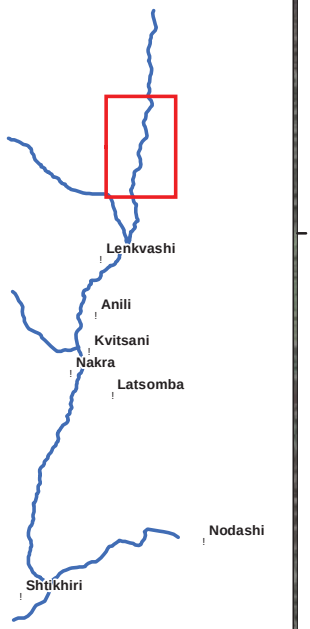
WGS 84 UTM 38 N

0 0.05 0.1 0.2 km

Tree Debris

Flow Conditions - Upstream View

Tree Debris - Upstream View



RHS 8 End

RHS8 Mid

Nakra Intake

TransferTunnel

RHS 8 & 9 Start & End

Valley Form - Downstream View

Large Boulders in Channel - Upstream View

RHS9 Mid

RHS 9 Start

Boulder Banks - Downstream View

Legend

- River Habitat Survey

Habitat Type

- Holding Grade 1
- Holding Grade 2
- Holding Grade 3
- Nursery Grade 1
- Nursery Grade 2
- Nursery/Holding Grade 2
- Spawning Grade 1
- Spawning Grade 2

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Map n° 2-26
River Habitat - RHS 8

Scale 1:5,000 @ A3

Date FEBRUARY 2017

File n°
901.6.2_River Habitat RHS8_V13feb2017
Source: L_6768-B-GE-GE-GE-DW-003_003
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L_6768-B-UW-HR-GE-DW-001_001
L_6768-B-UW-TT-GE-DW-001_001

288000 288500 289000

4778500 4778000 4777500 4777000

N

WGS 84 UTM 38 N

0 0.05 0.1 0.2 km

Boulders

Change in Gradient Near Bridge
- Downstream View

TransferTunnel

RHS8
Mid

Nakra Intake

Flow Types

RHS 8 & 9
Start & End

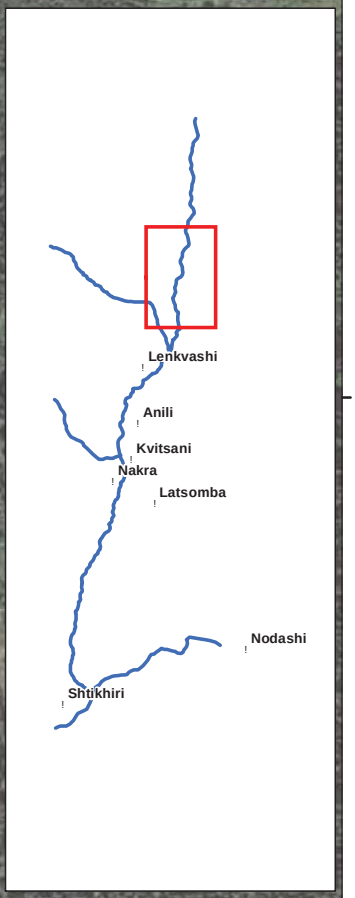
Boulder Banks - Upstream View

RHS9
Mid

RHS 9
Start

Valley Form - Downstream View

Marginal Gravel Deposits
- Upstream View



Legend

River Habitat Survey

Habitat Type

- Holding Grade 1
- Holding Grade 2
- Holding Grade 3
- Nursery Grade 1
- Nursery Grade 2
- Nursery/Holding Grade 2
- Spawning Grade 1
- Spawning Grade 2

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Map n° 2-27
River Habitat - RHS 9

Scale: 1:5,000 @ A3

Date: FEBRUARY 2017

File n°
901.6.2_River Habitat RHS9_V13feb2017
Source: L_6768-B-GE-GE-GE-DW-003_003
L_6768-B-GE-PH-GE-DW-001_001
L_6768-B-UW-HR-GE-DW-001_001
L_6768-B-UW-TT-GE-DW-001_001

This pattern of steep sections of channel interspersed with narrow and wider low gradient sections continues upstream until to the point that the survey ended. After this the upper River Nakra becomes inaccessible by road although there are a limited number of local tracks established by local lumberjacks. The survey team met a local woodsman at this point, who reported that after a landslide in 2013, there had been a big reduction in fish caught. His impression was that there were very few fish within the upper River Nakra, though during September 2015 he had met a local fisherman who had caught 10 trout.

Within the geomorphology assessment several tributaries of the Nenskra and Nakra were also assessed in support of the scheme. The tributaries of the Nenskra and Nakra not only provide a flow of water to the main channel but are also a source input of sediment.

Below the proposed dam site on the Nenskra, the finer input sediment from tributaries, material probably cobble size or smaller (i.e. <200mm diameter) is being transported through the catchment to the River Enguri. There is no evidence from the walkover survey that this material is being deposited and stored in the Nenskra catchment below the proposed dam site.

Similarly, along the Nakra River there is no evidence of finer bedload material being stored in the catchment in floodplains or river terraces as the finer material is being deposited into the Enguri River. Good water quality is critical for fish survival and successful spawning; fine sediment in the water can create inhospitable habitats for fish spawning and survival. There are numerous sources of sediment input along the rivers from tributaries and mass wasting slope failure events which input a range of materials directly to the river channel.

Anecdotal evidence from the Nakra catchment supports this as locals reported a noticeable decrease in the fish population in the river following a landslide event in 1987 in the catchment.

2.3.4 Abundance and distribution of fish within Nenskra and Nakra watersheds

Accurate estimation of the population and density of fish within the Nenskra and Nakra rivers is not possible without employing standard quantitative fish survey techniques[84]. One such technique is based upon electrofishing[85] and provides baseline fish population estimates throughout Europe at part of Water Framework Directive classification[86].

Once the baseline trout population has been established via a number of reference sites then an assessment of the population can be made. Adult trout in rivers are territorial in their behaviour, and will protect their territories or 'lies'. The use of quantitative fisheries survey data would support an assessment of trout biomass and density encountered within both the Nenskra and Nakra Rivers. However at the time of survey (2015) electrofishing in Georgia was illegal so could not be undertaken.

In the absence of any quantitative data then comparisons would have to be drawn from other trout studies within European alpine river systems[87]; however for this river catchment it was

[84] Cowx, I.G. (1991). Catch effort sampling strategies. Their application in freshwater fisheries management. Fishing News Books, Blackwell Scientific Publishing Ltd, UK.

[85] EU standards14011:2003 Water quality - Sampling of fish with electricity

EU standard 14962:2006 Water quality - Guidance on the scope and selection of fish sampling methods

[86] EU Water Framework Directive (2000). Directive of the European parliament and of the council 2000/60/EC establishing a framework for community action in the field of water policy. Official Journal of the European Communities 22.12.2000 L 327/1.

[87] Caudron, A., Champigneulle, A. & Guyomard, R. (2009). Evidence of two contrasting brown trout *Salmo tutta* populations in the River Borne (France). Journal of Fish Biology, 74, 1070-1085

assessed that comparisons with alpine rivers systems could lead to too much error in prediction, therefore have not been undertaken.

Baseline fisheries data was gathered on the River Nenskra during the LCUM & RHS fieldwork survey at the reservoir site. The SLR the survey team encountered a local fisherman who caught 10 trout on-site and the following trout lengths were recorded:

Table 14 – Trout caught on site

Fish No.	Fish Type	Length (cm)
1	Trout - *Salmo trutta morfa fario*	20
2	Trout - *Salmo trutta morfa fario*	18
3	Trout - *Salmo trutta morfa fario*	14.5
4	Trout - *Salmo trutta morfa fario*	11
5	Trout - *Salmo trutta morfa fario*	16
6	Trout - *Salmo trutta morfa fario*	15
7	Trout - *Salmo trutta morfa fario*	11.5
8	Trout - *Salmo trutta morfa fario*	8.5
9	Trout - *Salmo trutta morfa fario*	17
10	Trout - *Salmo trutta morfa fario*	18

07/10/2015 – Above Dam site RHS 3 & FL2

Detailed dissection of fish was not possible on site given that the fish were food for the fisherman. However, it was possible to establish that the fish were in spawning condition and that the both male and female fish were present at the reservoir site area (see Figure 2 and Figure 3 below).

Figure 2 - Male trout top (with milt) and female trout below (with eggs) Salmo trutta morfa fario.

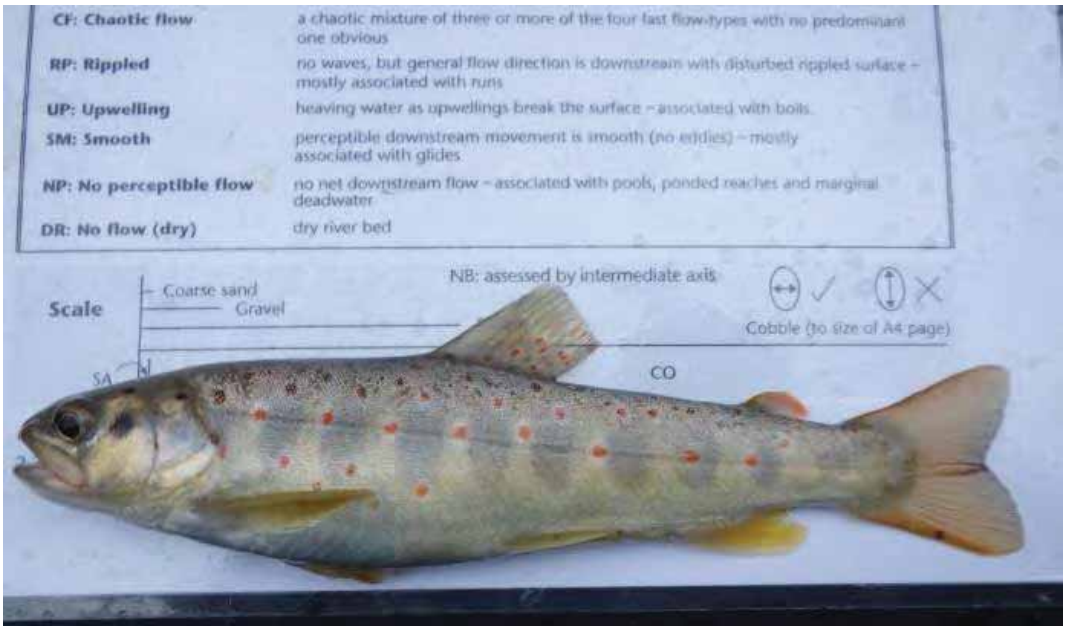


Figure 3 - Photograph B Trout caught by local fisherman at the reservoir site

2.4 Critical habitat assessment

2.4.1 Background

Based on the biodiversity baseline summarised above, a Critical Habitat Assessment (CHA) has been performed, in line with relevant guidance (IFC 2012a, 2012b, 2013, ADB 2012, and EBRD 2014), to identify areas of high biodiversity value and which would be sensitive to the proposed development.

Discrete Management Units (DMU) are areas with a clearly demarcated boundary within which the biological communities and/or management issues have more in common with each other than they do with those in adjacent areas. A DMU must be defined with regards to criteria C1 – C3 (IFC 2012b) and may vary depending on the species, subspecies or biodiversity feature of concern.

- For the flora assessment, the DMU subject to the CHA includes all areas where vegetation will be permanently lost and could be temporarily lost/impacted/modified. The DMU for the flora assessment is shown on Map 2-28 and encompasses all the areas below the tree line where man's influence has affected the landscape/species composition. The main habitat included here is logged/degraded forest habitats; for completeness and ease of mapping, urban conurbation and farmed land has also been included as these habitats also lie within the potential influence of the project.

The DMU does not include for the full length of the transfer tunnel and headrace tunnel, as these tunnels will be underground and will not have associated adits. The start and end point for both tunnels has however been included in the DMU.

For the faunal (Critical Habitat Assessment Area) CHAA, a landscape scale approach has been used (Map 2-29). While direct effects are anticipated to be as stated in the bullet points above; the habitats outside this zone of influence have also been assessed as these could be impacted by indirect effects. The landscape scale DMU gives the CHA a wider context especially where it concerns assessments for species such as brown bear and lynx which can move between watersheds.

Critical Habitat (CH) is a description of the most significant and highest priority areas of the planet for biodiversity conservation. It takes into account both global and national priority setting systems and builds on the conservation biology principles of 'vulnerability' (degree of threat) and 'irreplaceability' (rarity or uniqueness). Determination of CH is based upon quantitative thresholds of biodiversity priority which are largely based on globally accepted precedents such as IUCN Red List (IUCN, 2012) criteria and Key Biodiversity Area (KBA) thresholds (in this case the Georgian Red List).

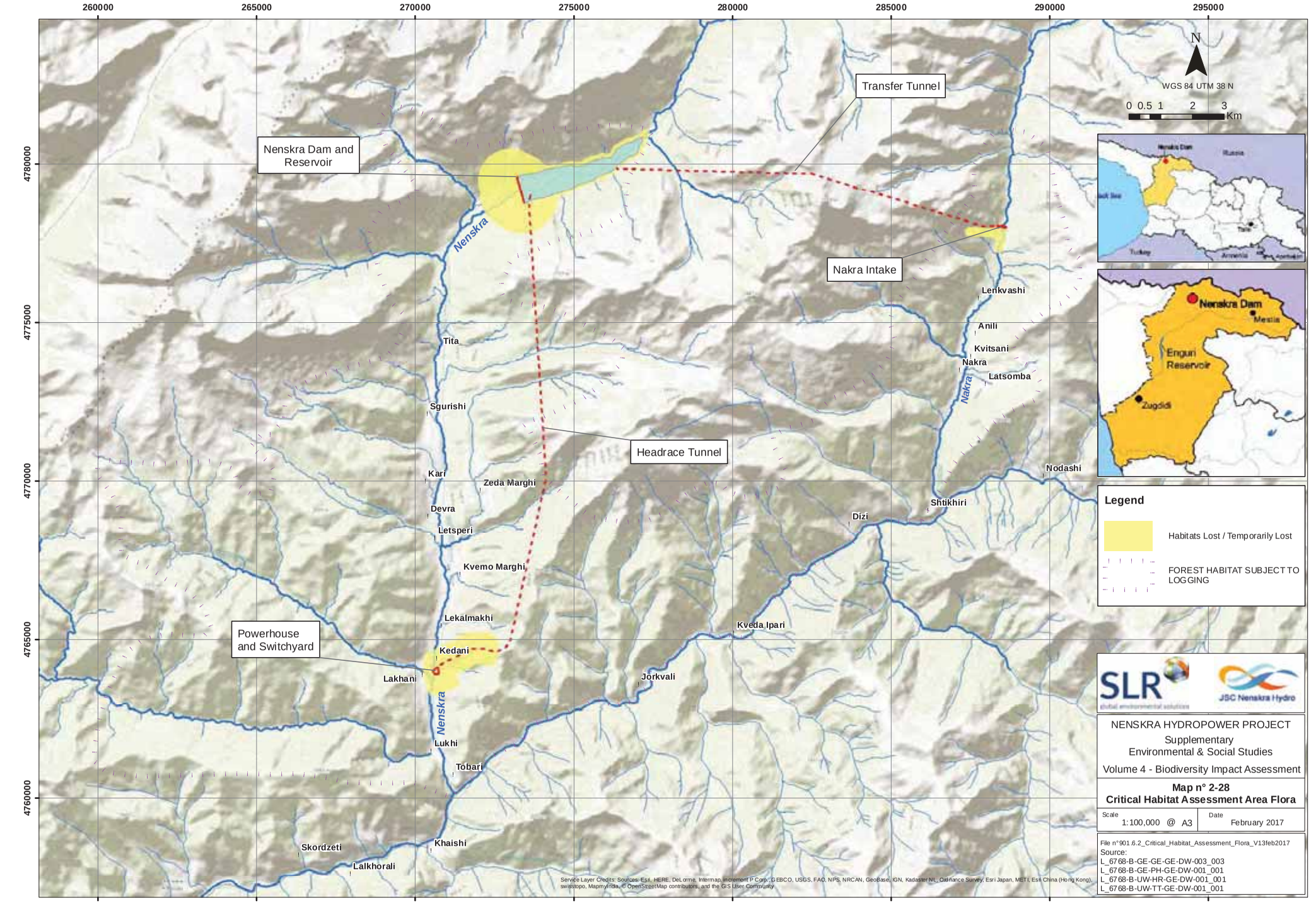
The IFC guidance breaks down the category of critical habitat in to two main grades:

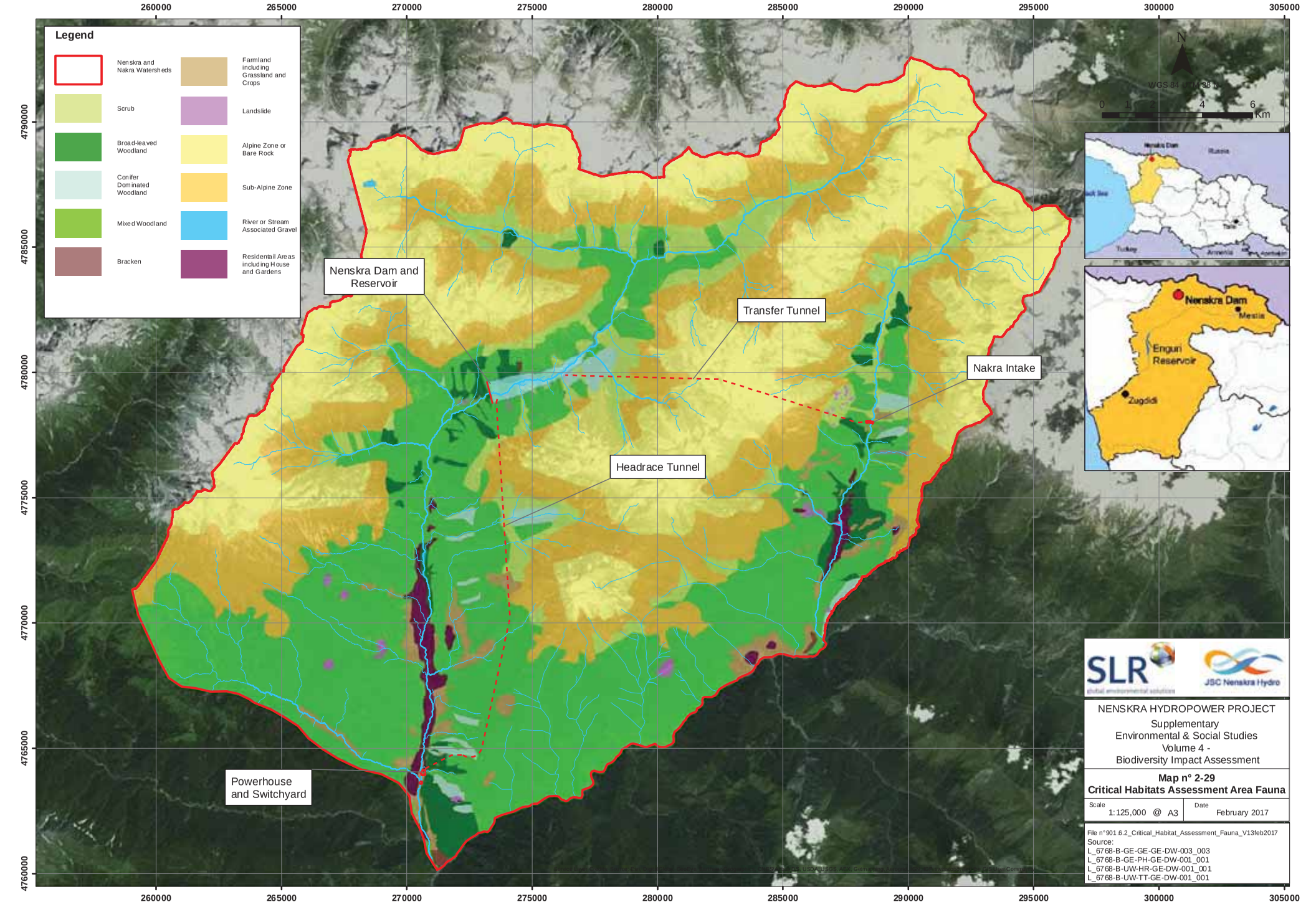
- Tier 1 critical habitat, highest importance, in which development is generally very difficult to implement and offsets are generally not possible except in exceptional circumstances.
- Tier 2 critical habitat, high importance, in which development can be implemented through appropriate planning and mitigation, and offsets may be possible under some circumstances.

The identification of critical habitat is based on five criteria (IFC, 2012a, 2012b):

- C1: Habitat of significant importance to critically endangered and/or endangered species;
- C2: Habitat of significant importance to endemic and/or restricted-range species;
- C3: Habitat of significant importance to concentrations of migratory and congregatory species;
- C4: Highly-threatened and/or unique ecosystems; and
- C5: Areas associated with key evolutionary processes.

Further areas for consideration during a CHA are legally protected areas and internationally recognised areas. In addition to this, other lender's requirements have been taken in to account, including an assessment of Natural Habitats and Priority Biodiversity Features.





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Map n° 2-29

Critical Habitats Assessment Area Fauna

Scale	Date
1:125,000 @ A3	February 2017

File n°901.6.2_Critical_Habitat_Assessment_Fauna_V13feb2017

Source:
L_6768-B-GE-GE-GE-DW-003_003
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L_6768-B-UW-HR-GE-DW-001_001
L_6768-B-UW-TT-GE-DW-001_001

2.4.2 Assessment of Critical Habitat

This assessment of Critical Habitat has been undertaken using the defined CHAA, which represents 2 DMUs corresponding to:

- Flora – extent of logged/degraded forest Map 2-28.
- Fauna – the extent of the area shown on Map 2-29.

As stated above, these areas include both the Nakra and Nenskra river valleys. Each of the five criteria provided by the IFC has been assessed based on the data available. Also referenced within this assessment is the requirement of the EBRD to identify Priority Biodiversity Features and of the EIB to identify Natural Habitats[88].

The EBRD guidance states that the identification of Priority Biodiversity Features also includes "significant biodiversity features identified by a broad set of stakeholders or governments (such as Key Biodiversity Areas or Important Bird Areas)". It is therefore noted that while the Project area is located wholly outside the candidate Emerald site, the Project area does lie approximately 0.76 km from the candidate Emerald site boundary (or Area of Special Conservation Interest) - See Map 3-1 in page 120. To date, the boundaries, qualifying features and management plans for this candidate Emerald site have not yet been finalised and the management plans have not yet been written. The fact that the CHAA currently lies partially within a candidate Emerald site does not automatically mean that the habitats will be assessed as Critical Habitats. However, in line with the European Lender's requirements, an Appropriate Assessment Screening Report in respect of the candidate Emerald site has been undertaken and is located in Annex 5.

It is also worth noting that the assessment of Critical Habitats and Priority Biodiversity Features and Natural Habitats, has simply been done on a presence/absence or qualifies, does not qualify basis. Impacts have been assessed later in Sections 4 to 7 in the absence of mitigation. The proposed mitigation, enhancement and compensation for impacts on the features brought forward for assessment are contained in Section 8 – Mitigation Strategy.

2.4.2.1 C1: Critically endangered and/or endangered species

None of the plant species recorded within the CHA are listed as being Endangered or Critical, therefore no floristic species have been considered here.

There are six faunal species, which occur within the CHAA which are listed either on the Georgian Red List or the IUCN Red List as Endangered or Critical. Twenty-two species which occur within the CHAA are also listed on Annex I of the EC Birds Directive or Annex II of the Habitats Directive. All of the species covered by the various designations are listed in Table 15 along with an evaluation of whether the CHAA includes habitat of significant importance to each species. Only one species qualifies to be assessed against Criteria 1, Tier 1 and Tier 2 – the Egyptian vulture, which is endangered according to the IUCN database.

The other species all qualify due to their national status to be assessed against Criteria 1, Tier 2 only. While it is acknowledged that the EBRD and EIB criteria differs from the IFC assessment framework used here, the EC Habitats Regulation and Birds Regulation species have also been assessed against the Critical Habitat criteria and are also shown in Table 15.

[88] The definition of Natural Habitats is contained within the EC Habitats Directive 92/43EEC, Definitions Article 1.

Table 15 - Evaluation of species against the CHA criteria

Species	IUCN Status	Georgian Status	European Status	Evaluation	Critical Habitat in CHAA?	Critical Habitat in Project Area?
Evaluation Against C1 – Tier 1 and Tier 2						
Neophron percnopterus Egyptian Vulture	EN	VU	AI	This bird is a passage migrant, only likely to pass through the CHAA in spring or autumn. As a passage migrant it is unlikely to use the habitats within the CHAA, other than as a transit corridor. According to Abuladze (2015 Annex 2) this bird species is likely only to be recorded on 1-5% of field surveys during the migratory season. The global population of this species is estimated to be 21,000 – 60,000 (Birdlife International 2015[89]) therefore a few individuals transiently visiting the Project area or wider CHAA would not represent 10% of the global population. Also, as discussed previously, the Nenskra and Nakra valleys are not considered to be main fly-ways for migratory bird species. Therefore, the habitats in the CHAA do not support nationally/regionally important concentrations of this species to justify CH for this species being present.	No	No
Evaluation Against C1 – Tier 2 only						
Aegypius monachus Cinereous Vulture	NT	EN	AI	Although this bird species may rarely be recorded within the Nenskra and Nakra valleys (see Annex 2). the IUCN distribution data suggests that while the Georgian Caucus may be part of the vulture's range, it forms the edge of its resident (non-breeding) range. Birdlife International (Heredia n.d.[90]) states that this vulture occurs in the south eastern part of the country where it breeds in Vashlovani State Reserve (8–14 pairs) and Chachuna Game Reserve (2–5 pairs). The CHAA is therefore not considered to support a nationally/regionally important population of this species. The habitats within the CHAA are therefore not considered to be of significant importance for this species.	No	No
Great Rosefinch, *Carpodactus rubicilla*	LC	EN	-	This bird species is only an irregular winter visitor to the Project area and only then in small numbers as an occasional forager. It nests at high altitudes outside of the Project area, therefore within the CHAA, Critical Habitat for this species is present (see Annex 2), but is assessed pertain to those areas where this species breeds and is most prevalent i.e. above 3000m. As this species is assessed to only be an occasional visitor to the Project area (in winter it can occasionally descend to 2000m)and does not breed within it, the Project area itself is not considered to support a nationally important population of this species. The habitats present within the CHAA above 3000m only, are therefore considered to be of significant importance for this species.	Yes	No
Common Crane, *Grus grus*	LC	EN	AI	The common crane is described in the Ornithological Report (see Annex 2) as an occasional visitor, when on seasonal passages. This species does not nest in the CHAA being considered here. Only very small numbers of common crane would ever be present, and only on a temporary basis while on migration. The CHAA is not considered to support a nationally important population of this species. As a result of this the CHAA is not considered to be of significant importance to this species.	No	No

[89] BirdLife International (2015) Species factsheet: Neophron percnopterus. [Online] Available at: http://www.birdlife.org [Accessed: 16 November2015]

[90] Heredia B. (n.d.) Action plan for the Cinereous Vulture (*Aegypius monachus)* in Europe [Online] Available at: http://ec.europa.eu/environment/nature/conservation/wildbirds/action_plans/docs/aegypius_monachus.pdf [Accessed 11 November 2015]

Species	IUCN Status	Georgian Status	European Status	Evaluation	Critical Habitat in CHAA?	Critical Habitat in Project Area?
Ursus Arctos *Brown bear*	LC	EN	AII/AIV	Based on the IUCN evaluation, this geographically widely occurring species is of least concern. However in Georgia where this species is now protected, it is evaluated as Endangered on the Georgian Red List; but still, one of the main reasons for brown bear death in Georgia is illegal hunting (Lortkipanidze 2010); an activity which is still practiced by local people in the Nenskra and Nakra valleys today. In Europe this species is listed on Annex II and IV of the EC Habitats Regulation, so would also be classified as a Priority Biodiversity Feature. The habitats assessment (Map 2-6) produced for this species shows that the habitats present within the Project areas (Nenskra and Nakra) are generally of low/moderate value to this species, due to disturbance, logging and agricultural activities. Only very limited habitat within the Project area, (c. 0.5km^2) at the upper end of the reservoir area has been valued as good (an area which at the time of survey had not be subject to logging). Within the Project Area, due to high levels of disturbance through logging, it is concluded that it would not support regionally/nationally important concentrations of brown bear, a Georgian Endangered species; therefore the Project Area does not constitute CH itself On a land scape level however, the Natural Habitats which are present upstream of the reservoir area are considered to be of high value to this species. Data received from the Emerald Network Georgia database[91], suggests that based on a government commissioned brown bear survey (2012-2013), populations in Georgia could be as high as 1643 individuals. The mapping provided also shows bear presence across the Svaneti region; though a population estimate was not given. Based on this information, and the estimation that up to 10 brown bears may be present in the faunal CHAA, this would represent 0.6% of the brown bear population in Georgia. It is therefore considered that the CHAA does not support nationally/regionally important concentrations of this species nor is the habitat within the CHAA considered to be a discrete management unit for this species, as similar habitats are present throughout the region. That said, the CHAA does contain large areas of potentially "good" habitat for brown bear, habitats which create connectivity to neighbouring valleys. If, as according to the tests for Tier 2, this habitat was removed (in totality), then it would have a significant impact on the ability of this Georgian Endangered species to disperse within the region, and therefore have an impact on the conservation status of this species in Georgia. It is therefore concluded that Critical Habitat is present within the watershed level CHAA.	Yes	No
Lynx lynx Lynx	LC	CR	AII/AIV	As with the brown bear, the IUCN evaluation of this widespread Eurasian species is of least concern. In Europe this species is listed on Annex II and IV of the EC Habitats Regulation, so would also be classified as	Yes	No

[91] Data was received in person, but it has been taken from the data set which can be found here: http://www.coe.int/en/web/bern-convention/-/emerald-biogeographical-evaluation-seminar-for-armenia-azerbaijan-and-georgia?redirect=http://www.coe.int/en/web/bern-convention/meetings-2015?p_p_id=101_INSTANCE_m7e5S53R6UDr&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-4&p_p_col_pos=2&p_p_col_count=4 [Accessed 16 January 2016]

Species	IUCN Status	Georgian Status	European Status	Evaluation	Critical Habitat in CHAA?	Critical Habitat in Project Area?
				a Priority Biodiversity Feature. In Georgia, where this species is or has been hunted regularly in the past, its population levels have dropped significantly. The main food of the lynx is described in Section 2.2.2.3 and concerns ungulate species such as tur, chamois and roe deer. These species were all confirmed to be present in the upper reaches of the Nenskra and Nakra valleys, where man made disturbance is minimal and suitable grazing habitat is present. Chamois and tur especially are found within the sub alpine zone rather than in the lower valley (where the Project area is located). Potential signs of lynx were found in the Project area, but it is considered most likely that these were signs of an individual moving through its range, rather than using the reservoir area as core habitat, critical for its survival, e.g. where its prey lives, or where denning takes place. Due to high levels of disturbance and lack of prey items, the Project Area itself is not considered to be CH for lynx, as it is not considered to support regionally/nationally important concentrations of this Georgian Critical species. The CHAA for this species is represented at a watershed level; the habitats within the Nenskra and Nakra watersheds are not unique in the Caucasian mountain range. Based on the tier 2 sub-criteria, the loss of the CHAA would not have an impact on the long term survivability of the lynx species at a global level. However as the population distribution of lynx in Georgia is not well documented or understood, it cannot be argued that the hypothetical loss of all suitable habitats within CHAA would not have a significant effect on the conservation status in Georgia. For this reason, it is assessed that Critical Habitat for lynx is present within the CHAA.		
European Protected Species (Annex 1 Birds and Annex II and IV Terrestrial Fauna)						
Barbastellus Barbastellus Barbastelle bat	NT	VU	AII	This species of bat was only tentatively recorded as being present down at Tita, it was not recorded within the reservoir area. This is a species which roosts in old mature trees and which likely has an altitudinal limit for roosting and foraging. In Azerbaijan it has been only recorded up to 1500 metres altitude (Kandaurov (2008) Editor: Bats conservation plan for the Caucasus.) The reservoir area is at an altitude of 1350m which is likely to be approaching the limit of their range, as backed up by the lack of records (at this altitude) for this species during the 2015 surveys. Therefore if suitable habitat is present it is likely to be represented by the mature trees down stream of this altitude. Due to the abundance of mature trees at lower altitudes, the habitats within the CHAA are not considered to be critical for this species.	No	No
Canis lupus Wolf	LC	-	AII/AIV	Wolf is a widely occurring species of least concern. It is not listed on the Red List of Georgia. The 2016 surveys recorded a single wolf on a camera trap. Wolf prints were also noted. As wolf territories are large (100 – 500 km^2) it is considered that the habitats present within the CHAA, while they form part of a wolf territory, are not critical for maintaining the conservation status of this species.	No	No
Lutra lutra *European otter*	NT	VU	AII/AIV	No otter signs were detected within the Nenskra or Nakra watersheds. It is therefore considered that the habitats present within the CHAA are not critical for this species due to its absence.	No	No
Scirulus anomalus *Caucasian squirrel*	LC	VU	AIV	Signs of this species were noted during the2016 survey and suitable habitats were noted across the entire CHHA. The distribution of this species covers most of the trans-Caucasian area as well as Turkey (IUCN 2016). As a result of this, the habitats within the CHAA are not considered to be critical for this species.	No	No
Gypaetus barbatus	NT	VU	AI	This species is a passage migrant; therefore it is not resident within the site CHAA. It is considered	No	No

Species	IUCN Status	Georgian Status	European Status	Evaluation	Critical Habitat in CHAA?	Critical Habitat in Project Area?
Bearded vulture				therefore that the habitats within the CHAA are not critical for this species.		
Gyps fulvus Eurasian griffon vulture	LC	VU	AI	This species is described as a regular, non-breeding visitor to the CHAA, but in small numbers. It is therefore considered that the CHAA does not provide critical habitat for this species.	No	No
Aquila chrysaetos Golden eagle	LC	VU	AI	This species is generally widespread across the Western Palearctic area. It is likely to nest within the CHAA, but outside of the Project area. Due to the widespread nature of this species, the habitats within the CHAA are not considered to be critical.	No	No
Aquila heliaca Eastern imperial eagle	VU	VU	AI	This species was not recorded during the 2015 bird surveys. Bird distribution maps (IUCN 2016) suggest that this species does not breed or readily occur within the CHAA, the habitats here are not considered critical.	No	No
Aquila clanga Greater spotted eagle	VU	VU	AI	This species is a passage migrant; therefore it is not resident within the site CHAA. As a result it is considered that the habitats within the CHAA are not critical for this species..	No	No
Accipiter brevipes Levant sparrowhawk	LC	VU	AI	This species was not recorded during the 2015 bird surveys. This is a species which tends to reside in foothills and warmer lower altitude areas up to 1000m (Snow 1998). As a result of this, the CHAA which has a minimum altitude of 950m is not considered critical for this species.	No	No
Pernis apivours Honney Buzard	LC	-	AI	This species is a passage migrant; therefore it is not resident within the site CHAA. As a result it is considered that the habitats within the CHAA are not critical for this species.	No	No
Milvus migrans Black Kite	LC	-	AI	This species is a passage migrant; therefore it is not resident within the site CHAA. As a result it is considered that the habitats within the CHAA are not critical for this species.	No	No
Changa pomarina Lesser Spotted Eagle	LC	VU	AI	This species is a passage migrant; therefore it is not resident within the site CHAA. As a result it is considered that the habitats within the CHAA are not critical for this species.	No	No
Hieraaetus pennatus Booted Eagle	LC	-	AI	This species is a rare passage migrant; therefore it is not resident within the site CHAA. As a result it is considered that the habitats within the CHAA are not critical for this species.	No	No
Anthus campestris *Tawny pipit*	-	-	AI	This species is a rare passage migrant; therefore it is not resident within the site CHAA. As a result it is considered that the habitats within the CHAA are not critical for this species.	No	No
Lullula arborea *Woodlark*	LC	-	AI	This is a numerous species which is both found as a summer breeder and as a passage migrant. Due to the widespread and common occurrence of this species in Georgia, the habitats present within the CHAA are not considered to be critical for the conservation status of this species.	No	No
Lanius collurio *Red-Backed Shrike*	LC	-	AI	This species is common and is found both as a summer breeder and as a passage migrant. Due to the widespread and common occurrence of this species in Georgia, the habitats present within the CHAA are not considered to be critical for the conservation status of this species.	No	No

The results of the evaluation presented in Table 15 above, show that based on the Criteria 1 critical habitat guidance that the Project Area does not constitute Critical Habitat as it does not support nationally/regionally important concentrations of Endangered or Critical species on a national/regional red list. However at a CHAA level, which covers two whole watersheds, Critical Habitat is considered to be present, based on the Criteria 1 sub-criteria tier 2 guidelines for lynx and brown bear only.

2.4.2.2 C2: Endemic and/or restricted-range species

During the floristic surveys, a number of species were identified which are described in the Flora, Vegetation and Habitat Assessment Report (Annex 1) as being endemic or of restricted range. Under Criterion 2, an endemic species is that which has ≥95% of its global range inside the country or region of analysis. Plants are generally described as being endemic rather than restricted range (as applied to invertebrates (IFC 2012b)). All bar one of the species described in Table 3, as restricted range are documented as occurring within the Caucasus Region, estimated to be 170,00km^2 (E.B. 2015[92]). Therefore, under this criteria, they do not qualify as endemic. As a result they do not qualify under Criteria 2 for assessment.

The exception to this is *Paracynoglossum imeretinum*. The IUCN database states that this species is listed as Vulnerable in view of the extent of occurrence, estimated to be 12,500 km^2, its area of occupancy, is estimated to be no more than 200 km^2. It has been recorded in thinned out forests glades of the Caucasus: Abkhazeti, Samegrelo, Imereti, Guria and Adjara, but is apparently in decline. This decline is attributed to rates of grazing and land development for construction in its area of occurrence. Interestingly this species is described as being found in the foothill shrub-lands on the Black Sea coastal area, habitats not represented by the reservoir area, where it was recorded. In addition to this it should be noted that lack of data for a particular species does not always imply rarity, it may in fact just be under recorded.

Figure 4 - Paracynoglossum imeretinum

Based on the C2 criteria, *Paracynoglossum imeretinum* is an endemic species to Georgia (≤95% of its global range is inside the country of analysis. According to the Flora of Georgia, this species has been recorded in five regions of west Georgia, at 17 locations. This record in the Svaneti region would be the sixth region if the record can be verified. As only one individual was noted, the Tier 2 sub-criteria is not considered to apply as only one individual plant was found in the reservoir area. Essentially, if more than 100 plants are found elsewhere (as is likely due to the number of locations at which this species has been recorded), then the Tier 2

[92] E.B. (2015) Encyclopaedia Britannica [Online] Available at: http://www.britannica.com [Accessed 19 November 2015]

sub-criteria would not apply. Simply put, the survey area is likely to provide suitable habitat for less than 1% of the global population of this species.

To verify and validate this single vegetative record, further surveys will be undertaken for this species, so that if the species is confirmed, appropriate and targeted mitigation can be implemented. Section 4 sets out the impact assessment for this species, with Section 8 setting out the resulting mitigation and monitoring.

Of the terrestrial faunal species identified no species present within the CHA are assessed to be endemic or restricted in range.

2.4.2.3 C3: Concentrations of migratory and congregatory species

Migratory species are considered to be those species which perform cyclical movements between two distinct geographical areas, one of which is usually the area in which they breed[93]. The only truly migratory species groups identified here are birds and bats. Brown bear and lynx in this context are not considered to move between two distinct geographical areas; however they do have large territories, through which they may range on a cyclical basis.

Brown trout have also been considered here as they do move on a local scale between feeding areas and spawning areas. The brown trout population within the Nenskra river system is considered most likely to remain within this river and its tributaries, throughout its life cycle and that significant numbers of brown trout do not pass up or down through the Nenskra - Enguri Confluence. The Nenskra river is approximately 40km long from source to the Enguri confluence and is considered to be part of the same geographic area, surrounded by high glaciated peaks. Therefore based on the definition of a migratory species, the brown trout population within the Nenskra watershed is not considered to perform cyclical movements between two distinct geographical areas and is therefore not migratory.

For birds the Nenskra and Nakra valleys are not considered to be used as main flyways for migratory species. As stated previously, the main migratory fly-ways over the Caucus mountain range lie to the west of the Project area, along the coast of the Black Sea and to the east along the Rioni river valley. The Enguri river valley forms a secondary fly-way migration route. The Nakra and Nenskra valleys are linked to the Enguri river valley so are used by a much reduced number and range of species as minor fly-ways. As a result of this, the Nenskra valley and the Nakra valley are not considered to be of significant importance to concentrations of avian migratory and congregatory species.

For bats, it is considered most likely that the species do move on a local scale, foraging as far up as the reservoir area in the summer months, when insects are present, then moving downstream 30 km or more to roost in limestone caves. The lower levels of bat activity and number of bat species recorded in the reservoir area, when compared to Tita, strongly suggest that the habitats within the reservoir area are not critical for this species. All of the species recorded during the bat surveys are relatively widespread species therefore the habitats present within the CHAA are not considered to be critical for the bat assemblage present.

2.4.2.4 C4: Highly-threatened and unique ecosystems

As described previously, there are a range of habitats within the Project area, and consequently the DMU for this CHAA. The habitats within the Project area are dominated by woodland and have been modified over many years by man, for harvesting wood and for grazing animals. Habitats which would once have been dominated by mixed woodland (conifer

[93] Quote taken from: Cyrille de Klem (1994), 'The Problem of Migratory Species in International Law', in Helge Ole Bergesen and Georg Parmann (eds.), Green Globe Yearbook of International Co -operation on Environment and Development 1994 (Oxford: Oxford University Press), 67–77.

and deciduous) as well as dense conifer woodlands, have been modified. The main timber which is harvested is conifer, leaving behind often fairly open broadleaf woodland (once the conifer has been removed). Where open areas exist, these are used by domestic animals for grazing, creating grazed, open areas within the woodland. Natural Habitats are described in IFC (2012) as being areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified and area's primary ecological functions and species composition. It goes on to say in IFC (2012): "In practice, natural and modified habitats exist on a continuum that ranges from largely untouched, pristine natural habitats to intensively managed modified habitats. In reality, project sites will often be located among a mosaic of habitats with varying levels of anthropogenic and/or natural disturbance. Clients are responsible for delineating the project site as best as possible in terms of modified and natural habitat."

In the logged areas of forest, as described above, conifer and pine has been removed, fundamentally altering the species composition of these woodlands, especially the understory composition where cows have grazed. However with time, money and support, the remaining habitats could be restored. Based on this, the remaining dark coniferous forest, according to IFC PS6 should therefore be classified as a Natural Habitats. Despite the anthropogenic modification of the forest habitats, it is also assessed that with regards to the beech forest with Colchic understory, even though none of the habitat within the Project area is pristine, and the vast majority has been modified by logging/grazing etc to some extent it could still be restored and therefore qualifies as Natural Habitat. Compensation for habitat loss natural and modified will be undertaken for this project. For more information please refer to Section 8

The CHAA for habitats assessment covers two valleys at a watershed level. Within this CHAA, there are limited forest habitats which have not been subject to logging or other man-lead activities. It is estimated that where forest habitats are present, 70% of forest cover has been affected by logging or domestic stock grazing to some extent.

There are habitats within the DMU (and Project area which could qualify as Annex I Habitats under the EC Habitats Regulations; however as described above, it should be noted that these habitats are generally modified to some extent by man's actions, so are unlikely to represent good quality examples of the cited Annex 1 habitat types.

The floristic surveys identified two main habitat types which are considered to be of high sensitivity value. These are:

- Beach forests with Colchic understory (also considered to be an Annex I Habitat). This habitat is described as being widespread in western Georgia and is found on the north western slopes of the Greater Caucasus and the Adjara-Imereti Range (Akhalkatsi 201594). Of the forest habitat distributed in Georgia, beech forests make up 46.6% of the forested areas, which equates to 10,600km2.
- Dark-coniferous forest (Piceeta orientale-Abieta nordmanniana). This habitat is less wide spread in Georgia, making up about 7.1% of forest cover, or about 1,615km2 (Akhalkatsi 2015). This habitat type is present in Georgia and Abkhazia occupying an altitudinal band in the south side of the Caucasus mountains parallel to the Black Sea (rusnature n.d.95).

Due to the relatively wide spread occurrence of these habitats within Georgia, and the fact that similar habitats are known to occur elsewhere within Europe/Russia they are not considered to represent highly threatened and unique ecosystems as defined by Criteria 4.

[94] Akhalkatsi M. (2015) Forest habitat restoration in Georgia, Caucasus Ecoregion. Published by Mtsignobari.

[95] Rusnature (n.d.) Website with information about the Biomes and Regions of Northern Eurasia. The Caucus. [Online] Available at: http://www.rusnature.info [Accessed 18 November 2015]

The floristic survey also identified two further habitats which are considered to be Annex I Habitats, but which were assessed to have a low sensitivity value and are therefore not considered to qualify under criteria C4 as critical habitats.

- Colchic relic broad-leaved mixed forest: Beech – alder – chestnut – hornbeam forest. This habitat was found in the reservoir area and is described by the surveyor as degraded, forming an ordinary phytocenosis. Vehicle tracks, grazing and logging were evident in this area too.
- Alluvial forests: Floodplain forest. This habitat covered limited areas within the Project area, as it was generally found where flatter ground was present and seasonal flooding/inundation occurs. Where this habitat was recorded the surveyor also noted that the habitats present had been subject to grazing and logging; leading to degraded habitats or ordinary phytocenosis.

In April 2016 SLR held a meeting with the NACRES Project co-ordinator Kakha Artsivadze about the candidate Svaneti Emerald Site. During the meeting he stated that further surveys of the Svaneti Area had been undertaken in 2014 and 2015, and that the new boundary for the candidate Emerald Site would exclude the Nenskra valley as NACRES intended to exclude areas which were considered not to be of conservation interest[96], or areas which were subject to grazing and farming. This further lends weight to the assessment that the habitats present in the CHAA are not considered to be highly threatened or unique ecosystems.

2.4.2.5 C5: Key evolutionary processes

The Caucasus area is defined by the Critical Ecosystem Partnership Fund (CEPF 2014[97]) as a Biodiversity Hotspot Area. The deserts, savannas, arid woodland and forests that comprise the Caucasus Hotspot contain a large number of endemic plant species. The Caucasus hotspot spans 532,658km^2 in the nations of Georgia, Armenia, Azerbaijan and the north Caucasus portion of the Russian Federation. The hotspot vegetation covers 143,818km^2 and contains 1,600 endemic plant species, 2 threatened mammal species and 2 threatened amphibian species.

A range of habitats have been identified within the Nakra and Nenskra valleys, however, one of the main features within these habitats is the presence of man, as signs of logging and forestry clearance were noted in a number of areas (See Volume 3 “Social Impact Assessment” of the Supplementary Environmental & Social Studies). Both valleys, where infrastructure is proposed and the CHA has been defined, have been used by man for harvesting wood and grazing domestic animals for many years. As a result of this only the northern part of the Nenskra valley beyond the reservoir impoundment area (and outside of the CHAA), was considered to truly represent a pristine environment. Therefore, while the Project area lies within a broad scale Biodiversity Hotspot Area, the habitats present within the Project area are not considered to be critical habitats for key evolutionary processes.

2.4.2.6 Priority biodiversity features

With regards to the habitats within the Project area being Priority Biodiversity Features[98], it is considered as with the Critical Habitats assessment, there are habitats within the DMU which would qualify under this criterion. For flora, these would be habitats which comprise alpine, bog, rocky ledge or scree habitats; all habitats which lie outside of the Project area. Although

[96] See also NACRES, 2016, Development of Emerald Network in Georgia - Narrative Report - Section #2.3

[97] CEPF (2014) Critical Ecosystem Partnership Fund. Information on Biodiversity Hotspots. [Online] Available at: http://www.cepf.net/resources/hotspots/Pages/default.asp [Accessed 11 November 2015].

[98] Priority biodiversity features are a subset of biodiversity that is particularly irreplaceable or vulnerable, but at a lower priority level than critical habitats.

as described above, some habitats are present within the Project area are classified as potential Annex 1 habitats, in Georgia they are not considered to be vulnerable, so therefore are not considered to be priority biodiversity features. For fauna, it is the mountain rivers which are considered to qualify as priority biodiversity features, specifically areas which provide suitable habitats for brown trout during their life cycle; spawning and winter holding habitat. Fish habitats have therefore been subject to an impact assessment and a mitigation strategy has been proposed to manage the riverine habitats, in conjunction with a monitoring plan.

2.4.2.7 Summary

The assessment for critically endangered or endangered species was undertaken at a landscape level, which included both the Nenskra and Nakra valleys. As a result of this, habitats considered to be "critical habitats" were considered likely to be present for brown bear, lynx and great rosefinch. It should be noted that the habitats considered to be critical habitats, are those habitats which are natural habitats, remaining relatively unaffected by man. With regards to brown bear, these would be the forested habitats which have not been subject to logging and manmade disturbance. For lynx these would be the steep cliffs and ledges of the sub-alpine and scrub areas where their prey items such as tur, chamois and roe deer are present. For the great rosefinch, it is the sub-alpine zone which constitutes critical habitat for this species. These are all habitats which lie outside of the Project area.

With regards to endemic or restricted range species, only *Paracynoglossum imeretinum* was potentially recorded within the DMU for flora. The DMU set for the floristic assessment was limited to areas affected by man (logging, farming etc), and includes all habitats which could be impacted upon by the project. On a wider landscape level, it is acknowledged that there may well be additional floristic species which would qualify as restricted range and or endemic.

No highly-threatened and unique ecosystems were noted within the floristic DMU. However it is acknowledged that at a landscape level, within the Natural Habitats, there will likely be discrete areas which would qualify as unique ecosystems (under EBRD guidance); however as these lie outside of the floristic DMU they have not be assessed here.

None of the habitats present within the DMU for fauna, which is set at a watershed level, were assessed to be critical for congregatory or migratory species. Key evolutionary processes were also assessed at a landscape level, but such habitats were not considered to be present.

3 Conservation initiatives

3.1 Svaneti proposed protected area

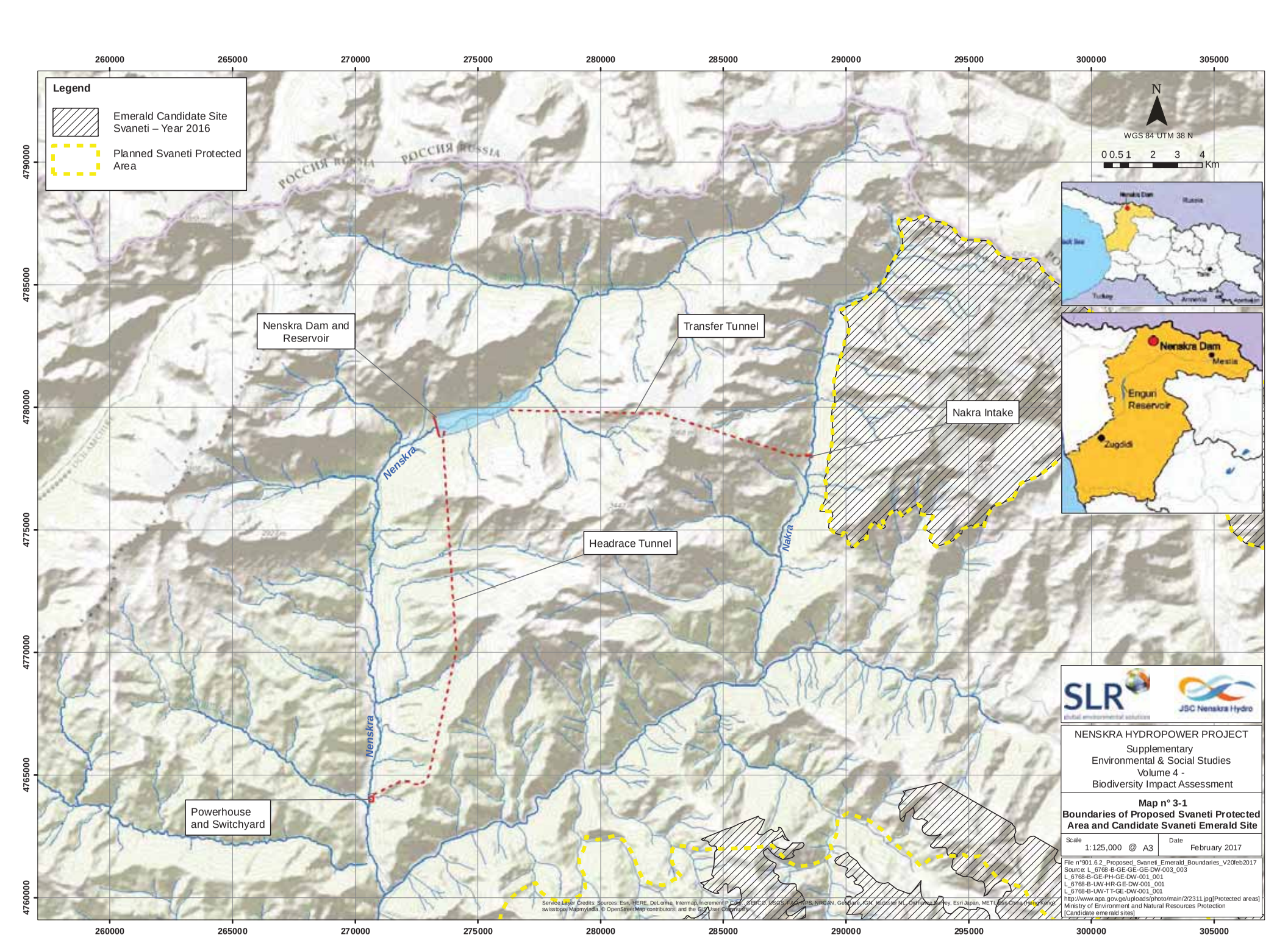
The Project infrastructure (dam, reservoir, powerhouse, Nakra water intake, access roads) is not included in an existing protected area boundary.

JSCNH met the Ministry of Environment and Natural Resources Protection on 14 September 2015 to obtain information on the creation process of the proposed Svaneti Protected Area, identified by the Georgian Agency for Protected Areas (APA). It was understood that at the time, the definition of the proposed Protected Area (boundaries, timeframe, conservation target, management plan) was not yet finalized and still being studied.

In March 2016 SLR held a meeting with KfW, who are funding the Georgian Open Spaces Programme which is identifying biodiversity hotspots. They informed us that the information generated during these surveys will be used by the GoG and the MoENRP to make the final decisions on the location of National Parks and Protected Areas within Georgia.

At a meeting with the MoENRP (April 2016), SLR were informed that a map showing the updated indicative Protected Area boundaries was available on the internet (see Figure 5 below and on line at www.apa.gov.ge/uploads/photo/main/2/2311.jpg). This map has been digitised (by SLR) and the boundaries added to Map 3-1. As can be seen on this map, the Project area lies outside of the proposed Protected Areas boundary. Although the boundaries are now available, a management plan has not yet been finalised or made available.

Figure 5 - Protected area sites of Georgia



SLR

JSC Nenskra Hydro

NENSKRA HYDROPOWER PROJECT
Supplementary
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Map n° 3-1
Boundaries of Proposed Svaneti Protected Area and Candidate Svaneti Emerald Site

Scale	Date
1:125,000 @ A3	February 2017

File n°001.6.2_Proposed_Svaneti_Emerald_Boundaries_V20feb2017
Source: L_6768-B-GE-GE-GE-DW-003_003
L_6768-B-GE-PH-GE-DW-001_001
L_6768-B-UW-HR-GE-DW-001_001
L_6768-B-UW-TT-GE-DW-001_001
http://www.apa.gov.ge/uploads/photo/main/2/2311.jpg[Protected areas]
Ministry of Environment and Natural Resources Protection [Candidate emerald sites]

3.2 Candidate Emerald Site

During 2015 and the majority of 2016, the Project area was partially located within a large (2338.48km^2) candidate Emerald Site; however the boundary was subject to an application for revision in February 2016, based on recently collected biodiversity data which has been evaluated against the criteria of the Bern Convention on the Conservation of European Wildlife and Natural habitats. The Bern Convention Standing Committee ratified the boundary changes (in November 2016), so the Project area is now located wholly outside of the candidate Emerald site.

The Background Information is as follows.

According to the EIONET Central Data Repository[99], the Georgian Emerald Network was under consideration by November 2010. Following this, a list of candidate sites was drawn up and registered with the Bern Convention by 2012.

The candidate Svaneti Emerald site "Standard Data Form" indicates that the Project area is located partially within the candidate Emerald Site (Registration number GE0000012), the western border being created by the river Nenskra. The NACRES web site (http://adlab.ge/da2/) states that Phase 1 of the initiative to select the potential Emerald sites has now been completed and registered with the Bern Convention.

The next phase (Phase II) involves the evaluation of the efficiency of the candidate sites. This is done on a species by species and habitat by habitat basis. This is being done at (sub)-regional and biogeographical level, in cooperation with the European Environment Agency. Submission of the final database for final adoption by the Bern Convention Standing Committee has not yet been completed, but began in the spring of 2013. Once Phase II is complete then Phase III will entail the official designation of the adopted Areas of Special Conservation Interest (ASCIs) at the international level.

At a meeting with a representative from the Ministry of Environment and Natural Resources Protection of Georgia (14th January 2016), it was understood that the government wished to revise the boundaries of several of the candidate Emerald Sites in Georgia.

The government representative also stated that the Nenskra valley (which includes the Project area) had been evaluated against the criteria of the Bern Convention on the Conservation of European Wildlife and Natural habitats, in conjunction with more recent survey data collected from the Svaneti area. Following this, the government's advisors had determined that the habitats located within the Project area did not meet the Convention's criteria for the inclusion into the Emerald Network.

A further meeting was held with the Ministry of Environment and Natural Resources Protection of Georgia in April 2016. It was confirmed at this meeting that the boundaries of the candidate Svaneti Emerald site were in the process of being amended. The reasons for amending the boundary had also been substantiated by NACRES: that the initial boundary which was submitted was an 'area of interest' boundary, rather than a more refined proposed Emerald site area, based on evidence based assessment. The GoG's aim (now achieved) was that by December of 2016 this change would be ratified and enacted.

NACRES confirmed in April 2016 that the 2015 Narrative Report had been submitted to the secretariat of the Bern convention and the Council of Europe and that the updated candidate Emerald Site maps and data base had been uploaded to CDR on the EIONET server which is part of the European Environment Agency (EEA).

[99] Information available from: http://cdr.eionet.europa.eu/ge/coltlvahq/coltlvamg/

3.3 National Biodiversity Strategy and Action Plan 2014-2020

The National Biodiversity Strategy and Action Plan 2014-2020[100] (NBSAP) includes an overview of Georgia's biodiversity followed by the vision and the overall national targets for safeguarding the biodiversity. The document sets out the strategy and actions for biodiversity, outlined in the form of a table of national targets, indicators and specific objectives for Georgia along with critical assumptions. Under the targets and objectives, a number of activities are included that should help achieve the objectives, targets and eventually, the Strategic Goals. The time frame and implementing organizations are also indicated for each activity.

Section 4.1 of the plan describes some of the problems which affect species and habitats, some of which are considered to be particularly relevant to the Svaneti Region. One of the problems described is Hunting:

"Since the soviet times, ineffective management of hunting has resulted in a decline of many game species while some have completely disappeared. Wild ungulates have suffered from illegal hunting particularly severely….. "At present, anti-poaching mechanisms are largely ineffective and administrative resources allocated to law enforcement are not sufficient. National strategies of community and/or trophy hunting and sustainable hunting need to be developed. The lack of awareness and education among sport hunters may be facilitating violations of hunting regulations."

Section 5.4.1 also describes problems which have been encountered while trying to set up Protected Areas (PA), this is considered also to include the Zemo Svaneti Protected areas.

"Funding for the PA system has increased in recent years. However, almost all components of the PA management structure and operation are still underfinanced, including salaries and operational costs. Practically no funding is allocated to monitoring and additional research or educational activities. The lack of financing is one of the major causes of the above-listed problems and obstacles for effective PA management."

The plan also sets out targets to reduce unsustainable forest use, which includes illegal logging; which is an issue relevant to the Project area. Essentially the NBSAP seeks to set a strategic approach for remedying these problems and safeguarding biodiversity.

When developing appropriate mitigation strategies for the impacts caused by the Project, the points raised in the National Biodiversity Strategy and Action Plan 2014-2020 will be taken in to account.

[100] NBSAP (2014) Information on biodiversity targets in Georgia. [Online] Available at: https://www.cbd.int/doc/world/ge/ge-nbsap-v2-en.pdf [Accessed 12 November 2015].

4 Impact on flora

4.1 Habitats and species brought forward for analysis

A number of different factors are considered likely to have an impact on the flora of the Project area. These have been listed below and then considered in conjunction with the valued floristic receptors which have been selected for assessment. Please note that the impact assessment has been undertaken in the absence of mitigation. Mitigation (compensation and enhancement) measures have then been detailed separately in Section 8. Mitigation has also been implemented for impacts, even where they are not considered "significant" as even non-significant impacts, such as habitat loss, can still be negative and therefore should be mitigated or compensated for, e.g. through the implementation of a Reforestation Management Plan. The residual impacts, once mitigation, compensation or enhancements have been implemented have been assessed in Table 24, Section 9, Summary of impacts and commitments.

Construction impacts:

- Direct loss due to infrastructure location or impoundment, calculations for which are set out in Table 16 and Table 17 below;
- Indirect loss due to hydrological changes;
- Introduction of invasive species.
- Operational impacts
- Improved access – illegal logging.

Table 16 - Habitat loss within the reservoir impoundment and dam area only

Type	Description	Area Ha	Km^2
a	River or Stream & Associated River Gravels	50.12	0.50
b	Farmland including Grassland & Crops	1.60	0.01
d	Broadleaved Woodland	89.66	0.90
e	Conifer Dominated Woodland	10.71	0.11
f	Mixed Broadleaf & Conifer Woodland	151.71	1.50
h	Landslide Areas	5.34	0.05
i	Scrub	45.86	0.46
	Reservoir Impoundment Area Total	355.00	3.55

The losses within the reservoir impoundment and dam areas are shown in Table 16 above and represent total loss. Once the dam is built and the reservoir area flooded, the habitats present in these areas cannot be replaced.

The second table (Table 17) shows the areas to be lost (due to infrastructure footprint e.g. power house and reservoir footprint), in addition to those habitats which are likely to be temporarily lost, e.g. the temporary workers' camp, which will be revegetated post construction.

Table 17 – Whole Project area - habitats to be lost or temporarily lost during construction

Type	Description	Permanent loss ha	Temporary loss ha	Total ha
a	River or Stream & Associated River Gravels	55.01	1.5	56.51
b	Farmland including Grassland & Crops	24.43	132.36	156.79
c	Residential Areas including Houses & Gardens, roads and amenity areas	7.72	26.66	34.38
d	Broadleaved Woodland	96.8	98.16	194.96
e	Conifer Dominated Woodland	12.8	20.6	33.4
f	Mixed Broadleaf & Conifer Woodland	159.04	164.1	323.14
h	Landslide Areas	5.34	0.92	6.26
i	Scrub	45.86	10.1	55.96
	Total habitats to be lost or temporarily lost	**407**	**454.4**	**861.4**

The habitat area losses (temporary and permanent) have been calculated based on the infrastructure locations as detailed in Volume 3: Social Impact Assessment , Table 62. Caution needs to be applied to these figures as they are a conservative estimate on where temporary facilities such as the construction camp and disposal areas will finally be located. As a result, they have been calculated based on a worst case scenario basis (i.e. largest area likely). The final areas for temporary facilities and power service line land take etc. are anticipated to be substantially less than those presented here.

Due to the use of existing roads, fragmentation of vegetative habitats has not been considered here; however habitat fragmentation with regards to the reservoir location, has been addressed in the Impact on Animals Section 5. There will be habitat take due to the reservoir, dam and dam infrastructure (access to head race and transfer tunnels), the power house and penstock, and Nakra weir; however outside of this, habitat loss will be minimal and disturbance will only occur during the construction period.

Only one species was identified as being a Georgian endemic species. This is *Paracynoglossum imeretinum*, a single plant of which was identified within the reservoir area. It was identified at Location 16 (Map 2-1) which is described as: typical vegetation of riverside rock on the banks of the River Enguri and its tributaries. This habitat also gets covered with water during the summer floods. Common alder *Alnus barbata*, white alder *A. incana* and species of willow *Salix spp*. grow here. Among the bushes there are large amounts of hazel nut *Corylus avellana* and azalea *Fageta azaleosa media*. As the floristic survey was not exhaustive, there may be more individual plants of this species present in the reservoir and wider Project area.

Two Georgian Red list species are present within the Project area (Table 3). Both are listed as Georgian Vulnerable species: sweet chestnut *Castanea sativa* and yew *Taxus baccata.* These two species have not have not been assessed further here for the following reasons:

- Only a small number of sweet chestnut trees were recorded, and were recorded outside of the Project footprint.
- Only a single tree was recorded during the floristic inventory survey. Yew is a very widely occurring species (Europe, western Asia and North Africa).

For all Project areas, where vegetation/tree clearance may occur, a tree survey prior to construction will be undertaken. Mitigation for removal of yew and sweet chestnut (if applicable) will be implemented as outlined in the conditions of the Environmental Permit. The

Permit requires replanting at a ratio of 1:10 for all Georgian Red List species which will be lost to the project footprint. For more information please refer to Volume 8: Environmental and Social Management Plan.

The two high sensitivity value habitats identified during the floristic surveys (see Section 2.1) will be taken forward for assessment. Both of these habitats are present in the reservoir area where direct loss will occur.

One medium sensitivity habitat was also recorded: Oak or oak-hornbeam forests (*Quercitum – Carpinion betuli).* One habitat which fits the criteria as an Annex 1 Habitat under the EU Habitats Directive was also identified: Alluvial forests, flood-plain forest. However this habitat was assessed to be of low sensitivity value, so it has not been brought forward for further assessment here.

Valued floristic receptors taken forward for analysis therefore include:

- Paracynoglossum imeretinum
- Dark-coniferous forest Piceeta orientale-Abieta nordmanniana
- Beech forest with Colchic understory *Fageta fruticosa colchica*
- Oak or oak-hornbeam forests (Quercitum – Carpinion betuli).

4.2 Impact analysis

4.2.1 Valued Floristic Receptors – Reservoir and Dam Area

During the construction period, when impoundment of water will occur and in the absence of mitigation, the single specimen identified as *Paracynoglossum imeretinum (a* rare endemic species) will be lost. Without verification that this is the species that was recorded, and a further understanding of the location, abundance and local distribution of this species, and in the absence of mitigation, this loss can only be assessed to be a significant impact as it has only been recorded at 17 locations in Georgia (Pers. Com M. Dr. Kimeridze Botanical Expert 24/11/15).

The most abundant high sensitivity value habitat (and equivalent EC Habitats Regulation Annex 1 habitat type) identified within the reservoir area and subject to habitat loss, is the Beech forest with Colchic understory. This type of habitat, where recorded in the Project area, has generally been described as degraded through man made disturbance such as logging and grazing of the understory by domestic livestock. IFC PS6 states “In practice, natural and modified habitats exist on a continuum that ranges from largely untouched, pristine natural habitats to intensively managed modified habitats. In reality, project sites will often be located among a mosaic of habitats with varying levels of anthropogenic and/or natural disturbance. Clients are responsible for delineating the project site as best as possible in terms of modified and natural habitat.” As a result of this, it is assessed that with regards to the beech forest with Colchic understory, none of the habitat within the Project area is pristine, and has been modified; however with time, money and support, it could be restored. Based on this, the Colchic understory according to IFC PS6 should be classified as Natural Habitat, but would not be classified as a Priority Biodiversity Feature (EBRD PR6), due to the habitat not being threatened etc.

This habitat is described as being widespread in western Georgia and is found on the north western slopes of the Greater Caucasus and the Adjara-Imereti Range (See Section 2.1.4 for references). A similar type of habitat may be present in northern Turkey, however it is considered predominantly to be of Georgian provenance. Other types of beech forest are fairly wide spread across Europe, especially in the western Carpathians, where nearly pure beech

forests dominate the montane zone[101]. Of the forest habitat distributed in Georgia, beech forests make up 46.6% of the forested areas, which equates to 10,600km$^{2.}$. The area of broadleaf forest which will be lost due to the creation of the reservoir and dam is (based on the broad scale mapping for broadleaf woodland, which may also include other types of beech forest, riparian forest etc.) is 0.94km^2.

This represents an estimated loss of 0.00009% of this habitat within Georgia. The habitats present here have been subject to disturbance by man, through creation of dirt tracks for logging and the grazing of animals (as noted in the Flora, Vegetation and Habitat Assessment Report, inventory sheets, Annex 1). The loss of this degraded habitat is not considered to be significant in isolation; though its loss is considered to have a negative impact and therefore will be subject to a compensation plan.

The other habitat identified as having areas of high sensitivity value, is dark-coniferous forest (which has not been evaluated as an EC Habitats Directive, Annex 1 habitat). Within the reservoir area logging has occurred. Pine and other conifer species are generally targeted for harvest. As a result of this, although this habitat is present within the reservoir area, most areas show signs of logging and human disturbance. The dark-coniferous forest habitat is less wide spread in Georgia, making up about 7.1% of forest cover, or about 1,615km^2 (Akhalkatsi 2015). Dark coniferous forest most closely equates to the broad habitat type of conifer-dominated woodland. Based on this, the loss of the degraded elements of dark-coniferous forest will be approximately 0.11km^2. Due to the effects of logging in the reservoir area, (as noted on the detailed floristic inventory forms Annex 1) the loss of this degraded example of the dark coniferous forest habitat is considered to be non-significant, but will still represent a negative impact so will be subject to a compensation plan.

The moderate sensitivity value habitat Oak or oak-hornbeam forests (*Quercitum – Carpinion betuli)* is more difficult to assess as it appears to be a fragmented habitat type, located within a larger area of Beech forest with Colchic understory *Fageta fruticosa colchica*, so it has in fact been included within the calculations for the high sensitivity value habitats.

4.2.2 General – Whole Project Area

During the construction period a total land take due to the reservoir and dam will be 3.55 km^2, further losses, both permanent and temporary will occur due to the location of the power house, penstock and access road, dam encampment area, Nakra Weir area and diversion tunnel (where is lies above ground) and borrow pits. Permanent loss includes habitats which will be removed to enable the placing of infrastructure such as the dam area, roads, penstock etc. Temporary loss includes those areas which will be used for laying down and storage of materials as well as the temporary workers camps.

The broad scale floristic survey covered an area of 142.15km^2, which included the both valleys. Floristically the habitats present within the survey area are considered to be relatively widespread throughout the Svaneti Region. It is worth noting that the more pristine habitats within these two valleys are those which exist upstream of the proposed infrastructure. These habitats will remain unaffected by land take. The whole Project area habitat loss (temporary and permanent taken from Table 17) will be total 6.07km^2 (8.61 – 2.54 (Habitat Type a, b, c and h)), even though it is occupied by a range of habitats some with a lower conservation value, this loss of habitat is considered to be significant and therefore mitigation and enhancement measures should be implemented.

[101] Information taken from the World Wildlife Fund [online] available at: http://www.worldwildlife.org/ecoregions/pa0504 [Accessed 14 January 2016]

Hydrological changes will occur as a result of the Project, the impoundment area will flood all of the vegetation within the impoundment area in the Nenskra Valley, and the weir area on the Nakra Valley. Changes in the hydrological regimes may also change the vegetation composition of the two valleys downstream of the intake on the Nakra and the dam on the Nenskra. The vegetation surrounding the reservoir impoundment area may be subject to a slow change in floristic composition as a result of being adjacent to a large fluctuating water body. The only comparison available was a visual assessment of the Enguri reservoir, where the vegetation close to the reservoir edge did not appear to be significantly different to that present above, due to the steepness of the valley sides, which is similar to the reservoir area here too. It is therefore considered unlikely that the presence of the reservoir would have a significant effect on the vegetation located above the highest level of water impoundment.

Downstream of the reservoir however, hydrological changes may affect vegetation types present. Due to the control of the flow regimes by the dam on the Nenskra river, spring and summer inundations of riparian habitat may no longer occur. This may, over time, change the species components of these small flood zone areas which are used for animal grazing, however in a valley which is predominantly steep-sided, these flood areas are limited in extent and are generally represented by low conservation value farmland on Map 2-1 and Map 2-2. It is therefore assessed that this would be a non-significant effect. The weir on the Nakra river will change the flow rates too, however the weir has been designed so that in high water levels, the water will flow over the weir. Therefore while hydrological changes may occur on this river, they are not considered to be as pronounced as those on the Nenskra.

4.2.3 Invasive species

The introduction of invasive floristic species has been considered, as it could occur during the construction period when lorries/trucks and other machines are being moved into the Project area from outside of the Svaneti region. However, currently understood that rubble, fill and stone will be quarried from within the Nenskra or Nakra valley, therefore is unlikely to represent an introduction source for invasive species from outside the region. As a result of this, bio-control has not been recommended.

4.2.4 Improved access

As part of the development of Project, improved access to the current summer grazing areas within the side valleys of the Nenskra valley, will be implemented. These grazing areas are located in the upper side valleys of the lower Nenskra Valley (i.e. not beyond the proposed reservoir area). The grazing areas to be targeted for improved access are located at altitude, with access routes which run up through already heavily logged forest. As a result of this, improving these access routes is assessed to have a non-significant impact on the habitats present.

JSCNH has committed to build a reservoir by-pass cattle track adjacent to the reservoir, leading to the upstream part of the proposed reservoir during operation. As a precaution, the calculation for direct habitat loss due to this track has been included in Section 4.2.2 above.

The habitats upstream of the reservoir consist of generally mixed species unlogged natural forest habitats (Natural Habitats). The forests upstream of the proposed reservoir area remain generally unlogged; due to vehicular access issues. The *in situ* track does currently run the length of the proposed reservoir area but is frequently destroyed during flood events, avalanches and landslides. The creation of a permanent access, running alongside the reservoir, in the absence of mitigation or management measures, could increase the rate of illegal logging currently occurring. Increased logging of the habitats upstream of the reservoir would change the composition of the forests. Generally it is the pine and conifer species which

are logged as they have greatest commercial value. The loss of these species would lead to a thinning of the forests and the creation of large areas of solely broadleaf forest. In the absence of mitigation, this may have a significant effect on the ecology of the forests, through disturbance and loss of ground flora, as well as loss of tree species diversity.

During the construction of the Nakra weir, the current access track will be improved to allow easier movement of project related vehicles. At the current time there is a vehicle track which runs up the Nakra valley, to the proposed weir location and the up the valley for a further 3km. The track improvement will only be to the Nakra weir location, so the improved section of track is not considered likely to increase the level of vehicular traffic significantly in the area, post construction, or the rate of illegal logging currently being practiced within the valley.

5 Impact on mammals

Please note that the mammal impact assessment has been undertaken in the absence of mitigation. Mitigation (compensation and enhancement) measures have then been detailed separately in Section 8. Mitigation and enhancements have also been implemented for impacts, even where they are not considered "significant" as even non-significant impacts, such as tree felling, can have a negative impact on mammals, such as bats. The residual impacts, once mitigation, compensation or enhancements have been implemented have been assessed in Table 24, Section 9, Summary of impacts and commitments. Section 1.3.5 outlines the reasons that some species e.g. Dinnik's viper and Caucasian viper were scoped out of further assessment.

5.1 Sources of impact

Potential sources of impact are listed below. They have been discussed in the next section where relevant to each receptor. For example water flow change has been discussed in respect of otter, but not for Caucasian squirrel. Due to the type of works taking place, the largest impacts due to habitat loss and disturbance will take place in the Nenskra valley, however for completeness the Nakra valley weir works have also been taken into account where relevant.

Source of impact – construction phase:

- Direct habitat loss
- Indirect habitat loss/change
- Water flow changes
- Human disturbance
- Hunting pressure increase

Source of impact – operational phase

- Water flow changes
- Habitat severance
- Human disturbance

The species taken forward for assessment are those listed as threatened (CR, EN, VU) on the IUCN or Georgian red list, and/or listed as European Habitats Directive Annex II or IV species and are considered to have the potential to be affected by the Project, either directly or indirectly. The receptors being considered are:

- Brown bear
- Eurasian lynx
- Bats (all species)
- European Otter
- Caucasian Squirrel
- Wolf

5.2 Bear

The population evaluation for this species found that there are likely to be between six and ten individual bears using the whole of the Nenskra valley as part of their core range. Only limited signs of bear were identified within the Nakra valley. The habitat mapping (Map 2-6) shows that there is both good and moderate value habitat in both valleys. Over a total area of 683.38km^2 mapped, high value habitat occupies 150.42km^2 and moderate value habitat 204.36km^2.

The average range size for a female brown bear is 100 – 1000km^2 (IUCN 20015). During construction, the Project will result in the loss of 3.55km^2 of habitat in the Nenskra valley, classified as being of generally medium habitat suitability (dam and reservoir impoundment area) but with small areas of transit and good habitat (0.5km^2). The habitats to be lost are widespread and common throughout the area, and are currently being subjected to logging. Habitat loss in the Nakra valley is considered to be minimal, and includes land of low value to bear – open areas for stock grazing. With regards to hibernation habitat, it is considered likely that the reservoir area does not include suitable hibernation habitat for the reasons discussed in Section 2.2.2.1. The direct loss of habitat is considered to have a non-significant effect on the conservation status of this species.

During construction indirect habitat loss is likely to take the form of temporary loss of foraging areas while construction is on-going, such as the laydown areas, quarry areas and encampment. During the site survey bear tracks were frequently noted on vehicle tracks and bear dung was noted in proximity to residential properties. As a result of this, it is anticipated that during construction there may be temporary displacement of bear from the construction areas due to un-natural noise and activity. However, post construction it is anticipated that bears would return to these areas if vegetation is left to re-grow, e.g. in the encampment areas. Indirect habitat loss is considered to have a non-significant effect on the conservation status of this species.

During the construction period human activity in the Project area, specifically where the dam is being constructed, will impact upon bear activity. It is considered likely that due to noise, lighting and disturbance bear would seek to avoid this area. In the absence of mitigation, of excavations are left open, this could lead to entrapment. However after four years, when construction has ceased, bear may seek to transit through the area again while moving through their range. Construction disturbance is considered to have a non-significant effect on the conservation status of this species.

During the construction phase there is the potential for increased hunting pressure on brown bear due to the number of additional people who will be based in the Project area, adjacent to the dam. As it is illegal to hunt brown bear in Georgia (without a licence) all employees of the EPC Contractor will be forbidden to hunt while working on this Project. With no prevention measures in place, increased hunting pressure on brown bear during the construction phase is considered to potentially have a significant effect on the conservation status of this species.

Post construction, habitat severance with regards to the reservoir impoundment area may affect bear movements. The bear signs noted during the 2015 surveys suggested that the bears in the Nenskra valley are using the river as a movement corridor and are likely to be crossing the river within the proposed reservoir impoundment area. However the results of the 2016 surveys show that the bears are able to freely move up into the sub-alpine zone from the valley bottom. From the bear signs noted, brown bear are considered likely to also move between tributaries and valleys without having to use the Nenskra river itself as a movement corridor (i.e. brown bear will cross small passes above the tree line in order to travel throughout the watershed).

Post construction, the reservoir and dam will cover an area of 3.55km^2 and will flood a length of 4.8 km of the Nenskra river, forming a barrier which can only be swum across. At the current time, the bears within the valley do cross the river both below the proposed dam area and above the end of the upstream impoundment area (evidenced by footprints); therefore while free movement within the flooded area will be restricted, their large ranges are unlikely to be severed by this 4.8km long waterbody. No impacts are anticipated in the Nakra valley as the waterbody to be created there will be less than 1 ha in size. In summary, post construction habitat severance is considered to have a non-significant effect on the conservation status of this species.

The habitats upstream of the reservoir represent good quality habitats for brown bear, as they have generally not been logged. Discouraging future human activity in these areas would therefore be beneficial. For the proposed access cattle track which is to be built, in the absence of mitigation, it could allow better vehicular access to the upper part of the valley, which may create easier access for the illegal hunting of this species. Evidence suggests (Pers. Com. Mrs Nona Khelaia acting head of the Biodiversity Protection Service at the MoENRP) that illegal hunting is generally practiced on a local scale. Where hunting of brown bear occurs, it is the local residents who undertake the hunting, using their local knowledge of the area, as brown bears can be quite difficult to track down. Increasing the ease of access to the upper valley (on the Nenskra and Nakra watersheds) may not necessarily increase the rate of illegal hunting. Those that undertake this 'sport' do so on foot at the moment, and are not likely to increase their hunting rate just because they can drive further up the valley. An increase in trophy hunting by outsiders is a possible consequence; however paid for illegal hunting generally involves the use of a local paid guide to find the brown bear to shoot. As a result of this, any increase in brown bear hunting will have to be agreed to by a local resident (to provide the guiding service). The use of locals as guides, to some extent, may end up limiting the amount of hunting taking place, as local hunters do not actually want the brown bear population to be wiped out. It is therefore currently considered that the proposed cattle track leading to the upper watershed parallel to the reservoir would have a non-significant impact on the conservation status of brown bear even in the absence of mitigation.

5.3 Lynx

As stated in Section 2.2.4.2 lynx ranges can be very large covering many hundreds of km^2. During the field surveys only two possible lynx signs were noted. The social impact questionnaire (excerpt not published) also returned a number of results for residents of the Nenskra and Nakra valleys having seen individual lynx in the last two years. While this information is anecdotal only, it suggests that lynx are present in the wider Nenskra and Nakra valleys. Due to the likely range size of this species, the permanent loss of 3.55 km^2 to the reservoir impoundment area and dam, is considered to be a non- significant loss of habitat to this species when compared to the likely total range size for each individual.

As discussed previously the habitat present within the reservoir area is not considered optimum for this species as it is unlikely to support the usual prey species which lynx eat e.g. chamois, tur and lagomorphs, as they tend to live at higher sub-alpine levels. The presence of tur, chamois, and roe deer were all confirmed within the upper Nenskra/Dalari rivers during the 2016 surveys. During the site surveys in 2015 and 2016 only a small number of footprints attributable to roe-deer were identified within the Project Area, strongly suggesting only a small population of this potential prey item is present at these lower altitudes. Temporary habitat loss or change, due the Project, will only affect a very minor part of the lynx's range, and so, is considered to have a non-significant effect on the conservation status of this species. Similarly the 4.8km length of the reservoir is not considered likely to sever the lynx's habitat, as it will occupy such a relatively small section of its larger range.

During the construction phase there will be higher levels of disturbance in the area of the dam, power house and Nakra weir areas (noise, deep excavations and lighting). It is considered likely that this disturbance will temporarily displace the small number of lynx which may occasionally be present from these areas. If lynx are transiently present in works areas, in the absence of mitigation deep excavations could entrap lynx. Studies have shown that lynx are able to adapt to live in a shared landscape and do habituate to human presence (Bouyer 2014[102]), so it is considered likely that post construction, lynx would habituate to the presence of the dam, penstock and weir structures and so would transit through these areas to their hunting grounds if required. Disturbance during construction is considered to have a non-significant effect on the conservation status of this species.

The habitats upstream of the reservoir represent more optimal habitats for lynx as the habitats here are more pristine and less disturbed, with access to the sub-alpine and alpine areas where lynx prey species are to be found. Discouraging future human activity in these areas, would therefore be beneficial to the lynx population. In the absence of mitigation, the installation of a more accessible cattle track leading up to the upper part of the reservoir area could have a negative effect on lynx through disturbance, however it is considered that this would present a non-significant increase in disturbance, as local residents already access the upper valley on foot, by vehicle (when conditions permit) and on horseback, as evidenced during the 2016 surveys and the well-worn foot paths.

5.4 Bats

All bat species in Georgia are protected under the framework of the Convention on Conservation of Migratory Species of Wild Animal (CMS) and its agreement on Conservation of Populations of European Bats (EUROBATS). Therefore, all species of bat present within the Project area, have been subject to an impact assessment. Fourteen bat species were identified from sonogram calls as being present (or potentially present where tentative identifications were made) within the Project area. Of these species, seven were recorded in the reservoir area. No records of Georgian Red List (2006) species were made from the reservoir, however calls identified as being from the Georgian Red List species, barbastelle bat were made at Tita. It is also worth noting that the overall bat activity rate was also a lot lower in the reservoir area than at Tita downstream (91 bat passes over seven nights recording, compared to 920 bat passes at Tita during the same recording period).

The main impact for bat species within the Nenskra valley will be direct habitat loss. The reservoir impoundment area and dam will result in the loss of 3.55km^2 of land, of which 2.4km^2 may contain suitable roosting habitat for bats in the form of trees. No caves were found in this area and it is assessed that bats do not hibernate within the impoundment area.

During the construction period the actual flooding of the reservoir will take place over eighteen months; therefore the waters will rise slowly. It is anticipated that any bats present during the summer/autumn months, will be able to fly away from their roosts in advance of the rising water, as they would seek not to roost within trees already surrounded by rising water due to localised changes in climactic conditions caused by the water. As a result of this the flooding is not considered to cause the direct death of bats, and is considered to have a non-significant effect on the conservation status of this species.

During the construction period, disturbance during night time may occur through the use of machinery and lighting. Due to the wide availability of alternative foraging and roosting habitat

[102] Bouyer Y. (2014) Tollerance to anthropogenic disturbance by a large carnivore: the case of Eurasian lynx in south-eastern Norway. Animal Conservation 18, 271-278.

within the Nenskra valley, disturbance during the construction period is considered to be non-significant in terms of the conservation status of the bat species present.

As bats are flying mammals, habitat severance is not considered to be an issue, changes in the flow of the river Nenskra are also not considered to be relevant. In fact, post construction, the presence of a water body within the foraging range of the bat species may have a significant beneficial effect on the conservation status of bat species, by providing alternative open foraging areas away from trees. The bats in the Project area are insectivorous; so the reservoir may also provide additional suitable foraging habitat, with an increase in aquatic flying invertebrates for bat species to forage on.

5.5 Otter

The surveys undertaken in 2015 did not find any signs of presence of otter. Otter presence was identified at four separate locations 2015 ESIA. Otter populations on the Nenskra River are therefore considered to be low. Riverine habitat loss as a result of the Project is likely to be limited; however habitat creation may result when the reservoir is created. The reservoir will be subject to seasonal variations in capacity, however if the trout populations can be sustained within the reservoir area, these fluctuations in levels are not assessed to have a significant impact on the local otter population and the provision of a reservoir with a brown trout coud have a positive impact on the conservation status of the otter in the region. During operation, the current river flow down the Nenskra and Nakra rivers will be significantly altered. In the Nenskra River, the minimum outflow from the dam will $0.85m^3s^{-1}$, after 2km, the confluence with the Memuli River is reached, beyond this, the Memuli and downstream tributaries will contribute to an increased flow rate. Beyond this, the Nenskra River will carry a flow rate lower than the original, but a flow which is assessed to be potentially beneficial to fish populations (See Section 7.3). As fish are considered to be the main prey item for otter, it is assessed that the change in flow rate in the Nenskra River will have a non-significant impact on the conservation status of this species.

The area where the dam is to be built has been subject to vegetation clearance (September 2015) and now represents unsuitable habitat for otter holts due to lack of vegetation cover. Once construction has been completed however, otter may return to this area, if suitable prey items (fish, frogs, reptiles and small mammals) are present. The dam will be constructed with no fish pass, so if otter are to cross the dam then they will have to do so via the vegetated slope on the east side of the dam face, or via the access track on the west side. This change in upstream dispersal route (to move up past the dam) is considered to have a non-significant impact on the conservation status of this species.

5.6 Caucasian Squirrel

During the 2016 site survey sightings of Caucasian squirrel were made and red squirrel was sighted too. Suitable habitat for this species is present throughout the Nenskra and Nakra valleys. The flooding of the reservoir area will cause the loss of $2.4km^2$ of potentially suitable habitat, which represents only a very small fraction of the habitat present within the Nenskra valley. The loss of this habitat is considered to have a non-significant effect on the conservation status of this species

The reservoir in the Nenskra valley may present a constraint to the movement of Caucasian squirrel from one side of the valley to the other; however the river in its current form is likely to provide a barrier to movement as it is up to c.800m wide in places and not bridged in any way within the proposed impoundment area. Crossing of rivers is likely to be undertaken only where fallen trees span the river or manmade bridges do. These are currently only present

upstream of and downstream of the proposed impoundment area. Habitat severance due to the reservoir is considered to have a non-significant effect on the conservation status of this species.

During the construction period, Caucasian squirrel, are likely to be subject to localised disturbance. However this is a mobile species, which can habituate to human presence sometimes foraging openly in residential areas, even scavenging food from dumpsters[103]. Disturbance during construction is considered to have a non-significant effect on the conservation status of this species

Due to the availability of suitable habitat in the areas surrounding the Project area, and the general ability of squirrel species to habituate to human presence, it is assessed that the Project would not have a significant effect on this species. The operational phase of the project is considered to have a non-significant effect on the conservation status of this species.

5.7 Wolf

The 2016 surveys recorded a single wolf on a camera trap, feeding on a carcass. Wolf prints were also noted in a side valley of the Nenskra Valley. As wolf territories are large (100 – 500 km^2) it is considered that the habitats present within the Project Area, while they form part of a wolf territory, only form a very small part of the total territory. Due to the likely range size of this species, the permanent loss of 3.55 km^2 to the reservoir impoundment area and dam, is not considered to be a significant loss of habitat to this species when compared to the likely total range size for each individual or pack. In addition to this, temporary displacement of wolf, during the construction phase of the dam is not considered to have a significant effect on this species. In fact wolf do not appear to be deterred by human presence (in 2016 a female wolf was recorded on camera just 100 metres from a house in Tita Village); so the construction phase is assessed to have a non-significant impact on the conservation status of this species.

Post construction it is anticipated that wolf will habituate to the presence of the reservoir and dam and will continue to use the area as part of their current range. Therefore the operational of this scheme is considered to be non-significant impact on the conservation status of this species.

[103] Sadeghnezhad, J., Z. Tootian, G. Akbari, R. Chiocchetti. 2012. The Topography and Gross Anatomy of the Abdominal Gastrointestinal Tract of the Persian Squirrel (Sciurus anomalus). International Journal of Morphology, 30/2: 524-530.

6 Impacts on birds

Please note that the bird impact assessment has been undertaken in the absence of mitigation. Mitigation (compensation and enhancement) measures have then been detailed separately in Section 8. Mitigation and enhancements have been implemented for impacts, even where they are not considered "significant" as even non-significant impacts, such as tree felling, can have a negative impact on birds. The residual impacts, once mitigation, compensation or enhancements have been implemented have been assessed in Table 24, Section 9, Summary of impacts and commitments.

6.1 Source of impacts

Potential sources of impact are (i) habitat loss or (ii) disturbance. The impact analysis has been structured so that every receptor brought forward for analysis has been assessed in relation to the likely Project impacts where relevant.

6.2 Receptors being considered

The receptors considered in this section are those bird species which are listed on the Georgian Red List (2006) and or IUCN red list as "threatened" (critically endangered, endangered or venerable) and which have been recorded within the ornithological study area (Table 6). Species which are European Birds Directive Annex 1 but are not listed as a red list threatened species, have not been included in this assessment as significant impacts on the conservation status of these species is not anticipated as a result of the Project. The species have been grouped for ease of analysis based on their likely usage of the Project area. The groups are: passage migrants, regular non-breeding visitors, year round breeding residents and altitudinal migrants present in some winters. Each species within these groupings has then been subject to an impact analysis.

6.3 Impact analysis

6.3.1 Passage Migrants

These species are described as passage migrants as they are only likely to occur within the wider area while on passage to other areas, i.e. during their spring or autumn migrations. They are listed and considered in Table 18 . The information used below has been taken from the Ornithological Report (Annex 2) unless otherwise referenced.

Table 18 - Impact analysis of passage migrants birds

Species	Status of presence	Assessment
Egyptian vulture	PM	A very rare passage migrant in the ornithological study area. Restricted to open habitats[104], which are limited within the Project area Most records are therefore likely to refer to birds flying over on migration. On this basis, and due to the infrequency with which this species has been recorded in the ornithological study area, the Project is considered to have no effect

[104] Snow D.W., Perrins C.M. (1998) The birds of the Western Palearctic (Concise Edition). Oxford University Press.

Species	Status of presence	Assessment
		on the conservation status of this species.
Greater spotted eagle	PM	A very rare, irregular passage migrant, which is relatively more common in the autumn. This species prefers remote areas with no or only few humans. Outside the breeding season occurs in more open and drier habitat (Jais n.d.), which are limited within the Project area. Most records are therefore likely to refer to birds flying over on migration. As a result of this the Project is considered to have no effect on the conservation status of this species.
Common crane	OV	An occasional, irregular visitor, but in very small numbers. The habitats within the Project area are considered to be of low value to this species, no wetlands are present and this is a species which is described as generally avoiding heavily wooded areas (Bird Life International 2015[105]). Most records are therefore likely to refer to birds flying over on migration. As a result of this the Project is considered to have no effect on the conservation status of this species.
Cinereous vulture	OV	An occasional visitor on passage, recorded only as solitary individuals. Forages in open habitats (Snow & Perrins, 1998), which are limited within the Project area and most records are therefore likely to refer to birds flying over on migration. As a result of this the Project is considered to have no effect on the conservation status of this species.

PM – passage migrant; OV – occasional visitor.

The following abundance categories of the birds in the suitable habitats in the wider area are used in the table above (taken from the Ornithological Report Annex 2):

- Numerous species - recorded on all of field excursions;
- Common species - recorded on not less than of 50 % field excursions;
- Uncommon species - recorded on 5-50 % of field excursions;
- Rare species - recorded on 1-5 % of field excursions;
- Very rare species - recorded on less than 1 % of field excursions;
- Occasional species or vagrant - recorded occasionally (species was recorded only 1-10 times during study period).

6.3.2 Regular Non-breeding Visitors

These species are described as regular non-breeding visitors as they have been recorded in the wider area throughout the year but breed outside the area. They are listed and considered in Table 19 below. The information used below has been taken from the Ornithological Report Annex 2 unless otherwise referenced. The abundance terms used are the same as those described in relation to Table 18 above.

Table 19 - Impact analysis of altitude breeding birds

Species	Status of presence	Assessment
Eurasian Griffon (vulture)	YR-V	This species is a very rare visitor during the breeding season, a rare passage migrant an occasional winter visitor. It does not breed within the ornithological study area. Forages in open habitats which are limited within the Project area and therefore most records are likely to relate to birds flying over. The Project is therefore considered to have no effect on the conservation status of this species.

[105] BirdLife International (2015) Species factsheet: Grus grus. [Online] Available at: http://www.birdlife.org [Accessed 17 November 2015].

Species	Status of presence	Assessment
Golden eagle	YR-R	Golden eagle is a very rare year-round resident breeding in adjacent areas. Forages in open habitats which are limited within the Project area and therefore most records are likely to relate to birds flying over. As a result of this the Project is considered to have no effect on the conservation status of this species.
Bearded vulture (Lammergeier)	YR-V	This is a regular but rare visitor to the ornithological study area on passage and in winter and a very rare visitor during the breeding season from nesting sites in adjacent areas. This species searches for food mostly above the tree line (Jais n.d.). This species also has vast home ranges. The species occupies remote, mountainous areas, with precipitous terrain, usually above 1,000m, and in particular areas where large predators such as wolves and Golden Eagles are present, and there are herds of mammals such as mountain goats, ibex, and sheep (reported in Birdlife International 2015). The Project area is wholly situated below the tree line and most records of birds within the Project area are likely to relate to birds flying over only. As a result of this the Project is considered to have no effect on the conservation status of this species.

YR-R- year-round resident; YR-V- year-round visitor.

6.3.2.1 Year round breeding residents

Only one Georgian Red List species is considered to be a year round breeding resident. This is the Boreal Owl (or Tengmalm's owl). This species is described as inhabiting forest, particularly spruce forest, but also lives and breeds in mixed (conifer and broadleaf forest) between 1100 and 1800 metres (Snow & Perrins, 1998). The Ornithological Report (Annex 2) describes this species as being a rare, year round resident.

Habitat loss within the reservoir area could have an impact on this species if present; however there are no population statistics available for this species, so it is difficult to assess the significance of the potential impact. Further surveys would be required in order to determine whether this species is present within the reservoir area (where habitat will be lost) so that the impact can be more fully assessed and appropriate mitigation provided, if required.

In the absence of mitigation, disturbance to this species (if present within the reservoir area) could occur during tree felling and construction if nests are present. The destruction of nests during tree felling may have a significant impact on the conservation status of this species, if found to be present.

6.3.2.2 Altitudinal migrants

Two Georgian Red List bird species are considered to be altitudinal migrants. These are species which generally live at altitude, i.e. above the treeline, but that during the winter, may drop down to valley bottoms. The two species are listed and considered in Table 20 below. The information used below has been taken from the Ornithological Report (Annex 2) unless otherwise referenced. The abundance terms used are the same as those described in Section 6.3.1.

Table 20 - Impact analysis of altitudinal migrant birds

Species	Status of presence	Assessment
Guldenstadt's redstart	YR-V	Very rare or occasional visitor to the ornithological study area, recorded in late autumn and winter. This species breeds up to 5000m in severe climates with summer snow. In the Caucasus it inhabits the uppermost belts of mountains and narrow defiles traversed by rapid mountain streams, also scree and detritus of glacial moraines. (Snow & Perrins

Species	Status of presence	Assessment
		1998). These are habitats which lie outside of the Project area. In winter this species is a short distance altitudinal migrant, mainly descending to the foothills, valleys and plains for winter months, to feed on berries. While habitat loss due to the creation of a reservoir will occur, the loss will represent less than 2.6km^2 of suitable winter berry feeding habitat, which are likely to be used only rarely by small numbers of birds and which when compared to the availability of other such habitats in the Nenskra and Nakra valleys is considered to be minimal. As a result of this the Project is considered to have a non-significant effect on this species. During the construction period disturbance will occur around the dam and inflow areas. Areas which occupy habitats which are common in the wider valley area. The area of disturbance will be limited; as a result of this the Project is considered to have a non-significant effect on the conservation status of this species.
Great rosefinch	WV	Very rare and irregular visitor to the ornithological survey area. This species breeds above 2500 metres (Snow & Perrins, 1998). In the winter they descend to upper valleys, occupying thickets of *Viburnum* etc. Although this species is described as having a range mainly on the northern Caucasus slopes, it can be present on the south side too. This species usually remains above 2000 metres even in winter, feeding in alpine and sub-alpine zones, especially on steep wind swept slopes with little snow. They will generally descend down to as low as 900 metres only after heavy snow fall. Due to the limited numbers of this species likely to be irregularly present in the ornithological survey area, the loss of 2.6km^2 of valley habitat to the reservoir and the wide availability of similar habitats elsewhere in the valley, the Project is considered to have a non-significant effect on this species. During the construction period disturbance will occur around the dam and inflow areas. Areas which occupy habitats which are common in the wider valley area. The area of disturbance will be limited; as a result of this the Project is considered to have a non-significant effect on the conservation status of this species.

6.3.2.3 General

The Project will lead to the creation of a reservoir, a large body of water. Although a reservoir will be created, it is anticipated that due to the steep sided topology of the Nenskra Valley the flooding of this area will not create wetlands, suitable for attracting waterfowl or other passage migrants which rely on wetlands for feeding, breeding or roosting. In addition to this, it is considered unlikely that passage migrants would change their migratory patterns, as the passes which lead over the mountains and in to the Nenskra valley are not as favourable as those located to the west in Abkhazia and to the east, further upstream on some of the other tributaries of the Enguri river. It is therefore considered that the Nenskra reservoir would not attract additional bird life into the Project area.

7 Impacts on river fish

Please note that the river fish impact assessment has been undertaken in the absence of mitigation. Mitigation (compensation and enhancement) measures have then been detailed separately in Section 8. Mitigation compensation and enhancement measures have been implemented for impacts, even where they are not considered "significant" as even non-significant impacts can still have a negative impact on fish. The residual impacts, once mitigation, compensation or enhancements have been implemented have been assessed in Table 24, Section 9, Summary of impacts and commitments.

7.1 Source of impact

Potential sources of impact are listed below and relate to both construction and operational impacts. They are discussed in the next section in respect of their potential to impact upon the only fish species considered to be present in the Nenskra and Nakra rivers –brown trout *Salmo trutta morfa fario.*

Section 7.3.1.1 assesses the impacts of the environmental flow changes which will occur as a result of the Nenskra dam and Nakra weir.

Section 7.3.1.5 and Section 7.3.2 goes on to assess the other impacts which may occur as a result of the construction and operation of the dam.

- Construction Impacts
  - Sediment release due to construction of the dam
  - Pollution Incidents
  - Habitat loss/change
- Operational Impacts
  - Severance of fish migration
  - Habitat loss/change
  - Changes in water quality
- Fish impingement at intake structures
- Death/injury of fish through transfer pipes.

7.2 Receptors being considered

The only fish species which has been brought forward for further assessment is the brown trout. It is considered to be the only fish species present within the Nakra and Nenskra watersheds and is therefore the only species likely to be impacted upon by the Project. The brown trout is listed on the IUCN Red List states that it is a species of Least Concern. It is not listed on the Georgian Red List as it is not currently considered to occur in Georgia.

7.3 Impact analysis

7.3.1 Nenskra watershed

7.3.1.1 Habitat loss/change

There will be a permanent impact with the loss of a section of the River Nenskra within the reservoir area. This reach currently provides a wide diversity of fisheries habitat including tree debris, braided channels and meanders. The habitat loss will include the loss of river spawning habitat, as trout do not spawn in lakes/ reservoirs and require running freshwater and gravels to spawn.

Given the habitats surveyed, it is considered likely that the future Nenskra reservoir trout population could be enhanced by a net downstream migration of young trout from above the reservoir area, for example from the landslide spawning area. The spawning areas upstream of the reservoir will not be impacted by the construction or operation of the reservoir and therefore should continue to be used by spawning trout.

Within the created Nenskra reservoir, fluctuating water depth is likely to provide the greatest challenge to an establishing trout population, as the operational change in reservoir depth is likely to be up to 90 metres. During summer months, conditions will be favourable for trout as the water level increases within the reservoir offering greater foraging habitat for food.

For more information on the changes in hydrology which are likely to occur on the Nenskra and Nakra rivers, please refer to Volume 5: Downstream Hydrology & Water Quality Impact Assessment.

7.3.1.2 Severance of fish migration

The construction of the Nenskra dam will result in the cessation of downstream fish migration from the reservoir to the lower valley as no fish pass is to be built. No fish pass has been proposed due to the height of the dam (130 metres) and the expected fluctuation in reservoir levels up to 90 metres.

The Enguri River was considered as a potentially hostile environment for brown trout, however recent literature from surveys undertaken for the Khudoni proposed hydropower scheme[106], strongly suggest fish presence in the Enguri River. Despite this, it is considered likely that any upstream migration, from the Enguri would not compensate for the cessation of downstream migration, as the fish would have to pass up through the very fast flowing narrow gorge section on the Nenskra just above the confluence with the Enguri River.

Since no suitable spawning areas were identified on the river Nenskra, downstream of the dam, without mitigation measures the altered migration pattern could reduce the brown trout population over time, post construction, in this river section. Although not surveyed, it is considered highly likely that rivers which flow into the Nenskra such as the Darachi and Ormeleti may provide suitable spawning areas for brown trout as these rivers were found to contain brown trout when surveyed in 2015. Pers. Comm. (email 25/01/16 with Dr., Professor Sergey Afanasyev - Deputy Director of Institute of Hydrobiology of National Academy of Sciences). These tributaries would not be affected by the Nenskra HPP, so may aid in sustaining a viable population of brown trout in the Nenskra river, even in the absence of proposed mitigation.

[106] Ministry of Energy of Georgia (2010) Khudoni – Environmental and social impact assessment. [on line] Available from: http://siteresources.worldbank.org [Accessed 09 May 2016].

7.3.1.3 Water quality in the reservoir

During winter the drop in water-level is likely to bring the trout into contact with lower oxygen levels and thus cause the fish more stress. It is uncertain which areas of the reservoir the fish will favour, but they will avoid the deeper less hospitable areas and remain closer to the surface. Therefore no significant impacts are predicted.

During the first two or three years of post-construction, water quality within the reservoir will be poor and considered likely to be unsuitable for trout, as oxygen levels in the water of the reservoir will be depleted by the decomposition of submerged vegetation and soils. For any fish populations present within the newly created reservoir, this could present a significant impact; however if fish remain in the upstream part of the reservoir close to the inflow of the Nenskra river, during filling, they will likely escape these impacts.

Secondary water quality impacts may also occur during the operation of the reservoir via the establishment of a thermocline. During summer months, water could naturally stratify. The surface water becomes significant warmer than deeper cooler water forming a thermocline, preventing mixing between the surface waters and those beneath the thermocline. In the Nenskra reservoir this is considered unlikely to occur due to the through put of water and the variations in water level over the year. If stratification does occur, it is considered likely to only be present for a relatively short period of time (3-4 months) due to the mixing and movement of water within the reservoir. Nevertheless, a temperature gradient is expected with the surface water being warmer than the bottom water.

During such periods oxygen is not transferred throughout the water column and the surface layers remain well oxygenated and the deeper layers become deoxygenated. Fish will remain in the well oxygenated warmer surface layers and are considered unlikely to be affected by the development of a thermocline. In autumn, air temperature will start to cool the surface of the water, thus changing the density properties of water. This could cause the surface layer to sink and bring the deeper and warmer deoxygenated layer to the surface. Such event could have a significant impact on fish populations if present within the reservoir area (S. Coates, Pers. Ob.). This may not apply to the Nenskra reservoir as during the autumn period the reservoir will be at its highest level, being filled by glacial melt water. Despite surface cooling, the bottom layers of the reservoir are likely to still be cooler, preventing such large scale surface water sinking.

The upper parts of the Nenskra River would likely provide refuge during the first two years of reservoir operation, when dissolved oxygen levels may drop. As the brown trout can seek refuge away from these areas, fish deaths are considered less likely and therefore non-significant.

Water quality impact assessments undertaken by SLR (2017) suggest that by Year 3 of reservoir operation that water quality will be suitable for trout. Dissolved oxygen levels are predicted to be >5mg/l and trout will therefore have access to the reservoir area throughout the year as a habitat.

7.3.1.4 Environmental Flow: change in river flow and water quality

One of the other key sources of potential impact for this Project is the change in flow conditions for trout. More specifically if the proposed environmental flow of 0.85 m^3/s will be sufficient to support aquatic faunal populations, downstream of the Nenskra Dam. In assessing the impacts, the environmental flow rates are only considered critical for the sections of river immediately downstream of the dam until the next tributary forms a confluence, where the river flow will comprise a combination of the environmental flow and the additional tributary flow.

Hydraulic studies undertaken by Stucky[107] and SLR[45] were assessed in relation to flow and changes in water depth. Flow data including river velocities were gathered as described previously and were linked to RHS site assessment and LCUM trout assessment (Annex 4).

Baseline information regarding flow rates can be found in Section 3.1.5 of Volume 5. In summary the baseline mean annual flow rate of the river at the dam site is currently 16.2m^3S^{-1}. The maximum flow rate is 38 m^3S^{-1} (June after the snows melt) and the minimum in winter is 4.3 m^3S^{-1}.

The environmental flows (Discharge Q and River Depth D) have been calculated for the Nenskra for the post Dam scenario in the Volume 5 "Downstream hydrology and water quality impact assessment" of the Supplementary Environmental and Social Studies issued in 2017. The summary flow data for the Nenskra are presented below in Table 21.

Table 21 - Summary flow data for the Nenskra post construction of the Dam

Site	Minimum Mean Monthly Flow (m^3s^{-1})	Maximum Mean Monthly Flow (m^3s^{-1})	Minimum Water Depth (m)	Maximum Water Depth (m)	Minimum flow velocity (ms^{-1})	Maximum flow velocity (ms^{-1})
Dam (FL02)	0.85	0.85	0.40	0.40	0.4	0.4
Tita (FL05)	2.44	15.76	0.53	1.04	0.53	1.1
Powerhouse Upstream	3.33	24.10	0.65	1.37	na	na
Powerhouse Downstream (FL01)	13.06	62.28	1.05	2.21	1.3	1.8

The flow details for the future scenario of the Nenskra indicate that with tributary inputs of water to the main channels then the flow conditions (i.e. velocity and water levels), although reduced from the present day, will continue to provide suitable habitat for fish.

A fish's ability to cope with changes in water velocity is dependent upon their size (length), duration and exposure to flow coupled water temperature (Bone 1995[108]). Trout sustainable swimming speeds where assessed utilising the SWIMIT, Version 3.1 program. Fish swimming speed and endurance was assessed using four trout size/length classes in relation to flow speed and water temperature. The SWIMIT program was developed in the UK to investigate swimming speed ability of 10 species of freshwater fish, including trout. The data gathered for the SWIMIT model is from laboratory test results obtained from a high speed tunnel and a low speed flume (Clough 2009[109]).

The SWIMMIT program allows the user to select the fish species (i.e. trout) and assess the endurance of the length of fish. Five flow scenarios were chosen (1cm/s, 25 cm/s, 50cm/s, 75 cm/s and 100cm/s) and these were based upon 'trout sensitive life stage requirements' (Table 7). Each of the flow scenarios for trout was assessed in relation to four size classes (5cm, 9cm, 14cm and 20cm). The selection criteria for these lengths were based upon fish measured within the reservoir area. Output has been shown for a water temperature of 5°C which is considered to be close to the estimated winter water temperature in the rivers, the results are shown in Table 22 below.

[107] Stucky, 2012, Nenskra Hydropower Project. Phase II Initial Design Hydraulic Studies Report N° 5048.4011.0

[108] Bone, Q., Marshall, N.B., Blaxter, J.H.S., 1995. Biology of Fishes, Second ed. Chapman & Hall, London.

[109] Clough, S.C. & Turnpenny, A.W.H. (2001). Swimming speeds in fish: Phase 1, Environment Agency R&D Report W2-026/TR 1, UK.

The calculations shown in Table 22 show that as flow increases towards the maximum sustainable swimming speed, fish endurance time decreases. Adult trout of 20cm in length are well adapted to coping in high flow condition of 100cm/s which equates to 1 m/s. Although not cited in the table, adult trout can swim against flow velocities in excess of 1.5m/s. The peak flow within the Tita area post construction of the dam, as shown in Table 21, could have a minimum flow velocity of 0.53m/s and a maximum of 1.1m/s. This drop in flow rate especially in the winter months, to the minimum flow rate is likely to allow movement of fish of all size classes. Even fish of 5cm can burst swim against a flow rate of 0.75m/s, allowing them to seek refuge if flow rates increase within that river stretch. Suitable refuge areas, where flow velocities are decreased include eddies behind boulders and areas adjacent to river banks.

Table 22 - Fish assessment results from SWIMIT

5cm long fish				
Water Temperature	Water Velocity	Trout 5cm Burst Speed	Maximum Sustainable swimming speed (Median) cm/s	Maximum endurance time (Median) minutes
5 °C	1cm/s	69 cm/s	48 cm/s	200
5 °C	25cm/s	69 cm/s	48 cm/s	200
5 °C	50cm/s	69 cm/s	48 cm/s	40
5 °C	75cm/s	69 cm/s	48 cm/s	<0.33
5 °C	100cm/s	69 cm/s	48 cm/s	<0.33
9cm long fish				
Water Temperature	Water Velocity	Trout 5cm Burst Speed	Maximum Sustainable swimming speed (Median) cm/s	Maximum endurance time (Median) minutes
5 °C	1cm/s	109 cm/s	82 cm/s	200
5 °C	25cm/s	109 cm/s	82 cm/s	200
5 °C	50cm/s	109 cm/s	82 cm/s	200
5 °C	75cm/s	109 cm/s	82 cm/s	190
5 °C	100cm/s	109 cm/s	82 cm/s	<0.33
15cm long fish				
Water Temperature	Water Velocity	Trout 5cm Burst Speed	Maximum Sustainable swimming speed (Median) cm/s	Maximum endurance time (Median) minutes
5 °C	1cm/s	139 cm/s	120 cm/s	200
5 °C	25cm/s	139 cm/s	120 cm/s	200
5 °C	50cm/s	139 cm/s	120 cm/s	200
5 °C	75cm/s	139 cm/s	120 cm/s	200
5 °C	100cm/s	139 cm/s	120 cm/s	199
Notes: Where maximum endurance time = 200 minutes, then this has reached the theoretical maximum limit of the model and endurance will be a minimum of 200 minutes. SWIMIT Trout assessments for fish <13cm are based upon fish >13cm in length.				

The reduction of flow rate post construction is therefore assessed likely to have an overall effect within the Nenskra and Nakra rivers, of slowing the flow velocity downstream of the dam or weir. Where these flow velocities are reduced it is considered that the habitats present will become less hostile for juvenile fish. The increase in more suitable habitats with a lower flow velocity may also benefit the trout populations in the Nenskra valleys by reducing the amount of fish washed down stream, during peak flow events.

Consideration of Environmental Flows has been assessed at four strategic locations in relation to the impacts of the proposed changes in flow conditions. These are discussed as in the paragraphs below.

A. Downstream of Dam up to the confluence with the Memuli River

Downstream of the reservoir dam there will be a depleted reach to the first tributary, (Memuli tributary) over a distance of c. 2.2km, which will have only the Mandatory Environmental Flow (MER) of 0.85m^3/s.

This depleted reach will be unlikely to provide suitable habitat for trout populations.

The predicted MER water quality will be poor here too during the first two or three years, at 5% DO (saturation), which is equivalent to 0.55 mg/l [110]. Salmonid fish such as trout require good dissolved oxygen condition to thrive and they require dissolved oxygen levels above 5 mg/l (Templeton 1995[111]). As a result the channel upstream of the Memuli tributary to the dam is may become too overwide and shallow to support fish populations with an environmental flowrate of 0.85 m^3/s. The fisheries habitat is currently classified as nursery Grade 2. This habitat will be degraded for trout as a result of the reduction in flow rate.

B. Confluence with Memuli River to Powerhouse

Downstream of the first tributary, inputs of tributary and groundwater flow will improve the hydromorphology of the Nenskra providing flow condition to be approximately 15% of pre-construction levels. Within the river channel beyond this point, there is likely to be an increase in deposition of sediment materials from tributaries and valley sides, due to reduced main channel flow. This will result in more favourable conditions for trout downstream of the reservoir during the summer months and during the spawning season (October-November).

The reduction in flow regime coupled with the natural input of gravels may create new areas of deposition, between the Memuli River confluence and the power house. This could be a positive impact from a fisheries perspective as it will mean that bedload material, including that suitable for fish spawning, will be deposited in the river channel and create suitable habitat where there is currently none. The build-up of these sediments however could take 10-15 years. In the intervening years, the fish present within this stretch would likely still make use of the existing nursery areas and may spawn in these areas too. It is therefore assessed that during the initial 2-3 year post construction, the current population of trout present in this stretch of river should remain viable; however their overall population may decrease due to lack of initial spawning sites.

Therefore, the environmental flow of 0.85m^3/s from the dam, when combined with tributary flow is not considered to be a limiting factor to the viability of the trout populations here. Based on currently available information it is considered that the trout populations downstream of the dam (in the absence of man-instigated management) would be dependent on the natural formation of suitable spawning habitat.

Downstream of the dam, close to the Tita bridge, a stretch of 2.2 km of the river could become a suitable area for nursery (certain) and spawning (likely) grounds as a result of a reduction in river flow during the operational period of the dam. This section of river could therefore be managed as a spawning/nursery ground for trout to increase the likelihood and the timing of the formation of suitable spawning habitats in that part of the Nenskra River.

[110] Nenskra Hydropower Project (2015). Supplementary Environmental & Social Studies. Volume 5 Hydrological & Water Quality Impact Assessment. SLR Consulting Limited.

[111] Templeton, R.G. (1995). Freshwater Fisheries Management. Fishing News Books, Blackwell, UK.

C. Powerhouse to Enguri Confluence – River Nenskra

Due to the outflow of water at the Powerhouse during electricity generation, there will be a marked increase in flow principally during December, January, February & March compared to the existing situation. The fisheries habitat assessment survey classified the Powerhouse to Enguri confluence section of river as suitable for adult fish only (Class 3); no spawning areas are present in this stretch. During the winter generation months, peak flow velocities will increase providing less favourable conditions for adult trout.

The Enguri River was initially assessed not to provide particularly suitable habitat for trout, due to its high flow level and the amount of sediment that it appeared to carry; however published reports form the surveys being undertaken on the proposed Khudoni HPP, suggest that brown trout are present in the Enguri River. However, it is considered unlikely that upstream migration of trout from the Enguri would readily occur due to the steep fast flowing nature of the gorge above the Enguri-Nenskra confluence. The source of fish in the Powerhouse to Enguri confluence is likely to be from upstream on the Nenskra River and its tributaries. Fish which have migrated or been washed down from upstream.

The SWIMIT calculations show that adult trout will still be able to cope with the predicted increased velocities; therefore no significant changes are predicted for this section of river in respect of the trout populations and habitat types present.

7.3.1.5 Other Impacts Nenskra Catchment

A. Sediment release due to construction of the dam

During the construction of the dam and powerhouse the main impacts will be related to building activities that may cause particulate pollution, hydrocarbon/chemical pollution and/or low oxygen levels. Any uncontrolled release of potential pollutants may cause a change in water quality (e.g. dissolved oxygen) and a loss in nursery habitat caused by silt deposition and burden.

Significant impacts occurring from sediment release are considered unlikely to occur, given the fact that fish are a mobile species and will be able to avoid area of high sediment load. Particulate run-off and sediment release would however likely have a localised impact, but this is not considered to be significant as the Nenskra catchment is derived from glacial melt water and an area which is prone to landslides; fish are still present within the catchment, leading to the assessment that as a population they can withstand sediment release events.

Secondary effects from sediment release can cause a reduction in dissolved oxygen levels but this is considered to only have a localised impact upon water quality and therefore have a non-significant impact on the fish populations present.

B. Pollution Incidents

In the absence of mitigation or a pollution prevention management plan, a hydrocarbon release e.g. fuel spill, could have a localised significant impact on fish populations (DETR 1999[112]). The level of impact is dependent upon the volume and type of hydrocarbons released.

C. Death/injury of fish through intake structures/transfer pipes.

During the operation of the hydropower scheme there is potential for trout within the reservoir to travel with the release of flow down the headrace tunnel to the powerhouse. This

[112] DETR (1999) Guidance on the Interpretation of Major Accident to the Environment for the Purposes of the COMAH Regulations.

would result in the death of fish within the transfer tunnel before they reach the turbines due to pressure changes. Studies suggest that this risk is highly variable and can be dependent upon screening arrangements[113]. It is considered that due to the depth of the tunnel from the surface (minimum 30 metres), that even in the absence of mitigation, the trout would seek to actively avoid the headrace tunnel. As a result of this the headrace tunnel is not considered to have a significant impact on the trout populations which may become established in the reservoir area.

D. Power house outflow temperature changes

Due to the outflow of water at the Powerhouse during electricity generation, there will be a marked increase in flow principally during December, January, February & March compared to the existing situation. During these months, the average baseline river temperature is 3.55°c. During the summer months, when less generation will occur, the average water temperature is 12.4°C in July. Volume 5 discusses the predicted water temperatures of the reservoir in more detail than there, however in summary, during December – March the water flowing through the power house outflow is anticipated to be between 3 – 5°C. During the months April – November, when the reservoir is filling, principally with glacial melt water, but the surface waters are being warmed by solar energy, the outflow temperature is predicted to be approximately 10-11°C. The outflow temperatures are considered to be within the mean average baseline temperatures, therefore are considered to have a non-significant impact on brown trout in the lower section of the Nenskra River.

E. Dissolved oxygen levels

With regards to dissolved oxygen levels in the Nenskra River, water quality predictions for the Nenskra River downstream from the Dam have been calculated. These are presented in detail in Volume 5, Section 7.5. The dissolved oxygen levels predicted for the stretch of river downstream of the confluence with the Okrili tributary, will be a minimum of 6mg/l during year one, then will exceed 7mg/l in all subsequent years. This is above the baseline requirement of brown trout, which is 5mg/l.

7.3.2 Nakra catchment

7.3.2.1 Habitat loss/change

Downstream of the Nakra water intake, areas of the Nakra River were assessed to be Grade 2 Nursery areas. During operation, one impact of the water intake is that peak flow events will be attenuated. The resulting flow reduction will occur during all months; however this may actually provide better habitat conditions for supporting trout populations, due to a reduction in peak flow velocities present particularly during summer months. Alternatively the attenuation of peak flow could lead to landslides/avalanche events blocking or changing the river flow, preventing the river from being navigable to fish. Without peak flow events, these blockages of the river, downstream of the weir, could have a significant impact on fish movements.

[113]Federal Energy Regulatory Commission (1995). Preliminary Assessment of fish entrainment at hydropower projects. A Report on Studies and Protective Measures. Office of Hydropower Licensing Washington, DC.

7.3.2.2 Environmental flow

As for the Nenskra River, the present study examined if the proposed environmental flow of 1.20 m^3/s will be sufficient to support aquatic faunal populations, downstream of the Nakra water intake. In assessing the impacts, the environmental flow rates are only considered critical for the sections of river immediately downstream of the weir until the next tributary forms a confluence, where the river flow will comprise a combination of the environmental flow and the additional tributary flow.

The summary flow data for the Nakra River post construction are presented below in Table 23 below.

Table 23 - Summary flow data for the Nakra post weir construction

Site	Minimum Mean Monthly Flow (m^3s^{-1})	Maximum Mean Monthly Flow (m^3s^{-1})	Minimum Water Depth (m)	Maximum Water Depth (m)	Flow velocity (ms^{-1})
Downstream of Diversion Weir	1.2	1.2	0.45	0.45	0.46
2.1 km downstream of weir below Laknashura Confluence	1.4	3	na	na	na
5.5 km downstream of weir below Lekverary confluence at Nakra Bridge	1.9	7.2	na	na	na

Due to the reduction in flow levels on the Nakra River, it is assessed likely that the reduced flow will cause an increase in the deposition of sediment within the river bed. This will result in a more diverse channel habitat for fish where there is currently none.

7.3.2.3 Sediment release and pollution incidents

During the construction weir the main impacts are likely to be similar to those set out for the Nenskra River, that is, particulate pollution, hydrocarbon pollution and reductions in oxygen levels. As with the Nenskra evaluations, particulate pollution is not considered likely to have a significant impact on the fish populations present. A hydrocarbon pollution incident, in the absence of a pollution prevention control plan, could however present a significant impact by reducing the trout population within the polluted area.

7.3.2.4 Changes in water quality

Due to the size of the weir and the fact that a flow rate of 1.2m^3/s will be maintained, changes in water quality due to lack of oxygen etc. are not predicted to occur here; therefore have not been assessed.

7.3.2.5 Severance of fish migration

The construction of the weir on the Nakra River has the potential to create a discontinuous fish population. Embedded design mitigation has allowed for the installation of a fish pass alongside the Nakra weir. In addition to this, one of the key considerations has been the evaluation of a suitable environmental flow rate for the river to allow the fish pass to be used. A flow rate of 1.2 m^3/s will therefore be discharged from the weir via the fish pass. Once the fish pass has been installed, it is assessed that the weir would not cause severance to the fish

population here and so the weir will have a non-significant effect on the trout genetic populations in this river.

7.3.2.6 Fish impingement at intake structures

During the design phase of the Project, the Nakra weir transfer tunnel was designed so that a screen could be fitted. This screen as well as stopping debris from entering the transfer tunnel, will also prevent entry by fish. As a result of this, few if any live or dead fish should enter the Nenskra reservoir from the Nakra River. It is therefore considered that there will be a non-significant impact on fish populations in the Nakra River, as a result of the transfer tunnel.

8 Mitigation strategy

The Project will seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimize impacts and restore biodiversity and ecosystem services have been implemented. Given the complexity in predicting Project impacts on biodiversity and ecosystem services over the long term, the Project has adopted a practice of adaptive management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring throughout the Project's lifecycle.

Taking this in to account, the mitigation hierarchy will be applied. In essence this can be described as a three step process:

- 1. Avoid or prevent negative impacts on the environment in general and biodiversity in particular;
- 2. Minimise and rehabilitate on-site effects of development if impacts cannot be avoided; and
- 3. Offset/compensation measures that are undertaken as a last resort (on or off-site) for the residual adverse impacts.

As stated in EBRD performance Requirement 6 (EBRD 2014) one of the main aims of biodiversity conservation and sustainable management of living natural resources is to adopt the mitigation hierarchy approach with the aim of achieving no let loss of biodiversity and where appropriate a net gain of biodiversity. This section therefore aims to achieve this for the valued receptors identified in Sections 4 – 7.

All of the mitigation, enhancement and compensation measures set out below are designed to complement, incorporate or add further detail to those outlined in the ESIA (2015).

Although not part of the remit for this Project, as noted previously, there will be a 220 kV transmission line connecting the Nenskra power house to a sub-station within the Enguri valley. Based on the high level survey data gathered to date, the powerline, if sited correctly and with appropriate mitigation where required, is unlikely to have significant impact on the biodiversity of the area; however further surveys and a full ecological impact assessment will be undertaken by GSE's ESIA consultants in order to substantiate this high level assessment. Further surveys would also inform the siting of the pylons and cables, so as to reduce risk of bird strike. Bird strike is the main potential impact that may occur. Further surveys would also allow an assessment of bird migration routes, so that cables can be either re-routed or display bird deflectors, to reduce the risk of bird strike. It should be emphasized that the assessment of the cable route is not part of the remit of this Nenskra HPP however the Volume 10 "Cumulative Impact Assessment" provides a high level assessment of the potential environmental and social impacts of the 220 kV transmission line.

8.1 Flora

Avoidance has been achieved through the re use of existing roads where possible. Actual road building has been kept to a minimum to reduce habitat loss and severance. Quarry and borrow areas will be exploited within the Nenskra reservoir and will not encroach above the reservoir full supply level where practicable to keep habitat loss to a minimum. For a project of this scale, habitat loss cannot be avoided; however the area in which the reservoir is to be located,

while forested, has been modified by man and so does not represent pristine natural habitat. However compensation for habitat loss is still proposed.

The next step in the mitigation hierarchy is minimising impacts and rehabilitating on site effects. This will be achieved as follows:

8.1.1 Paracynoglossum imeretinum

The endemic plant species *Paracynoglossum imeretinum* (if verified as such) will be lost during the construction phase, if mitigation in the form of transplantation is not successfully implemented. The species is a biennial annual which grows on well drained basic sandy and/or gravelly soils. It grows in full sun or partial shade. The plant is generally found in the thinned out forests, glades of the Caucasus: Western Transcaucasia, Imereti, Guria, Adzhara). The plant smells of mice. *Paracynoglossum imeretinum* has the common name 'hound's tongue' and has a long history of use as a medicinal herb, though it is rarely used in modern herbalism. (Pers. Com. Dr M. Kimeridze Botanical Expert 24/11/15).

Further survey for *Paracynoglossum imeretinum* is proposed and will be undertaken prior to the main construction works. The survey will have the following aims:

(i) To take photographs and obtain plant material, if required and if able to be done without compromising the conservation status of the species at the site;

(ii) Use the information/material gathered in step (i) to verify the species identification;

(iii) More exhaustive search to determine whether other individual plants are present in the reservoir and wider Project area;

(iv) In situ environmental requirements of this species e.g. current levels of shade, soil type, associated species,

(v) Identification of potential receptor sites outside of the reservoir (or other impact areas) for possible translocation.

This measure is referred later in this report as:

- [BIO 1] Further survey for *Paracynoglossum imeretinum.*

Once the information on *Paracynoglossum imeretinum* has been gathered then a targeted mitigation strategy will be formulated. The Georgian MoENRP recommends in the case of Red List species that a planting ratio of 1:10 should be used, i.e. for the destruction of one plant, ten more should be planted at a donor site; although this is currently not enshrined in law. It is understood that it should be possible to propagate this species if required, through seed dispersal, (Pers. Com Dr. M. Kimeridze Botanical Expert 24/11/15); who provided the following information (source unknown):

"Propagation: Seed - sow in situ in early summer. The seed can be sown in spring or autumn, a period of cold stratification improves germination. Suitable for: light (sandy) and medium (loamy) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: neutral and basic (alkaline) soils. It cannot grow in the shade. It prefers moist soil. The plant can tolerates strong winds but not maritime exposure."

Based on the information gathered from the further surveys described above, a detailed mitigation strategy for transplantation and/or propagation as well as future monitoring will be required. This measure is referred later in this report as:

- [BIO 2] Detailed mitigation and monitoring strategy and implementation plan for *Paracynoglossum imeretinum*.

8.1.2 Reforestation

Over all, a loss of 8.61 km^2 of habitat (permanent and temporary) will occur due to the Project infrastructure - powerhouse, penstock, Nakra weir and impoundment area. This area of loss of habitat is considered to be a significant negative impact. The habitat loss must therefore be compensated for through the implementation of a Reforestation Management Plan, where possible located in the Nenskra/Nakra watershed, with the aim of achieving no-net loss of habitat (within the region) and if possible a net gain.

Implementation of such compensation would rely on securing permissions to plant trees, or specifically manage areas for re-forestation though natural regeneration within the Nakra/Nenskra watershed. Guidelines for setting up such compensation have been set out in Herbst, Kimeridze and Susan (2009[114]) and are based on the principle of no net-loss and where possible net gain. The compensation system relies on area of each habitat type being calculated. This value is then multiplied by a published figure (or habitat score) based on the conservation value of that habitat type. The result is a habitat hectare value, which is used to inform the area of compensation required for that particular habitat type. These principles have been used to compensate for habitat loss elsewhere in Georgia as a result of other large infrastructure (BTC and SCP Pipeline projects financed by the EBRD and the IFC) and may be applicable here.

A detailed floristic inventory will be undertaken prior to the main construction phase taking place. As some tree removal has already taken place, the information contained within the Flora, Vegetation and Habitat Assessment Report will also be used to inform the Reforestation Management Plan. The survey methodology to be used for undertaking the detailed floristic inventory is described in more detail in the Reforestation Strategy, Annex 6. This measure is referred later in this report as:

- [BIO 3] Detailed floristic inventory.

A detailed Reforestation Management Plan will be prepared during the Construction phase of the Project. It will include information on the identification of suitable areas for reforestation, management options and issues, roles and responsibilities. Annex 6 contains a Reforestation Strategy, which will be used as a template for the full plan. The aim at the current time is to reforest areas within the Nakra and Nenskra valleys which have been subject to logging, but are not valued as meadow grazing areas.

The main species which has been logged in the area for its commercial value is *Abies Normanianna* Caucasian fir, which can be replanted in order to recreate the original mixed conifer/deciduous woodland which was once dominant here. The plan will be written on the basis of No Net Loss for the Project, using the habitat hectare method described above. Therefore the areas identified as suitable for replanting and management have been identified as suitable, based on a calculation of the habitats that will be lost to the Project. The aim is that this will result in a greater than 1:1 replanting regime, so may result in a net gain for some habitat types. Although centred on net gain of habitats, the management of these logged habitats, will in the long term also benefit the biodiversity of the area, not just vegetation but also the fauna of the area by creating a forest with grater structural and species diversity than is current. This measure is referred later in this report as:

- [BIO 4] Preparation and implementation of a Detailed Reforestation Management Plan.

[114] Herbst P., Kimeridze M., and Susan C. *Forest eco-compensation in the context of pipeline constructions in Georgia: Economic and legal aspects*. Proceedings of the 10th International Symposium on Legal Aspects of European Forest Sustainable Development. 2009.

8.1.3 Reinstatement

Prior the main construction phase, areas which will be subject to temporary habitat loss will be mapped and surveyed by a suitably qualified botanist. This may be undertaken as part of the detailed floristic inventory. Where habitats have already been lost due to the preparatory works on the site, data will be extrapolated from the Flora, Vegetation and Habitat Assessment Report, so that all habitats can be mapped according to their likely original state/species composition. During the construction phase, a Revegetation and Habitat Management Plan will then be written in order to document the remedial actions required to recreate the habitats or to improve floristically, the habitats which were present in these areas prior to construction. This would involve measures such as tree planting, seeding and protection of slopes using locally occurring species. This measure is referred later in this report as:

- [BIO 5] Habitat loss areas will be mapped and surveyed prior to loss.
- [BIO 6] Revegetation and Habitat Management Plan prepared and executed.

As vegetation will be lost due to the construction phase, this will be collected where practicable and used to form compost, which in turn may be used to aid in the revegetation of areas which have been subject to stripping/erosion of top soils and vegetation.

As with all planting strategies, failures of plants do occur; either due to disease, environmental stress or for other reasons. In order to ensure the best possible success of the planting of the temporary loss areas an aftercare programme will be implemented. This would be in place for up to 5 years post construction. The aftercare programme will involve an annual survey of the revegetated areas to establish if any vegetation failures have occurred and to undertake remedial planting where required.

It is anticipated that by year five, trees and other plants will have established, so beyond this time, aftercare will not be required. This measure is referred later in this report as:

- [BIO 7] Implementation of a 5-year after care programme.

8.1.4 Accesses to remote and preserved areas

As discussed in Section 4.2.2, the presence of a reservoir by-pass cattle track running above the reservoir full supply level has been included in the habitat loss assessment. In the absence of mitigation there may be a significant impact on flora due to illegal logging, made possible by increased ease of vehicular access if not controlled. Mitigation would therefore take the form of blocking or gating the cattle track to vehicles. Local residents would be allowed access on foot, horseback and with stock to the track. Due to the distances involved, it is considered unlikely that cut trees from beyond the reservoir access track would be dragged 4.2 km down to the locked gate close to the dam area by horse, to be loaded on to a vehicle; therefore with mitigation implemented, it is not anticipated that the track would significantly facilitate illegal logging in the upper reservoir area, from that which is currently being practiced. This measure is referred later in this report as:

- [BIO 8] Control of access along the reservoir by-pass cattle track, prevent use by vehicles.

For the Nakra valley, the improved access to the Nakra weir is not considered likely to increase vehicular traffic (disturbance) or the rate off illegal logging in the area. It is however worth noting that the planned Svaneti Protected Area lies approximately 760 metres to the east of the Nakra Weir. Although no significant impacts are considered likely from the upgraded track, it may be a feature which needs to be taken in to consideration when identifying aims and management strategies for the conservation of habitats (and species) within the proposed Protected Area. With this in mind, it is proposed to implement a measure, which includes for

negotiation/meetings with the APA regarding this access track. This has been detailed in Section 8.5.

8.2 Mammals

No significant impacts are predicted in respect of mammals, however some impacts are still considered to be negative. As a result of this, mitigation and enhancement strategies have been proposed. Enhancement strategies include additional conservation actions (such as brown bear monitoring) which will ultimately support conservation actions in the area, such as the development of the proposed protected area.

8.2.1 Bear

The building of the reservoir is not considered to have a significant impact on the brown bear population in the area; though it will likely cause temporary disturbance and displacement from the construction areas. During the construction phase however, trenches and deep excavations will be created. As discussed in the impacts section, wondering mammals, such as brown bear, could become entrapped within in these, possibly causing injury or death. In order to prevent this happening, all excavations, when not being worked on will be fenced to prevent access, or covered with boards, if sufficiently small. These actions should prevent entry by wild animals. This measure is referred later in this report as:

- [BIO 9] Excavations and trenches to be fenced or covered when not in use.

During the construction period, there will be additional workers living in camps within the Nenskra valley. Unmanaged waste could present a draw to brown bear, encouraging them into conflict with humans. During the construction phase, a waste management plan will be implemented, which will contain provision to prevent access by wild animals (brown bear, wolf, lynx etc.) to storage areas. This measure is referred later in this report as:

- [BIO 10] Waste management plan to include measures for discouraging access to waste by wild animals.

Although not specifically implemented because of impacts on brown bear, it is considered that the Reforestation Management Plan (see [BIO 4]) may in the long term benefit brown bear by creating a more stable forest environment with greater tree and shrub cover.

Bear hunting is considered to be one of the main reasons that brown bear populations in Georgia are endangered[115]. It is therefore proposed, that most successful enhancement strategy would be to Engage with Civil Society Organisations (CSO) and to support educational projects in the area aimed at reducing illegal hunting of bear and promoting conservation (of wildlife in general). Educational projects would include actions such as presentations in schools and if practicable involving students in the monitoring of the brown bear and other wildlife. Other community related projects would include supporting eco-tourism as a source of income rather than illegal hunting of brown bear. This measure is referred later in this report as:

- [BIO 11] Engage with local SCOs, formulated educational programme

As discussed previously, the improved cattle track, leading to the upstream end of the reservoir will be created. It is assessed with a probable confidence that this increase in ease of access would be unlikely to lead to an increase in brown bear hunting; however due to the low confidence in the prediction of no increase in brown bear hunting, monitoring for brown bear will be implemented. The results of the monitoring will be used to inform additional conservation actions if hunting is found to have increased. The brown bear data gathered will

[115] Lortkipanidze (2010) Brown bear distribution and status in the South Caucasus. Ursus 21, 97-103.

also be used in support of the development of future protected area, as the data gathered should provide a population estimate for the Nenskra valley, which can be used to inform future conservation objectives in the wider Svaneti area. In this respect the brown bear monitoring proposed here can be viewed as an enhancement measure.

Monitoring is most efficiently undertaken, if it is begun prior to predicted impacts occurring, so that a baseline can be established i.e. prior to the building of the reservoir track. The survey methodology must then be replicable so that year on year results can be compared in order to assess if a population change has taken back. The monitoring should therefore begin prior to the main construction phase of the Project.

The survey methodology will entail walking six to eight predefined transects through the Nenskra valley, which include tributaries to the lower valley and parts of the upper valley. The transect routes will be walked once in September and again in October. During the surveys prints, scats and other signs of brown bear would be noted. Samples of each dung pile will be collected and sent for DNA analysis. Autumn is a time when bears will move down into the valley bottoms in order to feed up on berried plants, so increasing the chance that their dung will be found during a transect walk. The DNA analysis will be used to identify the number of individual brown bears recorded in the valley. These surveys would be undertaken annually for the first five years post construction, the results would then reviewed and the frequency of future monitoring would be determined. From this survey data a population estimate can be made based on the number of individuals identified. If the population of bears appears to be decreasing, then remedial action may be required, such as engaging a ranger to monitor the area for illegal hunting activity. This measure is referred later in this report as:

- [BIO 12] Monitoring brown bear populations.

8.2.2 Lynx

Lynx presence was not confirmed during the surveys, however potential print and a tree mark were found. The building of the reservoir within the large range of the lynx is not considered to have a significant effect on the lynx population within the area. As a result no mitigation has been proposed in respect of this species; though habitat management through the re-forestation plan would likely benefit the conservation status of this species. The covering or fencing off of trenches and excavations will also benefit this species, to prevent entrapment.

8.2.3 Bats

Bats are considered likely to roost within the trees located in the reservoir impoundment area. At the current time it is understood that the trees within this area are to be cut down and removed prior to the impoundment of water taking place.

The 2015 ESIA currently proposes that 1500 bat boxes are erected in compensation for habitat loss.

The information gained during the 2015 surveys strongly suggests that while bats do use the reservoir area for foraging and likely roosting, the population size and species range is limited compared to lower altitudes within the Nenskra valley. Therefore it is considered more practicable to install 150 bat boxes per year for the first ten years of operation. These should be installed on trees within the Nenskra valley. Bat boxes should be of a constructin type which do not require ongoing maintenance. This measure is referred later in this report as:

- [BIO 13] Installation of 150 bat boxes in Nenskra for first 10 years of operation.

Although tree specific surveys for bat roosts were not undertaken in the reservoir area, the lower number of bats detected here suggest that (possibly due to the altitude) there are fewer

bats roosting in the reservoir area. Therefore, further roost surveys are not being recommended prior to tree felling. As a precaution, if trees with large cracks or fissures are felled and a bat roost is suspected, then the tree should be left in situ overnight, so that if any bats are present they can fly away themselves under cover of darkness. This measure is referred later in this report as:

- [BIO 14] If roost is suspected in felled tree, leave it in situ overnight.

Also, [BIO 15] states that tree felling cannot occur during the bird nesting season, unless a suitably qualified ornithologist has certified the tree nest free first. This will benefit bats too, as the reduction of felling during this period will also coincidently protect bat maternity roosts if present within the reservoir area. The bat maternity period occurs between June and July inclusive.

8.2.4 Otter

No otter were noted on the Nenskra or Nakra rivers during the 2015 surveys. However otter are mobile mammals and can cover large home ranges. At the time of survey of the Nenskra proposed dam area, vegetation removal had already taken place here. This will significantly reduce the chance that an otter would chose to use this area for breeding of the location of a holt due to disturbance and lack of vegetative cover on the river banks. In addition to this, the covering or fencing off of trenches and excavations should also prevent entrapment of otter, as otter.

Although no other species-specific mitigation has been recommended for this species, the mitigation implemented for the fish are likely to benefit the otter too. Fish is regarded as being one of the main food sources for the otter, so improving or at the least sustaining the fish population in the Nenskra and Nakra rivers will be directly beneficial to the otter. During the fish monitoring, surveys will also be undertaken (where accessible) within 100m upstream and downstream of the fish monitoring locations for signs of otter presence such as spraint and footprints. This measure will be incorporated into the fish monitoring plan.

8.2.5 Caucasian Squirrel

No mitigation is considered necessary for this species and as such no mitigation, compensation or enhancement has been recommended.

8.3 Birds

It is assessed that the only bird species likely to be impacted upon by the Project would be the boreal owl, due to habitat loss and tree felling within the reservoir area; however there its presence within the Project area has not been confirmed and there are no population statistics available for this species in Georgia, so it is difficult to assess the significance of the potential impact.

As a general mitigation strategy, no tree felling will be allowed in the Project area during the bird nesting season (April to end of July). Trees which have to be felled during this period will first have to be individually checked for absence of nesting birds by a suitably qualified ornithologist prior to removal.

The requirement to fell of trees outside of the bird breeding season is due to the fact that all nesting birds (and their nests/eggs/chicks) are protected by the EC Birds Regulation. Only trees which have been certified nest free will be felled during this time. This measure is referred later in this report as:

- [BIO 15] No tree felling during bird nesting period.

Mitigation for loss of habitats of the boreal owl would likely take the form of the installation of a minimum of five nest boxes, outside of the reservoir area as this species is reported to readily use nest boxes (Snow & Perrins, 1998). These nest boxes would not require ongoing maintenance.

This measure is referred later in this report as:

- [BIO 16] Boreal owl nest boxes to be placed in trees between the reservoir and Tita village.

8.4 Fish – Brown Trout

The mitigation strategy has been based on the assessment that once the dam has been built, the brown trout populations upstream of the dam, would be preserved and have access to spawning areas. The dam on the Nenakra river will sever the river, preventing brown trout from passing. For the populations of brown trout, downstream of the dam, they would lose access to potential spawning areas which are currently present in the reservoir areas. Therefore the downstream populations will possibly[116] only remain viable if suitable spawning habitat is formed downstream of the dam, due to the new flow conditions. Therefore, the strategy centres upon the section of the Nenskra downstream of the dam, where spawning habitats can be artificially created.

On the Nakra the strategy has been developed in order to prevent the likelihood of population severance by the weir and the transport of fish into the transfer tunnel.

The following areas are therefore considered to be key for implementing a suitable strategy:

- Regulation of ecological flow
- River channel maintenance
- Fish screen measures
- Design of fish pass on the Nakra weir
- Monitoring programme

8.4.1 Regulation of ecological flow - Nenskra

An ecological flow of 0.85m^2/s will be maintained from the dam. At the dam site there is a stream which flows into the Nenskra river, just downstream of the dam location. This very steep and in areas, due to landslide debris, subterranean stream, does not provide suitable habitat to support a fish populations. It is therefore proposed that this stream will be diverted from its current path, so that it flows into the reservoir area, upstream of the dam. The initial design planned to completely divert the flow of the stream into the reservoir; however the design of the diversion will be adapted so that a gate can be fitted at the diversion point. This will allow the flow from the stream to be diverted away from the reservoir and back onto its original course, flowing into the Nenskra, almost immediately downstream of the dam.

The stream's flow, via the diversion gate, can then be used to either augment the environmental flow from the dam if required, or to replace the mandatory environmental flow from the dam. This measure is referred later in this report as:

- [BIO 17] Stream diversion at dam to be used to augment or substitute river flows if required for water quality reasons

[116] The term possible is used here, as spawning habitats in the tributaries of the Nenaskra, downstream of the dam were not investigated, therefore spawning habitats may still be present post construction downstream of the dam.

The initial design allowed for the release of the environmental flow through a by-pass pipe in the bottom outlet gate chamber of the dam, designed for a maximum of 0.85 m^3/s, with no possibilities to increase the environmental flow if required. The design capacity of the environmental flow by-pass pipe in the bottom outlet gate chamber will be increased to allow larger release if decided by the operator. It is considered that the option of allowing a larger release should be implemented as it will allow flow rates to be increased from the dam during dry years, if required. This measure is referred later in this report as:

- [BIO 18] Capacity of environmental flow bypass pipe will be increased to allow for larger flow release if required.

8.4.2 River channel maintenance/habitat enhancement – Nenskra

Flow reduction downstream of the Nenskra Dam is likely to change the river channel morphology and impact upon trout habitat. A reduction in channel peak flows during summer periods will reduce the effect of downstream movement of natural bedload (i.e. gravel and cobble material). Over time, it is considered likely that areas of deposition will occur within the river channel and thus reduce the water depths available for fish.

Modern river management techniques have been well documented (RRC 2002[117]) and the development of techniques to maintain river habitat as part of a reduction in river flow. Standard river management would involve maintaining channel depth and width.

The Project will target a 2.2 km stretch of river, downstream of the Tita Footbridge, as a management area, as this area is considered likely to provide suitable habitat for nursery areas and probable spawning areas. This measure is referred later in this report as:

- [BIO 19] River channel maintenance/habitat enhancement to manage spawning areas.

Map 8-1 shows the proposed river area management area. An understanding of the potential change in channel morphology would be required in order to write a targeted management plan. As a result of this, in year 1 of operation, the RHS will be updated and will include both the Nenskra and Nakra rivers. The results of the RHS will be used to inform an understanding of the changes in channel morphology.

- [BIO 20] Year 1 of operation, River Habitat Survey to be undertaken.

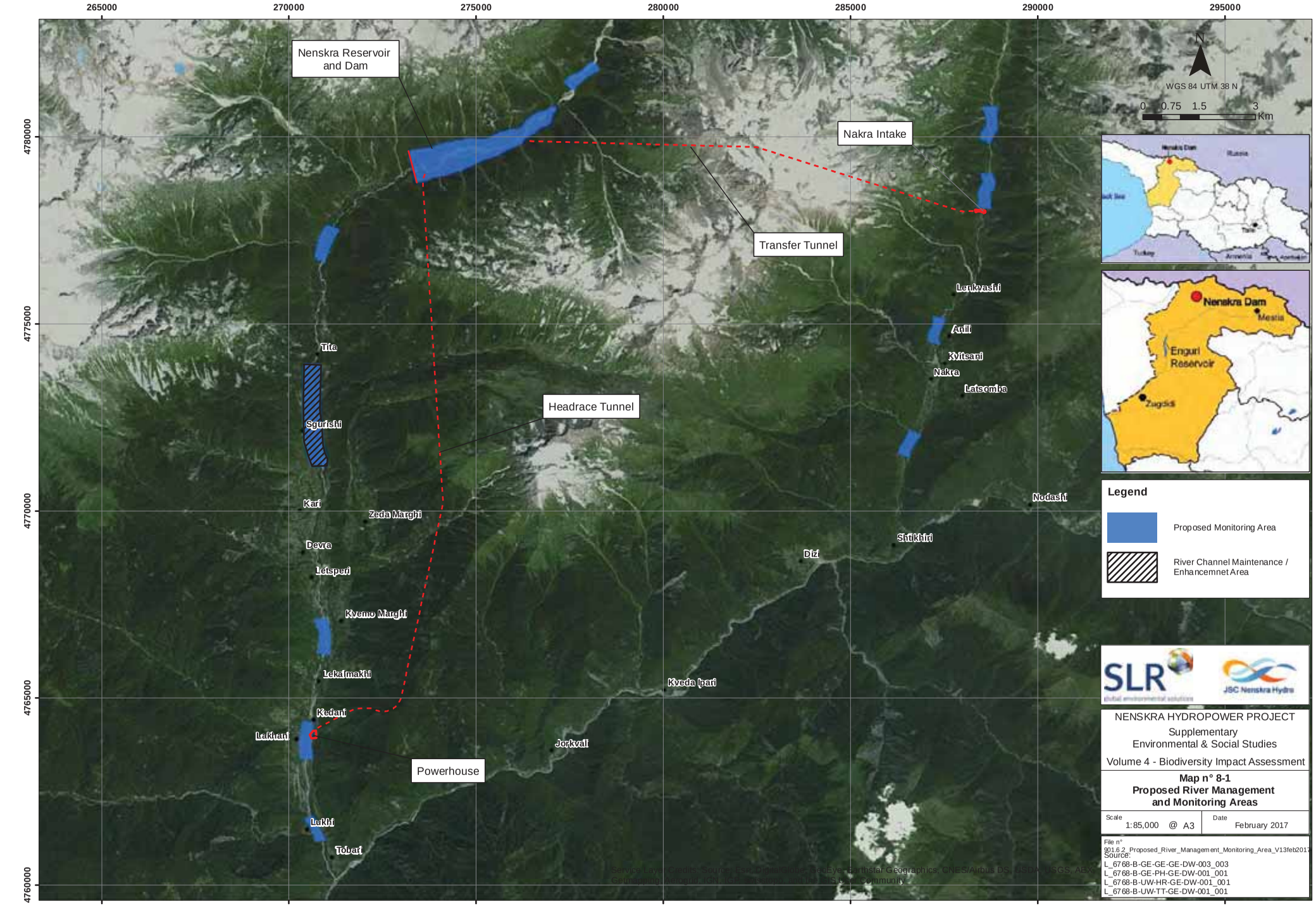
The management plan will also need to include actions which allow for participation of the local population, to foster a good understanding of the need and reasons for the river channel maintenance works. A proposed river channel design would also facilitate the development of any future requirements for channel maintenance. The implementation and aim of the river channel maintenance plan would be to either, facilitate the creation of suitable gravel beds where appropriate if natural deposition does not occur, or to remove gravels where over-deposition has occurred, to increase channel depth and maintain flow in these areas.

In addition to this, JSCNH will take into account the effect that the bottom outlet and spillway operations could have, while implementing the river habitat maintenance programme. This will be done in order to anticipate potential geomorphological changes on river stretches targeted for habitat enhancement and how these could be avoided, minimised or remediated. After a number of years of operation, the first reservoir sediment flushing operation will be required. As part of the preparation for this event an impact assessment will be performed to understand the potential effects which may occur on downstream biodiversity. This will include impacts on river stretches targeted for habitat enhancement. Mitigation measures, if required, will be determined and implemented prior to sediment flushing taking place.

[117] River Restoration Centre (2002). Manual of River Restoration Techniques, River Restoration Centre, UK.

Monitoring of fish populations is proposed for the river channel maintenance area; the results of this will be used to inform the river channel maintenance plan. The maintenance plan will be adaptive and should be reviewed and amended as necessary, based on the data collected, annually for the first five years, then every five years thereafter. Maintenance and monitoring should last for the life time of the project. More detail on the monitoring plan has been included in Section 8.4.5 Monitoring Programme. This measure is referred later in this report as:

- [BIO 21] Fish population monitoring in river channel maintenance/habitat enhancement areas.



8.4.3 Fish screen measures

It is proposed that given the amount of timber and debris naturally moving downstream within the Nakra catchment that standard vertical bar screening should suffice. Within the UK, vertical bar widths of 3-5cm should provide adequate protection for salmonid rivers[118]. This measure is referred later in this report as:

- [BIO 22] Standard vertical bar screening installed on entrance to transfer tunnel channel inlet.

It is likely that smaller screens or other mechanical /hydroacoustic deterrent systems will not work in such a high flow / high bedload environment[119].

A maintenance program will be implemented regarding the clearing and maintenance of the fish screens. The actions will be documented within the operation and maintenance procedures of the dam appurtenant structures. This measure is referred later in this report as:

- [BIO23] Fish screen maintenance measures.

8.4.4 Fish pass on the Nakra River diversion weir

The purpose of a fish pass is to allow the free passage of endemic species of the appropriate developmental stage(s) at the appropriate time(s) of year. It is necessary to understand that the fish pass should allow the passage of juveniles as well as adult trout and that individual fish have a wide range of abilities.

The Environmental Permit awarded in October 2015 by the Government requires that a fish pass be installed on the Nakra River. The initial fish pass design shown in the EPC Contractor initial design is a Denil or Larinier baffle type pass.

There are many different types of fish pass, which are generally variations on the themes of steps, slopes or lifts. The `step` approach involves splitting the height to be passed into a series of small drops with various forms of traverse separating resting pools. The `slope` approach involves spilling water down relatively steep slopes where various forms of baffles are used to dissipate energy and slow down the water velocity. To these can be added diversion, or by-pass channels, as they offer greater scope to allow migration under a range of flow conditions (FAO & DVWK 2002[120]).

Conceptual guidelines for nature-like by-pass channels have been well documented (Jungwirth 1998[121]) and have been incorporated into many recent designs to accommodate fish passage.

In assessing the viability of the fish pass design, a number of criteria were assessed, particularly in relation to channel gradient and bed-load and debris that naturally occur within the River Nakra. This measure is referred later in this report as:

- [BIO 24] A bypass channel is employed at the Nakra Weir site with a short baffled section across the steepest part of the pass.

[118] Turnpenny A.W.H. & O'Keeffe N. (2005). Screening for Intake and Outfalls: a best practice guide. Environment Agency, UK.

[119] Institute of Fisheries Management. (2011). Proceedings of the International Fish Screening Techniques Conference

[120] FAO & DVWK (2002). Fish passes – Design, dimensions and monitoring, FAO, Rome.

[121] Jungwirth, M., Schmutz,S., & Weiss,S. (Eds).(1998). Fish Migration and Fish Bypasses. Oxford: Fishing News Books. pp. 438.

This is principally due to the likely blockage of debris within the current weir fish pass design and the high level of site maintenance required for such a structure. Initially two design options were proposed for the River Nakra bypass channel

- Option A c. 750m in length and includes habitat suitable for spawning
- Option B c. 250m in length and provides the shortest length of channel to support trout migration.

Ultimately however, the greatest impact on the proposed fish pass is considered to be the variable head height behind the weir and the maintenance of a suitable flow level within the fish pass itself. As a result of this, a further option was decided upon, one which will work with variable water heights for both the fish and as an engineering solution:

- Option C: a hybrid fish pass.

The fish pass will consist of a number of different parts. At the upstream inlet there could be a small weir to allow for the maintenance of a minimum water level during the fish migration period. There will also be a protection wall to prevent flowrates greater than 2.4 m^3/s from entering the fish pass when in flood too. This will lead into the artificial, nature like, fish pass. Baffles and boulders will be incorporated into the nature like fish channel in order to dissipate the water's energy aiding fish migration.

The conceptual fish pass design is shown on Figure 6. The detail of the design will be done during the Detailed Design period in 2017. The detailed design will allow for free movement of the fish both up and down this section of the Nakra River avoiding in-river obstacles (weir and ponds).

During the operation of the Nakra weir, measures will be implemented to ensure that as a minimum, the minimum ecological flow will be passed through the fish pass to allow fish to use this pass at all times of the year.

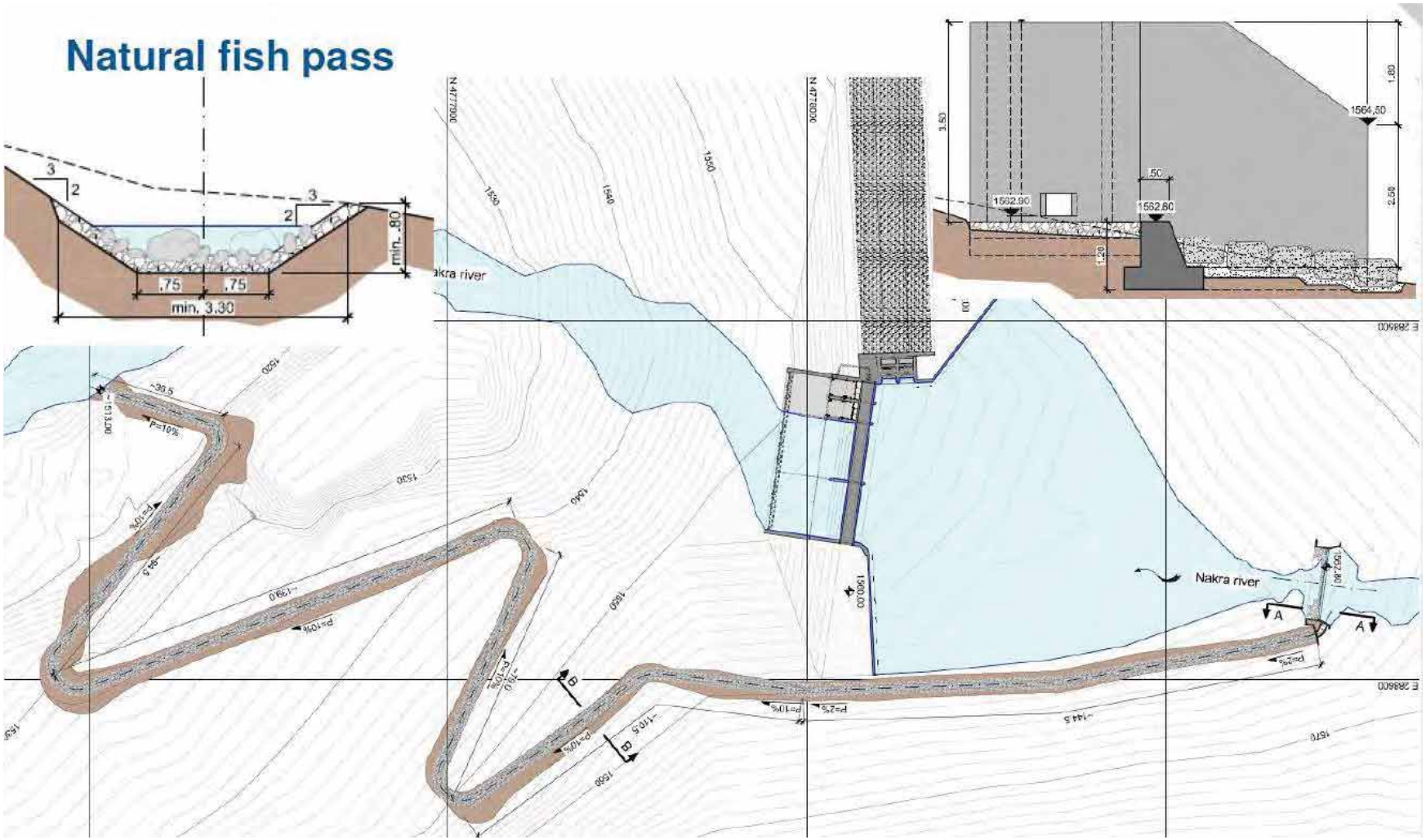
In addition to this, the river will be maintained downstream of the Nakra weir so that it retains the current level of ecological continuity with regards to brown trout. This would be undertaken in coordination with sediment flushing which would be performed periodically. The sediment flushing is expected to be undertaken during flood events, with the aim of re-establishing the Nakra's natural flow i.e. without the weir, to maintain the sediment transport function of the river. Areas requiring additional remedial maintenance would be identified on an annual basis, initially during the fish/invertebrate monitoring surveys, then latterly by undertaking annual update RHS surveys. This measure is referred later in this report as:

- [BIO 25] Nakra River - current level of ecological continuity within river to be maintained, remedial maintenance measures may be required.

Timing of weir and fish pass construction will take into consideration the migratory periods of brown trout. If any works that could block migration are unable to be scheduled outside of the migration season alternative measures must be identified and implemented to enable passage of fish (such as catch and release).

- [BIO 26] Nakra River – timing of weir and fish pass construction outside of migration period or provide alternative measures.

Figure 6 - Conceptual fish pass design at the Nakra water Intake



8.4.5 Aquatic Monitoring Programme

8.4.5.1 Background

The baseline section in Volume 4, has highlighted the lack of fisheries data within Georgia; however as fish surveys have recently been undertaken on tributaries of the Nenskra river, which confirm that brown trout is the sole species present, further baseline surveys have not been recommended.

It is proposed to monitor both the Nakra and Nenskra rivers and the monitoring will comprise two components:

- Fish surveys
- Aquatic invertebrate composition and abundance survey

As this monitoring programme is intended to inform future mitigation and management strategies, it needs to be replicable and to be based on an informative set of preconstruction results. At the current time, baseline data is available, for the River Habitat Survey (RHS) with a known survey methodology; however for the invertebrates and fish data on the methodology used, is not available. Because of this, it is recommended that a consistent approach to monitoring is implemented prior to construction of the dam, so that data from the construction and operational phases can be compared with that from the preconstruction phase.

There are a number of different techniques for undertaking fish monitoring; however at this time, electro fishing for monitoring purposes is banned in Georgia. This situation may change. Until that occurs, the monitoring will rely on other tried and tested methods such as netting.

8.4.5.2 Nenskra reservoir fish surveys - methodology

It is assessed likely that a viable brown trout population can develop in the Nenskra reservoir, as it has in the Enguri reservoir downstream. Monitoring is therefore proposed in order to provide information on the viability of the brown trout population here and also to assess if other species have been artificially introduced. Remedial action such as preventing the stocking of the reservoir with fish species (eg non-natives) may be required, as brown trout are the sole species present in the Nenskra, introducing alternative species could have a significant negative impact.

Ideally electro fishing would be used to estimate fish populations and species presence; however until this type of survey is licenced in Georgia, netting would be the preferred method. The fish quantity in the reservoir can be represented as catch per unitary effort (CPUE). In order to achieve a level of results from which statistically robust calculations and comparisons can be made, a number of standardised catches will have to be made. These will have to take in to account state and behaviour of the fish, weather conditions, time of day, and efficiency of the chosen capture method(s). As a result, a range of survey periods (spring, summer autumn) should be used.

This measure is referred later in this report as:

- [BIO 27] Monitoring of fish within the reservoir - remedial measures implemented if required.

8.4.5.3 Nenskra river surveys – methodology

As stated under [BIO 21] monitoring of fish populations is proposed for the river channel maintenance/habitat enhancement area of the Nenskra river. Monitoring is also proposed for

other reaches of the river, in order to build up a more detailed understanding of the use of the river by brown trout. Below is an outline strategy for undertaking the fish monitoring on the Nenskra river (downstream of the reservoir area). Contiguous with this monitoring, each survey location will be searched for 100m up and down stream for signs of otter. These survey results will be contained within the fish monitoring report.

The only fish species found in the Nenskra river to date is the brown trout. Further surveys will be undertaken on the Nenskra river so that they can provide preconstruction population and use estimates. This survey data will then enable year on year comparisons to be undertaken to identify if any brown trout population or behaviour changes occur in the river during the construction and operational periods. In order to facilitate this, replicable survey techniques will be required, using set survey points, representing a range of river channel types and reaches, as well as standardised survey techniques.

Proposed survey areas are shown on Map 8-1. The survey points will be located within these areas. The areas have been chosen as they represent a range of different habitat types within the river system. The areas cover gorges, braided channels, areas with vegetated banks, bolder cloaked channels and cobble river bed with stock grazed semi eroded banks. One survey point is located upstream of the reservoir. To catch adult fish the following devices will be used: box traps, casting net, fishing rods, trotlines and seine netting. The juvenile trout will likely be caught using seine/landing nets, drift traps and cone traps. As with the reservoir monitoring, the fish quantity in the river, or at each survey point, can be represented as catch per unitary effort (CPUE). In order to achieve a level of results from which statistically robust calculations and comparisons can be made, a number of standardised catches will have to be made. These will have to take in to account state and behaviour of the fish, weather conditions, time of day, and efficiency of the chosen capture method(s).

As can be seen on Map 8-1, there is a 2km survey section on the stretch below Tita Bridge. It is envisaged that a number of survey locations will be located here as this is the area proposed for river habitat management. The results of the surveys undertaken here will be used to inform the river channel maintenance plan. Although fish surveys are proposed here preconstruction, the initial hydrological monitoring will take place in year one after the Project is operational, and will allow for the River Habitat Survey to be fully repeated and re-assessed in light of the hydrological changes as stated in [BIO 20].

It is possible that the reduced water flow will create additional suitable spawning areas in this stretch of river; however this is not certain. A follow up RHS survey, will be undertaken in year one (post construction), using the same method as used for the initial bassline (SLR 2015). The updated RHS results combined with the fish survey results will then be used to assess the number, condition and sex of the fish present in this reach of river; combined with a fully updated RHS assessment. This data can then be used to inform the management of the 2km section from Tita Bridge downstream - or if required the creation of additional holding areas, which fish would use during the winter period, i.e. deep pools which do not freeze during the cold weather.

8.4.5.4 Fish surveys Nakra - methodology

A monitoring programme will be implemented on the Nakra weir. This monitoring programme will be developed in order to verify the efficiency of the installed fish pass and to quantify fish populations as they move up and downstream on the Nakra weir. The exact method used for survey has not yet been determined, but would likely involve the use of a camera or counter installed into the fish pass, such as a VAKI Riverwather system[122]. The data collected (year

[122] For more information on this product (and others like it) please see http://fishbio.com/field-notes/fish-biology-behavoir/vaki-riverwatcher.

round) can then be used to determine if remedial action is needed regarding the fish pass, such as redesign of the baffles, or changes to hydrological flow allowance. As the VAKI system stores data, it can be left in situ to monitor.

If there is no power available at the Nakra weir, then the more labour intensive approach of fish trapping will be undertaken. This type of survey would have to be targeted to a period, just prior to and during the fish spawning season when fish are most likely to migrate through the water course. Therefore surveys would be undertaken between September and November, prior to the freezing up of the river during the winter months. Although this method of survey takes more man hours to complete, it would also allow for the size, sex and health of each fish to be recorded once caught, prior to release back into the river. This measure is referred later in this report as:

- [BIO 28] Fish monitoring programme on Nakra water intake.

In order to allow the monitoring to take place on the Nakra weir, a structural provision will be made so that a control device (for example a trap or counting area) can be installed at the exit of the fish pass in order to monitor its effectiveness. If required the trap/counting area may be installed on the junction between the vertical slot pass and the rough channel section.

As a precaution, fishing for non-monitoring purposes will be banned within the fish pass area, and for a stretch of 25 metres above and below the fish pass. This measure is referred later in this report as:

- [BIO 29] Fishing ban within proximity to the fish pass.

Fish surveys will be undertaken on the Nakra river within the four areas shown on Map 8-1. The methodology used will be the same as described for the Nenskra river.

8.4.5.5 Invertebrate surveys

The study of water invertebrates was conducted with the following purposes:

- Obtaining of data about the natural composition and structure of aquatic macro-invertebrates, their quantitative distribution by main habitats.
- Assessment of biological status of Nenskra river prior Nenskra HPP commencement.
- Assessment of biological status of Nakra river prior to Nenskra HPP commencement (Nakra weir and diversion tunnel).
- Calculation of food basis for the trout based on indicators of abundance and biomass of water macroinvertebrates communities.

Aquatic invertebrate samples will be taken during the same survey periods as the fish surveys, so that the food basis for fish can be defined. For the invertebrates sampling, European Union (EU) standard methods (EN ISO 5667-3, ISO 7828, EN ISO 8689), should be used as these were developed for mountaineer rivers. They employ a sampling method known as “kick and sweep” (Schmidt–Kloiber, 2006[123]). These invertebrate surveys should be undertaken at the same points within the Nenskra river as the fish surveys Map 8-1. Four sample points have also been included on the Nakra river, two below the weir and two above the weir. Undertaking surveys on the Nakra river will aid in determining the health of this river and if the installation of the weir, and changes in hydrology have affected the “health” of the invertebrate assemblage here.

[123] Huber, T., Graf, W., & Schmidt-Kloiber. (2006). Key to Coleoptera (Bettles): Reginal Capacity Building Workshop on macroinvertebrates’ Taxanomy & Systematics for evaluating the ecological status of Rivers in the Hindu Kush-Himalaya (HKH) Region. Nepal: Kathmandu University Dhulikhel.

Homogeneities can be identified using the EU scheme "AQEM/STAR". Collection of drifting macroinvertebrates should be undertaken during each season. Identification of the invertebrates captured, can then be undertaken in a laboratory using invertebrate identification specialists. This measure is referred later in this report as:

- [BIO 30] Invertebrate surveys to be undertaken on the Nakra and Nenskra rivers.

8.4.5.6 Frequency of survey

Surveys of the Nenskra reservoir should be undertaken in year 2 after dam construction, then at 5 yearly intervals thereafter for 15 years, or until the population levels of brown trout in the reservoir have established and hopefully stabilised.

With regards to the Nenskra river fish surveys, it is anticipated that these should be undertaken initially prior to construction of the dam. They should then be undertaken annually during construction, then for the first five years, post construction. At year 5 post construction, the frequency of survey requirement should be reviewed, and may be reduced to once every five years thereafter, in order to continue to assess the efficacy of the maintenance works and the likelihood that the brown trout populations will survive in the Nenskra River. Within each survey year, it is anticipated that surveys would target spring, summer and autumn in order to account for seasonal fish movements within the watershed. The timings and frequency of surveys would be reviewed annually.

For the Nakra weir, monitoring should be started in year 1 post construction and continue for five years. If the computerised system is used, this can just be left to run for five years. After five years of monitoring the efficacy of the fish pass should have been established; so the need for it to continue should be assessed at this point.

For the Nakra fish surveys, these should be undertaken initially prior to construction of the weir. They should then be undertaken annually during construction, then for the first five years, post construction. At year 5 post construction, the frequency of survey requirement should be reviewed, and may be reduced to once every five years thereafter, in order to continue to assess the health and stability of this river.

8.4.5.7 Reporting to inform need for remedial actions

Reporting will be undertaken on an annual basis. A single report containing each year's survey results will be compiled no later than February the following year. These reports can then be used for comparison of the operational, construction and preconstruction fish survey results.

Based on the survey data gathered preconstruction, during construction and in the first year of operation, an assessment for the need for river channel maintenance can be undertaken. The river habitat maintenance plan will be formulated based on the results of these surveys. This measure is referred later in this report as:

- [BIO 31] Annual reports to be provided of the fish and invertebrate monitoring

It is envisaged that the river channel maintenance/habitat enhancement plan will be a fluid document, which should be reviewed and amended as necessary. At a minimum it should be reviewed annually for the first five years, then every five years thereafter. If required the report will be used to inform the need for remedial actions. For example if fish populations in the Nenskra river are found to have dropped significantly for two survey years running, then the following actions would be considered:

1. Catch and release: if brown trout populations below the dam are stable and those above had significantly reduced, it may be possible to catch brown trout from below the dam and

release them above the dam. If the opposite occurs, brown trout would be released below the dam.

2. Re-stocking: if it is not viable to catch and release brown trout from within the Nenskra River, then re-population of the river with brown trout grown in a local hatchery would be considered.

These measures would also be considered for the Nakra River too, if the fish pass on the weir is not being used/effective.

8.5 Proposed Svaneti Protected Area

The Nakra Weir, and improved access track will be located 760 metres from the boundary of the proposed Svaneti protected Area. The provision of an improved access track is not anticipated to increase significantly the current level of illegal logging taking place in the valley. In addition to this, although the boundary of the proposed Protected Area is located close by, it appears to lie predominantly above the main forested habitats, which are targeted for logging in this area.

Despite there being no predicted impacts, as a result of the Project, in the on the proposed Protected Area, it is considered good practice for the Project to aid in the formation of the proposed Protected Area. As result preliminary discussions are currently ongoing with MoENRP with regards to the Project providing assistance towards facilitating the creation of the proposed Svaneti Protected Area. The aim of the discussions is to identify a discrete project or action, which will aid in the creation of the proposed protected area, which can be funded by the JSCNH. This measure is referred to as:

- [BIO 32] Project to negotiate with MoENRP to identify defined conservation project(s) to (part) fund to aid in the creation of the proposed Svaneti Protected Area.

9 Summary of impacts and commitments

Table 24 on the following pages summarizes all impacts, as well as the avoidance, management and mitigation measures (JSCNH commitments) identified as part of the biodiversity impact assessment. The summary table refers to the measures marked [BIO] throughout this report. The [BIO] measures are not necessarily listed in the sequential order of their number.

Some of the measures are also proposed in other Supplementary E&S studies. They are all translated into implementable terms (management action, schedules, responsibilities) in Volume 8 “Environmental and Social Management Plan” of the Supplementary Environmental and Social Studies issued in 2017. For the sake of tracking and consistency, the summary table next page identifies which management plan of the ESMP addresses the commitment made in the present report.

Table 24 - Summary of impacts and commitments - Terrestrial Biodiversity

Environmental or Social Value	Impact Producing Factor	Phase				Assessment of significance without mitigation or compensation High Hi - Moderate M - Low Lo [+] positive, [-] negative Likelihood, Magnitude, Extent, Duration	Commitments Key Mitigation, Compensation or Management measures	Predicted residual impact	Management Action where the mitigation or compensation measure is addressed in the ESMP
		Early Works	Main construction	Reservoir Filling	Operation				
Biodiversity Terrestrial	Deforestation of the reservoir and other Project areas due to clearance prior to flooding and or building of infrastructure.	■	■	□	□	Lo Certain [-] During the construction and filling period, trees will be felled. This will cause the permanent loss of tree nesting habitat for birds both in the reservoir area and the power house area (a total of approximately 2.56km^2). Certain [-] During tree felling operations, bat roosts will be affected. Probable [-] It is anticipated that Boreal owl nesting habitat will also be lost during tree felling activity.	• [BIO 13] Installation of 150 bat boxes in Nenskra for first 10 years of operation. • [BIO 14] If roost is suspected in felled tree, leave it in situ overnight. • [BIO 15] No tree felling during bird nesting period. • [BIO 16] Boreal owl nest boxes to be placed in trees between the reservoir and Tita village.	Lo [-]	Environmental Surveillance of Construction works: SURV2. Wildlife conservation: WILD1.
	Permanent loss of vegetation within reservoir area including floristic species and wildlife habitats due to flooding.	□	□	■	□	M Certain [-] Total loss of vegetation will be 2.06km2 in the reservoir area. This will be permanent, irreversible loss. Lo Certain [-] Permanent loss of an endemic plant species *Paracynoglossum ineretinum* during the construction and flooding phase will occur, the likelihood being near-certain.	• [BIO 1] Further survey for *Paracynoglossum imeretinum.* • [BIO 2] Detailed mitigation and monitoring strategy and implementation plan for *Paracynoglossum imeretinum.* • [BIO 3] Detailed floristic inventory. • [BIO 4] Preparation and implementation of a Detailed Reforestation Management Plan.	Lo [-]	Vegetation management: VEG1. & VEG3.
	Areas subject to temporary habitat loss/disturbance.	■	■	■	□	M Probable [-] Within the Project area, the total loss of vegetation habitats, both permanent and temporary will total 4.25km2 Of this approximately 1.7km2 will be temporary loss. In the absence of mitigation, natural regeneration would likely to take 5-10 years to achieve vegetation cover. Lo Probable [-] During the early works and the construction period, temporary displacement of wildlife is likely to occur due to noise and vibration causing activities. This disturbance is considered likely to have an effect of up to one kilometre from the works areas, but will be temporary in nature lasting only for the four years duration of the construction period. Confidence in this prediction is probable as some wildlife will habituate quickly to the noise/disturbance, so would not be displaced for as long as 4 years.	• [BIO 5] Habitat loss areas will be mapped and surveyed prior to loss. • [BIO 6] Revegetation and Habitat Management Plan prepared and executed. • [BIO 7] Implementation of a 5-year after care programme.	Lo [-]	Vegetation management: VEG2.
	Manmade influence such as trenches and waste disposal.	■	■	□	□	M Probable [-] Wildlife could become entrapped in deep excavations and could be injured or killed Probable[-] Human waste products including waste food could attract wild animals bringing them into conflict with humans.	• [BIO 9] Excavations and trenches to be fenced or covered when not in use. • [BIO 10] Waste management plan to include measures for discouraging access to waste by wild animals.	Lo [-]	Environmental Surveillance of Construction works: SURV1.
	Access track to upper Nenskra valley	□	□	□	■	Lo Probable [-] The installation of an improved access road to the upper Nenskra valley is unlikely to cause an increase in illegal brown bear hunting due to ease of access. M Probable [-] The installation of an improved access road to the upper Nenskra valley may cause an increase in illegal logging activity.	• [BIO 8] Control of access along the reservoir by-pass cattle track, prevent use by vehicles. • [BIO 11] Engage with local SCOs, formulated educational programme • [BIO 12] Monitoring brown bear populations.	Lo [-]	Wildlife conservation: WILD2.
	Improved access to upper Nakra valley	□	□	□	■	Lo Probable [-] The installation of an improved section of access road to the upper Nakra valley is unlikely to cause an increase in illegal logging activity.	• [BIO 32] Project to negotiate with MoENRP to identify defined conservation project(s) to (part) fund to aid in the creation of the proposed Svaneti Protected Area.	Lo [+]	[.....]

Table 25 - Summary of impacts and commitments - Aquatic Biodiversity

Environmental or Social Value	Impact Producing Factor	Phase				Assessment of significance without mitigation or compensation High Hi - Moderate M - Low Lo [+] positive, [-] negative Likelihood, Magnitude, Extent, Duration	Commitments Key Mitigation, Compensation or Management measures	Predicted residual impact	Management Action where the mitigation or compensation measure is addressed in the ESMP
		Early Works	Main construction	Reservoir Filling	Operation				
Biodiversity Aquatic	Building of the dam, severing the continuity of the river Nenskra; creation of still water habitats.	☐	☐	■	■	Lo Probable [-+] Change of fish species diversity in future reservoir area and upstream, due to change from free flowing river to still water habitats. Only one fish species is likely to be present within the Nenskra river. Therefore impounding this species (brown trout) within the reservoir will not affect species diversity, but may affect genetic diversity. Approximately 10km of fish habitat is present upstream of the reservoir area; therefore impoundment is considered only to have a low impact.	• [BIO 27] Monitoring of fish within the reservoir - remedial measures implemented if required.	Lo [-]	Environmental Monitoring: MON3.
	Building of the dam causing severance and hydrological changes on the river Nenskra.	☐	☐	■	■	M Probable [-] In the absence of mitigation, the creation of a barrier to migration of fish (the dam), isolating them in a stretch of river with potentially limited suitable spawning/and or nursery grounds could in the long term (5 – 10) years, have a negative impact on the local trout population. Confidence in this prediction is probable as trout in the Nenskra may spawn in tributaries such as the Darachi and Ormeleti rivers, both of which currently contain viable populations of brown trout. Therefore the outcome of losing spawning grounds in the Nenskra river due to hydrological changes is not clear.	• [BIO 17] Stream diversion at dam to be used to augment or substitute river flows if required for water quality reasons • [BIO 18] Capacity of environmental flow bypass pipe will be increased to allow for larger flow release if required. • [BIO 19] River channel maintenance/habitat enhancement to manage spawning areas. • [BIO 20] Year 1 of operation, River Habitat Survey to be undertaken. • [BIO 21] Fish population monitoring in river channel maintenance/habitat enhancement areas. • [BIO 30] Invertebrate surveys to be undertaken on the Nakra and Nenskra rivers.[BIO 30] Invertebrate surveys to be undertaken on the Nakra and Nenskra rivers. • [BIO 31] Annual reports to be provided of the fish and invertebrate monitoring	Lo [-]	Environmental Surveillance of Construction works: SURV1. Wildlife conservation: WILD3. Environmental Monitoring: MON5.
						M Near-Certain [-] reduction of river flow rate below the dam will lead to loss of suitable habitat for brown trout. The Project has been designed so that an ecological flow will be maintained in the section below the dam and the powerhouse, however at low reservoir levels, without mitigation, water quality changes (reduced oxygen levels) may have a detrimental impact on fish populations.			
	Turbine affected flow rates downstream of powerhouse.	☐	☐	☐	■	Lo Near certain [-+] A 3.5km stretch of nursery/holding grade 2 habitat will be affected by temporary flow changes. The turbine flow rates here could create barren conditions due to intermittent high flow rates, with only low numbers of organisms present that are able to survive in these extreme flow conditions. This will affect only a limited stretch of habitat within the Nenskra valley, therefore it is not considered that mitigation would be appropriate.	• No mitigation proposed.	Lo [-+]	Environmental Monitoring: MON5.
	Transfer tunnel, headrace tunnel and turbine mortality	☐	☐	☐	■	Lo Probable [-] Due to the location of the intake for the headrace tunnel within the reservoir, it is anticipated that few fish would swim down it. The tunnel entrance is deep within the reservoir and will be in sub optimal conditions (dark and likely low oxygen conditions) for brown trout to be present. Any fish swimming down the tunnel will die as a result of pressure changes, before they even make contact with the turbines. Lo Near - certain [-] the Nakra weir has been designed to minimise the likelihood that brown trout would swim down the transfer tunnel.	• [BIO 22] Standard vertical bar screening installed on entrance to transfer tunnel channel inlet. • [BIO23] Fish screen maintenance measures	Lo [-]	Environmental Surveillance of Construction works: SURV1.
	Nakra Weir	☐	☐	☐	■	M Near-certain [-] In the absence of mitigation, the Nakra weir will sever continuity for fish within this river. Fish in the lower part of the river would be prevented from migrating up stream to spawning grounds if the weir did not have a suitable fish pass.	• [BIO 24] A bypass channel is employed at the Nakra Weir site with a short baffled section across the steepest part of the pass. • [BIO23] Fish screen maintenance measures • [BIO 33] Nakra River – timing of weir and fish pass construction outside of migration period or provide alternative measures. • [BIO 25] Nakra River - current level of ecological continuity within river to be maintained, remedial maintenance measures may be required. • [BIO 28] Fish monitoring programme on Nakra water intake. • [BIO 29] Fishing ban within proximity to the fish pass.	Lo [-]	Environmental Surveillance of Construction works: SURV1. Wildlife conservation: WILD3. Environmental Monitoring: MON5.

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