Non-Technical Updated Environmental and Social Impact Assessment Summary Report

Final

UPPER-TRISHULI HYDROPOWER PROJECT, NEPAL

June 2018

Prepared for:
Nepal Water and Energy Development Company (NWEDC) and International Finance Corporation (IFC)

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ERM

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FINAL REPORT

NON-TECHNICAL UPDATED ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT SUMMARY REPORT

FINAL VERSION

UPPER TRISHULI-1 HYDROPOWER PROJECT, NEPAL

June 2018

For and on behalf of:

Environmental Resources Management

Approved by: David Blaha, Partner

Signed: 

Date: 14 June 2018

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ACRONYMS AND ABBREVIATIONS

°C	degree Celsius
µmhos/cm	micromhos per centimetre
µS/cm	micro-Siemens per centimetre
AAPA	Aquatic Animal Protection Act
AD	anno Domini
ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
AoI	Area of Influence
APEC	Alternative Energy Promotion Centre
asl	above sea level
AZE	Alliance for Zero Extinction
BOD	biological oxygen demand
BCS	Broad Community Support
BDL	Below Detection Limit
BMCC	Biodiversity Monitoring and Coordination Committee
BMP	Biodiversity Management Plan
BMU	Biodiversity Monitoring Unit
BS	Bikram sambat
CaCO3	calcium carbonate
CBH	circumference at breast height
CCO	Chief Compliance Officer
CDO	Chief District Officer
CFC	Compensation Fixation Committee
CFUG	Community Forest User Group
CH_4	methane
CHAL	Chitwan-Annapurna Landscape
CIA	Cumulative Impact Assessment
CITES	Convention on the International Trade in Endangered Wild Fauna and Flora
Cl	chloride
CLO	Community Liaison Officer
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COD	chemical oxygen demand
CPUE	catch per unit effort
CR	Critically Endangered
DD	Data Deficient
DDC	District Development Committee
DEG	German Investment Corporation
DFO	District Forest Office
DO	dissolved oxygen
DOED	Department of Electricity Development
DRIFT	Downstream Response to Imposed Flow Transformation
DSCO	District Soil Conservation Office
DUDBC	Department of Urban Development & Building Construction
EA	Executing Agency
Eflow	environmental flow
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMP	Environmental Management Plan
EN	Endangered
EPC	engineering, procurement, and construction

ERM	Environmental Resources Management
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management and Monitoring Plan
ESMS	Environmental and Social Management System
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FI	financial intermediary
FPIC	Free, Prior, and Informed Consent
FUG	Forest Users Group
GHG	greenhouse gas
GLOF	glacial lake outburst flood
GLOW	Glacial Lake Outburst Flood
GoN	Government of Nepal
GP	Parbatikunda Gaupalika
GRM	Grievance Redressal Mechanism
GWH	gigawatt hour
ha	hectare
HMG/N	His Majesty's Government of Nepal
IBA	Important Bird Areas
ICIMOD	International Centre for Integrated Mountain Development
ICP	Informed Consultation and Participation
IDP	Internally Displaced Persons
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IP	Indigenous Peoples
IPA	Important Plant Areas
IPDP	Indigenous People's Development Plan
IPP	Indigenous Peoples Plan
IR	Involuntary Resettlement
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
km	kilometre
km^2	square kilometres
KOSEP	Korea South East Power Company Ltd.
kV	kilovolt
kW	kilowatt
LALRP	Land Acquisition and Livelihood Restoration Plan
LC	Least Concern
LNP	Langtang National Park
LPG	liquefied petroleum gas
LRP	Large Renewable Procurement
m	metre
m^3/s	cubic metres per second
MCT	Main Central Thrust
mg/l	milligrams per litre
MoSTE	Ministry of Science, Technology and Environment
mm	millimetres
MPa	mega Pascal
MW	megawatt
MWh/yr	megawatt hours per year
NA	not assessed
N	nitrogen
NDWQS	Kathmandu Valley Drinking Water Quality Exceeds Values
NEFIN	Nepal Federation of Indigenous Nationalities
NFDIN	National Foundation for Development of Indigenous Nationalities Act
NGO	non-governmental organization

NO^3	nitrate
NPR	Nepalese Rupees
NT	Near Threatened
NTFP	non-timber forest products
NTU	nephelometric turbidity unit
NWEDC	Nepal Water and Energy Development Company Limited
O&M	operations and maintenance
OM	Operations Manual
OM&S	Operations, Maintenance, and Surveillance Manual
OP	Operational Policy
PAF	Project Affected Family
PAG	potentially acid generating
PDA	Project Development Agreement
PDP	Public Disclosure Policy
PM	particulate matter
POL	petroleum, oil, and lubricant
PS	Performance Standard
REA	Rapid Environmental Assessment
RLNB	Red List of Nepal's Birds
RoW	right of way
RP	Resettlement Plan
SANS	S.A.N. Engineering Solutions
SP	spring
SPS	Safeguard Policy Statement
TAR	Tibet Autonomous Region
ToR	Terms of Reference
TSS	total suspended solids
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UT-1	Upper Trishuli 1
VAT	Value-Added Tax
VDC	Village Development Committee
VEC	Valued Environmental and Social Components
VU	Vulnerable
WB	World Bank

ES1. INTRODUCTION

The Nepal Water and Energy Development Company Limited (NWEDC) is proposing to construct the 216 megawatt (MW) Upper Trishuli 1 Hydropower Project (the "Project" or "UT-1") located on the Trishuli River within the Rasuwa District of the Central Development Region of Nepal, approximately 80 kilometres northeast of Kathmandu (Figure ES-1). The Project is of strategic national importance and will be the largest Foreign Direct Investment in Nepal to date, increasing the country's domestic power supply by approximately one-third compared to current levels and providing about 40 percent of its expected 1,456 gigawatt hours (GWH) of annual electricity output during the dry season, which includes the peak winter demand months. The Project's expected commissioning date is October 2023.

The World Bank Group (or WBG, including the International Finance Corporation, Multilateral Investment Guarantee Agency, International Bank for Reconstruction and Development, and International Development Association) is supporting the development of the Project. Other financial institutions considering participating in a lender's consortium include the Asian Development Bank, the Asian Infrastructure Investment Bank, and several European Development Banks, not yet confirmed, but likely to include DEG, FMO, and CDC Group (collectively referred to herein as the "Lenders").

NWEDC prepared an Environmental Impact Assessment (EIA) for the Project, which was completed in January 2012 (herein referred to as the National EIA) and approved by the Government of Nepal in February 2013.

With the subsequent involvement of international lenders, and in accordance with their environmental and social policies and standards, the Project has been classified as Category A due to the inherent and contextual risks associated with hydropower development and Nepal socio-political vulnerabilities. As a result, the National EIA was subjected to extensive strengthening and revisions through a number of supplemental studies to bring the Project into conformance with international standards, most notably the World Bank Performance Standards and Environmental, Health and Safety Guidelines, leading to a Supplemental ESIA (herein referred to as the Supplemental ESIA), which was disclosed by IFC in February 2015.

In April 2015, Nepal suffered a large earthquake centred within 100 kilometres of the UT-1 site. The Rasuwa District, where the Project is located, was one of the worst affected areas. NWEDC provided extensive relief to earthquake-affected people and assisted with some reconstruction efforts in the area. This earthquake resulted in both changed environmental and social baseline conditions in the Project area and modifications to the Project design to address geotechnical and other natural hazard risks. After the earthquake, most of the population from the Project area evacuated and many are still living in internally displaced person camps in the region. Over the last year, a few residents have returned (permanently or temporarily) to their local villages. Most of the local residents, however, are reported to be wary of returning to their original settlements due to the risk of landslides. Also, the younger population is reported to have gotten accustomed to living closer to urban centres, which provide better economic opportunities.

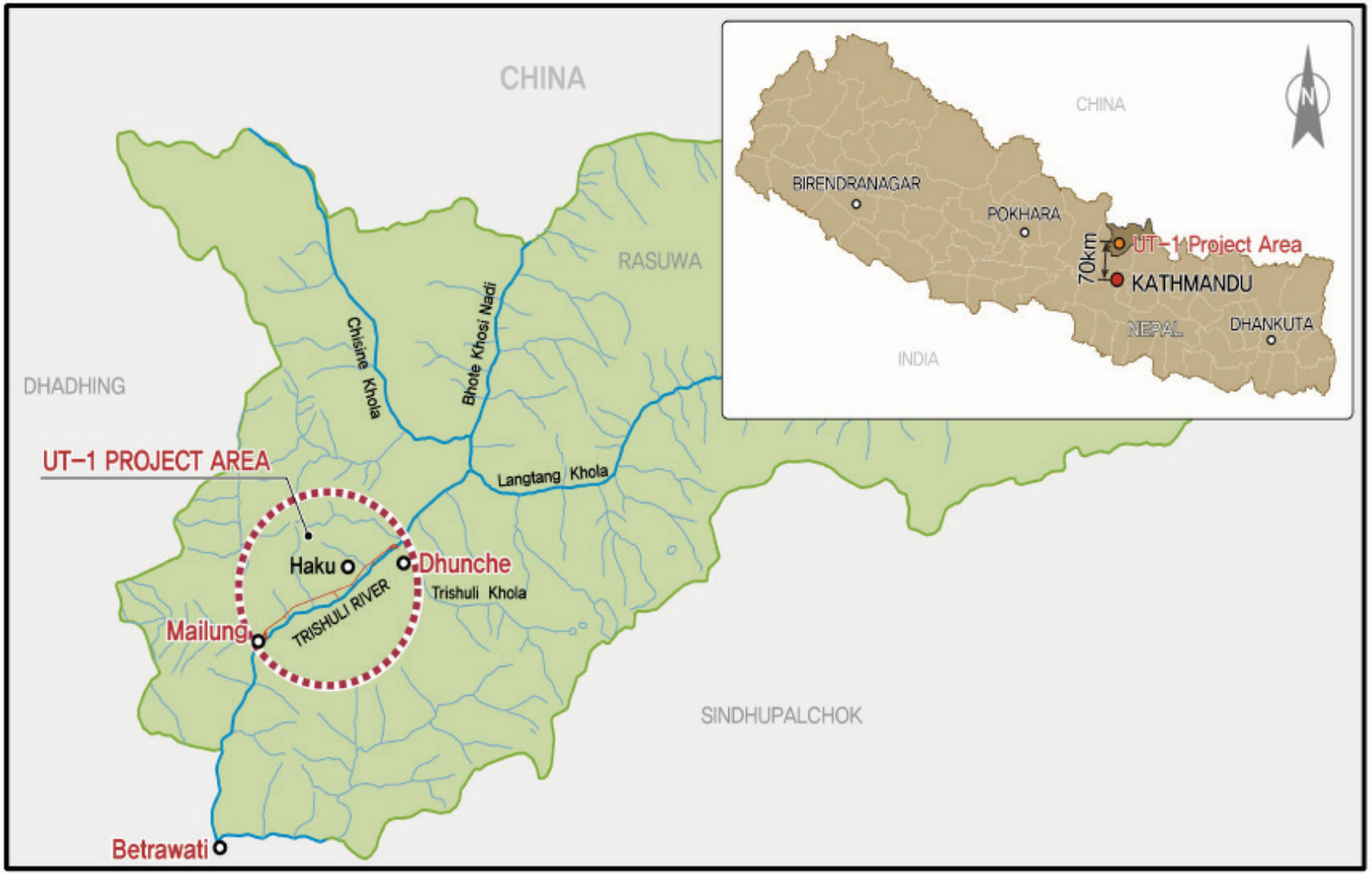

Figure ES-1: Project Location Map

Despite delays resulting from the earthquake, NWEDC has continued to move the Project forward, completing a number of complementary studies and updating other baseline studies. Given these changed baseline conditions, NWEDC selected the international sustainability consulting firm Environmental Resources Management (ERM) to consolidate all prior impact assessments and supplemental and complementary studies into a single Updated Non-Technical ESIA Report (Updated ESIA), along with an updated Environmental and Social Management System (ESMS) Framework and Environmental and Social Management and Monitoring Plans (ESMMP) Framework, including a Social Impact Management Framework. The attached document constitutes the Updated ESIA, with the ESMS and ESMMP Frameworks attached as appendices. By reference, this Updated ESIA includes the National EIA and the Supplemental ESIA. To the extent there may be any conflicts among these documents, the most recent document prevails.

Given the great need in Nepal for domestic power and the fact that other large planned hydropower projects in the country are expected to export a significant amount of their power generation to neighbouring countries, the Project is especially valuable in that it will supply only domestic demand; will increase the country's existing generation capacity by about one-third from a fully domestic resource; and will substitute for fossil fuel generation and could reduce up to 2 million $tCO_2(eq)$ GHG emission annually from the Nepali electric matrix, depending on the assumptions made for the calculation. The Project's location in relatively close proximity to Kathmandu facilitates delivery of power to Nepal's electricity demand centre. Further, as described below, the presence of several other existing hydropower projects along the Trishuli River is one of the rationales for supporting this Project over alternatives in undeveloped free flowing river systems.

ES2. PROJECT DESCRIPTION

The Project consists of a 100.9-metre-wide diversion dam in a narrow gorge located 275 metres downstream of the confluence of the Langtang Khola with the Bhote Khosi River. The diversion dam creates a small 2.1 hectare (ha) impoundment and diverts up to 76 cubic metres per second (m^3/s) of water through a powerhouse with a 216 MW capacity, returning the water to the Trishuli River approximately 10.7 kilometres downstream of the dam. The Project is designed to operate continuously as a run-of-river facility. The Project will connect to the Chilime–Trishuli transmission line via a 1184-metre long, high voltage extension from the Project take-off yard. The Project will be accessed via existing public roads, but NWEDC will construct an 11.84-kilometre private road upstream along the river to access the UT-1 dam.

Project construction will also require the establishment of five worker camps (3 for workers and 2 for JEPC staff - with associated accommodations, diesel power generation sets, fuel storage, water and wastewater treatment plants), four quarries, one crushing plant, three batch plants, several construction/equipment yards, and nine spoil disposal areas. Figure ES-2 shows the location of Project facilities.

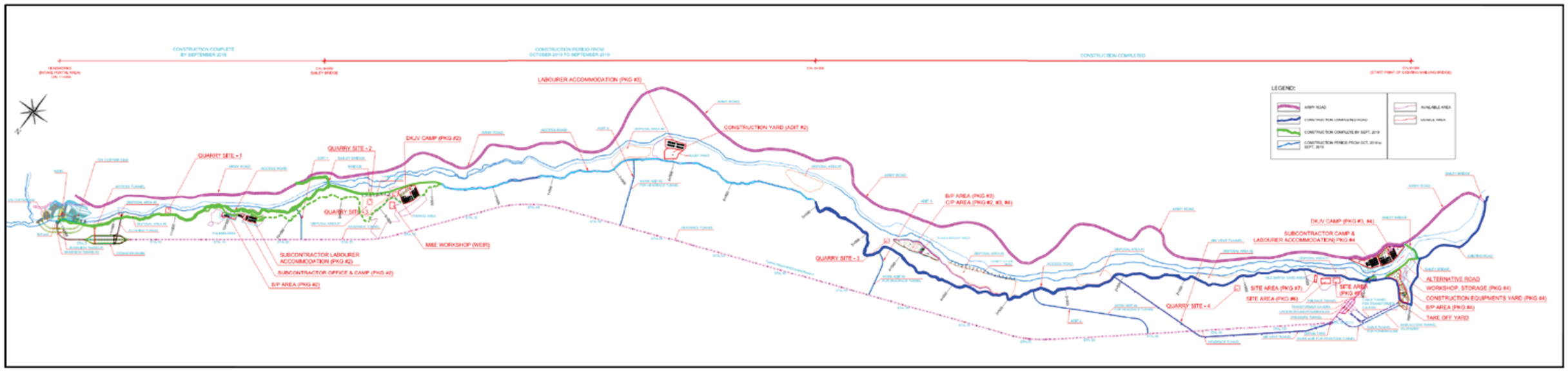

Figure ES-2: Project Design Details

The Project's early works construction (i.e., a portion of the Private Road and the Mailung workers camp) were significantly impacted or destroyed by the earthquake. The Project design was changed in response to the 2015 earthquake to strengthen its geotechnical and seismic design, relocate the Mailung worker camp to a safer location, take into account updated climate change forecasts, adjust to changes in landscape conditions (e.g. landslides), and to optimize engineering aspects of the dam.

An upgraded road from Nepal to China, locally referred to as the "Army Road" as it is being constructed by the Nepal Army, is currently under construction and its alignment generally follows the east side of the Trishuli River in the Project area. The Project design has also been modified to include three new, but temporary, bridges and short access roads to take advantage of the new Army Road and provide improved access to the Project dam and worker camps.

The Project footprint includes all of these facilities, and land clearance will be limited to these facilities.

The Project will take approximately 5 years to construct and will employ about 1,090 workers, with about 10 to 15 percent recruited locally and the remainder from elsewhere in Nepal or expatriates. NWEDC has restarted early works construction, including clearing the portion of the Private Road that was previously constructed of earthquake debris and initial clearing and grading for the relocated Mailung worker camp. Once in operations, the Project will employ 72 staff and produce about 1,456 GWH per year.

The Project is located in a remote area in the upper portion of the Trishuli River Basin, just downstream of the confluence of the Langtang Khola and the Bhote Khosi River. The Langtang National Park forms the eastern boundary of most of the Project area. There are six existing operating hydropower projects and seven projects under construction within the Trishuli River Basin. In addition, the Upper Trishuli-2 Project is proposed, but not yet under construction, and would be located approximately 0.5 kilometre upstream from the UT-1 dam. Two of the existing and two of the under-construction hydropower projects on the main stem of the Trishuli River downstream of the Project (the nearest, UT-3A Hydropower Project, is approximately 1.5 kilometres away). At this time, the Government of Nepal does not have authority in place to identify and manage potential cumulative impacts from multiple hydropower projects.

ES3. STAKEHOLDER ENGAGEMENT

Public consultation and the participation of the various relevant stakeholder groups is a critical component of the impact assessment process. NWEDC started engaging early with local stakeholders, using community liaison officers, and has maintained regular communication and interaction with both local and external stakeholders throughout the Project development process, including:

- 2009 to 2012 during the land acquisition process;
- 2012 to 2014 as part of the various environmental and social assessments (including the National Environmental Impact Assessment [EIA] and the Supplemental ESIA processes);
- 2015 as part of the Livelihood Restoration Plan development process;
- 2016 as part of the Gap Assessment process undertaken by ERM;
- 2017 as part of the Land Acquisition and Livelihood Restoration Plan development; and
- 2018 as part of the formal Free, Prior, and Informed Consent documentation process with affected Indigenous People.

Through these various engagements, NWEDC has attempted to ensure timely dissemination of relevant information to the stakeholders in terms of Project activities, potential impacts, and the proposed mitigation measures.

After the 2015 earthquake, NWEDC proactively engaged with the local community to provide relief and rehabilitation support to the earthquake affected communities. As a part of this engagement, NWEDC, in partnership with IFC, DEG, the local governments and community-based organisations, undertook relief activities, including providing livelihood and sustenance support to people living in internally displaced persons camps. In addition, the company is helping to rebuild two schools and one health centre; remove rubble; and open up local roads for local communities. These efforts have resulted in tremendous goodwill and trust in the Project and NWEDC by local communities (https://youtu.be/s39c3D9Zr6k).

NWEDC has worked to achieve community support and the social license to operate the Project. While the affected communities and other stakeholders may initially have had some concerns regarding the Project, the overall perception is now generally positive. As a result of the April 2015 earthquake, the concerns of the local people have changed as they struggle to restore their homes and livelihoods and adjust to a reorganized government administrative structure, increased land prices, and other changes triggered by the earthquake. The communities clearly view the Project as a source of local development, primarily in the form of access improvements, job opportunities, and benefit sharing. The stakeholders do, however, have areas of concern, including access to relief support, ability to repair family homes, reduced access to natural resources compensation received for trees and crops, and labour influx. The Project's Land Acquisition and Livelihood Restoration Plan (LALRP), Stakeholder Engagement Plan, Grievance Redressal Mechanism, and Labour Influx Management Plans have all been developed keeping these concerns in mind.

ES4. KEY PROJECT RISKS AND MANAGEMENT MEASURES

The Project poses several environmental and social risks. This section briefly describes these risks and how NWEDC proposes to manage them.

ES4.1. EFFECTS ON THE TRISHULI RIVER AND AQUATIC BIODIVERSITY

The Project will affect the water quality, sediment transport, aquatic habitat, and fish of the Trishuli River as summarized below.

The Project may impact water quality as a result of land disturbance and clearing; spoil and muck disposal; solid and hazardous material use/waste disposal; wastewater discharges; and elevated water temperatures. The Engineering, Procurement, and Construction (EPC) Contractor will implement several Environmental and Social Management Plans to manage relatively standard construction risks associated with erosion, sedimentation, waste management, and wastewater treatment. The post-earthquake revised Project design involves significant tunnelling, the rock cuttings from which have not been tested to see if they are potentially acid generating. A Rock Cuttings Management Plan will be prepared by the contractor to pre-emptively sample, analyse, and have in place a mitigation plan in case potentially acid generating rock is encountered. The small Project reservoir (2.1 ha) and short water retention time limit the potential for the Project to impact dissolved oxygen and temperature in the Trishuli River.

Hydropower projects, by their inherent nature, tend to modify the natural sediment regime of a river by trapping sediments behind the dam. The UT-1 Project design includes a desander to trap coarse sediments and periodically flush them back into the Trishuli River. The Project's operational regime also includes periodic flushing flows to move accumulated sediment downstream and prevent the reservoir from filling with sediment.

The existing Trishuli River in the Project area is considered to have an ecological integrity of near natural conditions, and the river is considered Natural Habitat pursuant to the IFC definition. The Project will impact this habitat by creating a 2.1 ha reservoir, constructing a dam across the river, and creating a 10.7-kilometre-long diversion reach that will experience reduced flows. The Project will operate in a true run-of-river mode, which avoids impacts downstream of the power plant discharge that are common with projects with a peaking operational regime. The Project is located at a relatively high elevation in the Trishuli River Basin where high gradient and cold water temperatures limit fish biodiversity. The Common snowtrout (*Schizothorax richardsonii*) is by far the most abundant species found in the Project area, is classified as "Vulnerable" by the International Union for Conservation of Nature (IUCN), and is a migratory species that moves upstream in the spring to spawn, but the winter water temperatures in the Project area are approaching their tolerance threshold.

The Project will divert up to 76 m^3/s of flow from the 10.7-kilometre segment of the Trishuli River between the dam and the powerhouse (i.e. the diversion reach). This flow diversion will reduce the width and depth of water in the diversion reach; thereby potentially impacting aquatic habitat and fish. In Nepal, hydropower projects are required to release 10 percent of the minimum monthly average flow to preserve the minimum habitat required to support fish and

other aquatic life in the diversion reach, and to preserve flow continuity for fish movement/migration through the Project area, which is referred to as an environmental flow, or Eflow. As shown in Table ES4-1, NWEDC has proposed an Eflow that is higher than that required by Nepalese regulations, essentially providing 10 percent of the average monthly flow for each month (i.e. ranging from 3.9 m^3/s to over 50 m^3/s, depending on the month), rather than the minimum monthly average flow (i.e. 3.9 m^3/s for every month).

Table ES4-1: NWEDC Proposed Eflow Regime

Flow Management Scenarios	Mean Monthly Flow (m^3/s) at the Intake Site											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing average river flow regime	43.7	38.6	38.6	49.5	87.5	230.4	487	557.8	370.8	160.4	79.9	54.6
Govt Required minimum diversion reach flow regime	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Proposed minimum diversion reach Eflow regime	4.4	3.9	3.9	5.0	8.8	23.0	48.7	55.8	37.1	16.0	8.0	5.5

Note: Shaded columns reflect fish migration/spawning periods in the Trishuli River based on field sampling.

NWEDC also proposes to install a fish ladder to allow the upstream passage of migrating Common snowtrout and will design a guidance mechanism to help guide downstream migrating fish away from the powerhouse intake. The fish ladder design was reviewed and found acceptable by fish experts from the IFC. The provision of sufficient flow to enable upstream migrating adult Common snowtrout to navigate through the diversion reach to the proposed fish ladder at the dam is critical to achieving successful fish passage to upstream spawning grounds. NWEDC will implement an Adaptive Management Program based on intensive monitoring during the Project's first few years of operation to ensure migrating Common snowtrout are able to their spawning grounds upstream of the UT-1 dam.

The Trishuli River does not meet the definition of Critical Habitat because it does not support any Critically Endangered, Endangered, endemic, or restricted range species; or any highly threatened or unique ecosystems; nor is it associated with any key evolutionary processes. The Trishuli River does support migratory species (e.g. Common snowtrout), but does not support globally significant concentrations of these species.

The Project will implement a Biodiversity Management Plan that achieves No Net Loss of Aquatic Natural Habitat (as evidenced by monitoring documenting successful Common snowtrout [and Dinnawah snowtrout if present] upstream and downstream migration past the Project dam and successful reproduction by Common snowtrout upstream of the Project dam) through provision of environmental flows; installation of a fish ladder; monitoring, adaptive management, documentation of effective fish ladder operation; and research on Common snowtrout migration timing and preferred spawning grounds. These efforts will also improve fish passage design for other future hydropower projects in Nepal and the broader Himalayan region.

ES4.2. EFFECTS ON LANGTANG NATIONAL PARK AND TERRESTRIAL BIODIVERSITY

Project construction and operation will directly impact approximately 108 ha of land, nearly all of which are disturbed and show evident signs of human activity. No globally listed critically endangered, endangered, or endemic terrestrial species have been found in the Project area, furthermore, the area to be directly impacted by the project does not constitute core or critical habitat of any nationally listed terrestrial species of conservation significance. Nearly all of the area affected by the Project is considered Modified Habitat, as defined by the IFC. The Project will not impact any IFC-defined Critical Habitat.

The Project will disturb approximately 6.77 ha of land within the boundaries of Langtang National Park (LNP) — 2.61 ha for dam construction and 4.16 ha for the new worker camp construction. Although within the national park boundary, both of these sites are classified as buffer zone land and are not part of the park itself. The LNP Management Plan specifically encourages development of hydropower projects within the LNP buffer zone. The project will also impact 76.62 ha of community forest outside of LNP, which is classified as modified habitat, but which must be compensated under the national forest policy.

NWEDC obtained approval from the Nepal Ministry of Science, Technology, and Environment for the 2.61 ha impact at the dam site as part of its original environmental authorization and obtained government approval for the revised 4.16 ha worker camp location on 31 December 2017. The 2.61 ha site required for the dam is forested and identified as Natural Habitat. The 4.16 ha site (2.8 ha of government-owned land and 1.36 ha of privately-owned land) required for the worker camp is disturbed, not forested, isolated from the remainder of the LNP by the new Army Road, and classified as Modified Habitat.

NWEDC will mitigate for impacts to Natural Habitat, LNP, and forests by:

- Acquiring at least an equivalent area of similar land for donation to the LNP;
- Contributing to enhanced management of LNP;
- Replacing trees removed during construction at a rate of 2:1 for all trees identified during the regulatory EIA process, and on a 25:1 basis for any additional trees which may be affected during the course of project implementation;
- Providing financial support to LNP and the Community Forest User Groups (CFUG) to support enhanced monitoring and protection of the remaining forest land; and
- Adopting a Worker Code of Conduct that expressly prohibits any hunting; poaching; fishing; collection of, or trade in, any endangered species; and collection of firewood, as well as non-timber forest products (NTFP) from LNP or any Community Forests.

ES4.3. EFFECTS ON PROJECT AFFECTED PEOPLE

The Project is located in a rural area within the Haku VDC, including nine small isolated villages near the Project (i.e., Haku Besi, Sanu Haku, Thullu Haku, Gogone, Tiru, Thanku, Mailung, Gumchet, and Phoolbari). The Project has the potential to affect landowners and tenants as a

result of land acquisition, physical resettlement, and economic displacement; and local villages as a result of impacts to government-owned community forests, construction-related nuisance impacts, and labor influx.

The Project acquired private land owned or leased by 38 owners and tenants (154 associated families) and government-owned community forestland managed by five Community Forest User Groups (CFUG) representing 422 families. These families are collectively referred to as the Project Affected People (PAP)[1]. A significant majority of the PAP belong to the Tamang community, which is a recognized Indigenous group. All PAP are considered vulnerable due to their pre-earthquake socio-economic status combined with the impacts of the earthquake on shelter and livelihoods. In addition to this broader vulnerability, however, certain PAP have been identified as being highly vulnerable due to certain key socio-economic characteristics.

Project effects on each of these Project-affected groups are summarized below.

ES4.3.1. Land Owners and Tenants

Overall, the Project is in general conformance with the requirements of IFC Performance Standard 5, Land Acquisition and Involuntary Resettlement, however, certain gaps were identified which will be addressed through the Land Acquisition and Livelihood Restoration Plan (LALRP) for the Project. The Project required acquisition of 107.79 ha of land through a procurement process that was broadly consistent with international standards (see Table ES4-2). Most of this land (approximately 78 percent) was owned by the government, but there were 39 affected private land owners representing 154 families, including 18 tenants farming the Trust (*Guthi*) land, which is owned by the monastery at Swayambhu in Kathmandu and who were treated the same as land owners in the land acquisition process. This land take and the earthquake, has impacted the livelihoods of these families as a result of reduced agricultural land holdings, changed productivity of remaining land parcels (due to rubble from landslides), and more difficult access to certain land parcels.

The Project required the acquisition of 36 residential structures, including houses, sheds, and a water mill. The Project did result in the loss of 14 primary residences, although several of these were damaged by the earthquake and were not occupied at the time of acquisition. The Project has also resulted in the loss of some community forest land used by 422 households within five Community Forest User Groups (CFUGs).

Table ES4-2: Summary of Land Acquisition

Government Land	Langtang National Park Land[1]	Private Land	Trust Land (*Guthi*)	Mailung HEP Land	Total (ha)	Number of Affected Private Land Owners
78.646	5.41	5.05	15.53	3.15	107.79	39

ha = hectares

[1] Land areas as follows: 2.61 ha to be used permanently for headworks, 2.8 ha of already disturbed/deforested land for the

[1] Please note that the 154 families affected by the private land take and the 422 families affected by the community forest take cannot be simply added together to determine the overall number of project affected families as most of the private land take families are also members of the affected CFUGs.

temporary placement of worker camps (to be returned once construction is finalized). Please note that there is an additional 1.36 ha of land located within the boundaries of LNP, but privately owned so reflected with the Private Land total.

NWEDC has prepared a Land Acquisition and Livelihood Restoration Plan that documents the land acquisition process and ensures that the livelihoods of those incurring economic displacement are restored. ERM notes that concerns have been raised by the owners of a few residential and non-residential structures that were left out of the compensation process. NWEDC has committed to resolving these few remaining compensation concerns in accordance with recommendations in the LALRP by June 2018 so that the land acquisition process can be documented as being consistent with international standards.

ES4.3.2. Local Villages

Project construction and operation will occur in the vicinity of nine rural villages, with those located closer to the river (and primary construction activities) being most affected, including Phoolbari, Haku Besi, Thanku, and Mailung. Residents of these villages will be exposed to typical nuisance construction impacts such as noise, vibration, lighting, traffic, and fugitive dust. These impacts are associated with construction, and therefore will be temporary (albeit the estimated construction period is 5 years) and NWEDC has agreed to several management plans to minimize these impacts such as restrictions on night time construction and spraying water to manage dust.

The CFUGs, to which most of the residents of the local villages belong, manage the community forests and use them for a variety of non-timber forest products. The CFUGs were compensated for the exact number and type of trees removed, but concerns remain that construction may clear more land than originally identified and that construction workers may damage the forests by collecting firewood, hunting, poaching, or other activities. NWEDC will require all personnel to participate in an induction program that includes environmental awareness and cultural sensitivity training, and also provides financial support to the CFUG to do their own monitoring/patrolling of the remaining community forest land.

The Project is expected to employ approximately 1,090 workers, with 85 to 90 percent of them likely to be from outside the Project area and some will likely be expatriates. This influx of labour into the area for an estimated 5-year period increases the risk of social conflict between the local community and the construction workers, illicit behaviour and crime, introduction of communicable diseases, traffic congestion, among other potential impacts. The World Bank has indicated that these labour influx risks are the greatest when the capacity of the host community is low (e.g. no formal law enforcement presence) and when the ratio of the number of workers to community members is high, both of which will be the case for the UT-1 Project (World Bank 2016). In this high risk setting, the World Bank guidance requires an additional specific labour influx management plan. NWEDC is preparing, and will implement, a Labour Influx Management Plan, with specific measures to manage these risks, such as adoption of a Worker Code of Conduct with associated penalties for any violations. NWEDC has already implemented a grievance mechanism so that local residents have an easy way to notify NWEDC of any concerns. Close monitoring of complaints and ongoing engagement with the local villages is critical to pre-empt these risks.

ES4.3.3. Indigenous Peoples

Nearly 90 percent of PAFs directly impacted by the Project belong to the Tamang ethnic group (Nepal's fifth largest), which is identified as an indigenous nationality, or *Adivasi Janajati*, in Nepal. The Tamang have their own language, traditional customary practices, distinct cultural identity, social structure, and oral or written history, as recognized by the National Foundation for Development of Indigenous Nationalities Act (NFDIN 2002).

The presence of this group triggers specific requirements under lender social safeguard policies. World Bank Group Performance Standard 7 (Indigenous Peoples) requires a client to seek the Free, Prior, Informed Consent (FPIC) of affected Indigenous Peoples (IP) communities under specific circumstances, including 'where a project impacts on land and natural resources subject to traditional ownership or under customary use.' Based on UT-1 project impacts on forest land, communally managed by the CFUGs, which are primarily composed of Tamang, it has been determined that FPIC is applicable to this project. NWEDC has been consulting with the Tamang for several years and is currently working with community representatives to finalize formal documentation of FPIC.

ES4.4. COMMUNITY HEALTH AND SAFETY

Even though the area downstream of the Project is not densely inhabited and mostly composed of agricultural lands or community managed forests, the Project has performed a standard dam break study and has committed to constructing the dam in accordance to best industry practices. After the 2015 earthquake, the Project design was modified to take into account better defined seismic hazards (e.g. the Lender's Engineer specified a Maximum Credible Earthquake of 0.83 g [acceleration of gravity] for a 3,000 year recurrence period based on a Deterministic Seismic Hazard Analysis), changes in landscape conditions (e.g. landslides), and to optimise engineering aspects of the dam. The dam design has also been upgraded to withstand a 10,000-year flood event with a combination of spillway gates and an emergency spillway overflow. The revised dam design will be reviewed by both the Lender's Independent Engineer as well as the Project's Panel of Experts. NWEDC will also be required to prepare and implement detailed Emergency Preparedness and Response Plan, in consultation with potentially affected downstream communities downstream.

During Project operations, NWEDC will be required to have the structural integrity of the dam regularly inspected by qualified experts. The common public safety risk associated with the sudden release of water from a hydropower dam is less in this case as the Project will be operated in a true run-of-river mode and as a result only has a small reservoir (2.1 ha).

The Project's Private Road was partially constructed at the time of the earthquake, but was damaged by landslides. The Engineering Procurement and Construction (EPC) Contractor will prepare a Landslide and Slope Stabilization Management Plan to specifically evaluate potential landslide risks on nearby villages, and to the road itself, from access road construction.

The Project will involve significant blasting for the construction of tunnels and other underground facilities and for the 11.84 kilometre Private Road. The EPC will prepare a

Blasting and Explosives Management Plan and a Noise and Vibration Management Plan, including pre-blasting assessment of nearby structures so as to confirm any reports of structural damage.

ES4.5. CUMULATIVE IMPACTS

The IFC is funding a Trishuli River Basin Cumulative Impact Assessment study, which is scheduled to be completed by the summer of 2018. At this point, several Valued Environmental and Social Components (VECs) have been identified as having the potential to be cumulatively impacted by the UT-1 Project, in combination with other proposed hydropower projects and other development activities within the Trishuli River Basin:

- Downstream Water Uses, including water used for irrigation, religious practices, water supply, and in-river sand and gravel mining;
- Fish and Aquatic Habitat – aquatic habitat fragmentation and effects on fish movement; and
- Local economy and livelihoods – loss of agricultural and forest land.

The Nepal government is currently constructing/upgrading the so-called "Army Road" along the east side of the Trishuli River and extending to China, which will significantly improve access to portions of the Langtang National Park and other areas of natural habitat. This improved access also comes with increased risks of illegal logging and poaching, hunting, fishing, firewood collection, and other activities that may undermine the purpose of the National Park and impact the biodiversity value of the natural areas.

Although the relative contribution of the UT-1 Project to cumulative impacts on these VECs in the Trishuli River Basin appears manageable, there is the potential for over 40 hydropower projects in the Trishuli River Basin, which collectively pose significant environmental and social risks. Since cumulative impacts typically result from the actions of multiple stakeholders, the responsibility for their management is collective. At times, cumulative impacts can transcend a regional/administrative boundary and, therefore, collaboration in regional strategies may be necessary to prevent, or effectively manage, such impacts. Where cumulative impacts already exist, management actions by other projects may be needed to prevent unacceptable cumulative impacts. NWEDC is participating in a Trishuli River Basin Cumulative Impact Assessment, and has indicated its commitment to actively participate in a Trishuli Basin Co-Management Platform, which will facilitate multi-stakeholder cooperation and commitment to collaborate in the monitoring and co-management of cumulative impacts in the Trishuli River Basin.

ES5. OWNER CAPACITY

The UT-1 Project will be one of the first hydropower projects developed in accordance with international standards in Nepal. As a result, there is relatively little experience with the international standards among Nepali hydropower developers.

NWEDC has committed to build its internal capacity by adding additional Environmental, Social, Health and Safety (ESHS) staff and by hiring an international advisor to help it operationalize its current Environmental and Social Management System Framework (see

Appendix A). NWEDC will also require its EPC Contractor and future Operations and Maintenance Contractor to have sufficient and qualified ESHS personnel to properly manage the ESHS risks of the project. These contractors will also prepare Construction and Operations Environmental and Social Management and Monitoring Plans (ESMMP) building off an ESMMP Framework that specifies the lenders minimum requirements (see Appendix B), and which will be reviewed and approved by the lenders. These Management Plans include a Management of Change process, which requires NWEDC to notify and obtain lender approval for any changes in the project design or construction that differ from that described in this ESIA and/or requires additional land acquisition or government permits/approvals.

ES6. UPDATED ESIA CONCLUSIONS AND RECOMMENDATIONS

In summary, the UT-1 Project will generate approximately 1,456 GWH of clean, renewable electricity for domestic use and reduce greenhouse gas emissions by up to 26,000 tons annually. Through careful Project siting and design, NWEDC has effectively applied the Mitigation Hierarchy to avoid many potential impacts (e.g. impacts to any IFC-defined Critical Habitat). The proposed true run-of-river operating mode, higher than required Eflow, the provision of a fish ladder, and commitment to an Adaptive Management Program to ensure migratory fish reach their spawning grounds upstream of the Project dam collectively help minimize impacts to aquatic habitat and fish. NWEDC has generally acquired land and compensated affected land owners in accordance with international standards. Where residual impacts exist, NWEDC has proposed measures to restore or mitigate these impacts (e.g. offset LNP land take, comply with Nepal Ministry of Forestry reforestation requirements). Further, NWEDC has committed to developing or implementing a range of Construction and Operation Environmental and Social Management Plans to ensure remaining impacts and risks are properly managed.

Tables ES5-1 and 5-2 summarize the key avoidance, minimization, mitigation, and management measures proposed by NWEDC to manage the Project's environmental and social risks and conform to international standards. Taking into consideration NWEDC's efforts at avoidance, minimization, restoration, and offsetting of impact, the Project's residual impacts are quite minimal, and much less than would be expected from alternative 216 MW sources of power.

With the proper application of the Environmental and Social Management Plans and implementation of a robust monitoring program, the UT-1 Project should be in full conformance with the IFC Performance Standards and other lender requirements; and the Project has the opportunity to set the standard for other hydropower projects in the Trishuli Basin and elsewhere in Nepal.

Table ES5-1: Project Construction Phase Environmental and Social Risk Management Measures

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Air Quality	Fugitive dust	• Spray water on disturbed surfaces as needed • Place gravel on access roads near villages • Cover truck loads • Provide dust control at crushing and crushing plants • Use high-efficiency dust suppression system for crushers operated at the site • Enforce speed limits along dirt roads near communities • Stabilize disturbed areas as soon as possible after construction with vegetation or other materials	• Air Quality MP • Blasting and Explosives MP	Minor	EPC Contractor
	Vehicular and Power Emissions	• All Project vehicles will comply with national emission standards • Use low-sulphur fuel diesel for diesel-powered equipment and vehicles to the extent available in Nepal • Provide regular maintenance of vehicles in accordance with manufacturer specifications • Provide covering for material transport • Enforce appropriate speed limits within construction site • Reduce vehicle idling time to a minimum	• Air Quality MP • Maintenance MP	Minor	EPC Contractor
Climate Change	Green House Gas Emissions	• Regular maintenance of vehicles in accordance with manufacturer specifications • Reduction of vehicle idling time to a minimum • Minimizing vegetation clearing to the extent practicable • Burning of biomass is prohibited in the worker camps	• Air Quality MP	Minor	EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Noise and Vibration	Noise and vibration	• Procure low noise generating compressors and diesel generating sets • Provide regular maintenance of vehicles and equipment in accordance with manufacturers specifications • Install noise control device at adit portal ventilators • Prohibit above ground blasting and construction activities at night • Assess structures near blasting areas and along Project Private Road before and after blasting • Notify local communities before blasting • Restrict use of horn near school and residential areas by placing signage • Place equipment generating vibrations on strong foundation • Practice controlled blasting near structures	• Noise and Vibration MP • Blasting and Explosives MP • Maintenance MP	Minor	EPC Contractor
Water Quality	Land Disturbance Spoil and Muck Disposal	• Avoid spoil disposal sites in floodplains, on unstable land that could can cause future landslides, affect drainage or irrigation ditches, or present risk of failure of spoil washing into watercourse • Construct spoil sites that are stable and not susceptible to erosion (e.g. use gabion structures) • Implement appropriate sediment and erosion control • Construct drainage system surrounding disposal sites to control surface runoff • Provide drains as needed within and around the spoil disposal site to manage water levels within the cells • Use spoils for construction purposes to the extent possible to reduce disposal requirements • Dispose of spoil only at authorized disposal sites, no spoil will be disposed in the Trishuli River or tributary streams, steep slopes, farmland, or forest areas • Rehabilitate spoils sites as soon as the disposal operations are complete with native vegetation(e.g. *Alnus nepalensis*)	• Clearing, Grading Underground Excavation, Sediment and Erosion Control MP • Stockpiles, Quarries, and Borrow Pit MP • Spoil Management and Disposal MP • Water Quality MP	Minor	EPC Contractor
	Rock Cuttings	• Evaluate the geologic formation through which the tunnelling will occur for the potential presence of sulphide and other PAG rock • Periodically test the rock to confirm the lack of PAG minerals • Have a plan in place to manage any PAG rock that may be encountered	• Rock Cutting MP	Minor	EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Water Quality	Solid and Hazardous Material Use and Waste Disposal	• Establish a system for collection, segregation, and disposal of solid waste in the worker camps • Provide training for recycling and reducing waste • Conduct an audit to identify available and appropriately permitted waste management facilities for Project wastes • Apply appropriate storage, transport and use practices to recognized standards for fuels, chemicals, explosives, hazardous substances • Waste storage facilities shall be located away from the Trishuli River and tributaries and be designed to prevent wastes from being washed away during the monsoons or other high flow periods • Explosives, chemicals, and hazardous substances to be handled by authorized personnel • Diesel to be stored in truck tankers or in overhead tanks to a maximum of 5000 litres and on flat ground at least 50 metres from a waterway • Dikes to capture 100 percent of fuel must be placed around fuel storage area • All refuelling to be done on flat ground • Spill kits and emergency procedures shall be used and staff trained • Collect and store liquid wastes (e.g. lubricants, paints, cleaning, chemical, and oil-based materials) in a suitable storage tank with concrete floor for ultimate disposal at an authorized disposal facility; • Prohibit deliberate discharge of oil, diesel, petrol or other hazardous materials to the surrounding soils and waterways.	• Materials Handling and Storage MP • Spill Prevention and Response MP • Waste MP • Wastewater MP • Water Quality MP	Minor	EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
	Wastewater Discharges	• Provide an on-site package wastewater treatment plant or community septic system to treat domestic wastewater at the worker camps • Use oil/water separators for drainage from repair and maintenance facilities • Provide settling ponds to manage runoff from work areas (e.g. crushing and batching plants) • Collect, test, and treat if necessary tunnel process water • All wastewater discharges (e.g. domestic, stormwater runoff, tunnel process water) will comply with the IFC General EHS Guidelines and Ministry of Environment standards	• Wastewater MP • Water Quality MP	Minor	EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Biodiversity	Aquatic Habitat and Fisheries	• Provide environmental flow • Construct fish ladder for upstream fish migration • Provide guidance mechanisms for downstream fish migration • Provide awareness training and prohibit fishing, or fish trapping/killing activities by construction contractors • Implement Connectivity Assessment, fish studies and continual monitoring of fish species and quantities • Hire international fish specialist to oversee construction and initial operation of the fish ladder and Eflow Adaptive Management Program • Terminate any employees found trapping or fishing in the diversion reach	• Biodiversity MP	Moderate	NWEDC/EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
	Terrestrial Habitat	• Primarily sited in Modified Habitat • Establish clearing limits • Demarcate in the field the approved limits of clearing • Collect and store topsoil for use in restoration • Stabilize and rehabilitate/reforest temporarily disturbed areas • Acquire, reforest, and donate area equivalent government land required for project to LNP • Mitigate the loss of trees on a 2:1 basis in accordance with Ministry of Forest requirements for all trees identified during the regulatory EIA process, and on a 25:1 basis for any additional trees which may be affected during the course of project implementation. • Provide awareness training and prohibit hunting, fishing, or poaching by construction contractors • Display of hording boards showing illegal acts (poaching, hunting, etc.) in consultation with LNP. The conservation significance of black bear will be also displayed in the hoarding board. • Install fencing around the dam site and the worker camp on the LNP side to prevent unauthorized worker access to LNP forest • Provide awareness program to construction workers regarding LNP and protected species • Inform contractor staff that unauthorized entrance to the LNP or damaging natural forest areas is prohibited and could result in the termination of their employment • Terminate any employee found collecting firewood, timber, or other forest products from the local community forests or LNP • Provided workers with adequate quantity of cooking fuels such as kerosene and LPG • Train workers about fire hazards and provide fire extinguishers • Provide staff to monitor activities in the LNP buffer zone at the dam site and in community forests to ensure no illegal activity by construction workers, to identify and discourage any encroachment by camp followers; and to report to LNP and coordinate with park patrol authorities etc.	• Biodiversity MP • Restoration and Revegetation MP • Spoil Management and Disposal MP	Minor	NWEDC/EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
	Impacts to Wildlife	• Provide awareness training and prohibit hunting, fishing, or poaching by construction and operation contractors • Terminate any employees found illegally hunting, poaching or trading protected species • Include terms in contracts with EPC and O&M contractors indicating that exploitation of biodiversity resources will result in penal action. • Use signage and speed humps in areas where wildlife crossing is likely. • Train vehicle drivers regarding the driving risks through biodiversity sensitive areas and along remote roads. • Prohibit wildlife meat at the worker camps	• Biodiversity MP	Minor	NWEDC/EPC Contractor
Biodiversity	Impacts to Birds related to Transmission Lines	• Raise the transmission poles with suspended insulators • Require bird-safe strain poles with insulating chains of at least 60 centimetres length. • Check for vacuums or holes in the towers to avoid nesting by any of the birds; • Monitor bird carcasses electrocuted on a monthly basis and record any threatened or migratory species observed	• Biodiversity MP	Minor	NWEDC/EPC Contractor
Community Health, Safety, and Security	Dam Safety	• Modified Project design to account for better defined seismic hazards and climate change predictions • Dam design to be reviewed by Project's Panel of Experts and Lender's Independent Engineer • A siren network will be installed to inform those in the dewatered portion in case of a sudden release of water	• Emergency Preparedness and Response MP	Minor	NWEDC/EPC Contractor
	Seismic Hazard and Risks	• Maintain a 0.39 g seismic acceleration coefficient for concrete structures, and use prefab for other light structures	• Emergency Preparedness and Response MP	Minor	EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
	Landslide Hazard	• Assess geologic hazard of access road alignment, including pegging and flagging of landslide area boundaries • Survey structure located within 250 metres of tunnels and access road to document conditions of these structures • Install temporary and permanent slope stabilization using appropriate civil structures (e.g. gabions, concrete, benches) • Provide for both vertical and horizontal drainage to avoid erosion and safely divert water from steep slopes • Maintain slopes at less than the angle of repose to the extent possible • Control blasting and use of explosives, especially near landslide susceptible areas • Provides compensation to structures damaged by blasting or other Project activities • Stabilize disturbed areas using bioengineering techniques where feasible and rehabilitate the site with native species	• Landslide and Slope Stabilization MP • Quarry Management Plan	Moderate	EPC Contractor
Community Health, Safety, and Security	Spoils and Muck Management	• Use excavated material for road construction, aggregate, and backfilling of quarries and borrow pits to the extent possible and suitable • Locate spoil disposal sites above the flood line of the Trishuli River and avoid disturbance of agricultural land and forestland to the extent possible • Remove and retain any topsoil for use in rehabilitation at closure • Provide retaining walls/ wire-crates at each disposal site • Provide appropriate erosion and sediment control, including routing drainage through sediment traps prior to release • Prohibit the disposal of spoils and mucks at unauthorized locations • Conduct regular training and awareness programmes for drivers transporting muck and spoil to designated site • Stabilize, revegetate, and rehabilitate the spoil disposal sites once it reaches capacity using stockpiled topsoil to the extent possible •	• Emergency Preparedness and Response MP • Spoil Handling and Disposal MP	Minor	NWEDC/EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Community Health, Safety, and Security	Traffic	• Access Roads Stability and Traffic Safety • Procedures to notify nearby communities of proposed traffic volumes and patterns • Provide educational materials to nearby residents and schools to inform children about traffic safety • Establish speed limits for all traffic, especially in proximity to villages • Provide training to all staff with driving responsibilities to sensitize them to potential safety risks such as children playing, livestock, and driver fatigue • Provide as needed warning sign and speed bumps to alert drivers that they are approaching sensitive receptors	• Emergency Preparedness and Response MP • Traffic Management Plan	Minor	NWEDC/EPC Contractor
Community Health, Safety, and Security	Natural Disasters and Accidents	• Project components have been modified relocating many underground • Provide a first aid health facility at the campsite and emergency rescue procedures if needed. • Provide protective equipment to all workers as per the nature of their work • Project design to withstand a 10,000-year flood event • Include an emergency communication and notification system to alert downstream communities of flooding and other natural disasters • Coordination with upstream and downstream hydropower projects for monitoring and coordinated response to natural disasters • Develop an Emergency Preparedness and Response MP in consultation with local health care providers, hospitals, and community leaders. • Provide traffic safety awareness training to both construction workers and local residents, including signage	• Emergency Preparedness and Response MP • Site Safety and Security Management Plan • Occupational Health & Safety MP • Blasting and Explosives MP • Worker Accommodations MP	Minor	NWEDC/EPC Contractor
Social	Land Acquisition	• Minimized Project physical resettlement requirements • Provided compensation for loss of land, structures, crops, and other forms of economic displacement in accordance with the requirements of IFC Performance Standard 5 and Government of Nepal • Provide counselling services to Project Affected Families on the effective use of their compensation payment	• Land Acquisition and Livelihood Restoration Plan	Minor	NWEDC

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
	Forest Land Loss	• Support to the community forest management initiatives as agreed to with the Nepal Ministry of Forest • Provide payment for extra losses of tree during the access road construction or during further construction • Implement a Grievance Redressal Mechanism • Prohibit firewood usage by the construction workers • Provide training and capacity building of the Community Forest User Groups	• Land Acquisition and Livelihood Restoration Plan	Minor	NWEDC/EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Social	Labour and Labour Influx	• Established Grievance Redressal Mechanism • Provide benefits to the local community from the Project, in keeping with the benefit-sharing plans formulated as part of the Project Development Agreement requirements • Prohibit child labour • Adopt a Worker Code of Conduct • Notify local law enforcement in the case of any prostitution activity • Provide community awareness program on sexually transmitted diseases and girl trafficking • Prioritize Project employment of Project Affected Families • Maximize use of local labour • Provide support to local schools receiving children of Project workers • Provide a health clinic for use by construction workers at the worker camps and require regular health check-ups • Provide equal employment opportunities for both men and women • Provide financial assistance to local health institutions • Provide water supply and wastewater treatment to meet Project demands without affecting local community systems • Provide financial assistance to the local District Police Office to maintain security in the Project area • Provide awareness training for non-local workers regarding respect for local traditions, culture, and religious practices • Provide fencing around the worker camps and not allow access to any unauthorized person • Organize Social and Corporate Responsibility programs and interaction with local communities to build awareness between the workforce and local inhabitants	• Labour Influx MP • Site Safety and Security Management Plan • Worker Accommodations MP • Local Benefits Sharing Plan • Nepal Employment and Skill Training MP	Minor	NWEDC/EPC Contractor
Indigenous and Vulnerable Peoples	Indigenous and Vulnerable Peoples	• A formal FPIC process will be implemented • Support preservation of Tamang traditions, culture, identify, and traditional occupations • Prioritize employment for Dalit group in accordance with their skills and capacities	• Indigenous and Vulnerable Peoples Development Plan	Moderate	NWEDC – for FPIC process EPC Contractor – for other measures

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Cultural Heritage	Impacts to cultural heritage sites	• Minimized impacts on known cultural and religious sites • Implement a Chance Finds Procedure during construction and ensure it is widely socialised and understood by the Project contractors; and • Establish a grievance mechanism to allow local residents to report concerns associated with cultural heritage impact (e.g. loss of access) and loss of cultural values	• Cultural Heritage MP	Minor	EPC Contractor
Cumulative Impacts	Cumulative Impacts	• Participate in the Trishuli River Cumulative Impact Assessment funded by the IFC		Moderate	NWEDC

EHS = environmental, health, and safety; EPC = engineering, procurement, and construction; FPIC = Free, Prior, and Informed Consent; IFC = International Finance Corporation; LNP = Langtang National Park; MP = Management Plan; NWEDC = Nepal Water and Energy Development Company Limited; O&M = operations and maintenance

Table ES5-2: Project Operation Phase Environmental and Social Risk Management Measures

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Operations Management Plans	Residual Risk	Responsibility
Air Quality	• Fugitive dust • Vehicle Emissions • Climate Change	• Enforce speed limits along dirt roads near communities • Regular maintenance of vehicles in accordance with manufacturer specifications • Reduction of vehicle idling time to a minimum	• Air Quality MP	Minor	NWEDC
Noise	• Noise	• Provide regular maintenance of vehicles and equipment in accordance with manufacturers specification • Restrict use of horn near school and residential areas by placing signage • Employees working within powerhouse shall be provided with earplugs and other required PPE.	• Noise and Vibration MP	Negligible	NWEDC

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Operations Management Plans	Residual Risk	Responsibility
Water Quality	• Solid and hazardous wastes • Wastewater • Sediment	• Manage sediments by periodic flushing of desanders • Manage solid waste generated from the powerhouse, dam, and accommodations areas through proper collection system and stored at designated locations. • Maintain vehicles, machineries, and equipment's in designated areas. • Lubricants, oils, grease, chemical shall be stored at designated area with impervious surface and a secondary containment system. • Ensure hazardous waste (used oil, transformer oil, and oil soaked cloths) is properly labelled, stored onsite at a location provided with impervious surface, shed and secondary containment system, and ultimately transported offsite to an approved disposal facility. • Spill Prevention and Response Plan shall be implemented for immediate cleaning of spills and leakages. • Sludge generated from a wastewater treatment plant shall be used in garden and landscaping. • Discharge of all sanitary and process wastewater to waterbodies must meet IFC EHS Guidelines and Government of Nepal standards.	• Water Quality Management Plan • Sediment Management Plan	Minor	NWEDC

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Operations Management Plans	Residual Risk	Responsibility
Biodiversity	• Flow • Habitat • Species	• Operate in true run-of-river mode • Operate fish ladder and fish guidance system to guide fish to the fish ladder and away from the turbine intake • Provide required Eflow at all times • Monitor Common snowtrout upstream migration and implement the Adaptive Management Program if needed • Monitor the fauna, flora and specific habitats within the impact areas • Monitor bird carcasses electrocuted on a monthly basis and record any threatened or migratory species observed along the transmission line route • Enhance riparian vegetation by developing a Riparian Vegetation Restoration Program • Designate vehicular routes to avoid soil compaction in other areas. • Provide signage and speed bumps where wildlife crossing are likely • Inform contractor staff that unauthorized entrance to the LNP or damaging natural forest areas is prohibited and could result in the termination of their employment • Install fencing around the dam site to prevent unauthorized worker access to LNG forest • Provide staff to monitor/patrol activities in the LNG buffer zone at the dam site and powerhouse worker camp to ensure no illegal activity by construction workers • Terminate any employee found collecting firewood, timber, or other forest products from the local community forests or LNP • Provide awareness training and prohibit hunting, fishing, or poaching by construction and operation contractors • Terminate any employees found illegally hunting, poaching or trading protected species • Prohibit trapping or fishing in the diversion reach	• Biodiversity MP • Sediment MP	Moderate	NWEDC

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Operations Management Plans	Residual Risk	Responsibility
Community H&S and Security	• Dam Safety • Landslide Hazard • Traffic • Natural Disasters	• Monitor structural stability of tunnels • Maintain drainage and slope stabilization structures • Install a warning siren network along the diversion reach to provide warning of any sudden release of water • Provide training and exercises to ensure Project is prepared to respond to any natural hazards or accidents in accordance with the Emergency Response and Preparedness Plan • Implement Employee Code of Conduct • Ensure access to a grievance redressal mechanism for employees and the local community. • Ensure adequate and timely disclosure of information to the local community in terms of Project activities and available opportunities, in keeping with Stakeholder Engagement Plan formulated for the Project. • Security personnel will be posted around the site to ensure that there are no unauthorised personnel within the Project site.	• Community Health, Safety and Security MP • Occupational Health and Safety MP • Employee Code of Conduct • Grievance Redressal Mechanism	Minor	NWEDC
Labour Influx		• Control hiring practices to limit labour influx	• Labour Influx MP	Minor	NWEDC
Indigenous Peoples		• Comply with requirements of the Indigenous and Vulnerable Peoples Development Plan	• Indigenous and Vulnerable Peoples Development Plan	Moderate	NWEDC
Cultural Heritage	• Intangible Heritage	• Grievance Redressal Mechanism	• Grievance Redressal Mechanism	Minor	NWEDC
Cumulative Impacts	• Cumulative Impact management	• Participate in a future Trishuli Basin Co-Management Platform to collaboratively monitor and manage impacts.	• Cumulative Impact Management Plan	Moderate	NWEDC

LNP = Langtang National Park; MP = Management Plan; NWEDC = Nepal Water and Energy Development Company Limited

1. INTRODUCTION

The Nepal Water and Energy Development Company Limited (NWEDC) is proposing to construct the 216 megawatt Upper Trishuli-1 Hydropower Project (the "Project" or "UT-1") located on the Trishuli River within the Rasuwa District of the Central Development Region of Nepal, approximately 80 kilometres northeast of Kathmandu (Figure 1-1). The World Bank Group (or WBG, including the International Finance Corporation, Multilateral Investment Guarantee Agency, International Bank for Reconstruction and Development, and International Development Association) is supporting the development of the Project. Other financial institutions considering participating in a lender's consortium include the Asian Development Bank, the Asian Infrastructure Investment Bank, and several European Development Banks, not yet confirmed but likely to include DEG, FMO, and CDC Group (collectively referred to herein as the "Lenders"). The project represents the largest Foreign Direct Investment in Nepal to date.

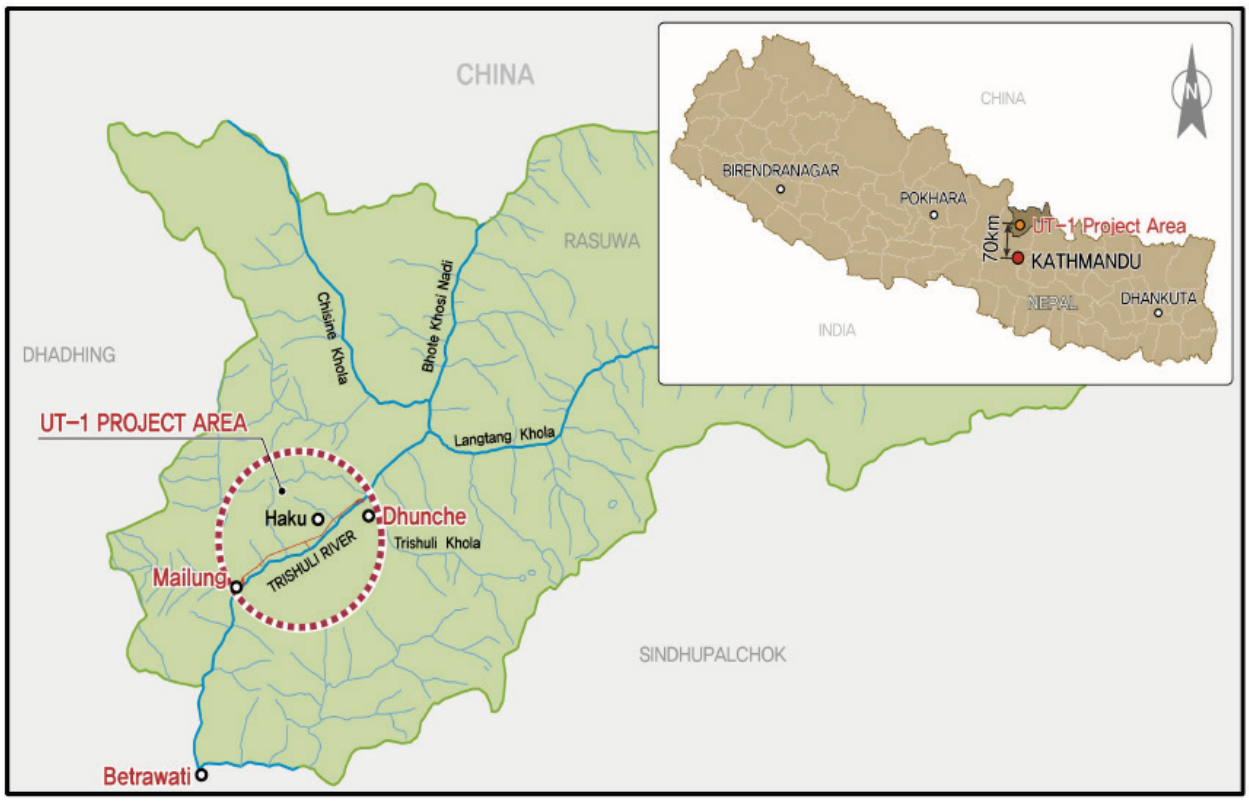

Figure 1-1: Project Location Map

1.1. PROJECT HISTORY

NWEDC prepared an Environmental Impact Assessment (EIA) for the Project, which was completed in January 2012 (herein referred to as the National EIA) and approved by the Government of Nepal in February 2013.

With the involvement of international lenders, and in accordance with their environmental and social policies and standards, the Project has been classified as Category A due to the inherent and contextual risks associated with hydropower development and Nepal socio-political vulnerabilities. As a result, the National EIA was subjected to extensive strengthening and revisions through a number of supplemental studies to bring the Project into conformance with international standards, most notably the IFC Performance Standards (PS) and the World Bank Environmental, Health and Safety Guidelines. These revisions were documented in a Supplemental Environmental and Social Impact Assessment (herein referred to as the Supplemental ESIA), including a Cumulative Impact Assessment and an Environmental and Social Action Plan (ESAP), which was disclosed by IFC in February 2015.

In April 2015, Nepal suffered a large earthquake centred within 100 kilometres of the UT-1 site. The Rasuwa District, where the Project is located, was one of the worst affected areas (see Figures 1-2 and 1-3). NWEDC provided extensive relief to earthquake-affected people and assisted with some reconstruction efforts in the area. This earthquake resulted in both changed environmental and social baseline conditions in the Project area and modifications to the Project design to address geotechnical and other natural hazard risks.

Figure 1-2: Mailung Village Before and After the April 2015 Earthquake

Figure 1-3: Trishuli Canyon and Access Road Before and After the April 2015 Earthquake

Despite delays resulting from the earthquake, NWEDC has continued to move the Project forward, completing a number of complementary studies called for in the Environmental and Social Action Plan and updating other baseline studies. These studies included:

- A Report on Earthquake Induced Landslides in UT-1 Project Area and their Impact to the Project Infrastructure, January 2016;
- Scenario-based Evaluation of Flow Impacts on *S. richarsonii* in the Trishuli River, January 2016;
- Field Visit Report Fishery Migration Research 29th of February – 4 March 2016;
- Land Acquisition, Resettlement Assessment and Livelihood Restoration Plan, April 2016;
- Baseline Monitoring and Aquatic Ecology and Water Quality Analysis, August 2016;
- Evaluation of Plans and Recommendations for Fish Passage, September 2016;
- Upper Trishuli-1 Hydropower Facility: Climate Change Risk Assessment, November 2016;
- E&S Gap Analysis and Scoping for ESIA and LRP Update for UT-1, December 2016;
- Terms of Reference for Fish Passage Expert (December 2016) and expert recommendations (May 2017);
- Environmental Flows Management Plan (EFMP) of Upper Trishuli-1 HEP, Nepal (draft February 2017);
- Swimming Performance of *Schizothorax sp*., 28 March 2017
- Upper Trishuli-1 Hydroelectric Project Updated Environmental Management Plan (for relocated construction yard and worker camp), December 2017;
- Terms of Reference for Initial Environmental Examination of Single Circuit 220 kV Transmission Line of Upper Trishuli-1 Hydroelectric Project (216 MW), December 2017;

- Design Advice on Fish Ladder and Associated Spillway Designs at the Upper Trishuli -1 Hydropower Project, January 2018;
- Social Impact Management Framework, including an updated social baseline, a Land Acquisition and Livelihood Restoration Plan, a Stakeholder Engagement Plan, a Gender Action Plan, and an Indigenous & Vulnerable Peoples Development Plan, March 2018;
- Upper Trishuli -1 Hydroelectric Project Detailed Survey Report of 220 kV Transmission Line, April, 2018; and
- Updated Project Environmental and Social Management and Monitoring Plan Framework, June 2018.

Given these changed baseline conditions and various post-earthquake complementary studies, NWEDC selected the international sustainability consulting firm Environmental Resources Management (ERM) to consolidate all prior impact assessments and supplementary and complementary studies into a single Updated Non-Technical Environmental and Social Impact Assessment Summary Report (Updated ESIA), along with an updated Environmental and Social Management System (ESMS) and Environmental and Social Management and Monitoring Plans (ESMMP). This document constitutes the Updated ESIA, including the Social Impacts Management Framework, with the Project's ESMS Framework and ESMMP Framework attached as appendices. By reference, this Updated ESIA includes the National EIA and the Supplemental ESIA. To the extent there may be any conflicts among these documents, the most recent document prevails.

1.2. NEED FOR POWER

Given the great need in Nepal for domestic power and the fact that other large planned hydropower projects in the country are expected to export a significant amount of their power generation to neighbouring countries, the Project is of strategic national importance as it will increase the country's domestic power supply by approximately one-third compared to current levels, and will provide about 40 percent of its expected 1,456 gigawatt hours (GWh) of annual electricity output during the dry season, which includes the peak winter demand months. The Project's location in relatively close proximity to Kathmandu facilitates delivery of power to Nepal's electricity demand center.

1.3. PROJECT CONTEXT

The Project is located in a remote area in the upper portion of the Trishuli River Basin, just downstream of the confluence of the Langtang Khola and the Bhote Khosi River. The Langtang National Park forms the eastern boundary of most of the Project area. The Project will affect nine small villages: Mailung, Haku Besi, Gogone, Tiru, Thulo Haku, Sano Haku, Thanku, Gumchet, and Phoolbari (see Figure 1-4).

An upgraded road from Nepal to China, locally referred to as the "Army Road" as it is being constructed by the Nepal Army, is currently under construction and its alignment generally

follows the east side of the Trishuli River in the Project area. The Project design has been modified slightly to take advantage of the improved access to the Project dam and worker camps.

There are six existing operating hydropower projects and seven projects under construction (see Figure 1-5) within the Trishuli River Basin. In addition, the Upper Trishuli-2 Project is proposed, but not yet under construction, and would be located approximately 0.5 kilometre upstream from the UT-1 dam. As Figure 1-5 indicates, there are two existing and two under construction hydropower projects on the mainstem of the Trishuli River downstream of the Project (the nearest, UT-3A Hydropower Project, is approximately 1.5 kilometre downstream).

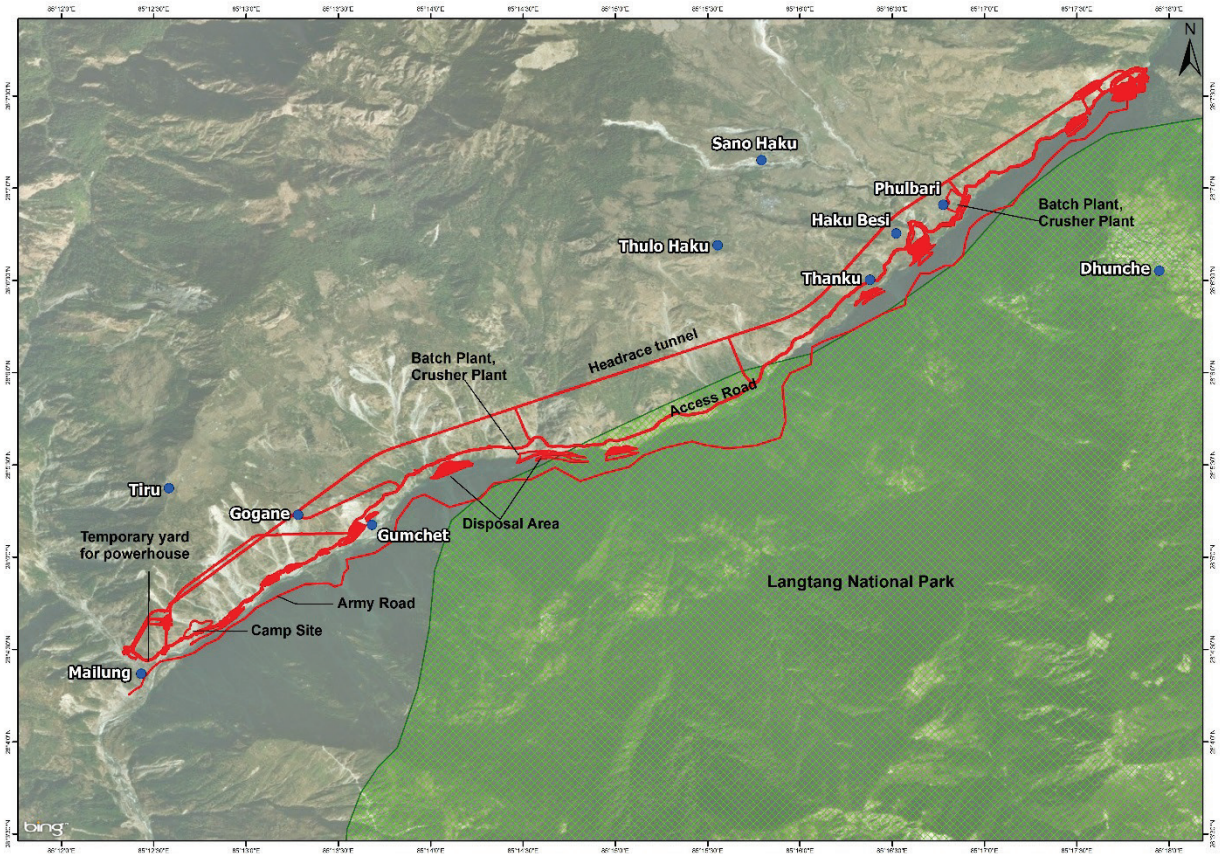

Figure 1-4: Project Affected Villages

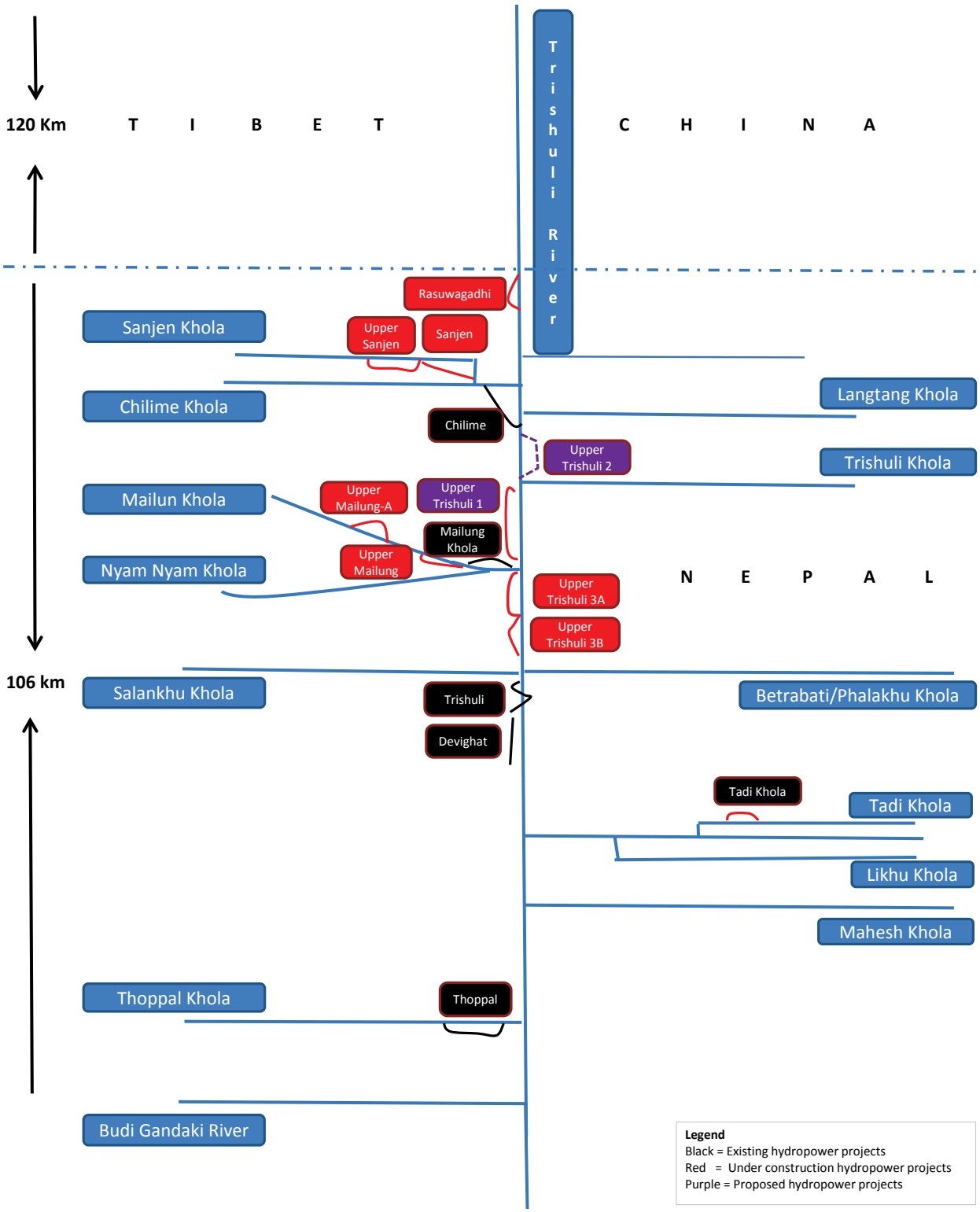

Figure 1-5: Existing, under Construction, and Proposed Hydropower Projects near UT-1

2. PROJECT DESCRIPTION

2.1. PROJECT FACILITIES

2.1.1. Permanent Facilities

The Project consists of a 100.9-metre-wide diversion dam in a narrow gorge located on the Trishuli River 275 metres downstream of the confluence of the Langtang Khola with the Bhote Khosi River (Figure 2-1). The diversion dam creates a small 2.1-hectare (ha) impoundment and diverts up to 76 cubic metres per second (m^3/s) of water through a powerhouse with a 216-megawatt (MW) capacity, returning the water to the Trishuli River approximately 10.7 kilometres downstream of the dam. The key Project facilities are briefly summarized in Table 2-1 and shown on Figure 2-2.

Figure 2-1: Trishuli River at Dam Site

Table 2-1: UT-1 Hydropower Project Facilities

Project Facility	Description
Dam	100.9 m long x 30.85 m wide x 29.5 m high concrete gravity dam
Spillway Gates	Three 11.0 m wide x 16.5 m high spillway gates capable of passing 200 year storm (2,555 m^3/s)
Reservoir	2.1 ha impoundment at normal operating elevation (1255.0 m)
Intake Structure	Horizontal bell-mouth type intake with two 3.25 m wide x 6.5 m high roller gates on right side near spillway at intake elevation of 1247.0 m
Desander	Underground horizontal flushing type desander with 3 chambers each 115.0 m long, 10.0 m wide, and 23.93 m high designed to remove particle sizes of 0.2 mm or larger, with three sediment flushing channel connecting into a 3.4 m wide x 1.7 m high flushing tunnel
Headrace Tunnel	6.5 m diameter x 9.7 km long low pressure tunnel
Surge Tank	8.5 m diameter x 38 m high tank to manage pressure changes in headrace tunnel
Vertical Pressure Tunnel	6.5 m diameter x 292 m long concrete lined high pressure tunnel
Horizontal Pressure Tunnel	6.5 m diameter x 40 m long concrete lined high pressure tunnel
Penstock	110.7 m long x 1.6 m to 6.5 m diameter concrete (upper section) and steel (lower section) high pressure pipe
Powerhouse	Underground 3 vertical axis Francis turbine generating units each with 72 MW of capacity accessed by a tunnel
Tailrace Tunnel	Three 6.5 m diameter x 55.0 m long concrete lined pipes combining into one 6.5 m diameter x 178 m long concrete tunnel
Tailrace Outlet	6.5 m diameter x 38.15 m long outlet at elevation 910.0 m
Transformer Cavern	Main transformer and 220 kV gas insulated switchgear
Cable Tunnel	381.5 m long

Project Facility	Description
Take-off Yard	Underground facility that will house transformers, disconnecting switches, circuit breakers, current transformers, voltage transformers, bus bars, and other necessary protection equipment
Administrative Complex	Administration, Main Control, Generator, Worker Accommodation, and Security buildings

Source: DKJV 2017

ha = hectare; km = kilometre; kV = kilovolt; m = metre; mm = millimetre; m^3/s = cubic metres per second; mm = millimetres; MW = megawatt

2.1.2. Ancillary Project Facilities

2.1.2.1. Access Roads

Vehicular access to the Project is from the public Betrawoti-Mailung-Syabrubesi Road (i.e. the road to China), via a public spur road, which was constructed by the nearby Mailung Hydropower Project, but is managed by the Rural Municipality. Nepal Water and Energy Development Company Limited (NWEDC) constructed a private bridge over Mailung Khola from the spur road to access their former construction camp and powerhouse site, but it was destroyed by the earthquake. NWEDC proposes a new access to the powerhouse site, downstream of the former bridge, which includes a new 39.6 m long by 4.3 m wide Bailey Bridge (a type of portable, pre-fabricated, truss bridge) across Mailung Khola. As part of the Project, NWEDC will construct an 11.84-kilometre-long/5.5-metre-wide private road from the Mailung Khola Bridge to the UT-1 dam site (see Figure 2-3).

The Project will also take advantage of the newly constructed "Army Road," which follows along the east bank of the Trishuli River and ultimately extends to China. There will be two points of access to the Project from the Army Road:

- Near the powerhouse – a short access road and temporary 51.8 m long by 4.3 m wide Bailey Bridge across the Trishuli River to access the Army Road as well as the Mailung Worker Camp; and
- Near the dam site and Haku Besi – a short access road and temporary 39.6 m long by 4.3 m wide Bailey Bridge across the Trishuli River that connects the Army Road with the NWEDC Access Road.

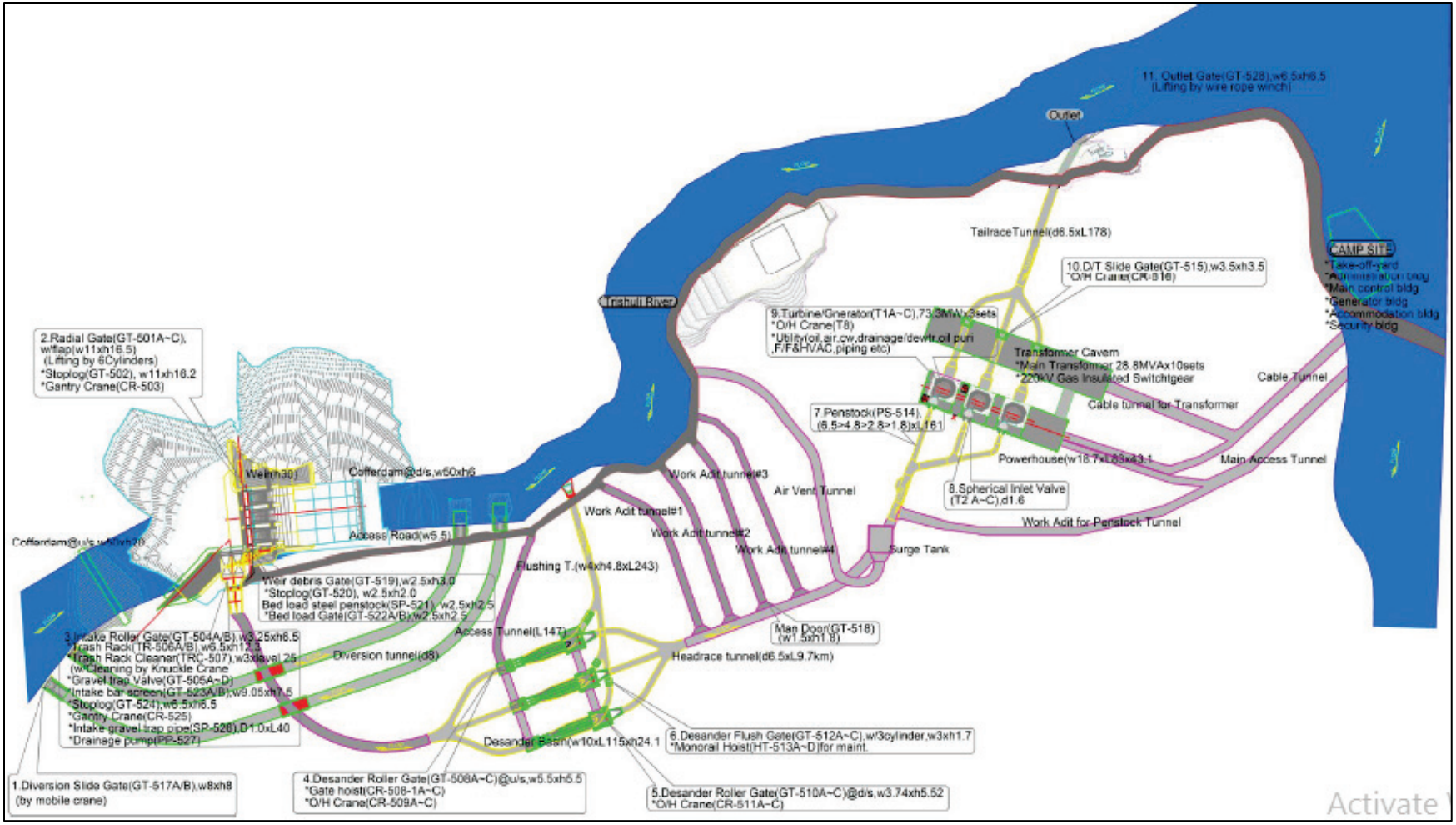

Figure 2-2: Project Layout Plan (not to scale)

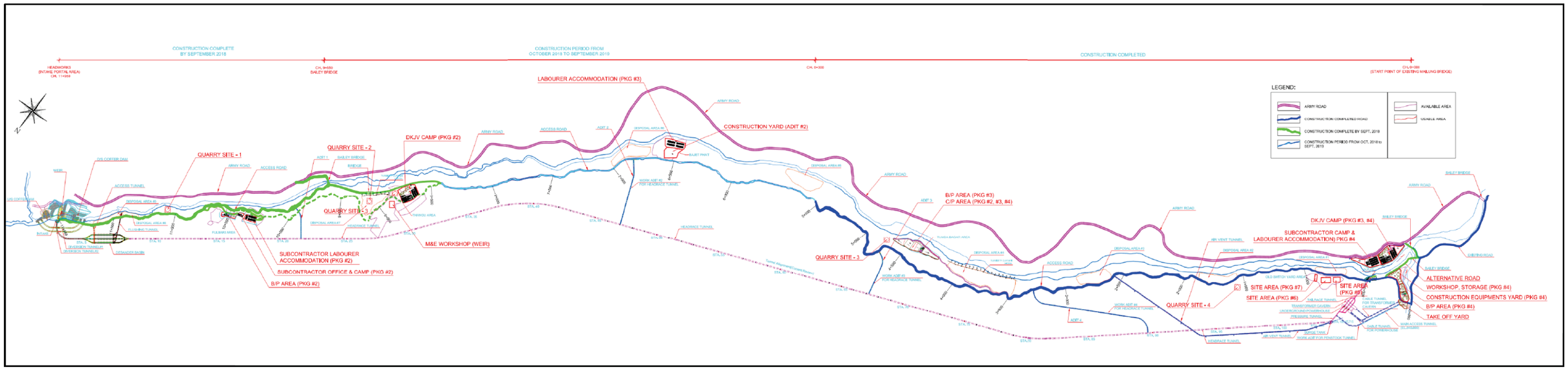

Figure 2-3: Project Details

2.1.2.2. Transmission Line

The Project will require construction of a 1184.5-metre-long single circuit 220 kV transmission line within a 30-metre-wide right-of-way (see Figure 2-4). The transmission line will require the construction of five new 35-metre-high steel lattice towers (i.e. AP-0, AP-1, AP-2, AP-3, and AP-4) from its take-off yard to the Tower AP-28 of Nepal Electricity Authority's (NEA) proposed Chilime-Trishuli 220-kilovolt double circuit transmission line. In accordance with Nepalese regulations, NWEDC will permanently acquire the land for the five towers (with each tower having a 13 metre by 13-metre concrete pad) and will lease the remaining right-of-way land from the government. The take-off yard will be built within the powerhouse boundary on land already procured by the Project. The transmission line will have a minimum ground clearance of 11 metres.

Construction of the transmission line will involve the following activities:

- Mark the right-of-way and clear all vegetation within the footprint of the tower base and for a distance of approximately two metres beyond the base to ground level;
- Excavate and stockpile soil for the legs of each tower;
- Lay the foundation of the tower; place the formwork, reinforcing bars, the embedded parts of the towers in the pits, overlaid by a concrete cement pad;
- Backfill and compact the foundation pits with stockpiled soil;
- Assemble and straighten prefabricated components of the lattice structure of each tower;
- String the transmission lines using a puller machine;
- Inspect all foundation work, tower erection, and stringing to ensure strict adherence to the technical requirements/specifications; and
- Place a sign to each tower warning of high voltage and anti-climbing devices on the tower.

Construction of the take-off yard will involve the following activities:

- Mark the boundary of the take-off yard and clear all vegetation to the ground level;
- Lay the foundation by pouring and curing the concrete;
- Install trenches to house electric and communication lines between the control house and equipment in the take-off yard;
- Install the electrical equipment and erect the ancillary buildings that house control equipment; and
- Inspect, place warning signage, and commission the take-off yard.

The use of government lands for the transmission line trigger the need for Nepal Water and Energy Development Company Limited (NWEDC) to prepare an Initial Environmental Evaluation (IEE) for review by the government. The Terms of Reference for the IEE was approved by the Ministry of Energy on 11 February 2018, but the alignment was subsequently

changed for technical reasons. NWEDC has requested authorization from the Ministry of Energy to proceed with the IEE based on the already approved Terms of Reference, but is awaiting that authorization. The IEE will be prepared to meet Ministry of Energy requirements, but will also be prepared to demonstrate compliance with lender requirements.

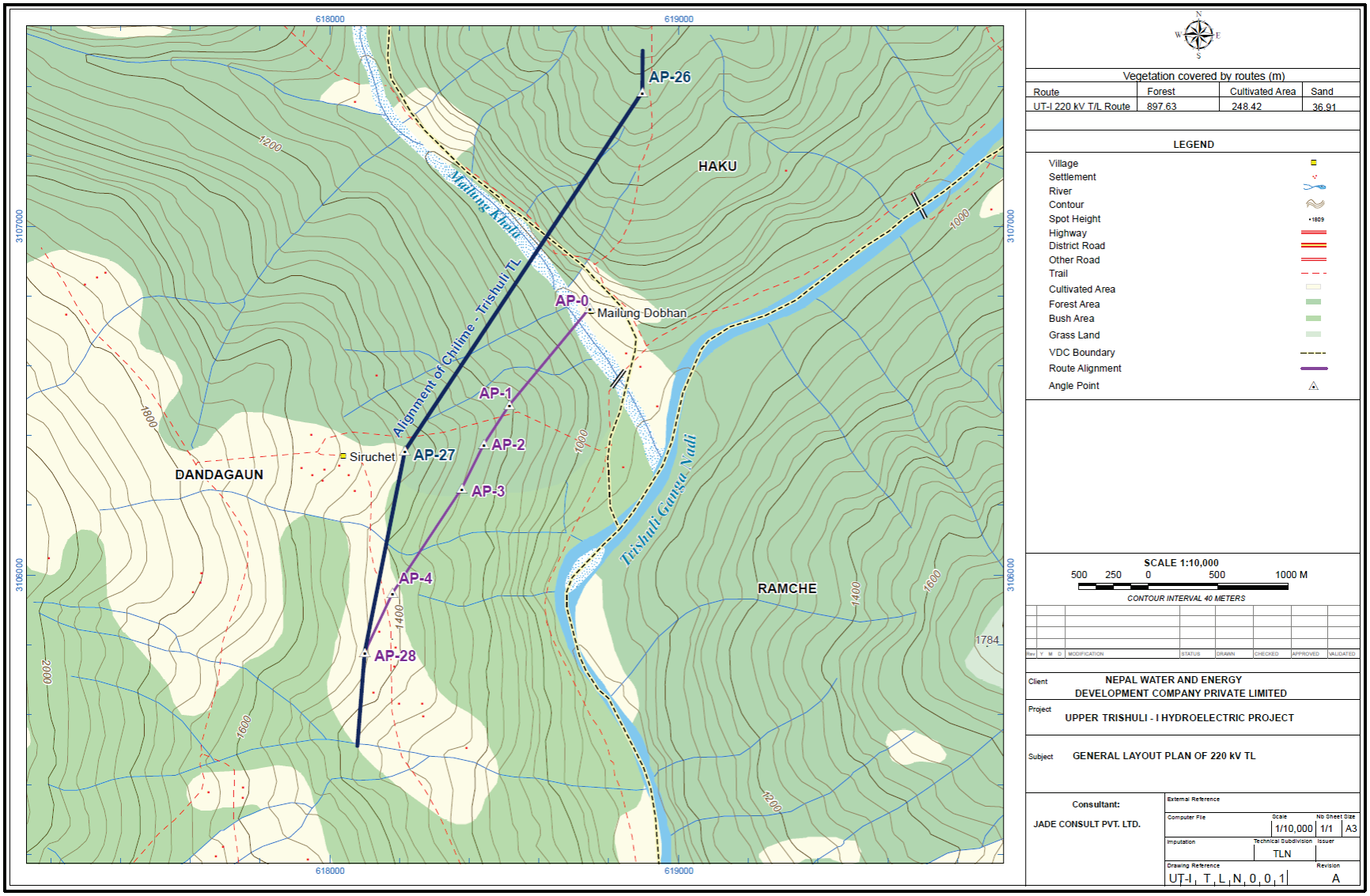

Figure 2-4: Project Proposed Transmission Line

2.1.2.3. Land Requirements

Overall the land requirements of the Project (including the transmission line) are 107.79 hectares (ha), including 84.06 ha of government-owned land (mostly community forests), 5.05 ha of private land, 15.53 ha of Guthi/Trust land owned by the Monastery at Swayambhu in Kathmandu, and 3.15 ha of land owned by the Mailung Hydroelectric Project. The land take for the Project has affected 38 families, including 20 owners of private land and/or structures and 18 Guthi land tenants. In addition, this land take has also resulted in the loss of some Community Forest land managed by five Community Forest User Groups representing 422 families.

2.1.3. Associated Project Facilities

Associated project facilities are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist, and without which the project would not be viable. For purposes of the UT-1 Project, no associated project facilities have been identified.

The Project is accessed by the existing Betrawati-Mailung-Syabrubesi Road. This road, however, was severely damaged by landslides triggered by the 2015 earthquake. The Government of Nepal is currently rehabilitating this road by removing landslide materials and constructing gabion and masonry walls to stabilize the hillsides, and the road is being upgraded, possibly to serve as part of the China One Belt One Road network. This is an existing public road and is not considered an associated project facility.

The Project will connect to the Chilime-Trishuli transmission line. Although this transmission line is not being funded as part of this Project (i.e. funded separately by other lenders) and is essential for UT-1 operations, it is not considered an associated Project facility because it is not being constructed solely for the use of the UT-1 Project, and would be constructed even without the UT-1 Project. The Upper Sanjen (14.8 MW), Sanjen (42.5 MW) and Rasuwagadhi (111 MW) hydropower project's all have connection agreements with NEA in place to evacuate their electricity using this transmission line.

2.1.4. Project Design Changes since Supplemental Environmental and Social Impact Assessment

NWEDC had initiated construction prior to the April 2015 earthquake, and at that time had constructed a bridge over the Mailung Khola, a worker camp at the Mailung School (adjacent to the powerhouse), and approximately 5.1 kilometres of the access road to the dam. As a result of the earthquake, the bridge was damaged, the worker camp destroyed, and portions of the access road were impacted by landslides.

As a result of the earthquake, NWEDC will construct a new bridge over Mailung Khola downstream of the damaged bridge, relocate the worker camp for safety reasons to the east side of the Trishuli River, and is in the process of removing the landslide debris covering portions of the access road. In addition, the Project design has been modified to take into account better defined seismic hazards (e.g. the Lender's Engineer specified a Maximum Credible Earthquake

of 0.83 g [acceleration of gravity] for a 3,000-year recurrence period based on a Deterministic Seismic Hazard Analysis), changes in landscape conditions (e.g. landslides), and to optimise engineering aspects of the dam. The dam design has also been upgraded to withstand a 10,000-year flood event with a combination of spillway gates and an emergency spillway overflow, as well as revised to accommodate a fish ladder. These Project design changes are summarized in Table 2-2.

Table 2-2: Project Design Changes in Response to Earthquake

Project Feature	Original Design	Revised Design	Reason for Change
Dam	Spread concrete foundation Design discharge – 3,563 m^3/s at 5,000 year frequency	Floating foundation Design discharge – 3,779.5 m^3/s at 10,000 year frequency Fish ladder included	Updated seismic design and to include a fish ladder
Intake	Spread concrete foundation Gravel trap at front of intake	Bored cast in-place pile Bed load sluice, settling basin and gravel trap	Updated seismic design To prevent sediment inflow
Powerhouse	Outdoor transformer	Transformer set in cavern	Updated seismic design
Take-off yard	Location – Station 0+800 Access Tunnel – 353 m Cable Tunnel – 183 m Penstock work adit – 196 m D/T Shaft work adit – 83 m	Location – Station 0+80 Access Tunnel – 377 m Cable Tunnel – 381.5 m Penstock work adit – 280 m D/T Shaft work adit – 150 m	Avoid landslide area
Access Roads	19 km	Revised alignment, reduced road length to 11.8 km by replacing some access roads with tunnels	Avoid landslide areas
Surge tank access	2,750 m access road with 18 m air vent tunnel	1,740 m air vent/access tunnel (no access road)	Avoid landslide area
Work adit-4	342 m tunnel	1,140 m tunnel	Avoid landslide area
Powerhouse Worker Camp	Powerhouse Worker Camp on west side of river near Mailung Khola	Powerhouse Worker Camp relocated to east bank of Trishuli River	Avoid landslide area

Source: UT-1 HEP Detail Design Report, DKJV, 2017

km = kilometre; m = metre; m^3/s = cubic metre per second

2.2. PROJECT CONSTRUCTION AND TEMPORARY WORKS

Project construction is expected to take approximately 60 months to complete and will include establishment of temporary worker camps, infrastructure, river diversion works, quarries, and spoil disposal areas, which are described below.

2.2.1. Project Workforce

Project construction is expected to employ approximately 1,090 skilled, semi-skilled, and unskilled workers over the 60-month construction period. Approximately 10 to 15 percent of the workforce will be recruited locally, with the remainder from elsewhere in Nepal or expatriates.

2.2.2. Temporary Worker Camps and Construction Yards

The Project will require temporary worker camps and construction yards at several locations as follows and listed in Table 2-3:

- Worker Camps – five worker camps are proposed (three for workers and two for JEPC staff), each including accommodations, mess hall, medical clinic, recreation facilities, parking areas, and various offices, workshops, warehouses, storage areas, waste management facilities, and infrastructure (see Section 2.2.3 Infrastructure);

Table 2-3: Summary of Worker Accommodations

Worker Camp[1]	Location	Capacity	Timing
Fulbari	Near dam site	Not yet determined	2019 - 2023
Thangu	Near Adit #1	400 workers	2020 - 2023
Bajet Phat	Near Adit #2	380 workers	2019 - 2022
Mailung	Near powerhouse and take off yard	500 workers	2018 - 2023

[1] Only four of the five workers camps are described above, final details on the camps are not yet available.

- Batch Plants – three Batch Plants are proposed for making concrete, one in the Fulbari area near the dam site, one in the Tumda Dagar area near Adit #3, and one in the Mailung area near the powerhouse and take off yard;
- Crushing Plant – one Crushing Plant in the Tumda Dagar area near Adit #3;
- Construction and Equipment Yards – several construction and equipment storage yards near the worker camps

All of these facilities are located on the west side of the Trishuli River across from Langtang National Park with the exception of the Mailung Worker Camp, which is located on the east side of the Trishuli River within the Langtang National Park buffer area. The Mailung Worker Camp was relocated to the east side of the river for worker health and safety reasons as the original worker camp, which was located on the west bank of the river, was severely damaged during the 2015 earthquake resulting in the death and injury of many construction workers. This facility will be located on 4.16 ha of land, of which approximately 2.80 ha are located within the Langtang National Park buffer zone and will be leased for 7 years from the Park, and 1.36 ha, which will be leased from a private landowner. This selected site was the only site with suitable topography and safe from earthquake-induced landslides in reasonable proximity to the powerhouse. NWEDC, with the consent of the Langtang National Park and the Buffer Zone Committee of Ramche, submitted an Updated Environmental Management Plan addressing potential impacts associated with this revised worker camp location, which was approved by the Nepal Ministry of Population and Environment on 31 December 2017 (NWEDC 2017). After construction is complete and/or the lease expires, NWEDC will return the 2.80 ha to the Langtang National Park.

2.2.3. Infrastructure

Project construction will require sources of power, water, wastewater treatment, and fuel storage as summarized in Table 2-4.

Table 2-4: Infrastructure Summary

Infrastructure	Source	Capacity	Comments
Power	Diesel generation sets	5 MW	Facilities at each worker camp and construction yard.
Water	Water treatment plant and storage tanks	189,500 litres per day	Water source – groundwater. Facilities at each worker camp.
Wastewater	Wastewater treatment plant	175,500 litres per day	Facilities at each worker camp. Discharge to Trishuli River
Fuel Storage	Diesel	2,000,000 litres	Facilities at each worker camp. Aboveground tank with secondary containment

MW = megawatt

2.2.4. River Diversion Works

River diversion works are required to safely divert the river flow during construction so that it will not damage construction activities. The diversion works are divided into upstream and downstream cofferdams to cut off the river flow and direct it to a diversion tunnel to bypass construction activities. This design was selected taking into consideration the narrow river width, hydrologic conditions, cost, and worker safety.

2.2.5. Quarry Sites

The Project will require approximately 120,000 cubic metres of aggregate material for impervious core material, coarse and fine aggregates, riprap stone, and boulders, and approximately 60,000 cubic metres of sand. These materials will primarily be obtained from four quarry sites, all located on west side of the Trishuli River in the Project area (see Figure 2-3 above and Table 2-5), although some of the material will be sourced from Project tunnelling and excavation. These quarry sites have been selected based on test pits, laboratory analysis, an assessment of the volume and quality of aggregate available to meet overall Project demand, and avoid Langtang National Park. Excavation of material from the quarries, as well as excavation of the underground Project facilities (e.g. powerhouse, tunnels, transformer cavern) will require blasting. The estimated amount of explosives to be used is 7,800 tons.

Table 2-5: Description of Quarry Sites

Quarry Site #	Location	Permanent Land Area (ha)	Temporary Land Area (ha)	Total Land Area (ha)
1	Downstream of dam	0	1.27	1.27
2	Thangu area (near Haku Besi)	0	0.77	0.77
3	Tumda Dagar area (near	0	1.30	1.30
4	Near take-off yard	0	6.27	6.27
Total		0	9.62	9.62

ha = hectare

2.2.6. Excavation and Spoil Disposal Areas

The Project originally required the excavation of approximately 2.7 million cubic meters of material, the reuse and/or replacement of approximately 0.3 million cubic meters, and ultimately the disposal of approximately 2.4 million cubic meters as summarized in Table 2-6. As a result of the earthquake, there will be an increase in access tunnel excavation as the surge tank access road has been converted to a tunnel, but NWEDC indicates that this increase in tunnel excavation is offset by a reduction in access road excavation, with no appreciable change in total excavation volumes. There is approximately 14,000 cubic metres of landslide debris covering some segment of the already constructed access road that will require removal.

Table 2-6: Excavation Sources and Volumes (units in cubic metres)

Work items	Excavation	Requirement	Replacement	Spoil
Temporary facilities		103,127		
Access road	981,681		91,265	890,416
Diversion facilities	88,278	13,509		88,278
Weir & spillway	344,345			344,345
Intake	19,646			19,646
Desander	187,249			187,249
Headrace tunnel	632,298		178,763	453,535
Surge tank	84,606			84,606
Horizontal pressure tunnel	1,742			1,742
Vertical pressure tunnel	20,046			20,046
Still penstock tunnel	9,870			9,870
Powerhouse	96,689		42,680	54,009
Transformer cavern	68,811			68,811
Access tunnel	25,098			25,098
Tailrace tunnel	16,266			16,266
Outlet	15,172			15,172
Take off yard	29,133		25,371	3,762
Cable tunnel	19,930			19,930
Adit tunnel	99,478			99,478
Aggregate production		221,443		
Total	2,740,338	338,079	338,079	2,402,259

NWEDC proposes nine spoil disposal areas as shown in Figure 2-3 above and summarized in Table 2-7 below. Please note that none of the spoil disposal areas is located in Langtang National Park. NWEDC indicates that these nine proposed spoil disposal areas have sufficient capacity to accommodate the slight increase (<1 percent) in total excavation volume resulting from the removal of landslide debris.

Table 2-7: Summary of Project Spoil Disposal Areas

Spoil Disposal Areas (DA)	Location	Spoil Capacity (m^3)	Size (ha)
DA-1	Mailung	190,919	1.09
DA-2	Mailung	278,047	1.65
DA-3	Mungtabar	99,478	2.09
DA-4	Dharnatar & Tungabagar	862,674	5.38
DA-5	Bugetphat	291,565	2.59
DA-6	Bugetphat	418,369	2.22
DA-7	Thangu	358,860	1.79
DA-8	Fulbari	52,780	0.26
DA-9	Fulbari	95,600	0.48
Total		2,648,652	17.56

ha = hectare; m^3 = cubic metre, m^2 = square metre

2.3. PROJECT OPERATIONS

This section briefly describes Project operations, including facilities, workforce requirements, operational mode, sediment management, and power generation.

2.3.1. Operational Facilities and Workforce

The Project will be operated from an Operations Centre, which will include several buildings (Administration, Main Control, Generator, and Security) located near the take-off yard at the Powerhouse Site (see Figure 2-2 above) and employ approximately 72 workers. Because of its remote location, accommodations for all operational staff will be provided at the Project site.

2.3.2. Infrastructure

Infrastructure to support the operations workforce is summarized in Table 2-8.

Table 2-8: Infrastructure Summary

Infrastructure	Source	Capacity	Comments
Power	UT-1 Project	11.2 GWH	Transformer to transform generation voltage to transmission voltage
Water	On-site water treatment plant	8,640 litres per day	Water source – local springs near Operations Centre
Wastewater	On-site wastewater treatment plant – package plant or community septic system	6,912 litres per day	Discharge point - Trishuli River near Operations Centre
Fuel Storage	Diesel	12,000 litre	Aboveground tank with secondary containment

2.3.3. Water Management and Operational Regime

The Project is designed to operate continuously as a run-of-river facility, diverting up to 76 m^3/s of water from a small reservoir created by the dam. The diverted water will be transported via tunnels to an underground power station. The Project discharges the water back to the Trishuli

River downstream of the dam, creating a 10.7-kilometre-long diversion reach. Flows in excess of 76 m^3/s will spill over the dam into the diversion reach.

2.3.4. Sediment Management

The Project design includes a desander to trap sediments with a particle size as small as 0.2 millimetres so as to protect the turbines, which can be damaged by exposure to large sediment particles, and help maintain the Trishuli River's natural sediment balance. The sediment deposited in the three flushing channel will be periodically flushed out with flows of 6.0 m^3/s per channel over a 3 hour period about 5.5 days per year. The sediment will be discharged to the diversion reach a short distance downstream of the dam (see Figure 2-2). Large cobble and other sediments deposited in the reservoir will be flushed by opening the gates.

2.3.5. Power Generation

The Project has a capacity of 216 MW and based on historic river flow records, is predicted to generate about 1,456 gigawatt hours per year, as summarized in Table 2-9.

Table 2-9: Summary of Project Power Generation

Project Component	Description
Installed Capacity	216 MW
Turbines	Three vertical Francis turbines of 72 MW capacity each
Net head	327 m (for 3 units generation)
Design Discharge	Q_{50} – 76 m^3/s
Maximum Diversion Flow	76 m^3/s
Average Annual Energy	1,456 GWH

GWH = gigawatt hour; m = metre; m3/s = cubic metres per second; MW = megawatt

2.4. STATUS OF REGULATORY REVIEW

As a result of earthquake and the recent construction of the Army Road, there have been several changes to the Project from the original design approved by the Government of Nepal. Table 2-10 summarizes the status of these changes from a regulatory approval perspective.

Table 2-10: Summary of Project Regulatory Review

Project Component	Documentation	Government Agency Review Status
Original Project	Original National EIA	The original national EIA was approved by Ministry of Science, Technology, and Environment on February 17, 2013
Powerhouse Worker Camp	Environmental Management Plan (EMP)	The EMP for the revised powerhouse (Mailung) Worker Camp was approved by the Ministry of Population and Environment on December 31, 2017
Transmission Line	Initial Environmental Evaluation (IEE)	The Ministry of Energy approved the IEE Terms of Reference on February 11, 2018. The transmission line alignment subsequently changed, however, for technical reasons and NWEDC has requested authorization on April 27, 2018 to proceed with the IEE based on the already approved TOR. NWEDC is awaiting authorization.

Project Component	Documentation	Government Agency Review Status
Thangu and Bajet Phat Worker Camps	Original National EIA	The addition of these worker camps returns the Project to the original design approved in 2013
Additional bridges and access roads to connect with the Army Road	Letter authorization	NWEDC sent letter to the Uttargaya Rural Municipality on January 2, 2018 to seek permission to construction temporary bridges and access roads. NWEDC is awaiting authorization.

3. LEGISLATIVE AND REGULATORY FRAMEWORK

3.1. OVERVIEW OF REGULATORY FRAMEWORK

This section provides an overview of Nepal's administrative framework and identifies relevant Nepal legislation, international treaties, and industry standards and guidelines that the Project must follow. Specifically, this chapter provides a summary of the following:

- National environmental and social legislation applicable to the Project;
- International conventions to which Nepal is a signatory; and
- International standards and guidelines applicable to the Project.

3.2. NEPAL NATIONAL ENVIRONMENTAL AND SOCIAL LEGISLATIONS

The applicable Nepalese National environmental and social legislation to the UT-1 Project is presented in Table 3-1.

Table 3-1: Applicable Regulatory Framework for the Assessment

Regulation/ Standard	Description and Key Provisions	Applicability to the Project
Constitution of Nepal, 2072 BS (2015 AD)	• Grants every citizen the right to acquire, own, sell, and otherwise dispose of property. • State shall arrange for the protection of sustainable use of and the equitable distribution of benefits derived from the flora, fauna, and biological diversity. • Calls for the elimination of feudalism and prohibits forced labour and the exploitation of people on the basis of custom, tradition, or use. • Establishes the right to property for every citizen of Nepal, whereby they are entitled to earn, use, sell, and exercise their right to property under existing laws [Art. 25(1)]. • Except for public interest, the state will not requisition, acquire, or otherwise create any encumbrances on property of a person [Art. 25(2)]. • When the state acquires or establishes its right over private property, it will compensate for loss of property, as specified under relevant laws [Art. 25(3)].	The current Constitution of Nepal is the seventh constitution of Nepal, passed on 26 September 2015, by the Constituent Assembly.
Environment Protection Act (1997 AD) and the Environment Protection Rule (1997 AD)	• Project proponent is required to carry out IEE, and if required, an EIA as per Schedule 1 & 2 (Rule 3). • Rule 5 states that in case of IEE report, the proponent should prepare and submit the ToR for approval from concerned agency. In case of EIA report, the proponent should prepare and submit the ToR to the concerned agency, which forwards it to ministry for necessary approval • No Project Proponent may implement the proposal without approval from the concerned agency, as obtained by submitting the proposal along with its IEE or EIA to the concerned agency for approval. • Section 6(5) states that while granting approval to any proposal, the ministry must take into account public comments received on the EIA report and the opinion of the committee, if any. The Ministry can only grant approval if the project does not cause significant adverse impact on the environment. Section 6(6) states that if based on the IEE or EIA, significant adverse impact can be mitigated/minimised, the concerned agency or Ministry may grant approval with the prescription of necessary terms. • Rule 10 states that the proponent should submit 15 copies of the IEE or EIA report along with the recommendation of the concerned Village Development Committee (VDC) or municipality to the concerned agency for approval	ToR for the UT-1 Project was approved by MoSTE on 2066/12/16 for 75 MW, and further revised on 2068/06/05 for 216 MW. EIA clearance was obtained by NWEDC on 17 February 2013.
Forest Act, 2049 BS (1993 AD)	• An EIA is required if Projects are in and/or pass through a forest area. • Section (68) empowers the Government of Nepal (GoN) to consent to a project to use any part or any category of forest areas, and in the absence of alternatives with the assurance that it does not pose significant adverse impacts to the environment. • Lead to the formation of forest user groups (FUGs) throughout the country. Under this Act and the Forest Regulation of 1995, FUGs are allowed to find ways to achieve financial sustainability. Requires FUGs to spend a quarter of their income on forest management.	The Project has received approval for the diversion of forestland.

Regulation/ Standard	Description and Key Provisions	Applicability to the Project
Electricity Act, 2049 BS (1992 AD)	• Enacted to manage the survey, generation, transmission, and distribution of electricity and to standardize and safeguard electricity services. • According to Section 4, sub-section (1), "Any person or corporate body who wishes to conduct survey, generation, transmission or distribution of electricity over 1 MW, shall be required to submit an application to the prescribed officer along with an economic, technical and environmental study report". • Forbids negative impacts on the environment (e.g. erosion, floods, landslides, and air pollution) while producing, transmitting, and distributing electricity. • Per Section 33, a license must be submitted with an application to the GoN when lands or houses need to be acquired. The GoN may make land and houses available in the same manner as it makes available to any corporate body under the prevailing laws.	Applicable to the Project as it will involve production and transmission of electricity.
Electricity Rules, 2050 BS (1993 AD)	• The proponent willing to produce and transmit electricity should analyse environmental impacts of the proposed projects and include impact mitigation measures and environment protection measures including arrangements for the settlement of displaced people (Rules 12 and 13). • According to Rule 66, any person or corporate body desiring to produce or transmit electricity shall submit an application requesting permission for the use of such land. The use of such land if regulated should be compensated (Rule 87), as determined by the Compensation Fixation Committee (Rule 88).	Applicable to the Project as it will involve production and transmission of electricity.
The Water Resources Act (1992 AD) and Water Resource Regulation (1993 AD)	• Contains provisions to minimize environmental impacts, including soil erosion, floods, and landslides. Requires carrying out EIA study prior to project implementation (Section 20). The Act also empowers GoN to frame standards while utilizing water resources (Section 18) and to frame rules on environment related matters and controlling pollution (Section 24). • Requires the proponent analyse environmental impacts of a proposal and provide environmental control and safety measures and other necessary arrangements to resettle people during hydro-electricity development.	Applicable to the Project for completing environmental legal requirements effectively
Aquatic Life Protection Act (1961 AD) and First Amendment (1998 AD)	• Section 5B mandates construction of a fish ladder if developing a dam or diverting water for irrigation and water supply. If a fish ladder is not possible, then a hatchery for artificial breeding of the aquatic animals should be constructed.	Applicable to the Project as dam is being constructed and the Project includes a fish ladder.
National Park and Wildlife Conservation Act (1973 AD)	• Is the key legal instrument for protecting wildlife. Section 10 of the Act provides protection status to 27 species of mammals, 9 species of birds, and 3 species of reptiles in Nepal. • Rules contain a number of regulatory measures to minimize environmental impacts within forests, national parks, wildlife reserves, and conservation areas. • An important amendment to this Act in 1993 required establishing buffer zones in areas adjoining parks to facilitate people-centred management of forests and to empower local people by involving them in all phases of planning and management	Applicable to the Project as wildlife presence have been reported in the Project area

Regulation/ Standard	Description and Key Provisions	Applicability to the Project
Solid Waste Management and Resource Mobilization Act (1987 AD)	• The main objectives of this act are to a) manage and mobilize solid waste and b) minimize the adverse effect(s) of solid waste on public health and the environment.	Applicable to the Project as solid wastes will be generated during construction and operation phases.
Soil and Watershed Conservation Act (1982 AD)	• Prevents impacts from natural calamities such as floods, landslide, and soil-erosion and maintains the volume, quality, and flow of water in a normal condition. • Prevents the mismanagement of watersheds, which could lead to the degradation of valuable land by flooding, waterlogging, and accelerated silt deposition in storage reservoirs, by outlining parameters for proper watershed management (rivers and lakes). Applicable only to protected watersheds. • Allows the GoN to declare any area as a conserved watershed area (via a notification in the Nepal Gazette), if it considers it necessary for soil and watershed conservation. • Authorizes Watershed Conservation Officers (WCOs) to carry out, or enforce requirements such as construct, look after, and maintain a prevention or control dam, check dam, embankment, terrace improvement, ditch, feeder ditch, or diversion channel or drainage, retaining wall, pond, or similar other necessary structure; conserve, look after, maintain, and support the forests, weeds, grasses, and other natural vegetation in areas where landslide may occur; maintain soil fertility, water quality, and balanced environments; and carry out such other soil and watershed conservation related acts as prescribed by the GoN. Also, authorizes the WCO to grant permission to construct dams, drainage ditches, and canals, cut privately owned trees, excavate sand, boulders and soil, discharge solid waste, and establish industry or residential areas within any protected watershed. • Notwithstanding anything contained in the prevailing law, no person shall, without permission of the WCO, carry out any of the aforementioned activities in conserved watershed areas.	Applicable to the Project as it involves working in close proximity to waterbodies and is located in an area with high seismic activity.
Nepal Environmental Policy and Action Plan (1993 AD)	• The GoNs major environmental policy initiative, endorsed by the GoNs Environment Protection Council. Incorporates environmental concerns into the development process. • Identifies significant environmental impacts of a hydropower project. Outlines EIA as a necessary tool in planning hydroelectric projects and emphasizes a greater participatory role of the local communities from the feasibility study stage to plan execution, especially in regards to mitigation measures.	Applicable as the Project is a river valley hydro project.
Hydropower Development Policy 2056 BS (2001 AD)	Intends to make hydropower development in Nepal clear, transparent, and investment-friendly. Lead to the creation of a model Project Development Agreement (PDA) by the Ministry of Energy in 2010, which identified benefits/provisions as follows: • Depending on the project capacity, allot a max of 10% equity share of the project to VDC residents of the project site and resettled/ rehabilitated people at the initiation of construction activities. • Encourages electrification in rural areas directly affected by the project (households within 500 metres) and provides 20 kWh of electricity per month per family residing in the area. Exempts the collection of royalties on electric energy for the first 15 years.	Applicable as the Project is a run of the river hydropower Project.

Regulation/ Standard	Description and Key Provisions	Applicability to the Project
	• Sets up a rural electrification fund for the development of micro-hydropower and rural electrification from a certain percentage of the royalties. • Makes provisions to provide grants through the Alternative Energy Promotion Centre (AEPC) to the domestic private sector to build hydropower projects of up to 100 kW at the rural level. • Requires provisions be included in the agreement made with the licensee to benefit local people from the operation of the hydropower projects. Such provisions shall be. • Implementation of ESIA recommendations shall be emphasized. • Requires downstream flows at either 10% of the minimum mean monthly flow or the quantity identified in the EIA study, whichever is higher. • Encourages private sector to acquire houses or land on its own, Rehabilitation/Resettlement for displaced families shall be as specified by the GoN. • Royalties shall be shared as prescribed with the District Development Committee (DDC), and spent on development and construction	
Explosives Act (1961 AD)	• Gives the GoN the right to define the explosive and the requirement of publication of notice. • Defines explosive matter (Section 2),Section 3 authorizes the GoN to declare materials harmful to life or property (Section 3), forbids production, storage, use, sale, transportation, and import of explosives without license from the Chief District Officer (Section 4), requires the GoN be informed of accidents related to explosives substances (section 8).	Applicable to the project as it provides guidelines and specifications regarding the use of explosives to be used for blasting activities.
Land (Survey and Measurement) Act (1963 AD)	• Sets out provisions related to survey of lands, ownership, and registration of land. • Recognizes ancient land use (without any requirement of supporting evidence of registration or payment of land revenue) on land except land that is barren or public, or land in a forest, and grants ownership to such users (Sect. 6). • Encroached land is categorized as GoN or public land in the process of survey and measurement, on completion of survey and measurements, land ownership registration certificates are provided to concerned landowners (Sect. 8) • Schedule 12 of the Land Survey Rules (2058) provides an overview of the types of land categories on the basis of features such as road access, source of irrigation, etc.	Applicable to the Project in terms of providing an understanding of the land use and classification, the process of surveying the land, registering the land, and the land rights identified by law.
The Land (Measurement and Inspection) Act, 2020 BS (1962 AD, as amended)	• Classified lands for survey and registration into four types Abal, Doyam, Sim, and Char. The aim of this Act is to measure and classify land resources to improve the land use system. This act therefore did not focus on protection of tenancy rights, but accepted that long-term possession of land – 15 years without dispute – would ensure ownership right	
Agriculture (New Arrangements) Act and Land Administration Act (1963 AD)	• Sets out the classification of land and requirements for land survey and registration. • Restates earlier legislation abolishing intermediaries and landlord systems of tenure. • Establishes district-level land administration offices and sets procedures for maintaining land registration records.	

Regulation/ Standard	Description and Key Provisions	Applicability to the Project
Land Reform Act, 2021 BS (1964 AD)	• According to Section 3, Private land (known as Raikar land) is subject to payment of land revenue. Kipat land, which is communally owned land, is also subject to payment of land revenue and can be transferred like Raikar land to another entity (Sect. 3). • Sets upper ceiling on the amount of land to be owned by a person: according to the regulation, a person (a single entity) is not allowed to own over 10 Bigha land in all Terai regions (including inner Terai), Kathmandu Valley, and all hilly regions except Kathmandu Valley. Their families may additionally own land not exceeding the following ceilings: Terai region: 1 Bigha; Kathmandu Valley: 5 Ropani; All hilly regions except Kathmandu Valley: 5 Ropani (Sect. 7). • The title to any land in excess of that stated above, if transferred to any other party, will not be recognized by Law. • As per the Act, tenants are those people that cultivate land that is obtained on lease. The upper ceiling for tenants is as follows: Terai region: 4 Bigha; Kathmandu Valley: 10 Ropani; All hilly regions except Kathmandu Valley: 20 Ropani	
Land Acquisition Act, 2034 BS (1977 AD)	This Act and subsequent amendments (1993 AD) are the core legal documents to guiding land acquisition and resettlement. Empowers the GoN to acquire land for development purposes by paying compensation to the landowner. Some of the key features are as follows: • Authorizes the GoN to acquire land required for public purpose or for operation of any government institution initiated development project by compensating pursuant to the Act (Sections 3 and 4). Compensation should be in cash, per current market value. However, Clause 14 allows to compensate land for land, provided government land is available in the area. • The of acquisition and compensation process includes (a) initial procedures, (b) a preliminary investigation process, (c) acquisition notification, (d) compensation notification, and (e) appeal procedures. The public notification process is undertaken by the Executing Agency (EA) and includes the dissemination of the land and structures to be affected by the project • To identifying the compensation amount, a Compensation Fixation Committee (CFC) is formed under the chairmanship of the Chief District Officer (CDO) of the district. The CFC verifies the land to be acquired, reviews and fixes compensation rates, identifies proper owner(s), distributes compensation, and provides necessary administrative support for addressing associated issues. CFC's implementation process begins once the GoN grants formal approval for the land acquisition. • Allows two separate rates of compensation, distinguishing between families who lose all their land and those who lose only some part of their landholdings. The GoN may allot land it possesses such as *ailani*, or other Government-owned land, if they prefer land for land (Sect. 14).	Project land was mostly bought through private purchase, although some of the provisions of the Act were partially used by the District administration in the interest of the Project.

Regulation/ Standard	Description and Key Provisions	Applicability to the Project
The Land Revenue or Malpot Aien (Land Administration and Revenue) Act, 2034 BS (1977 AD)	Administers land, including maintenance and updating records, collection of land revenue and settlement of disputes after completion of surveys, and handing over Survey Party records to the Land Revenue Office (LRO). Authorizes the LRO to registration, ownership transfer, and deed transfer of land (if any person applied for the ownership transfer of his/or land with mutual understanding for public use with recommendation of relevant committee).	This Act guided the process of transfer of land from private landowners to the Project.
Land Acquisition, Resettlement and Rehabilitation Policy for Infrastructure Development Projects, 2071 BS (2015 AD)	The key objective of this policy is to avoid or at least minimize displacement, and where not possible, provide adequate compensation and rehabilitation assistance to affected persons. Puts in place provisions for early screenings and assessment of potential impacts and the formulation of adequate mitigation plans. Requires adequate engagement and information disclosure to be undertaken, including a grievance redressal mechanism. Puts in place a process for land acquisition, depending on project classification, based on the region of the project and the number of families displaced (economically and physically); and for land valuation and identifying provisions for relocation and social inclusion. Discourages land acquisition through eminent domain. Key features of the policy (relevant to the Project) are as follows: • Social mobilization income restoration and life skill program: gives project-affected persons necessary training for development of life skills, income generating, savings, and credit schemes so they can take up self-employment projects at the resettlement zone; preference should be given to women • Entitles vulnerable groups such as Janajati/Adivasi, Dalits, women (women-headed households), differently-abled, poverty groups and senior citizens to special benefit and assistance packages in addition to compensation and resettlement	According to the project classification criteria, the UT-1 project is categorised as a High Risk Project. This policy shall guide the identification of mitigation measures for the Project and the formulation of management plans for the implementation of the same.
The Guthi Corporation Act, 2033 BS (1976 AD) and Second Amendment (1993 AD)	Deals with the management of the Sanstahan, powers, duties, etc. and includes provision for the rent and tenancy rights associated with Guthi land. Per Section 30 “Notwithstanding anything contained in Lands Act, 1964 and other prevailing Nepal law, the tenancy right in a land cultivated on tenancy according to this Act may be sold and purchased.” Chapter 6 details provisions relating to Tenants. Section 35 details registration of tenants on payments of fees.	This Act is applicable as a portion of the land impacted by the Project is Guthi land.

AAPA = Aquatic Animal Protection Act; AD = anno Domini; APEC = Alternative Energy Promotion Centre; BS = Bikram sambat; CDO = Chief District Officer; CFC = Compensation Fixation Committee; DDC = District Development Committee; EA = Executing Agency; EIA = Environmental Impact Assessment; EPC = engineering, procurement, and construction; ESMMP = Environmental and Social Management and Monitoring Plan; ESMS = Environmental and Social Management System; GoN = Government of Nepal; HMG/N = His Majesty's Government of Nepal; IEE = Initial Environmental Examination; kW = kilowatt; LRP = Large Renewable Procurement; MoSTE = Ministry of Science, Technology and Environment; MW = megawatt; NWEDC = Nepal Water and Energy Development Company; PAF = Project Affected Family; PDA = Project Development Agreement; ToR = Terms of Reference; UT-1 = Upper Trishuli 1; VDC = Village Development Committee

3.3. PROVISIONS OF THE PROJECT DEVELOPMENT AGREEMENT

On 29 December 2016, the Project Development Agreement (PDA) for the Project was signed between the Ministry of Energy, the Government of Nepal (GoN), and NWEDC. The provisions of the PDA are a binding commitment for the Project. Some of the key clauses of the agreement pertaining to environmental and social aspects are as follows (this is not an exhaustive list):

- The following plans shall be prepared as part of the project:
  - The Local Benefit Sharing Plan
  - Employment and Skill Training Plan
  - Industrial Benefits Plan
- The Company shall ensure that its Nepal Employment and Skills Training Plan provides for appropriate training of suitable citizens of Nepal for Project-related opportunities.
- The Company shall comply with the Nepal Employment and Skills Training Plan, Nepal Industrial Benefits Plan, and Local Benefit Sharing Plan and ensure that appropriate programmes are designed to assist suitable Nepali citizens, entities, and firms to meet the Project's requirements for goods and services.
- The Company shall conduct employee training programmes from time to time, including training in each of the skills used in the Project, including management training.
- **Prior to Commercial Operation Date**, the Company shall build the distribution network to supply such Local Free Power to each Eligible Household within the Free Electrification Area.
- GoN shall be responsible for the operation and maintenance of such distribution network at its sole cost.
- GoN and the Company shall jointly prepare a Plan (the "Rural Electrification Plan"), based on a pre-feasibility study to be carried out by GoN and the Company (at the Company's sole cost) to assess the costs and scope of rural electrification.
- The Company shall implement the Rural Electrification Plan.
- **From and after commercial operation date**, the company shall supply at its own cost 20 kilowatt-hours of free power each month to each household within the free electrification area to up to 200 percent of the number of original Households.
- The company shall not impair the use of the river for drinking and cultural uses, existing irrigation, or industrial and recreational uses. Where impaired, it shall be mitigated.

The Company shall submit reports every six months to the GoN for the first three years of the Construction Period and every 12 months thereafter. These reports shall describe in detail (a) its employee training programmes, (b) the implementation of such training programmes, (c) the progress made towards meeting the objectives of using Nepali resources, training, and development, the Nepal Employment and Skills Training Plan, Nepal Industrial Benefits Plan, and Local Benefit Sharing Plan.

3.4. NATIONAL ENVIRONMENTAL GUIDELINES

Table 3-2 provides national Nepalese guidelines that are applicable to the Project.

Table 3-2: Applicable Nepalese Environmental Guidelines

Guideline	Description
National EIA Guidelines, 1993	Procedures for integrating environmental aspects to development projects, including objectives, criteria for project screening, IEE, scoping, preparation of TORs, EIA format, impact identification, mitigation measures, review, monitoring, evaluation and auditing, community participation, and schedules and annexes to the IEE and EIA.
EIA Guidelines for Water Resource Sector, 1994	For the (a) identification of positive and negative impacts of water resource projects (short-term and long-term) on natural and human environments, (b) development of mitigation, management and monitoring plans, and (c) public hearings and interaction with affected groups, NGOs, donors and relevant government agencies. Per the guidelines, hydropower projects with transmission lines of 75 km length and 66 KV require an EIA.
EIA Guidelines for Forestry Sector, 1995	Promotes sustainable use of forest resources for socioeconomic development while meeting basic needs of the communities. Requires identification of Positive and negative impacts of development projects in forest areas and plans must be developed to minimize environmental damage, conserving genetic resources and biodiversity.
Community Forest Guidelines, 1997	Provides process and procedures to identify and capacitate community groups, establish community forest-user groups and their registrations, prepare forest management plans and registrations, regulations and implementation of forest management plans, amendments to regulations and management plans, and roles and responsibilities.
Forest Product Collection and Sales Distribution Guidelines, 2000	Clauses 3-10 specify various procedures and formats for getting approval for vegetation clearance, delineation of lands for vegetation clearance, evaluation of wood volume, etc., and government offices and officials responsible for the approval, delineation, and evaluation.
Guidelines on Environmental Management Plan, Monitoring and Auditing Published by MoEST, 2006	Details methods and procedures for the preparation of EMPs, environmental auditing and environmental monitoring of hydropower development projects

EIA = Environmental Impact Assessment; EMP = Environmental Management Plan; GoN = Government of Nepal; IEE = Initial Environmental Examination; km = kilometre; KV = kilovolt; MoSTE = Ministry of Science, Technology and Environment; ToR = Terms of Reference

3.5. PROJECT RELEVANT INTERNATIONAL TREATIES AND CONVENTIONS

Nepal is party to a number of international environmental conventions, treaties, and agreements. International treaties and conventions relevant to the Project which have been signed, ratified, or are in the process of ratification by Nepal are detailed in Table 3-3.

Table 3-3: Project Relevant International Treaties and Conventions

International Convention/ Treaties	Description	Current status
Ramsar Convention, 1971	The convention urges parties to conserve wetlands, promote their sustainable utilization, and set aside special areas as wildlife reserves. Every country is required to designate at least one wetland for inclusion.	Ratified in 1987
Convention on the International Trade in Endangered Wild Fauna and Flora (CITES), 1973	Classifies species according to criteria where access or control is important (e.g. I - species threatened with extinction; II - species which could become endangered; III - species that are protected; E - Endangered; V - Vulnerable, R – Rare) (CITES 1983). The Project will have to minimize impacts to CITES species as much as possible	Ratified in 1975
International Tropical Timber Agreement, 1983	Ensured that exports of tropical timber originated from sustainably managed sources by the year 2000, and established a fund to assist tropical timber producers in obtaining the resources necessary to reach this objective. It defined the mandates of the International Tropical Timber Organization emphasizing the management, conservation, and sustainable development of all types of forests.	Accession to the agreement in 1990
Basel Convention, 1989	The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, adopted on 22 March 1989	Accession to the convention in 1996
Biodiversity Convention, 1992	Urges Parties to introduce appropriate procedures requiring an EIA of proposed projects that are likely to have significant adverse impacts on biological diversity with the objective of avoiding or minimizing such impacts and, where appropriate, allowing public participation in such procedures. The convention also focuses on reducing trans-boundary impacts on biodiversity.	Ratified by Parliament in 1993, and entered into force in Nepal on 21 February 1994
ILO 169: Convention on Indigenous and Tribal Peoples, 1989	Convention No. 169 supports the principle of self-management and guarantees the rights of Indigenous Peoples to consultation and participation in issues relating to their own development. The land rights of Indigenous Peoples are linked to the Land Reform Act of 1964.	Ratified in 2007

CITES = Convention on the International Trade in Endangered Wild Fauna and Flora; EIA = Environmental Impact Assessment

3.6. INTERNATIONAL FINANCIAL INSTITUTIONS SAFEGUARD REQUIREMENTS

Financing sources and financial support for the Project will come from multi-lateral financial institutions such as the World Bank (WB), the International Finance Corporation (IFC), the Asian Development Bank (ADB), Asian Infrastructure Investment Bank's (AIIB) Policies and Standards, as well as from the export credit agencies of the countries where major pieces of equipment for the Project will be sourced. Support from these institutions depends on adherence to international best practices and the environmental and social safeguard requirements of the lenders. The following subsections outline the key environmental and social requirements of the ADB, EIB, and IFC applicable to the Project.

3.6.1. Asian Development Bank

In July 2009, ADB's Board of Directors approved the new Safeguard Policy Statement (SPS) governing the environmental and social safeguards of ADB's operations. The SPS builds upon ADB's previous safeguard policies on the Environment, Involuntary Resettlement, and Indigenous Peoples, and brings them into one consolidated policy framework with enhanced consistency and coherence, and more comprehensively addresses environmental and social impacts and risks. The SPS also provides a platform for participation by affected people and other stakeholders in the Project design and implementation.

The SPS applies to all ADB-financed and/or ADB-administered projects and their components, regardless of the source of financing, including investment projects funded by a loan, and/or a grant, and/or other means such as equity and/or guarantees. ADB works with borrowers and clients to put into practice the requirements of SPS. The objectives of ADB's safeguards are to:

- Avoid adverse impacts of projects on the environment and affected people, where possible;
- Minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
- Assist borrowers and clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

ADB's SPS sets out the policy objectives, scope and triggers, and principles for three key safeguard areas: environmental safeguards, involuntary resettlement safeguards, and indigenous people's safeguards. In addition, there are special requirements for different finance modalities (Appendices 1-4 of SPS). The ADB does not finance activities on the prohibited investment activities list (Appendix 5 of SPS). Furthermore, ADB does not finance projects that do not comply with its safeguard policy statement, nor does it finance projects that do not comply with the host country's social and environmental laws and regulations, including those laws implementing host country obligations under international law. Relevant ADB Policies are described in Table 3-4.

Areas where ADB policies and guidelines differ from WB Guidelines and IFC Performance Standards (PS) (described in Section 3.6.2) include the physically handicapped or disabled people's inclusion in "vulnerable groups" core labour standards where ADB's SPS makes no direct reference to these standards as part of ADB's operational safeguard requirements. However, the SPS prohibited investment activities list (Appendix 5 of SPS) excludes production or activities involving forced and child labour from qualification for ADB financing.

Table 3-4: Applicable ADB Policies and Guidelines

Policy/Guideline	Description
ADB Public Communications Policy, 2011	Sets out disclosure requirements for consultation and information disclosure during project preparation and operation to affected populations and other key stakeholders. Requires the borrower disclose information via ADB's website. Documents must provide relevant environmental information in a timely manner, in an accessible place, and in a form and language(s) understandable to affected people and other stakeholders. For uneducated people, other suitable communication methods must be used. Requires consultation and participation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.
ADB Social Protection Strategy, 2001	Social protection is a key step in ADB's battle to have Asia and the Pacific region "free of poverty." The SPS spells out the scope of social protection and commitment of the ADB to develop priority interventions in five major elements including labour market policies and programs, social insurance programs, social assistance and welfare service programs, micro and area-based schemes to address vulnerability at the community level, and child protection.
ADB Operations Manual (OM) C3 Sector and Thematic Policies on Incorporation of Social Dimensions, 2011	All ADB operations have social dimensions that need to be taken into account from the country strategy formulation, programming, and project processing phases onward. Key social dimensions, supported by specific ADB policies or strategies, include participation, gender and development, social safeguards, and management of social risks, especially among vulnerable groups. In pursuing these social development outcomes, the ADB encourages consultation with and participation by stakeholders; addresses gender considerations in relevant aspects of operations; integrates social analysis in preparing country partnership strategies as well as regional strategies and programs; and ensures that project design and implementation arrangements include actions to enhance benefits and to monitor and evaluate the distribution of the benefits of the project.
ADB Gender Mainstreaming Guidelines, 2012	Provide a detailed overview on the definition, requirements and application of the following gender four mainstreaming categories: • Category I: gender equity as a theme (GEN); • Category II: effective gender mainstreaming (EGM); • Category III: some gender elements (SGE); and • Category IV: no gender elements (NGE).

ADB = Asian Development Bank; EIA = Environmental Impact Assessment; EMP = Environmental Management Plan; IEE = Initial Environmental Examination; IPP = Indigenous Peoples Plan; RP = Resettlement Plan; SPS = Social Protection Strategy

3.6.1.1. ADB Project Categorisation

The SPS further outlines a classification system for the categorisation of projects. The classification tentatively occurs at the project identification stage, during the initial screening of anticipated impacts. However, classification is an on-going process, and the classification can be changed at any time with the concurrence of the Chief Compliance Officer (CCO) as more information becomes available and the project proceeds.

Environment

A project's environment category is determined by the category of its most environmentally sensitive component, including direct, indirect, induced, and cumulative impacts. Each proposed project is scrutinized as to its type, location, scale, sensitivity, and the magnitude of its potential environmental impacts. The level of detail and comprehensiveness of the Environmental Impact

Assessment (EIA) or Initial Environmental Examination (IEE) are commensurate with the significance of the potential impacts and risks.

Involuntary Resettlement

A project's involuntary resettlement category is determined by the category of its most sensitive component in terms of involuntary resettlement impacts. The involuntary resettlement impacts of an ADB-supported project are considered significant if 200 or more persons will experience major impacts, which are defined as (a) being physically displaced from housing, or (b) losing 10% or more of their productive assets (income generating). The level of detail and comprehensiveness of the resettlement plan are commensurate with the significance of the potential impacts and risks.

Indigenous Peoples

ADB also screen all projects to determine if they have potential impacts on Indigenous Peoples. For projects with impacts on Indigenous Peoples, an Indigenous Peoples Plan needs to be prepared. The degree of impacts is determined by evaluating (a) the magnitude of the impact on Indigenous Peoples' customary rights of use and access to land and natural resources; socioeconomic status; cultural and communal integrity; health, education, livelihood systems, and social security status; or indigenous knowledge; and (b) the vulnerability of the affected Indigenous Peoples.

3.6.1.2. Upper Trishuli 1 Project Classification as per ADB SPS

Categorization for the proposed Project was undertaken by using ADB's Rapid Environmental Assessment (REA), Involuntary Resettlement (IR), and Indigenous People (IP) Assessment checklists during the screening and scoping exercise (see Table 3-5).

Table 3-5: Project Categorisation as per ADB Safeguards

Criteria	Remarks	Category
Environmental Categorization	The Project is a Run of River Hydropower Project and could potentially have significant adverse social and/or environmental impacts that are diverse, irreversible, and unprecedented. The Project is also located in close vicinity of the Langtang National Park, which is a biodiversity-protected area. The Project will result in regulated/ reduced downstream flow and will have associated impact on aquatic biodiversity. There is also loss of 76.62 ha community forest, 2.6 ha from Langtang National Park.	A
Indigenous Peoples Category	Approximately 89% of the total PAFs for the project belong to the Tamang group and are categorised as Indigenous Peoples, in keeping with ADB's definition. However, no land or resource under customary rights of use is likely to be impacted due to the project. Impacts primarily pertain to the loss of land and subsequent impacts on livelihood.	A
Involuntary Resettlement Category	The Project has resulted in the loss of land for 39 land owners/tenants. While no physical displacement is expected, the Project has impacted 23 structures. Furthermore, the Project will result in an adverse impact on the livelihood of 154 PAFs.	B

ADB = Asian Development Bank; PAF = Project Affected Family

3.6.2. International Finance Corporation

3.6.2.1. Performance Standards

The IFC is a division of the World Bank Group that lends to private investors. The IFC released a Sustainability Policy and set of PSs on Social and Environmental Sustainability in January 2012. These standards stipulate that the Project shall meet certain requirements throughout the life cycle of an investment by IFC or other relevant financial institution or commercial banks, which are signatory to the Equator Principles (EP 2006).

These PS and guidelines provide ways and means to identify impacts and affected stakeholders and lays down processes for management and mitigation of adverse impacts, see Table 3-6.

Table 3-6: IFC Performance Standards

Performance Standard	Description	Purpose
PS 1: Assessment and Management of Environmental and Social Risks and Impacts	Underscores the importance of managing environmental and social performance throughout the life of a project (any business activity that is subject to assessment and management).	• To identify and assess environmental and social risks and impacts of the project. • To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise impacts and risks • To promote improved environmental and social performance through management systems. • To ensure grievances and external communications from are responded to and managed appropriately. • To promote and provide means for adequate engagement with Affected Communities
PS 2: Labour and Working Conditions	Recognises that the pursuit of economic growth through employment creation and income generation should come with the protection of worker's fundamental rights.	• To promote the fair treatment, non-discrimination and equal opportunity of workers and to protect workers. • To promote compliance with national labour and employment laws. • To promote safe and healthy working conditions, and health of workers.
PS 3: Resource Efficiency and Pollution Prevention	Recognises that increased economic activity can generate increased levels of pollution and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels.	• To avoid or minimise adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. • To promote more sustainable use of resources, including energy and water. • To reduce project-related greenhouse gas emissions.
PS 4: Community Health, Safety and Security	Recognises that project activities, equipment, and infrastructure can increase community exposure to risks and impacts.	• To anticipate and avoid adverse impacts on health and safety of the Affected Community during the project life from both routine and non-routine circumstances • To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimises risks to the Affected Communities.

Performance Standard	Description	Purpose
PS 5: Land Acquisition and Involuntary Resettlement	Recognises that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land.	• To avoid, and when avoidance is not possible, minimise displacement by exploring alternative project designs. • To avoid forced eviction. • To anticipate and avoid, or where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land use • To improve or restore, the livelihoods and standards of living of displaced persons.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Recognises that protecting and conserving biodiversity, maintaining ecosystems services, and sustainably managing living and natural resources are fundamental to sustainable development	• To protect and conserve biodiversity. • To maintain the benefits from ecosystem services. • To promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities.
PS 7: Indigenous Peoples	Recognises that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalised and vulnerable segments of the population.	• To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples • To anticipate and avoid or minimize adverse impacts of projects on communities of Indigenous Peoples • To promote sustainable development benefits and opportunities for Indigenous Peoples • To establish and maintain an ongoing relationship based on Informed Consultation and Participation with the Indigenous Peoples affected by a project through the project's life cycle. • To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples
PS 8: Cultural Heritage	Recognises the importance of cultural heritage for current and future generations	• To protect cultural heritage from the adverse impacts of project activities and support its preservation • To promote the equitable sharing of benefits from the use of cultural heritage.

Source: IFC Performance Standards, January 2012

3.6.2.2. Additional IFC Policies

IFC EHS Guidelines

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimising, and controlling EHS impacts during the construction, operation, and decommissioning phase of a project or facility. The EHS Guidelines serve as a technical reference source to support the implementation of the IFC PSs, particularly in those aspects related to PS 3: Pollution Prevention and Abatement, as well as certain aspects of occupational and community health and safety. General EHS Guidelines (30 April 2007) also exist, which contain information on crosscutting environmental, health, and safety issues potentially applicable to all industry sectors.

When host country (Nepal) regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is required.

3.7. WORLD BANK

The World Bank has several key environmental and social safeguard policies, known as the Operational Policies (OPs). These policies are considered critical to ensuring that potentially adverse environmental and social consequences are identified, minimized, and mitigated, and that they receive particular attention during the WB's project preparation and approval process. Because this Project is a private-sector project, it must comply with the requirements of OP 4.03 – Performance Standards for Private Sector Activities. OP 4.03 requires that projects designed; owned, constructed, and/or operated by a Private Entity comply with the IFC Performance Standards.

3.8. ASIAN INFRASTRUCTURE INVESTMENT BANK

The Asian Infrastructure Investment Bank (AIIB) is a multilateral development bank that invests in sustainable infrastructure projects in Asia. The Bank's Environmental and Social Framework aims to achieve environmentally and socially sustainable project outcomes by integrating good international practice in to all phases of a project, from the decision making to the preparation and implementation. Included in its framework[1] are:

- An Environmental and Social Policy (ESP), which sets forth mandatory environmental and social requirements for each Project.
- Environmental and Social Standards (ESSs), which set out more detailed mandatory environmental and social requirements relating to the following:
  - ESS 1: Environmental and Social Assessment and Management (ESS 1);
  - ESS 2: Involuntary Resettlement (ESS 2); and
  - ESS 3: Indigenous Peoples (ESS 3). And,
- An Environmental and Social Exclusion List (as an appendix to the ESP) that provides an exclusion list of activities or items that will not be funded by the AIIB.

Together, the Bank's Policy and Standards comprise an environmental and social management approach that is designed to:

- Support decision-making by the Bank.
- Provide a robust structure for managing operational and reputational risks of the Bank and its shareholders in relation to environmental and social risks and impacts in Projects.

[1] AIIB's Environmental and Social Framework: https://www.aiib.org/en/policies-strategies/framework-agreements/environmental-social-framework.html

- Provide for environmental and social screening and categorization of Projects.
- Analyse potential environmental and social risks and impacts of Projects.
- Identify actions to avoid, minimize, mitigate, offset or compensate for environmental and social impacts of Projects.
- Support integration of environmental and social management measures into Projects.
- Specify environmental and social management provisions to be included in agreements governing Projects.
- Provide a mechanism for public consultation and disclosure of information on environmental and social risks and impacts of Projects.
- Provide for monitoring and supervision of environmental and social management measures under Projects.
- Facilitate development and dissemination of lessons learned from Projects to improve environmental and social management practices.

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4. PROJECT ALTERNATIVES

This section provides an overview of some of the major Project design alternatives that were considered through the course of Project planning and the rationale for selecting the proposed alternative. In general, the robustness of the alternatives evaluation should be commensurate with the magnitude of potential impacts (e.g. design features that would result in significant impacts should have a more rigorous evaluation of alternatives).

4.1. NO ACTION ALTERNATIVE

There is a large unmet demand for electricity in Nepal. Under the No Action Alternative, the proposed Project would not be constructed and the residents of Nepal would likely continue to rely on fossil fuels or biomass for their power needs, both of which have adverse climate change, environmental, and social implications; and would not provide the electrical reliability needed within the national power grid to promote economic development. The use of solar power and biogas can be alternative sources of power, but are unlikely to fulfil all of the country's power demands and meet baseload power requirements. Further development of the Trishuli River's hydropower potential (i.e., there are already six other operating hydropower projects within the river basin – see Section 7.12) offers environmental advantages compared with affecting an undeveloped free flowing river system. Therefore, hydroelectric power, especially in already partially developed river basin, is a very attractive renewable energy alternative for Nepal.

4.2. PROJECT LOCATION

The proposed Project location has been optimized using technical, environmental, and social criteria. From a technical perspective, locations further upstream would conflict with other existing and proposed hydropower projects, are limited to some extent by terrain and access, and would provide less water resource for hydropower generation. Locations further downstream would conflict with other existing and proposed hydropower projects and result in the physical resettlement and economic displacement of more villages and people because of the greater population densities (see Figure 4-1).

From an environmental perspective, there are already six existing operating hydropower projects on the Trishuli River, including two along the mainstem of the Trishuli River downstream of the UT-1 Project, and seven more hydropower projects under construction, including the UT-3A project located approximately 1.5 kilometres downstream of the UT-1 Project. Locating the Project on a river with existing/under construction dams both upstream and downstream is preferred to locating the project on a river without dams. Further, fishery data suggest that the Common snowtrout (*Schizothorax richardsonii*) population (an IUCN-listed Vulnerable species; see Section 6.2.1.1) may be limited in the Trishuli River upstream of confluence with the Mailung Khola tributary (i.e. the approximate location of the UT-1 powerhouse) by the river's cold temperature. Therefore, the proposed location optimizes power generation, while minimizing potential social and environmental impacts.

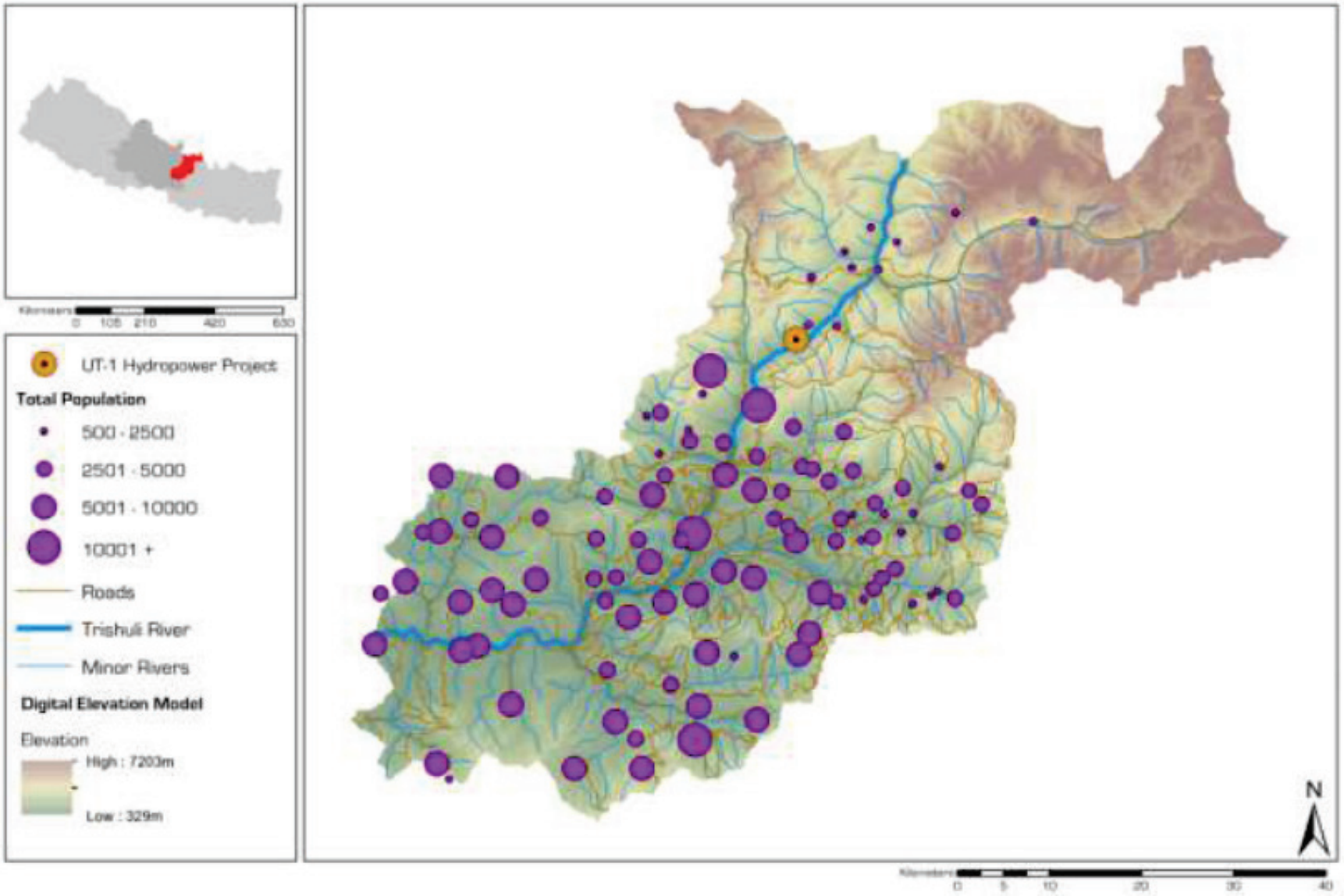


Figure 4-1: Project Location

4.3. PROJECT SIZE

The Nepal Water and Energy Development Company (NWEDC) evaluated four potential Project sizes in terms of installed capacity ranging from 175 to 437 megawatts (MW). The proposed 216 MW size would have a design discharge that approximates the average annual flow in the Trishuli River at the dam location (e.g. 76 cubic metres per second [m^3/s]). Project designs with less capacity (e.g. 175 MW option with a hydraulic capacity of 60 m^3/s) would not optimize the power potential of the river, while having similar magnitude environmental and social impacts to the 216 MW option. Project designs with more capacity (e.g. the 353 MW and 437 MW options with hydraulic capacities of 120 and 150 m^3/s, respectively) would likely require larger reservoirs and possibly peaking operations to justify the larger capital expense, which would result in more environmental and social impacts. Therefore, the proposed 216 MW capacity for the UT-1 Project is considered an optimal size. An economic analysis concluded that the 216-MW capacity also has the best Internal Rate of Return among the four installed capacity options (NWEDC 2012).

No other form of renewable energy generation in the region can offer a baseload of 216 MW. A smaller hydropower project combined with wind or solar power generation could potentially provide a similar baseload, but this would not fully use the energy potential of the Trishuli River and would come with the additional environmental impacts associated with the peaking operations needed to meet baseload requirements.

4.4. OPERATING REGIME

NWEDC proposes to operate the Project in a continuous run-of-river mode, with very little water storage in the proposed 2.1-hectare reservoir. From a fisheries and ecosystem services perspective, a continuous run-of-river facility is generally considered to have the least downstream impacts because there is negligible alteration of the natural flow regime. A peaking operation would result in more significant alteration of the natural flow regime and would require a larger upstream reservoir, resulting in greater environmental, and potentially social, impacts both upstream and downstream of the dam. Therefore, the proposed run-of-river operations is considered the preferred operating regime alternative, so other alternatives would not offer any meaningful environmental and/or social benefits.

4.5. LOCATION OF PROJECT FACILITIES

NWEDC has carefully located Project facilities to avoid or minimize environmental and social impacts. For example:

- Underground facilities – Locating several Project facilities underground, although primarily for engineering and safety reasons, also avoids disturbance of steep slopes, natural vegetation, and agricultural lands, and minimizes private land acquisition.
- Facilities along the west bank of the Trishuli River – Locating the headrace tunnel, penstock, and powerhouse along the west bank of the Trishuli River minimizes impacts to the Langtang National Park, which is located along the east bank of the river.

- Location of quarry and spoil disposal sites – Locating these facilities so as to avoid cultivated and forest land minimizes impacts to local communities and the environment.
- Location of the Powerhouse Site worker camp – These Powerhouse Site worker camp has been relocated to the east bank of the Trishuli River to reduce landslide risk and to enhance worker safety, since the former worker camp at Mailung School was severely damaged in the 2015 earthquake, resulting in many injuries and fatalities. Suitable sites for a worker camp in the Project area are limited by topography. The proposed site, although within the Langtang National Park buffer area, is isolated from most of the remainder of the park by steep slopes and the Betrawoti-Mailung-Syabrubesi Road, is already disturbed and has little tree cover, and is not currently occupied, although it was prior to the earthquake (see Figure 4-2). For these technical, environmental, and social reasons, the proposed location for the Powerhouse Site worker camp was found to be the preferred site for the worker camp.

Figure 4-2: Proposed Powerhouse Worker Camp Site

5. AREA OF INFLUENCE

As per International Finance Corporation (IFC) Performance Standard (PS) 1, the Area of Influence (AoI) encompasses, as appropriate:

- The area likely to be affected by:
  - The activities and facilities that are directly owned, operated, or managed by the client (including by contractors) and that are a component of the project;
  - Impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or
  - Indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.
- Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist, and without which the project would not be viable.
- Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned, or reasonably defined developments at the time the risks and impacts identification process is conducted.

Based on this definition, the following AoIs were identified:

- Environmental AoI that encompasses environmental receptors, as established through relevant baselines studies, likely to be affected by the footprint of the Project and associated facilities;
- Socioeconomic AoI incorporating socioeconomic and cultural receptors that are likely to be affected by Project activities and components; and
- Cumulative Impact Assessment AoI based on cumulative impacts arising from incremental impacts from the Project on aquatic resources over and above other existing or planned activity in the watershed of the Trishuli River.

5.1. ENVIRONMENTAL AOI

The Environmental AoI (see Figure 5-1) was defined as including:

- All project facilities and lands, as described in Chapter 2, Project Description, extending from the upstream extent of the Project reservoir, downstream to the powerhouse near the village of Mailung;
- Ancillary Project facilities, such as the proposed access road (i.e. the Mailung to the Project dam road) and the Project transmission line (approximately 1184.5 metres long);
- The Project is located in a steep canyon, so the extent of Project nuisance impacts (e.g. noise, fugitive dust, air emissions) is very limited, but we have assumed the AoI extends approximately two kilometres laterally from the Trishuli River. This two kilometres also extends beyond the crest of the canyon to approximately the Dhunche Road and portions of the Langtang National Park; and
- Given that the UT-1 is a hydropower project, the Project AoI is extended upstream approximately 2 kilometres, which includes the proposed Trishuli -1 Hydroelectric Project, and downstream approximately 2 kilometres to where the Upper Trishuli-3A Hydropower Project is partially constructed.

5.2. SOCIOECONOMIC AOI

The Socioeconomic AoI is spread across three Village Development Committees (VDCs): Haku, Dhunche, and Ramche. The land take for the Project is from nine villages in the Haku VDC: Haku Besi, Sanu Haku, Thullu Haku, Gogone, Tiru, Thanku, Mailung, Gumchet, and Phoolbari). As discussed in Chapter 3, Legislative and Regulatory Framework, the introduction of a new Constitution in 2015 was accompanied by a change in the administrative structure of Nepal. Under this new administrative structure, Table 5-1 and Figure 5-2 identifies the wards and Gaunpalikas affected by the Project.

Table 5-1: Changes in Administrative Structure for Project Impacted Villages

Impacted Village	Total Population	Old Administrative Structure	New Administrative Structure
Haku Besi, Sanu Haku, Thullu Haku, and Gumchet	1528	Haku Ward number 3	Parvati Kunda Ward numbers 1 & 2
Gogone and Tiru	427	Haku Ward numbers 8 & 9	Uttargaya Ward number 1
Mailung	47	Dada Gaun Ward number 9	Uttargaya Ward number 1
Thanku		Haku Ward number 5	Parvati Kunda Ward numbers 1 & 2
Phoolbari		Haku Ward number 3	Parvati Kunda Ward numbers 1 & 2
No directly affected villages	2268	Ramche	Kalika Ward number 1
No directly affected villages	2744	Dhunche	Gosaikunda Ward number 6

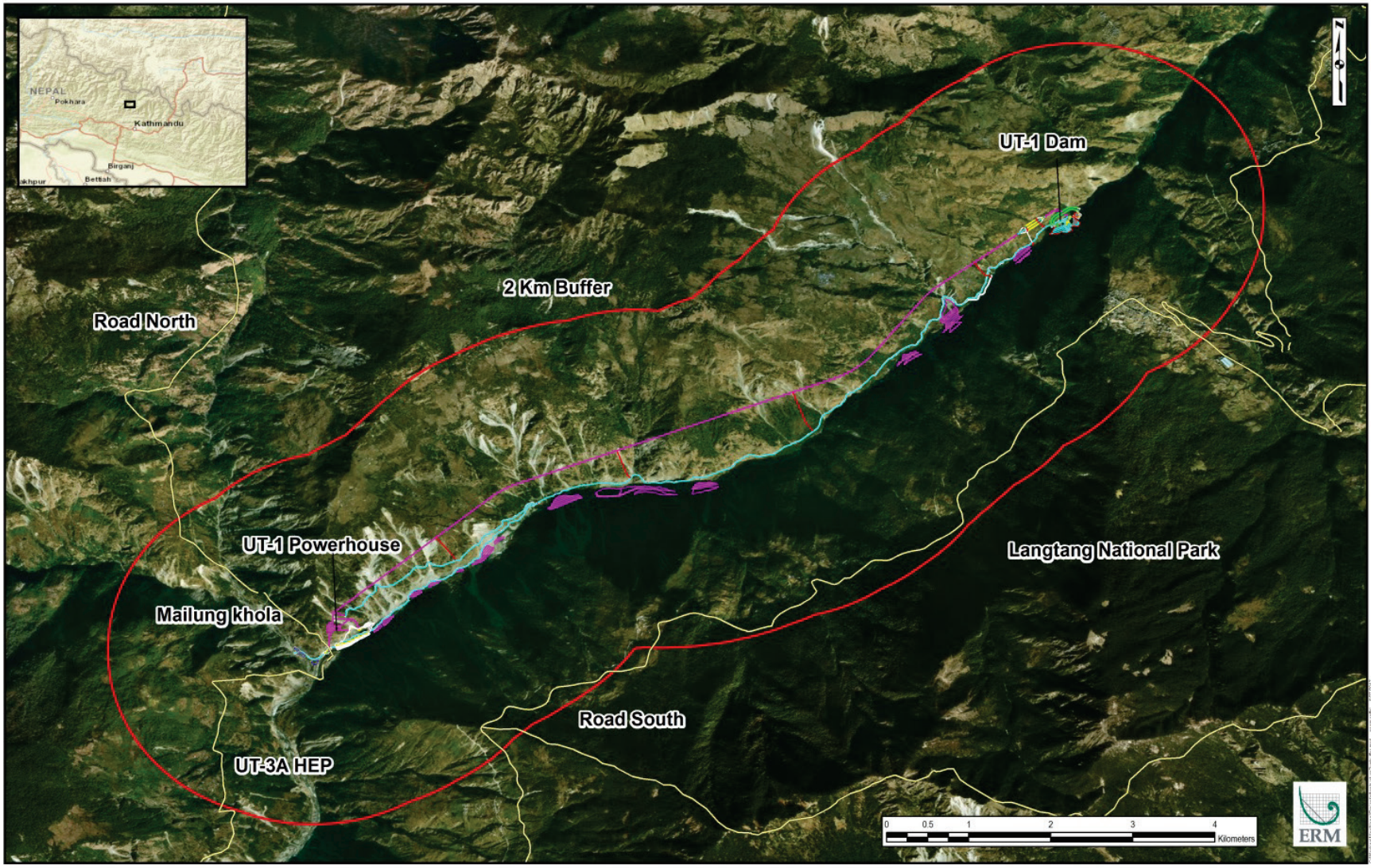


Figure 5-1: Environmental AoI

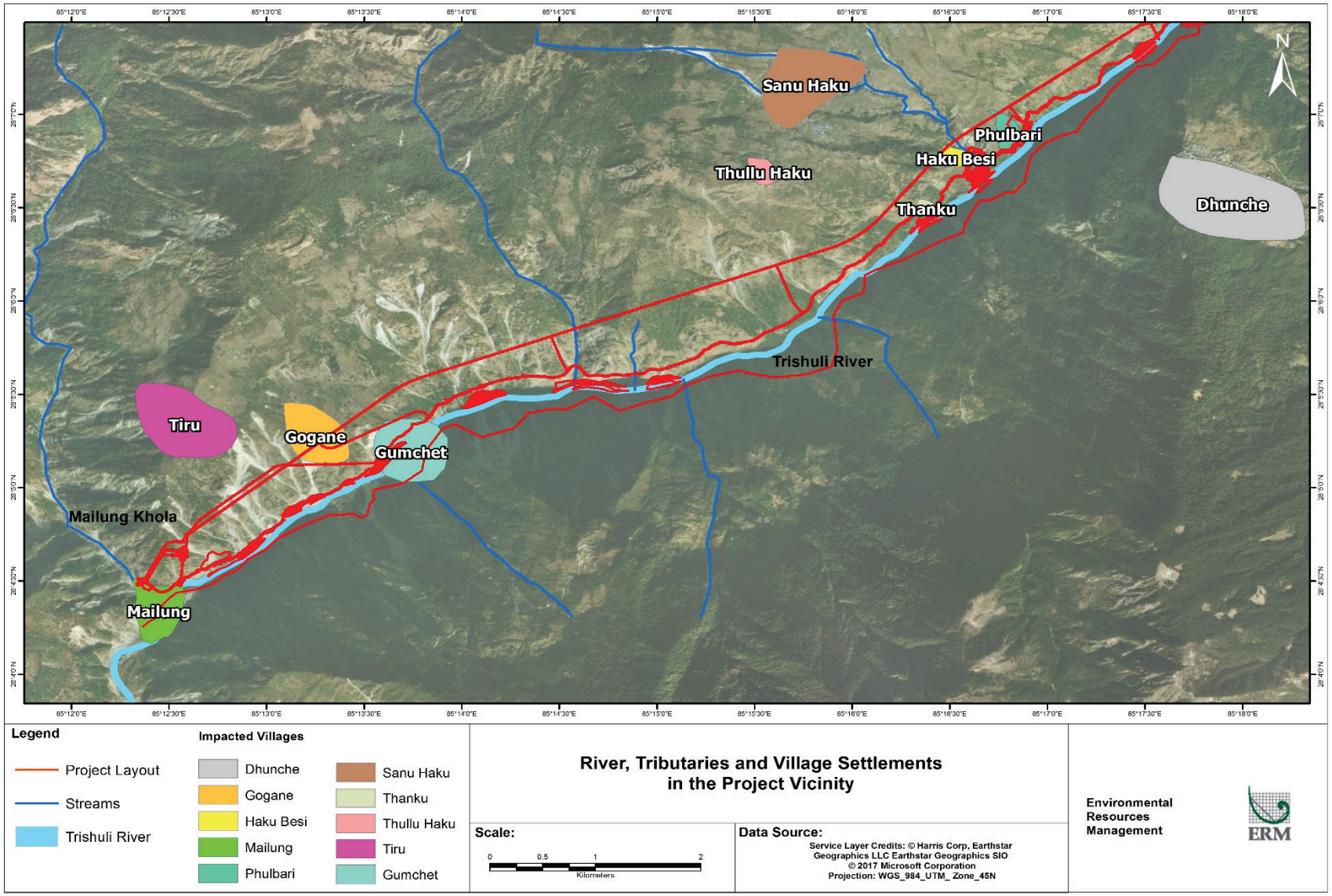


Figure 5-2: River, Tributaries, and Village Settlements in the Project Vicinity

The Socioeconomic AoI (see Figure 5-3) was defined as including:

- Area affected by Project facilities and land acquisition: all lands acquired for Project construction and operations, which has affected 39 land and/or structure owners/tenants, all from Haku Village Development Committee (now in Parbatikunda Gaunpalika[1]), in the form of economic and/or physical displacement;
- River use along the Trishuli River pre-earthquake: including two traditional watermills (ghatta), which are used throughout the year for grain grinding; irrigated agricultural land; a river segment used by inhabitants of a small hamlet in Dadagaon VDC for domestic purposes (e.g. drinking, bathing) during the dry season; and recreational fishing, particularly during the fish migration periods, by local fishermen in the lower part of the diversion reach and around the powerhouse area;
- Communities affected by loss of access to resources: communities which will incur loss of access (permanent or temporary) to forest resources (e.g. firewood, food, medicine, fodder), which can have negative impacts on their livelihoods; and
- Project Benefit Sharing: there is presently a lack of clarity on the manner in which the new administrative structure will impact Project benefit sharing requirements. Under the former structure, the Project was directly affecting 3 of the 18 VDCs in the district (i.e. Dhunche, Ramche and Haku); however, now it is directly affecting four of the five Gaunpalikas in the Rasuwa District. These are the four Gaunpalikas included in the Social AoI as potentially being directly and indirectly impacted by the Project and receiving local benefit sharing from the Project:
  - Parbatikunda Gaunpalika (GP)
  - Uttargaya GP
  - Kalika GP
  - Gosainkunda GP

The Socioeconomic AoI is thereby considerably larger than the area where direct Project impacts will occur.

5.3. CUMULATIVE IMPACT AOI

There are currently six hydropower facilities operating in the Trishuli River watershed, and approximately 41 hydropower licenses (survey and construction) have been granted by the government in the Trishuli River watershed (Figure 5-4). For purposes of the Project's cumulative impact assessment, the entire Trishuli River Basin from the China border to the confluence with the Budhigandaki River is included in the AoI for the cumulative impact assessment.

[1] Gaunpalika is the newly formed Lower Administrative Division in Nepal. In 2017, the Ministry of Federal Affairs and Local Development (Nepal) dissolved the existing Village Development Committees and announced the establishment of this new local body. There are currently 463 Rural Municipalities in Nepal out of 766 Local units.

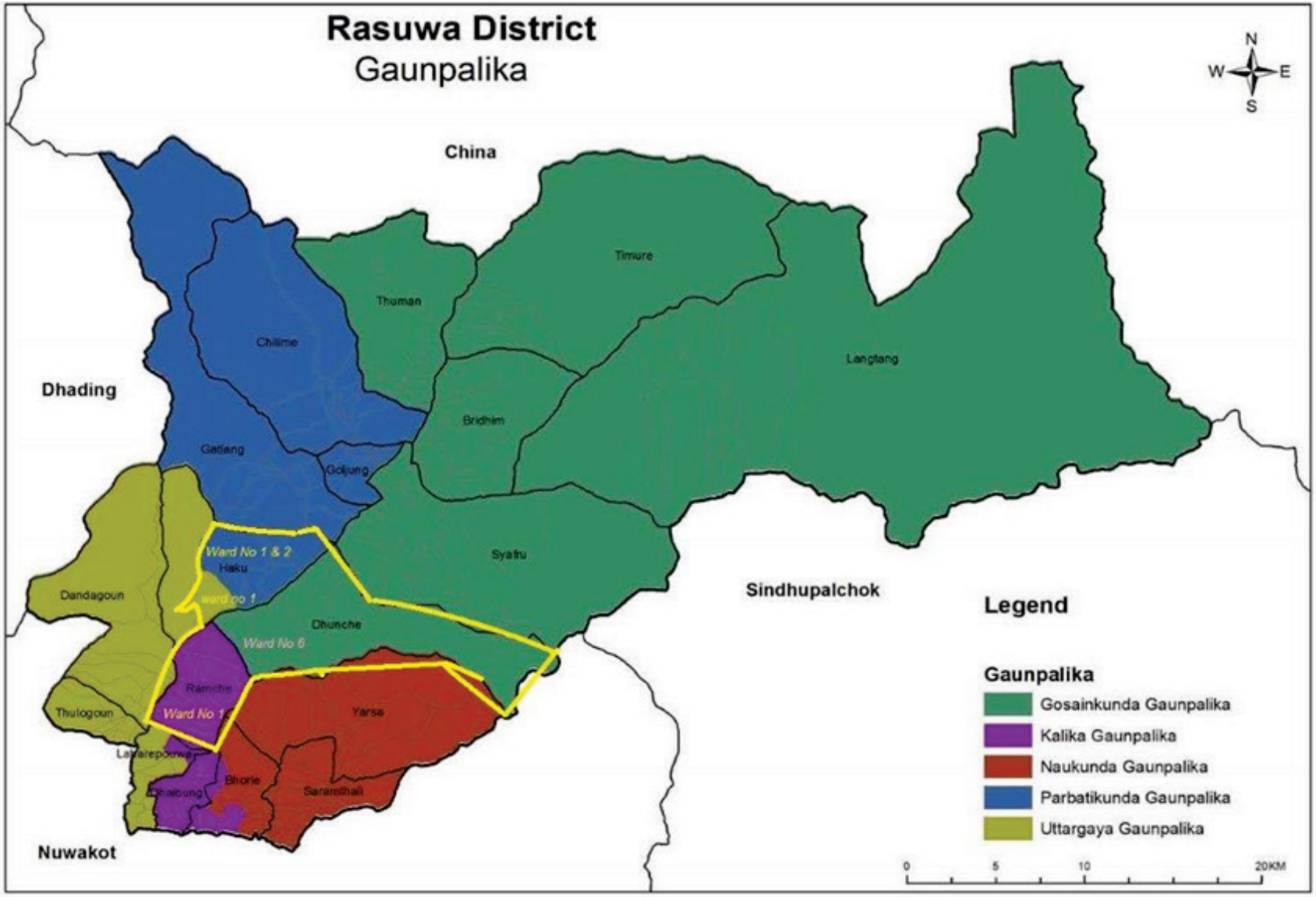


Figure 5-3: Socioeconomic AoI in Keeping with Changed Administrative Structure

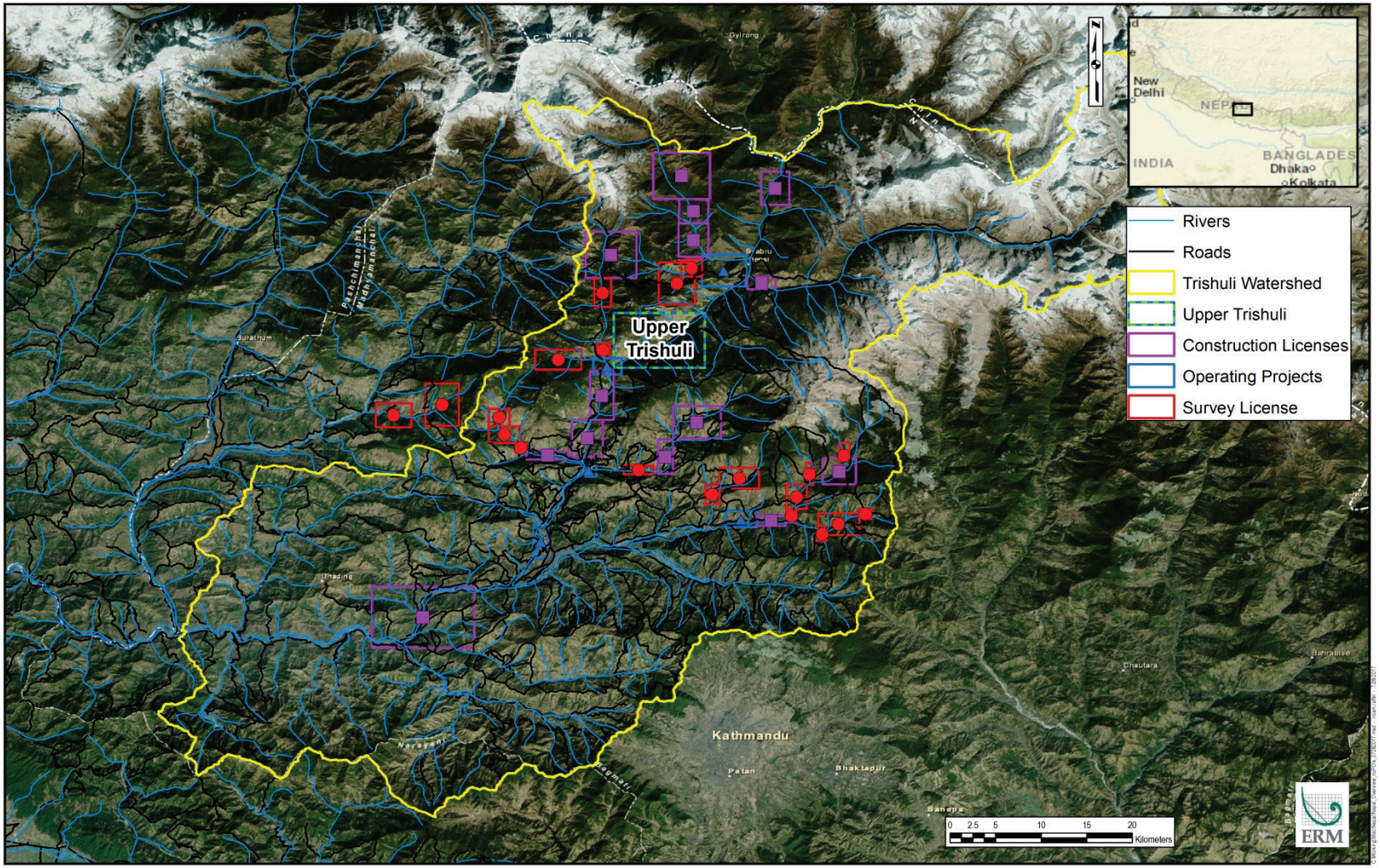


Figure 5-4: Trishuli Watershed Hydropower Licenses

6. CURRENT ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

6.1. PHYSICAL RESOURCES

6.1.1. Geology

6.1.1.1. Project Area

The geology of the Project area belongs to the Lesser Himalayan Zone of Central Nepal (NWEDC 2012). The predominant rock type of the Project area is Phyllitic schist with metasandstone, but in some areas Phyllite quartzite can also be found interbedded with Ulleri gneiss rock. At the confluence of the Langtang Khola with the Trishuli River, the Syabru Besi augen gneiss and their western prolongation in the Mailung Khola are considered as equivalents of the Ulleri gneiss, although they appear above the Benighat schist of the upper Midland group (Macfarlane et al. 1992).

The surface deposits in the Project area consist mainly of alluvium and colluvium. Alluvium is mainly found in the riverbed level; in the Dhovan area, as an alluvial terrace. This alluvium is mainly composed of boulder, cobble, and gravel in a sandy silty matrix. The colluviums deposits are mainly dispersed along the hill slope. The thickness of alluvium and colluvium deposits varies in different areas. These surficial alluvium and colluvium deposits are relatively unstable and prone to landslides, as evidenced in the 2015 earthquake.

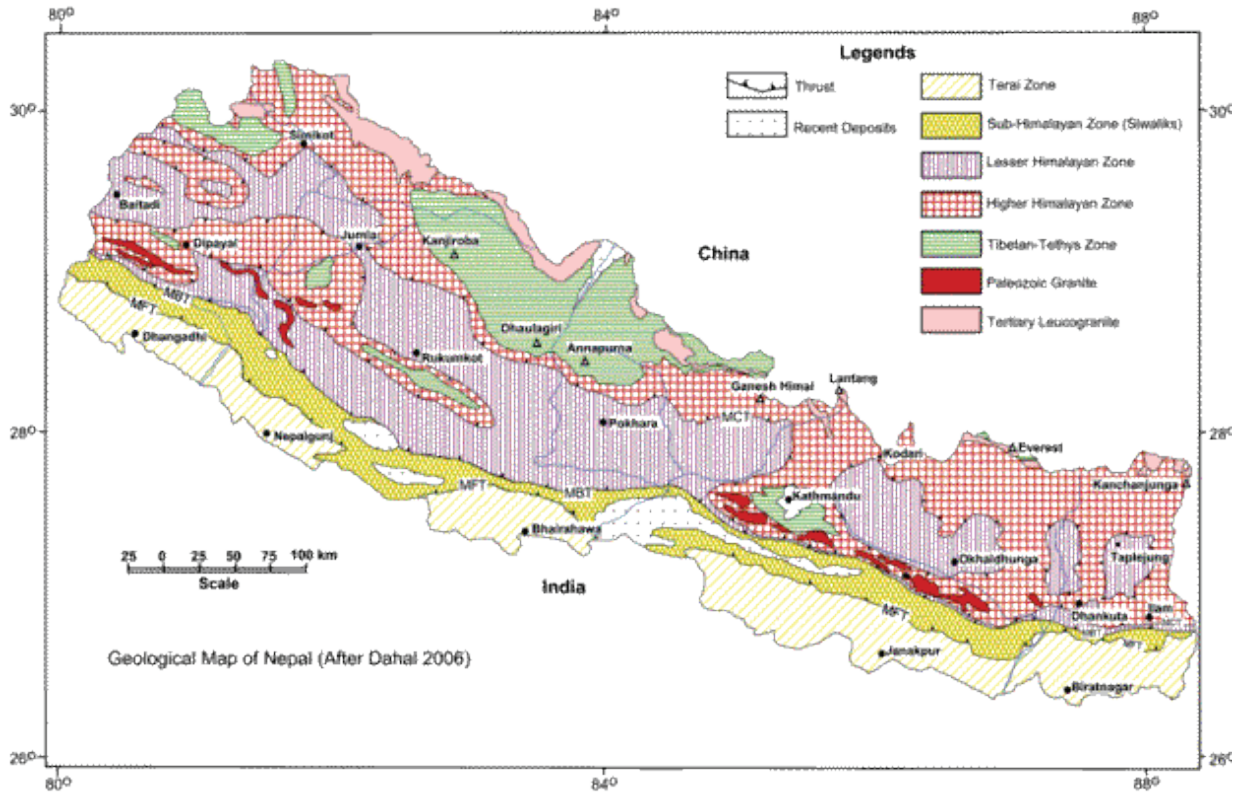
General geological conditions at the different Project component sites are presented in Table 6.1-1.

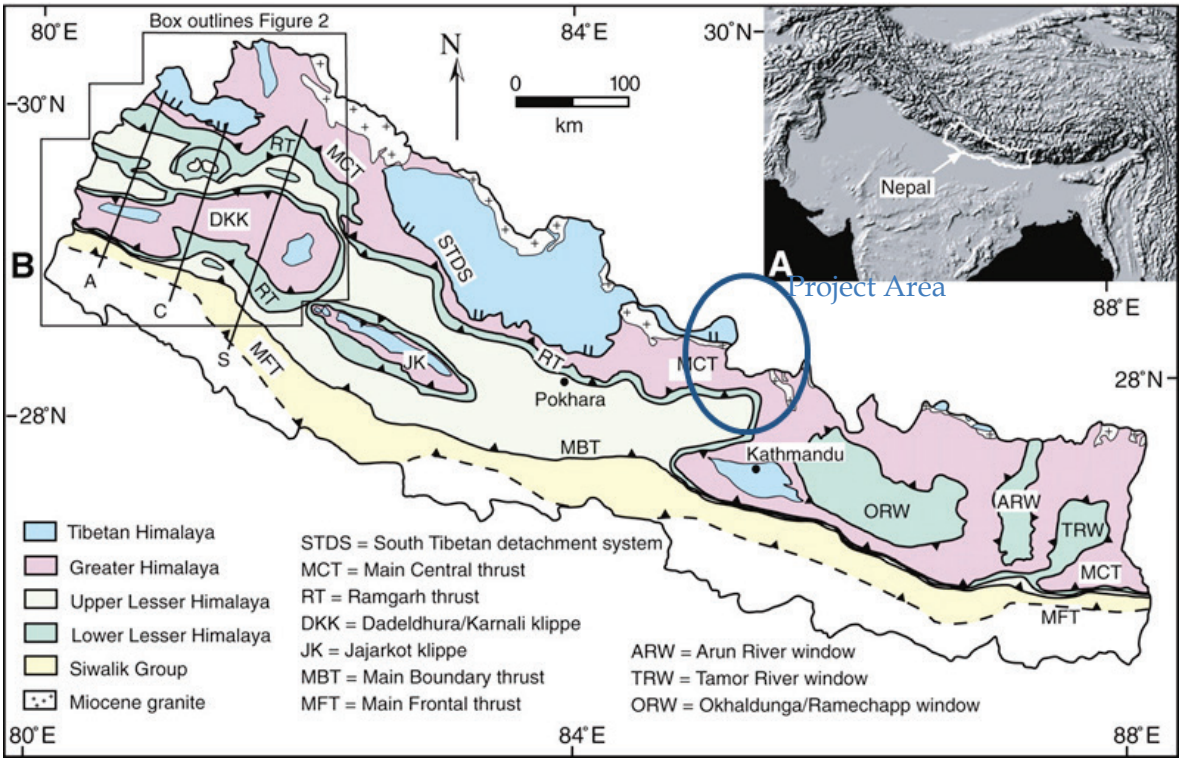
Table 6.1-1: Geological Conditions at Major Project Component Sites

S.N	Project Component	Geological Formations
1	Dam Site	Bedrock is exposed on the right bank of the Trishuli River. Predominant rock types at the dam site are massive blocky to locally fractured, moderately jointed, and slightly weathered Phyllite quartzite with schist. Joints are mostly tight; occasionally few centimetres open, rough, irregular, and moderately spaced. Rock slope on both banks is stable.
2	Tunnel	The entire headrace tunnel passes through the monotonous massive, blocky, locally fractured to slightly weathered Phyllitic quartzite rock sequence; though in some areas gneiss and schist are also found. The rock is medium strong to strong with uniaxial strength of around 70 MPa.
3	Powerhouse	The rock outcrops found in the nearby powerhouse area are generally massive, slightly fractured, and moderately weathered quartzite and grit stone. The rock is medium strong to strong with uniaxial strength of around 75 MPa.

Source: NWEDC 2012; MPa = Mega Pascal

The natural components that lead to instability zones in the Project area consist of tectonic activities (possibly stronger in this area because of the proximity to the Main Central Thrust [MCT]), unpredictable precipitation levels during the summer monsoon months, and steep slopes. The MCT passes near to Sybru Besi, which is only few kilometres away from the dam (see Figure 6.1-1).





Source: Robinson 2008

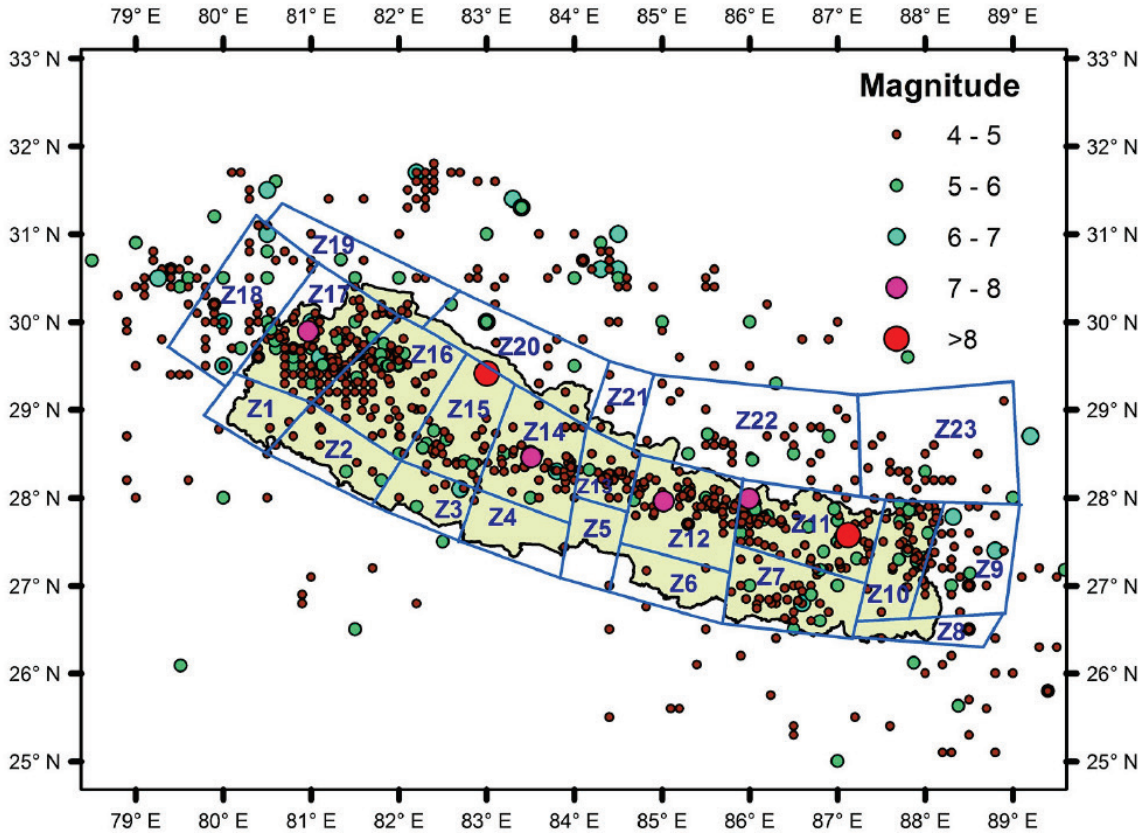
Figure 6.1-1: Geology of Nepal

6.1.2. Natural Disaster Risk

6.1.2.1. Seismic Hazard

The study of past earthquakes in and around the Nepal Himalaya shows that the whole area is seismically active (Chaulagain et al. 2015). However, micro-seismicity activities are particularly intense in the eastern, central (location of the Project), and far-western regions. It is believed that stress accumulation is ongoing in the form of strain at the front of the Himalaya, and is associated with continuous creep at depths beneath the north of the Himalaya. Figure 6.1-2 shows the spatial distribution of earthquakes in Nepal and the surrounding regions. The roughly east–west distribution of seismicity shows that the vast majority of earthquakes are located along the MCT.

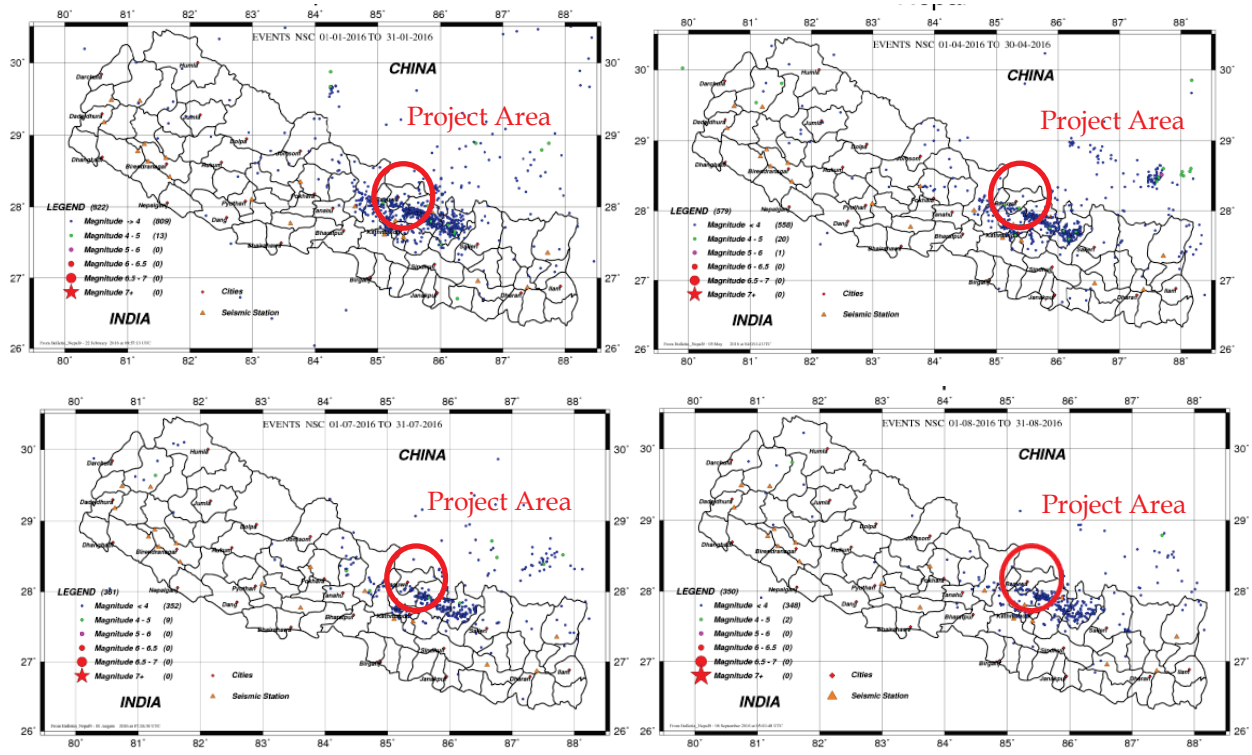
As per the latest seismic risk assessment study by Chaulagain et al. (2015), the highest ground movements were observed in eastern and the mid-western regions of the country, and lower values were observed in southern Nepal. The Project site and its surrounding area are located in a high ground motion area.



Source: Chaulagain et al. 2015

Figure 6.1-2: Spatial Distribution of Earthquakes in and around Nepal

Records of monthly epicentres of earthquake events in Nepal from January 2016 to August 2016 also indicate that most epicentres are located in and around the Project site (see Figure 6.1-3) (GoN 2017).



Source: GoN 2017

Figure 6.1-3: Monthly Epicentre Map

6.1.2.2. Glacial Lake Outburst Flood

Nepal has experienced at least 24 Glacial Lake Outburst Flood (GLOF) events (see Table 6.1-2). Of these, 14 are believed to have occurred in Nepal itself, and 10 were the result of flood surge overspills across the China (Tibet Autonomous Region [TAR])–Nepal border. The Trishuli River basin has reported two historical GLOF events as shown in Table 6.1-2, both of which were recorded in the TAR (China), but then flowed into Nepal.

In the Trishuli River basin, the International Centre for Integrated Mountain Development (ICIMOD) has identified about 117 glacier lakes with a total area of 2.03 square kilometres (km²) and 74 glacier rivers with total area of 246.65 km². Studies on the glaciers and glacial lakes in the upper catchment of the Trishuli River indicate that there is a minimum GLOF threat in the Project area (NWEDC 2012). Among the three identified glaciers (Langtang, Longda, and Khymjun), none are considered under the high risk GLOF category.

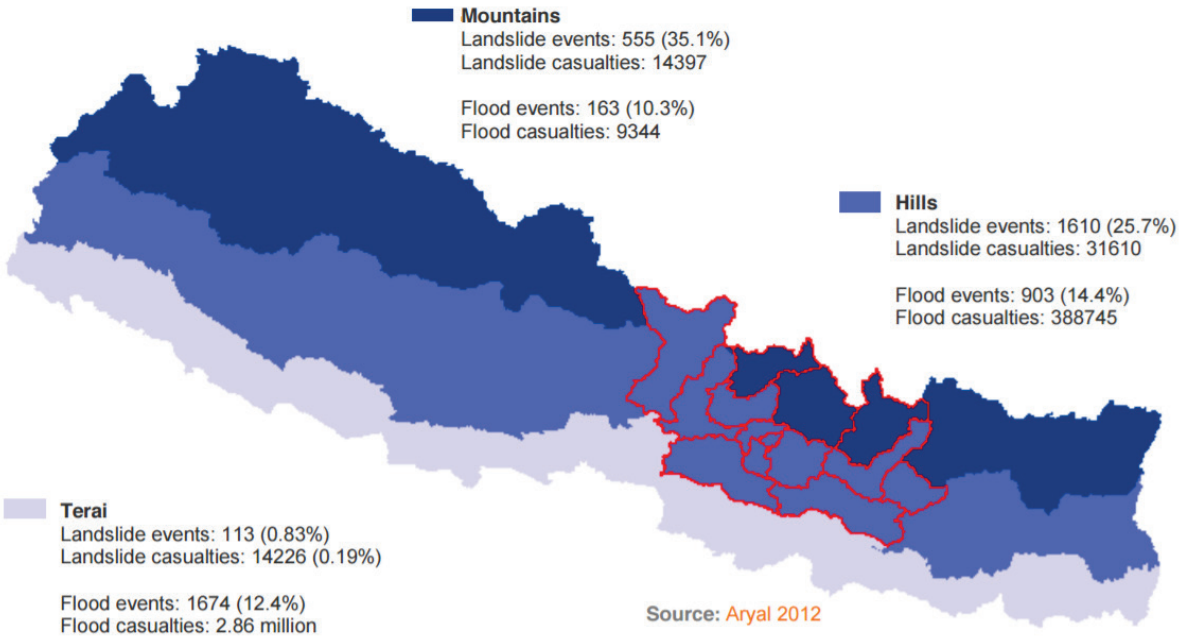
Table 6.1-2: GLOF Events Recorded in Nepal

S.N	Date	River basin	Lake	Cause	Losses
Originated in Nepal					
1N	450 years ago	Seti Khola	Machhapuchchhre	Moraine	Pokhara valley covered by 50–60-meter-deep debris
2N	1977	Dudh Koshi	Nare	Moraine collapse	Human lives, bridges, others
3N	1980	Tamor	Nagma Pokhari	Moraine collapse	Villages destroyed 71 kilometres from source
4N	1985	Dudh Koshi	Dig Tsho	Ice avalanche	Human lives, hydropower station, 14 bridges, etc.
5N	1991	Tama Koshi	Chubung	Moraine collapse	Houses, farmland, etc.
6N	1998	Dudh Koshi	Tam Pokhari	Ice avalanche	Human lives and more than Nepal Rupees (NRs) 156 million
7N	2003	Madi River	Kabache Lake	Moraine collapse	Not known
8N	2004	Madi River	Kabache Lake	Moraine collapse	Not known
9N	Unknown	Arun	Barun Khola	Moraine collapse	Not known
10N	Unknown	Arun	Barun Khola	Moraine collapse	Not known
11N	Unknown	Dudh Koshi	Chokarma Cho	Moraine collapse	Not known
12N	Unknown	Kali Gandaki	Unnamed (Mustang)	Moraine collapse	Not known
13N	Unknown	Kali Gandaki	Unnamed (Mustang)	Moraine collapse	Not known
14N	Unknown	Mugu Karnali	Unnamed (Mugu Karnali)	Moraine collapse	Not known
Originated in Tibet Autonomous Region/China and caused damage in Nepal					
1C	1935	Sun Koshi	Tara-Cho	Piping	66,700 square meters of wheat fields, livestock, etc.
2C	*1964*	*Trishuli*	*Longda*	*Not known*	*Not known*
3C	1964	Arun	Gelhaipuco	Glacier surge	Highway and 12 trucks
4C	1964	Sun Koshi	Zhangzangbo	Piping	No remarkable damage
5C	1968	Arun	Ayaco	Not known	Road, bridges, etc.
6C	1969	Arun	Ayaco	Not known	Not known
7C	1970	Arun	Ayaco	Not known	Not known
8C	1981	Sun Koshi	Zhangzangbo	Ice Avalanche	Hydropower station
9C	1982	Arun	Jinco	Glacier surge	Livestock, farmland
10C	*1995*	*Trishuli*	*Zanaco*	*Not known*	*Not known*

Source: ICIMOD 2011

6.1.2.3. Landslides

The steep mountainous terrain of Nepal combined with heavy monsoon rainfalls result in a high risk of landslides each year. Floods and landslides have caused approximately 8,400 deaths in Nepal from 1983 to 2013, with an average of 269 deaths per year. Another estimate puts the death toll between 1971 and 2010 at 4,327 for landslides and 3,899 for floods. The 2015 earthquake was considered one of the worst resulting in 8,856 deaths (Nepal Earthquake 2015). In general, the mountainous and hilly regions are more prone to landslides, while the Terai (lowland) region is more susceptible to floods. There tends to be a seasonal spike in deaths and building damage from landslides and floods in July and August during the monsoon period. A review of archived reports of natural disasters in Nepal shows that, between 1900 and 2005, the highest number of disaster events (6,255 incidents) was reported in the Hills zone. In the Mountain zone, there was a total of 1,580 disaster events reported (see Figure 6.1-4).



Source: NEAU 2015

Figure 6.1-4: Landslides, Flood Events, and Casualties over the Years.

Landslide risks have been further exacerbated by the 2015 earthquake and subsequent aftershocks, which have destabilized slopes, making the areas affected more susceptible to landslides during the monsoon than usual (Faris and Wang 2014). Over 3,000 landslides were observed after the 2015 earthquake (NEAU 2015), with many occurring from Mailung to the proposed dam site. Much of the Project area has high slopes with medium to high slope angle (NWEDC 2012; see Figure 6.1-5). The details of landslides reported are briefly discussed in Table 6.1-3.

Ramche Landslide Thade Landslide

Haku Landslide Sarghang Landslide

Source: NWDEC 2012

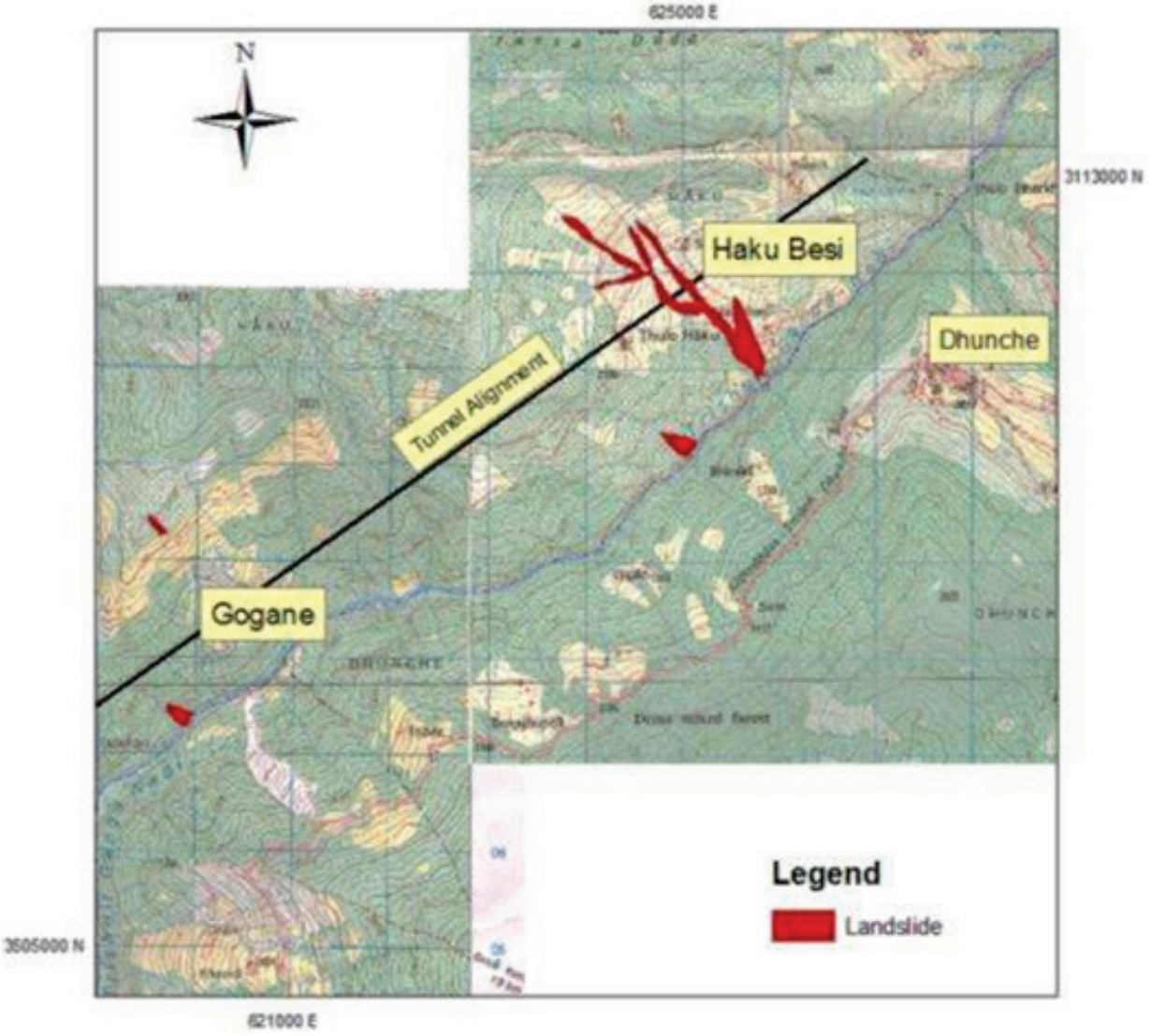
Figure 6.1-5: Landslide Photographs

Table 6.1-3: Major Landslides in and around Project Site

Landslide	Locations	Damage or effects
Dhunche	Dhunche village, near the bridge across the Trishuli River	Road blockages and damage affected access to farmland and transportation.
Ramche landslide	36-kilometre section of the Trishuli-Dhunche motor road in Rasuwa district. It was first activated in 1983 and reactivated 14 August 2003.	23 army men killed on site and many others injured; The slide seems more active in monsoon and relatively stable in winter; The movement rate is more than a metre per year; It has developed several cracks on the surface causing collapse of houses
Thade landslide	Location within the Project area road alignment, tunnel, Adit 4 construction facility area, and spoil disposal area	The topography of the slope movement area has changed several times after the area became active. The movement was observed mostly during monsoon season. Road blockages and damage affected the access to farmland and transportation.
Haku landslide	Major landslide within the Project area and it is continuously cutting slope mass and laterally moving towards Hakubesi near the perennial stream (active for approximately 10 years), located in the tunnel alignment and muck disposal land.	Crop loss, road blockages, and damage to property
Sarghang landslide	Near the proposed Adit 1. It lies between Hakubesi-Fulbariand Hakubesi.	-

Source: NWEDC 2012

The Government of Nepal (GoN) Department of Survey inventoried landslides in the Project area (Figure 6.1-6). Landslides observed along the tunnel alignment are mostly on the southeast facing slope with thick soil cover that is prone to landslides. Most of the identified landslides concentrate in the Haku Besi area, with a slope range of 30 to 35 degrees. The landslide distribution map helps with understanding the factors and conditions controlling the landslides and is used as a basis for landslide susceptibility zonation. NWEDC also commissioned *A Report on Earthquake Induced Landslides in the UT-1 Project Area and their Impact to the Project Infrastructures* (Jade Consult 2016).

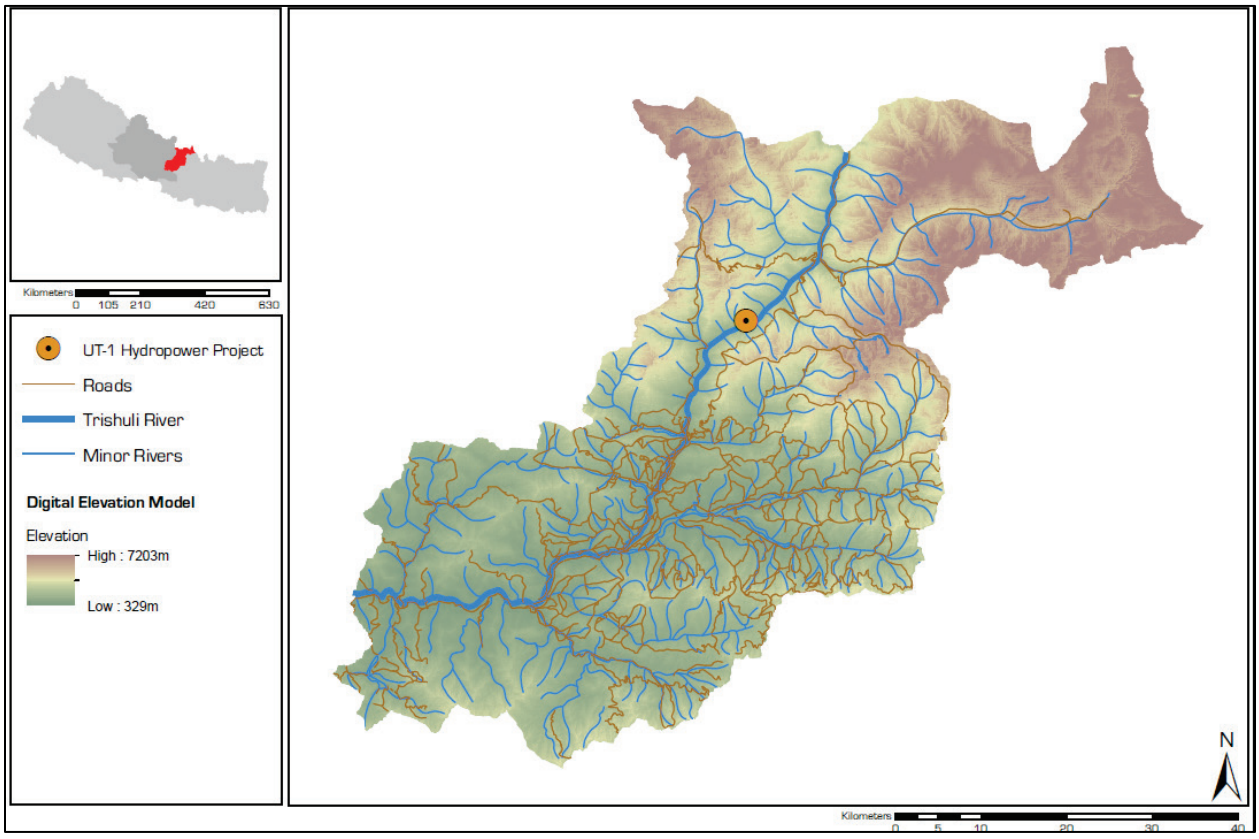


Source: ESSA 2014

Figure 6.1-6: Landslide Inventory Map along the Tunnel Alignment of UT-1 Project Area

6.1.3. Surface Hydrology

The Trishuli watershed arises in the TAR of China and is one of the major tributaries of the Saptagandaki River system. The Trishuli River originates at the confluence of Langtang Khola, which flows from Gosaikunda Lake in the Langtang National Park, and the Bhote Koshi River near Dhunche. At the Project dam, the Trishuli River encompasses a drainage area of 4,351 km^2 (see Figure 6.1-7). Water from the Trishuli River is primarily used for washing, drinking, watering animals, and a few local *Ghattas* (water mills used for grinding local crop products such as corn, buckwheat, and millet).



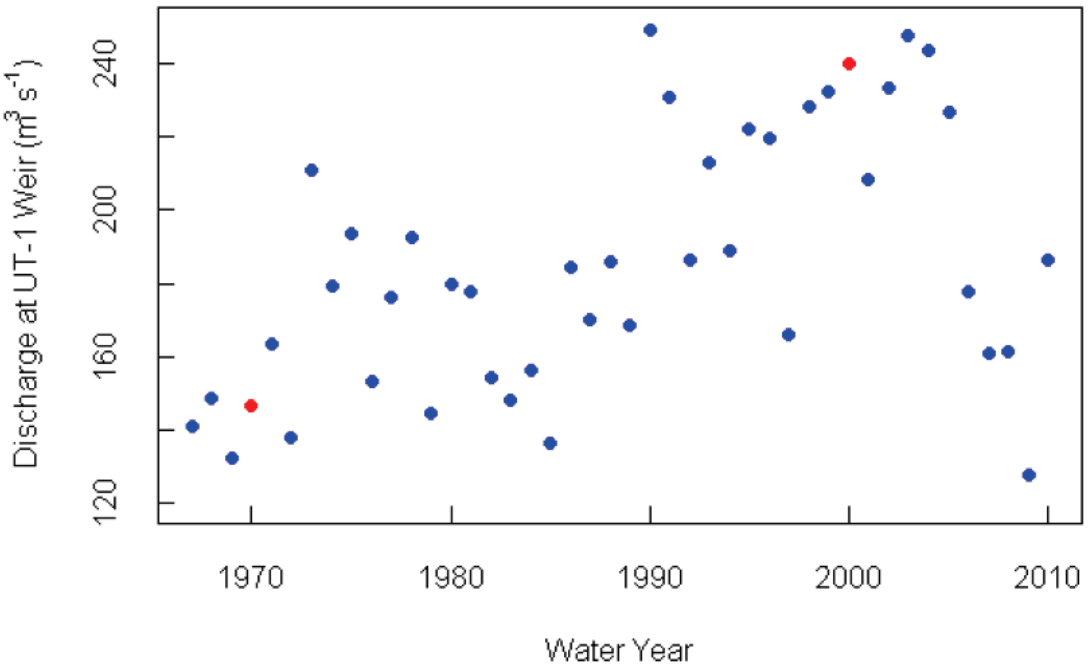
Source: ESSA 2014

Figure 6.1-7: Watershed Map of Trishuli River within Nepal

Flow in the Trishuli River is derived from a mixture of seasonal monsoon precipitation and meltwater from snow and ice at higher elevations (ESSA 2014). Of the total catchment, over 60 percent is located in the TAR of the Peoples Republic of China, while less than 40 percent lies within Nepal. Over 93 percent of the catchment area lies 3,000 metres above sea level. About 80 percent of annual precipitation falls during the June-October monsoon, with episodes of very high precipitation and discharge. Between-year climatic variation results in up to twofold differences (see Figure 6.1-8) in average discharge over the 44-year period of historical records (1967-2010). In addition to historical records, some forward looking studies

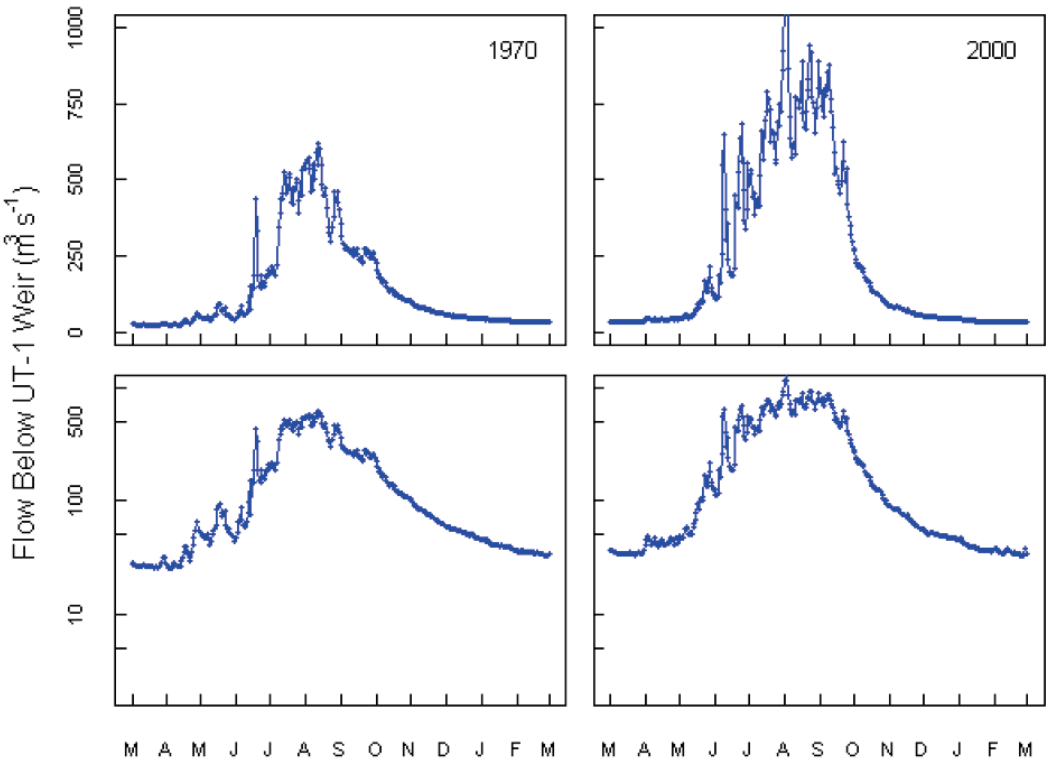
(Bajracharya et al. 2011) indicate climate change will affect flow regimes, as glaciers continue to decline in some parts of the region and monsoon patterns may become altered.

Hydrographic data for the Project are based on a 44-year record of continuous daily observations made at Betrawati (Gauge Station 447, Nepal Department of Hydrology and Meteorology), located 14 kilometres downstream of the proposed UT-1 powerhouse (see Figure 6.1-8). To predict daily hydrographs at the UT-1 intake, Betrawati gauge data are adjusted downward by a factor of 0.8971 to account for the slightly smaller watershed area upstream of the gauge. The daily hydrographs show the extent of variation in daily discharge for representative low-flow and high-flow in years 1970 and 2000 respectively (see Figure 6.1-9).



Source: ESSA 2014

Figure 6.1-8: Unimpaired Average Annual Discharge for the Trishuli River at the UT-1 Intake Dam



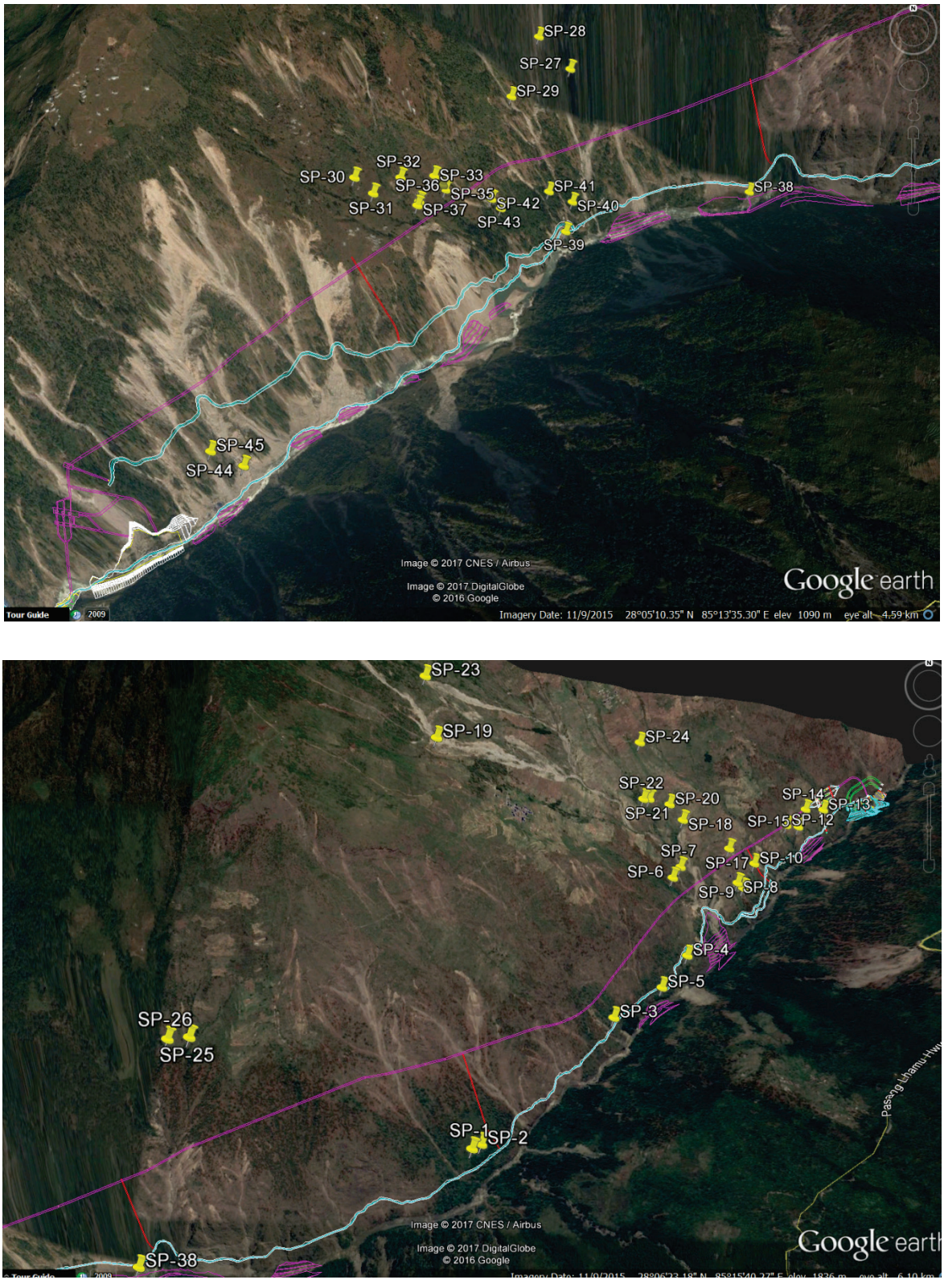
Source: ESSA 2014

Figure 6.1-9: Daily Flow Hydrographs for Representative Low-Flow (1970) and High-Flow (2000) Years in Linear (Upper) and Logarithmic (Lower) Scales

The Trishuli River carries a high sediment load, especially in the monsoon season, resulting from glacial melt, erosion, landslides and mass wasting. The riverbed material consists of boulders and cobbles, embedded in finer gravel, sand, and silt.

6.1.4. Groundwater

Based on a hydrogeological study along the tunnel alignment, two types of aquifers were identified in the Project area: the surficial aquifer that supports local springs, and a deeper regional aquifer that exhibits an effective porosity of 40 percent and is hydrologically connected to the Trishuli River. There are about 45 springs within the Project footprint (Figure 6.1-10), of which about 16 springs (i.e. SP-4, SP-5, SP-6, SP-8, SP-9, SP-12, SP-13, SP-14, SP-16, SP-17, SP-25, SP-30, SP-34, SP-37, SP-42, and SP-43) are known to be sources of water supply for local communities (ESSA 2014). Some of these springs, however, were reported to have dried up after the 2015 earthquake and associated landslides.



Data source: ESSA 2014, Figure source: ERM

Figure 6.1-10: Springs in the Vicinity of the UT-I Project

6.1.5. Surface Water Quality

6.1.5.1. Baseline Water Quality Analysis

A baseline water quality assessment was conducted at five locations (W-1 to W-5) in and around the Project site within the Trishuli River during 2011 as part of the EIA Study Report (NWEDC 2012), and also monthly from August 2013 to July 2014 at five different locations (F1 to F5) as part of the Supplemental ESIA study (ESSA 2014). These data are presented in Tables 6.1-4 through 6.1-7.

Table 6.1-4: Water Quality Sampling Locations (2011)

S.N.	Sample No.	Location	River
1	W 1	Upstream of Confluence	Bhote Koshi
2	W 2	Upstream of Confluence	Trishuli
3	W 3	Downstream of Confluence	Trishuli
4	W 4	Dam Site	Trishuli
5	W 5	Confluence of Trishuli River and Ghatte Khola	Ghatte Khola
6	W 6	Powerhouse Site (Mailun Dovan)	Trishuli

Source: NWEDC 2012

Table 6.1-5: Water Sampling Locations (August 2013 to July 2014)

Site	Latitude (N)	Longitude (E)	Location	VDC	Bank
F1	28° 08' 41.4"	85° 18' 47.1"	Upstream of dam site	Syapru	Left
F2	28° 06' 47.8"	85° 16' 53.6"	Diversion reach	Dhunche	Left
F3	28° 05' 20.6"	85° 13' 50.4"	Diversion reach	Haku	Right
F4	28° 04' 50.1"	85° 13' 01.6"	Diversion reach (Upstream of powerhouse)	Haku	Right
F5	28° 04' 15.1"	85° 12' 29.0"	Downstream of powerhouse	Ramche	Left

Source: ESSA 2014

° = degrees; ' = hours; " = minutes; E = east; N = north; VDC = Village Development Council

Table 6.1-6: Water Quality Sampling Results (2011)

Parameters	Unit	Sampling Locations						NDWQS
		W 1	W 2	W 3	W 4	W 5	W6	
Turbidity	NTU	34	< 1	7.1	31	4	39	5(10) (Max)
Conductivity	µS/cm	127	63	115	120	53	112.7	1500 (Max)
TDS	mg/L	55	27	50	52	23	49	1000 (Max)
TSS	mg/L	116.6	2.6	88.9	42.8	14.8	133.8	-
Total Solids	mg/L	38	149	109	48	194	183	
Total Alkalinity	mg/L as $CaCO_3$	41	24	41	43	19	40	-
Total Acidity	mg/L	86	103	77	77	120	206	-
Chloride	mg/L as Cl	2.5	1	2	5.6	1.5	NA	250 (Max)
Nitrate	mg/L as NO_3	0.8	1	1.3	1	< 0.1	0.7	50 (Max)
Ammonia	mg/L as N	0.1	< 0.1	0.1	0	< 0.1	0.1	1.5 (Max)
Total Hardness	mg/L as $CaCO_3$	55	28	51	51	16	48	500 (Max)
Calcium	mg/L as Ca	18	8	16	16	5	16	200 (Max)

Source: NWEDC 2012

µS/cm = micro-Siemens per centimetre; $CaCO_3$ = calcium carbonate; Cl = chloride; mg/l = milligrams per litre; N = nitrogen; NDWQS = Kathmandu Valley Drinking Water Quality Exceeds Values; NO_3 = nitrate; NTU = nephelometric turbidity unit; TSS = total suspended solids

Table 6.1-7: Water Quality Minimum and Maximum Values (August 2013 to July 2014)

Parameters (units in mg/l unless noted)	F-1		F-2		F-3		F-4		F-5		NDWQS
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
pH	6.6	7.4	6.8	7.5	6.9	7.5	7	7.7	6.6	7.8	6.5-8.5
Electrical Conductivity, (µmhos/cm)	91.4	150	85	161	81	150	81	151	86	150	1500
Turbidity, (NTU)	1	200	5	175	1	175	4	480	1	225	5 (10)*
Total Suspended Solids	1	658	1.5	544	2	539	1	917	1.5	268	-
Total Solids	90	1119	74	699	78	637	57	1243	68	553	-
Settleable Solids	0.67	633.7	0.5	520.7	0.67	481	0.67	566	0.5	242.3	-
Non-Settleable Solids	0.33	43	0.2	101	0.33	58	0.33	351	0.33	124	-
Total Hardness as $CaCO_3$	51	81	46	78	35	195.3	53	110	50	76	500
Total Alkalinity as $CaCO_3$	39.6	68.8	40	62	35	61	40	236	40	107	-
Sulphate	2.5	23.8	6.6	32	5.34	26.7	1.6	32.5	3.3	26.32	250
Chloride	1.9	4	1	5	0.5	4	1	5	0.97	5	250
Free Carbon Dioxide	0.58	2.3	1.1	2.33	0.58	2.33	0.56	2.9	0.58	2.33	-
Ammoniacal - N	BDL	0.33	BDL	0.1	BDL	0.25	BDL	0.14	BDL	0.8	-
Nitrate - N	0.2	0.74	0.2	0.96	0.18	1.1	0.23	0.81	0.17	1.25	50
Nitrite - N	BDL	0.03	BDL	0.03	BDL	0.07	BDL	0.03	BDL	0.01	-
Fluoride	BDL	0.29	BDL	0.23	BDL	0.32	BDL	0.28	BDL	0.33	0.5 (1.5)
Biological Oxygen Demand	1	5.5	0.7	5.5	0.5	9.4	0.5	7	0.5	3.6	-
Chemical Oxygen Demand	6	25	4	24	2	32	4	36	4	32	-
Phenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-
Oil & Grease	1	6	1	5	1	4	1	4	2	6	
Hydrogen Sulphide	BDL	0.8	BDL	1.6	BDL	1.9	BDL	1.6	BDL	0.8	-
Iron	0.18	9.4	0.17	7.9	0.18	7.8	0.23	6.9	0.23	6.8	0.3 (3.0)
Manganese	BDL	0.17	BDL	0.12	BDL	0.13	BDL	0.12	BDL	0.11	0.2
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.003
Lead	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01
Copper	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.0
Nickel	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-
Silver	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-
Zinc	BDL	0.05	BDL	0.08	BDL	0.04	BDL	0.04	BDL	0.05	3.0
Arsenic	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05
Mercury	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.001

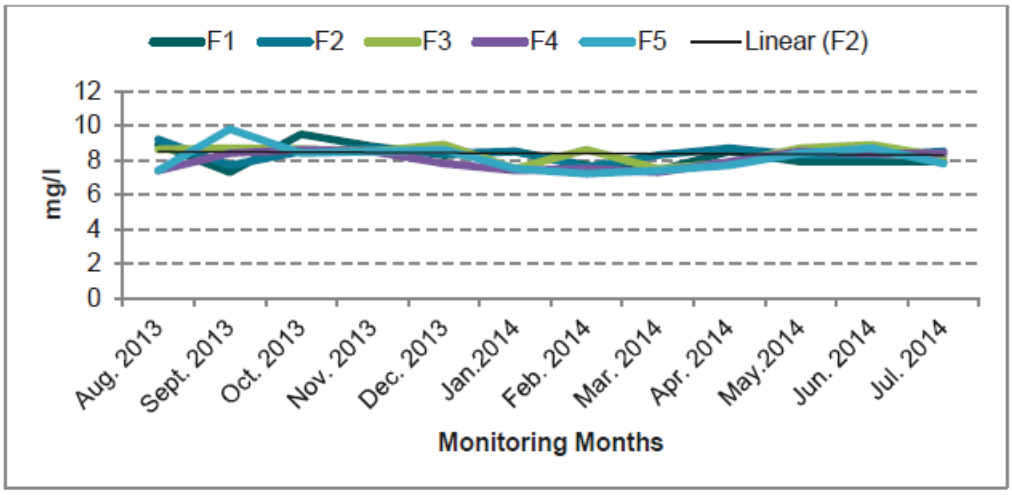
Source: ESSA 2014

*Values in parenthesis refer to the acceptable values only when an alternative is not available.
BDL = below detection limit; $CaCO_3$ = calcium carbonate; mg/l = milligrams per litre; NDWQS = Kathmandu Valley Drinking Water Quality Exceeds Values; NTU = nephelometric turbidity unit; µmhos/cm = micromhos per centimetre

The result of baseline monitoring indicates that most of the parameters were well within the Nepal Drinking Water Quality Standards (NDWQS) and the Nepal Generic Effluent Standards for Discharges into Inland Surface Waters.

6.1.5.2. Physical Quality

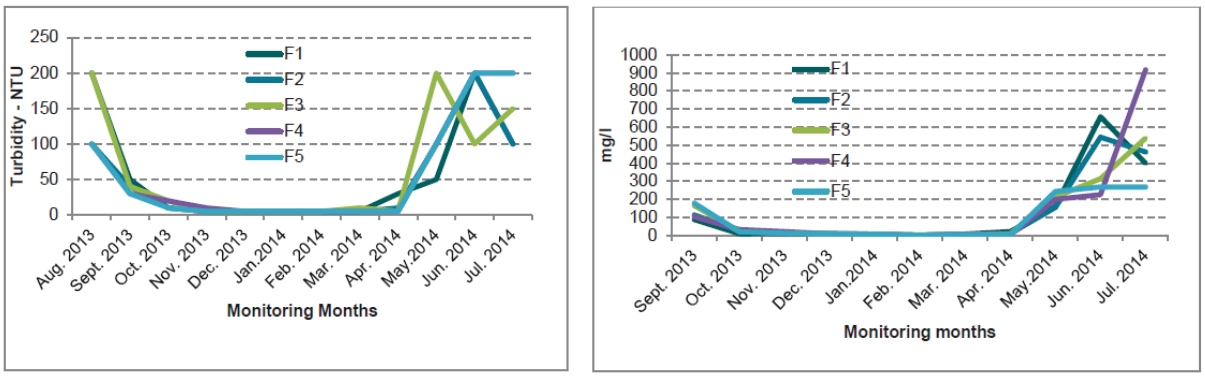
The pH of the Trishuli River is neutral to slightly alkaline with values ranging from 6.5 to 8.5. Dissolved oxygen (DO) levels are relatively high varying between 7.2 to 9.2 mg/l across different sampling location and different months. There is no distinctive spatial or temporal variation observed at the monitored reaches (see Figure 6.1-11).



Source: ESSA 2014

Figure 6.1-11: DO Levels during Different Months

Turbidity and total suspended sediment (TSS) concentrations vary considerably by season. Results of the 2013 to 2014 sampling events show turbidity variation trends reflective of monsoon and snow melt at the catchment and related surface runoff and erosion. Turbidity values are highest during the peak monsoon (June, July, and August) and decline steeply to values less than 6 NTU from November through March (see Figure 6.1-12). The TSS levels in the water sampling locations also followed the same trend as turbidity with higher values during monsoon season and snowmelt and lower value during remaining seasons.



Turbidity

Total Suspended Solids (TSS)

Source: ESSA 2014

Figure 6.1-12: Turbidity and Total Suspended Solids (August 2013 to July 2014) at Different Locations

The Trishuli is a snow-fed river. The water temperature of the river is thus governed by the atmospheric temperature of the surrounding area and the contribution of snowmelt. Monthly variation trends of the water and air temperature along the river reaches are depicted in Figures 6.1-13 and 14.

The water temperature is at its minimum during December and maximum during September, while the air temperature is maximum during May and minimum during December. The average difference between air and water temperature is around 8 degrees Celsius, with the maximums during May (14°C) and minimums during October.

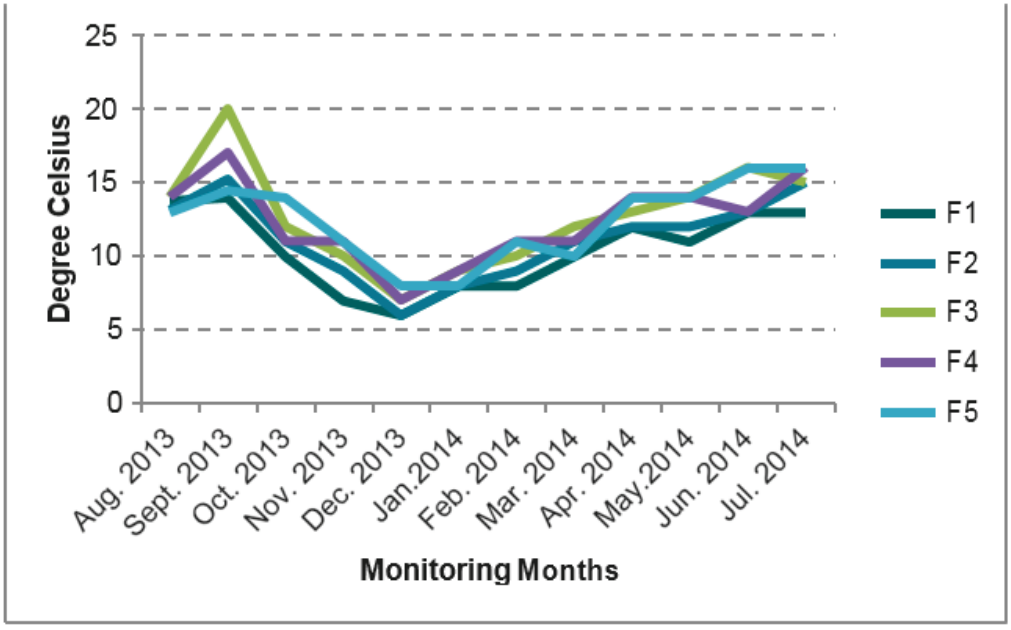


Figure 6.1-13: Monthly Variation of Water Temperature

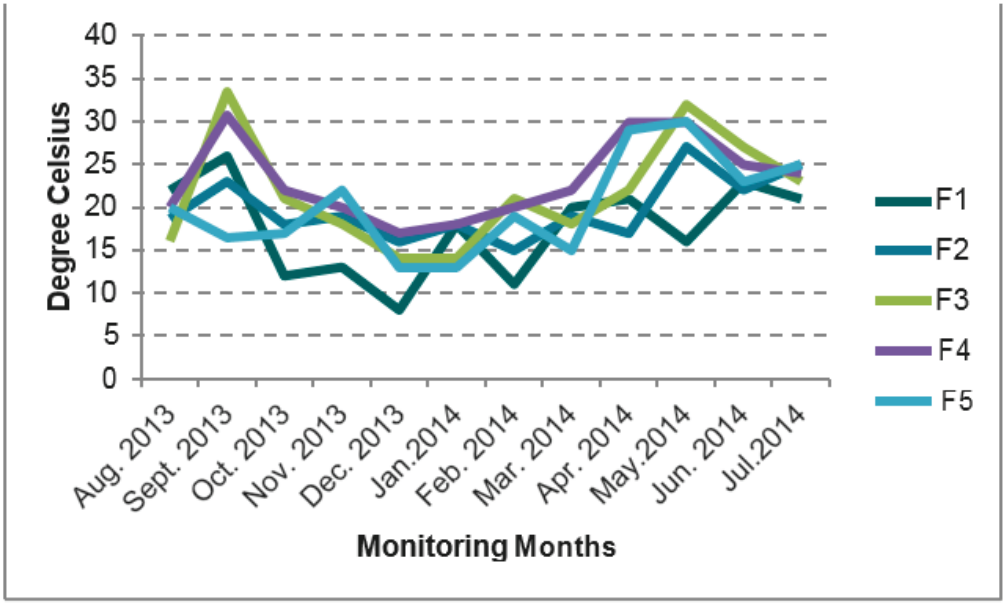


Figure 6.1-14: Monthly Variation of Air Temperature at the Monitoring Sites

The spring and rain-fed tributaries of the Trishuli River in the monitored stretch, which includes the Khorsyong Khola, Gogane Khola, Daldung Khola, Thanku Khola, Pangling Khola, and Bimali Khola, show water temperatures that are 5 to 8 degrees Celsius above the temperatures of the Trishuli River.

6.1.5.3. Chemical Quality

The chemical quality of the Trishuli River is good overall and not affected by industrial pollution, although the detection of oil and grease during some months indicates some contamination from traffic and construction activities within the watershed. Most metals were reported below the laboratory detection limit. Those metals that were detected (i.e. zinc, iron, and manganese) are likely naturally occurring in the rock and soils of the Project area. This conclusion is supported by the fact that the concentrations of these metals tend to increase during the monsoon season when river flow is significantly higher.

The biochemical oxygen demand (BOD_5) and chemical oxygen demand (COD) concentrations, although low, show that the river is not pristine and is influenced by anthropogenic activities. Improvement in sanitation habits of the catchment population, particularly related to discharge of the household wastes and open defecation, would help to improve these parameters of water quality.

6.1.5.4. Sediment Transport

As typical for most glacier-fed rivers, the Trishuli River carries a heavy sediment load. NWEDC conducted sediment monitoring during 2010 and 2012 to collect data on overall sediment load (bed and suspended sediments), particle size distribution, and other analyses required for the Project's engineering design. As Table 6.1-8 shows, nearly all (95 percent) of the total sediment load occurs during the monsoon season (June – September).

Table 6.1-8: Relationship of River Flow and Sediment Load

Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
River flow (m^3/s)	43.7	38.6	38.6	49.5	87.5	230.4	487.0	557.8	370.8	160.4	79.9	54.6	2198.8
sediment concentration (mg/l)	35	51	80	96	351	778	1798	1231	757	272	79	65	5593
Sediment load (Tons/day)	132	170	267	411	2,654	15,487	75,654	59,327	24,252	3,770	545	307	182,976

6.1.5.5. Microbiological Quality

Coliform counts varied considerably within the river reaches and across the months. Higher counts were observed at the onset (March through July) and decline of the monsoon, and lower values were detected during the winter season as shown in Figure 6.1-15.

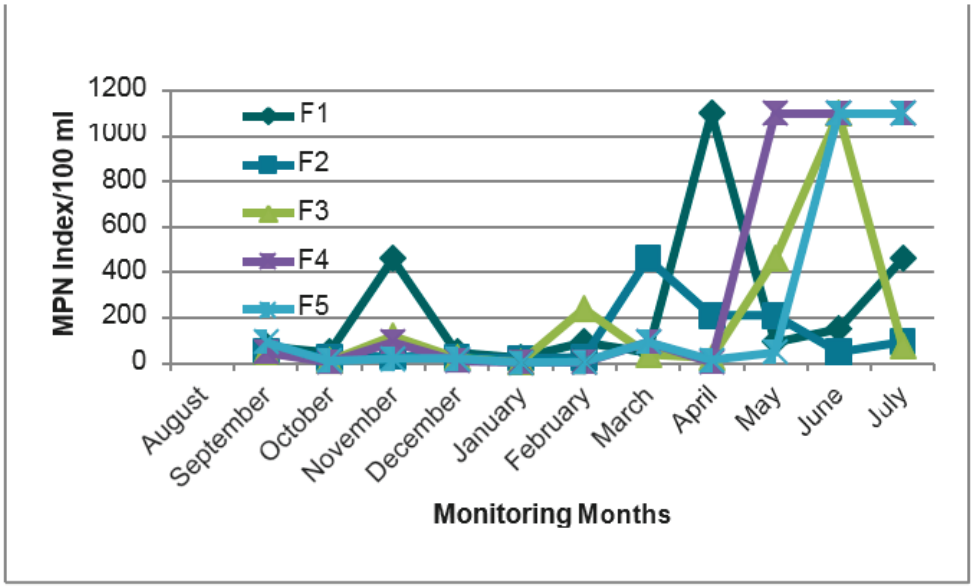


Figure 6.1-15: Coliform Counts at the Monitoring Sites

6.1.6. Ambient Air Quality

There are no permanent air quality monitoring stations in the Project area. However, site-specific monitoring conducted in 2008 indicated that the air quality in the Project area was good. There are no industrial pollution sources in the Project area, and vehicular emissions are low in the Project area.

6.1.7. Ambient Noise Quality

Ambient noise levels were not monitored at the Project site and surrounding area, however, no industrial or other significant noise-generating activities are found in the Project area. The major sources of sound in the Project area are natural, such as wind and flowing water, and localized noise from human activities in nearby villages.

6.2. BIOLOGICAL RESOURCES

6.2.1. Aquatic Ecology

The aquatic biodiversity of the Project area was studied and documented over a four year period between 2012-2016 (Table 6.2-1). The first survey was conducted in 2012 for the Nepali EIA. A full year of monthly sampling was conducted in 2013-2014 to study the seasonal variation of the aquatic fauna. Two additional surveys were conducted in 2016, after the 2015 earthquake, to collect specific data to confirm fish spawning locations and river conditions.

Aquatic sampling was conducted in several locations upstream of the proposed UT-1 dam (in both the mainstem of the river and tributaries), in the UT-1 diversion reach (only in the mainstem of the river as there are no significant tributaries in this reach), and immediately downstream of the powerhouse (in both the mainstem of the river and the Mailung Khola tributary) (Table 6.2-1). The surveys collected data on aquatic habitat, fish, and plankton, but focused mainly on fish.

Table 6.2-1: Summary of Project Fishery Studies

Study	Dates	Sampling Locations within the Project Area	Technique	Comments
NESS 2012	March (1 sampling event)	3 sampling locations upstream of the proposed dam 1 sampling location in the Diversion Reach 1 sampling location downstream of the proposed powerhouse	Cast and gill nets	Basis for Nepali EIA
NESS 2014	Aug 2013 – July 2014 (12 monthly sampling events)	1 sampling location upstream of the proposed dam 3 sampling locations in the Diversion Reach 1 sampling location downstream of the proposed powerhouse	Cast and gill nets	Full year of data
SWECO 2016	Late Feb to early March (1 sampling event)	3 sampling locations upstream of the proposed dam 1 sampling location in the Diversion Reach 1 sampling location downstream of the proposed powerhouse	Electrofish with some cast/drift nets	Spawning had already begun
NESS 2016	June (1 sampling event)	2 sampling locations upstream of the proposed dam 2 sampling locations in the Diversion Reach 2 sampling locations downstream of the proposed powerhouse	Cast nets	Provides regional perspective

6.2.1.1. Aquatic Habitat

The Trishuli River originates in the Tibet Autonomous Region of the People's Republic of China and flows south for 120 kilometres (km) before entering Nepal. The section within Nepal is high gradient with frequent rapids (S.A.N. Engineering Solutions [SANS] 2017). The hydrological

record for the Trishuli River indicate that the river has pronounced seasonal variations in flow, with four well-defined seasons: Dry, Transitioning from Dry to Wet, Wet, and Transitioning from Wet to Dry. The National EIA (NWEDC 2012) documented high energy habitats with high velocities as the predominant physical habitat type. Rapids, riffles, and runs together comprised 85 to 95 percent of the total instream habitat assessed (See Figure 6.2-1 below).

Source: NWEDC 2016

Figure 6.2-1: Trishuli River Immediately Downstream of Project Site

In April 2015 Nepal suffered widespread damage from a major earthquake. NESS conducted an aquatic field survey at nine sites upstream, within, and downstream of the Project Area in June 2016 to verify conditions after the earthquake. The survey covered the same general area as the 2014 survey. Overall habitat conditions remained largely unchanged throughout the study area, with high energy, swiftly flowing habitat types (riffles and rapids) predominating. The Trishuli River in this segment provides cold water habitat to a limited number of fish species that can tolerate ambient temperatures.

The Trishuli River is fragmented by the Trishuli Hydropower Project, which began operations in 1967, near Betrawati about 25 km downstream of the UT-1 Project. More recently (1984), the Devighat Hydropower Project was constructed just downstream of the Trishuli Project (approximately 35 km downstream of the UT-1 Project). Neither of these projects have fish ladders. NESS indicates that locals in the Project area reported a decline in fish diversity and abundance after these projects were constructed. It's likely that the Common and Dinnawah snowtrout populations are fragmented into upstream and downstream populations by these projects.

As mentioned above, the UT-3A HEP is currently under construction and appears to be further fragmenting the Trishuli River by preventing the Dinnawah snowtrout from reaching the Project

area. Presumably the UT-3A HEP is also preventing the upstream migration of the Common snowtrout, but the Common snowtrout is still found in the Project area, whereas the Dinnawah snowtrout is not. The Common snowtrout's enhanced cold water tolerance may allow it to overwinter in the marginally warmer waters at the confluence of the Mailung Khola, whereas the more temperature sensitive Dinnawah snowtrout were unable to survive the harsh winter water temperatures in the Project area. It is likely that the Common snowtrout population found in the Project area may now be isolated by the UT-3A HEP, but is able to survive and maintain a reproducing population in the Project area. The UT-3A HEP does have plans for a fish ladder, and if successfully operated could re-establish fish connectivity in the Trishuli River. The UT-1 Project will implement mitigation measures, including a fish passage, to maintain connectivity for the Common snowtrout population. See Section 7.2 for UT-1 Mitigation actions and Section 7.12 for a discussion of cumulative impacts within the Trishuli River Basin.

6.2.1.2. Fish Diversity and Distribution in the Project Area

A total of 8 species of fish were documented in the project area (Table 6.2-2) but the Common snowtrout, *Schizothorax richardsonii*, was by far the most widespread and abundant species, comprising 98% of fish captures across the project area. The Dinnawah snowtrout, *Schizothorax progastus*, was documented only in 2011 and not in subsequent surveys. The other six species were collected in small numbers.

Data from the fish surveys show a trend for fish biodiversity to increase slightly moving downstream through the Project area, from 4 species above the dam site, to 5 species within the diversion reach to 7 species downstream of the powerhouse (Table 6.2-2) However, given the distribution and water temperature tolerances of these fish species, it's likely that the fish biodiversity is the same at the sites surveyed above the dam (e.g. the confluence of the Bhote Koshi and Langtang Khola immediately upstream of the dam site) and at the sites sampled within the diversion reach, as this entire river segment can be characterized as having very cold water, high gradient, canyon habitat, without any major tributaries. The three small catfish species were variously found in the Project area, but would be expected to be found throughout the Project area given the similarity of the habitat from the confluence of the Bhote Koshi and Langtang Khola to just upstream of the confluence with the Mailung Khola. The Rainbow trout, which was only found in the diversion reach, is expected to be found upstream of the dam, as it is not a native species and is assumed to have escaped from a local fish farm near Dhunche.

Table 6.2-2: Fish Spatial Distribution within the Trishuli-1 Hydropower Project Area

Common Name	Scientific Name	Above Dam Site		Diversion Reach		Downstream of Powerhouse	
		Found	Expected*	Found	Expected*	Found	Expected*
Common snowtrout	*Schizothorax richardsonii*	X		X		X	
Dinnawah snowtrout	*Schizothorax progastus*	X		X		X	
Suckerthroat catfish	*Pseudecheneis sulcata*		x	X		X	

Common Name	Scientific Name	Above Dam Site		Diversion Reach		Downstream of Powerhouse	
Torrent catfish	*Euchiloglanis hodgarti*	X		X		X	
Pharping catfish	*Glyptosternum (Myersglanis) blythi*	X			x	X	
Banded loach	*Schistura savona*					X	
Mottled loach	*Nemacheilus botia*					X	
Rainbox trout	*Onchorhyncus mykiss*		x	X			
# of species found	*8*	4	2	5	1	7	

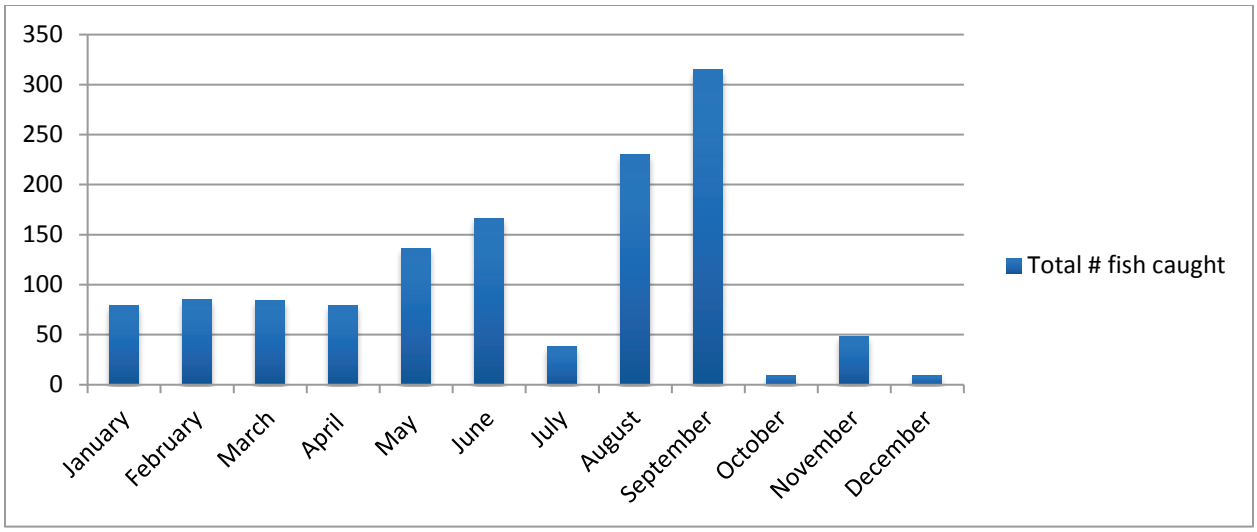
Source: NWEDC 2012, *Expected due to habitat characteristics

Near the powerhouse, however, the canyon begins to open, the river widens, and the Mailung Khola contributes warmer water, as its headwaters are not snow fed. Two loach species are found here, but not upstream, and, as described below, fish abundance increases significantly below the powerhouse and a more robust year-round fish population is found. Although not reported here, fish sampling conducted downsteam of the Project area documented several other species not observed in the Project area.

Overall, water temperature is believed to be a controlling factor limiting fish biodiversity in the Project area, with only extremely cold temperature tolerant species found upstream of the powerhouse, and additional species found downgradient as water temperatures gradually warm.

6.2.1.3. Fish Abundance and Temporal Distribution

The 2014 NESS data reflects a full year of monthly sampling and best characterizes fish abundance and temporal distribution in the Project area. These data show primarily adult fish in the Project area in January through April, with the increase in numbers of fish found in May and June reflecting some young-of-year fish, and the peak numbers of fish in August and September representing some adults but primarily young-of-year fish migrating downstream, with relatively few fish occurring in the river's main channel in the Project area between October and December (Figure 6.2-2).



Source: NESS 2014

Figure 6.2-2: Total Number of Fish Captured in the Project Area (2013-2014)

Common snowtrout is the overwhelming most common species found, found in every sampling event and every month and representing over 98 percent of the fish caught. The three catfish, two loach, and the rainbow trout species were far less abundant, with only a few individuals caught.

Figure 6.2-3 presents the same data, but disaggregates it by month and by sampling stations (i.e., Station 1 was upstream of the UT-1 dam, Stations 2 – 4 were in the diversion reach, and Station 5 was downstream of the powerhouse near the confluence with Mailung Khola). These data clearly show that the relative abundance of fish is low above the dam, increases slightly in the diversion reach (but primarily during the spring when the Common snowtrout are migrating upstream to spawn, and especially in August/September when the Common snowtrout move downstream to overwinter), and is relatively high downstream of the powerhouse.

Figure 6.2-3 also clearly shows that the river upstream of the dam and the diversion reach are primarily used as transit corridors, with relatively few fish found other than during upstream and downstream migration periods. NESS attributed the peak numbers of fish in their September samples to downstream migrants moving through the Project Area at the end of the monsoon season (NESS 2014). The area below the powerhouse does support more of a year round population.

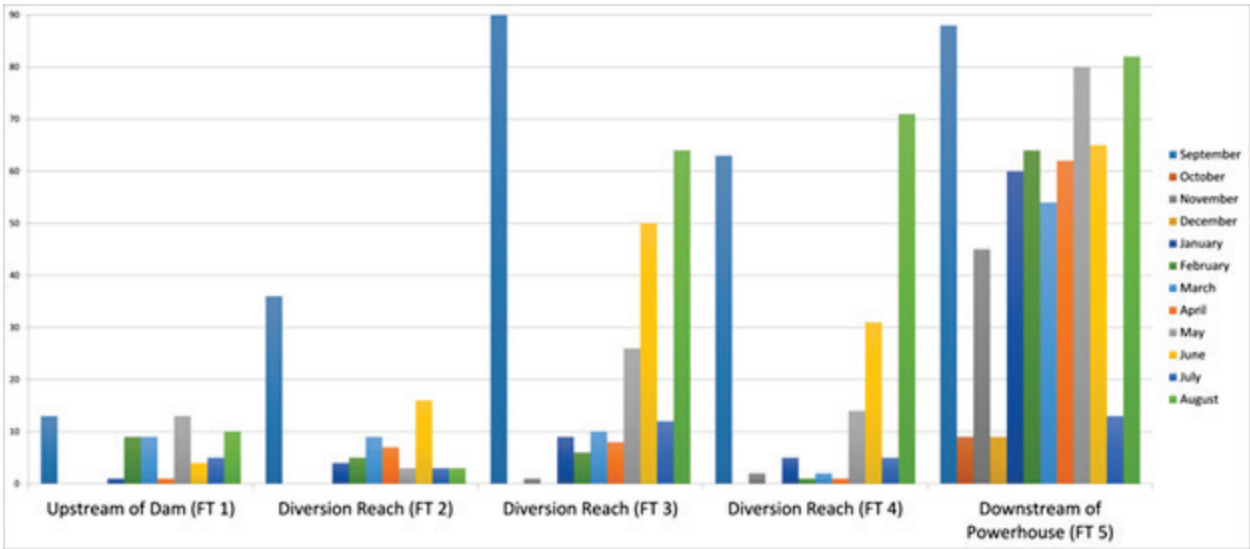


Figure 6.2-3: Number of Common Snowtrout Captured by Monitoring Station

The 2016 SWECO survey provides further insight on fish movement and spatial/temporal distribution. This survey conducted in late February and early March 2016 found evidence of spawning activity, but nearly all the spawning that was documented was found in tributaries, rather than the mainstem, of the Trishuli River. Similarly, SWECO found very few juvenile fish in the main river channel, but juvenile densities in the tributaries were more variable. Mailung Khola, Phalakhu Khola, and Andheri Khola in particular (all located downstream of the proposed powerhouse location) produced comparatively high densities of immature fish. Most other tributaries produced few or no fish, however Chilime Khola located upstream of the dam site produced several adult Common snowtrout from a single electrofishing pass through a small pool. The study demonstrated that the tributaries are vital rearing habitat for juvenile Common snowtrout, likely due to a combination of the higher availability of refuge habitat, lower turbidity, and warmer water temperatures than in the main Trishuli River channel (SWECO 2016).

These data, in combination with the average length and weight of fish caught (ESSA 2014) help to further interpret the results presented in Figure 6.2-2, suggesting that adults migrate upstream through the diversion reach and area above the proposed UT-1 dam in early Spring (February – May), most likely heading for spawning areas upstream of the confluence of the Bhote Khosi and the Langtang Khola, as there are no tributaries found in this segment of the river suitable for any significant spawning. During May – July, there are a mix of adults and some young-of-year fish moving through the area above the dam and the diversion reach. The high numbers of individuals caught in the August and September, and to a lesser extent October, are primarily young-of-year fish moving downstream as river temperatures begin to cool. The few fish caught in the Project area between November – January are primarily adults, except for downstream of the powerhouse where water temperatures appear to be warm enough to support young-of-year fish through the winter. This finding suggests there is possibly a small resident population upstream of the dam site, at least during comparatively warmer winters. See Table 6.2.3 for summary of the Common snowtrout's migration through the UT-1 project area.

Table 6.2-3. Common Snowtrout, *Schizothorax richardsonii*, Migration through the UT-1 Project Area

Month/Area	Feb-May	May-July	Aug-Oct	Nov-Jan
Upstream of proposed UT-1 dam	Adults migrate to spawning areas in tributaries upstream of the confluence of the Bhote Khosi and the Langtang Khola	Mix of adults and some young-of-year fish, Spawning in tributaries	Some adults and mostly young-of-year fish moving downstream as river temperatures begin to cool	A few adults, possibly a small resident population, at least during comparatively warmer winters.
Diversion reach	Adults migrate upstream through the diversion reach to upstream tributaries (none in in this reach)	Mix of adults and some young-of-year fish moving upstream	Some adults and mostly young-of-year fish moving downstream as river temperatures begin to cool	A small resident population during comparatively warmer winters.
Downstream of Powerhouse	Adults and juveniles present, feeding and growing	Adults and juveniles present, feeding and growing	Adults, juveniles, and young-of-year fish present, feeding and growing	Adults, juveniles, and young-of-year fish, water temperatures appear to be warm enough to support them through the winter

Common Snowtrout

Common snowtrout prefer riverine habitats with rocky bottoms. It is primarily an herbivorous bottom feeder, feeding mainly on algal slimes, aquatic plants, and detritus, but also aquatic insect larvae encrusted on the rocks (Vishwanath 2010). It requires cool to cold temperatures and well-oxygenated water. As an adult it is found in high velocity habitats, although larval and juvenile life stages are more typically found in slower areas near the sides of rivers.

Common snowtrout are migratory. They generally migrate upstream to spawn in spring, in response to various triggers including snowmelt, rise in water temperature, comparatively higher turbidity level, swelling of rivers, and creation of side channels (SANS 2017). These cues occur when the monsoon rains and snow melt increase flows in the upper reaches of the Himalayan rivers, but the timing of these increased flows varies across the snowtrout's range, so the timing of the snowtrouts' upstream migration is also variable (SANS 2017). Common snowtrout migrates downstream during early winter as water temperatures decline in the upper reaches of

the rivers and may spawn again at this time, but the timing of these downstream migrations are similarly variable.

SWECO found spawning activity occurring in late February and early March of 2016, while ESSA found migrating fish and spawning in March and April of 2014, and NESS's data suggest that in 2014 the upstream migration in the Project area actually began in May.

Dinnawah Snowtrout (Schizothorax progastus)

The Dinnawah snowtrout is widely distributed in mountain rivers of Nepal, Bhutan, and India. It is typically found in run and pool habitats. It is primarily carnivorous. It is considered an altitudinal migrant, moving upstream to spawn in the spring, and then typically moving back downstream in the early Fall as water temperatures begin to decline.

The Dinnawah snowtrout is less tolerant of cold water temperatures than the Common snowtrout, and its range, while overlapping with the Common snowtrout, does not typically extend as far upriver, with its upper elevation limit typically around 1440 metres. The river elevation at the UT-1 dam site is approximately 1230 metres, although the extremely cold temperatures of the snow-fed Trishuli River may limit the Dinnawah snowtrout's upward movement to less than the 1440 metres. The Dinnawah snowtrout was not found in fish surveys conducted in 2011 for the upstream Rasuwagadhi Hydroelectric Project (HEP), at elevation approximately 1600 meters, although the Common snowtrout was found.

The Dinnawah snowtrout were only found in the Project area in the initial 2011 field sampling, although they were relatively common representing 41 percent of the fish caught during the 2011 sampling campaign (the other 59 percent were Common snowtrout). Surprisingly, the Dinnawah snowtrout were never found again in any subsequent field sampling. As mentioned above, construction of the downstream UT-3A HEP, which began in late 2011, may have progressed far enough to functionally block upstream Dinnawah snowtrout migration by August 2013, when aquatic fieldwork began for the Supplemental ESIA. Although there was a fish ladder constructed for the UT-3A HEP, it is not clear whether it was functioning in 2013 – 2015 period, and it was known to have been damaged in the 2015 earthquake, and has not been operational since then.

In summary, the Project area appears to be within the Dinnawah snowtrout's historic range, albeit near the upper end of its likely range. The construction of the downstream UT-3A Hydroelectric Project is quite possibly the reason the Dinnawah snowtrout has not been found since 2011. As mentioned above, the UT-3A HEP design includes a fish ladder, although it was damaged during the earthquake. If the UT-3A fish ladder is repaired and is successful in passing fish, the Dinnawah snowtrout could return to the Project waters.

Rainbow Trout

Rainbow trout are not native to the Trishuli River, and it is assumed that the Rainbow trout that were caught had escaped from a local fish farm near Dhunche. The Rainbow trout that were

caught were only found during the summer (between May and August) and only in the diversion reach sampling stations. It is not known whether a reproducing population exists within the Trishuli River.

The Rainbow trout does represent a threat to the native fish species, as it is an aggressive predator and it will prey on smaller fish. Although NESS documented predation by rainbow trout on Common snowtrout, and Rainbow trout is known to be invasive in some settings where it has been introduced, the Common snowtrout population in the Project area appears robust at this time and the Rainbow trout population does not appear to have substantially altered the aquatic community to date.

6.2.1.4. Endangered, Unique, Migratory, and Restricted Range Species

Common snowtrout is listed as Vulnerable (VU) by the International Union for Conservation of Nature (IUCN), while the other species found are all listed as Least Concern (LC), with one listed as Data Deficient (DD). As mentioned above, Rainbow trout is not a native species and it is not protected by law or considered threatened in Nepal. No other unique aquatic species are known to occur in the Project Area. All the aquatic species documented from the Project area to date are widespread.

Although the Common snowtrout has a wide geographical distribution in the Himalayas region, this species is reported to be declining across its range, which is attributed to dams, overfishing, alien fish species introductions, and collection for the ornamental fish trade (NESS 2014, IUCN 2017).

Two of the species found in the Project area are identified as migratory by the IUCN and Froese and Pauly (i.e., commonly known as Fishbase, 2017) as summarized in Table 6.2-4. As described above, both the Common snowtrout and the Dinnawah snowtrout are considered altitudinal migrants, moving upstream to spawn in the spring, and then typically moving back downstream in the early Fall as water temperatures begin to decline.

Table 6.2-4: Fish Species in the Trishuli-1 Hydropower Project Area

Species			IUCN Conservation Status	Nepal Status[a]	Migratory Status	
Latin Name	**Common Name**	**Nepali Name**			**IUCN**	**Fishbase**
Schizothorax richardsonii	Common snowtrout	Buchche asala	VU	VU	X	X
Schizothorax progastus	Dinnawah snowtrout	Chuchle asala	LC	LC	X	X
Pseudecheneis sulcata	Suckerthroat catfish	Kabre	LC	LC		
Euchiloglanis hodgarti	Torrent catfish	Till kabre	LC	LC		
Glyptosternum (Myersglanis) blythi	Pharping catfish	Tel kabre	DD	LC		
Schistura savona	Banded loach	Gadela	LC	LC		
Noemacheilus botia	Mottled loach	Pate Gadela	LC	LC		
Onchorhyncus mykiss	Rainbow trout	Trout	DD	LC		

VU = Vulnerable; LC = Least Concern; DD = Data Deficient
[a] Source: : NRDB: Red data book of the fauna of Nepal (1995) Suwal, R. N.; Verheugt, W. J. M.; Smith, C. 1995. Dep. of National Parks & Wildlife Conservation, Kathmandu

6.2.1.5. Habitat Classification

The International Finance Corporation (IFC) identifies three categories of habitat under Performance Standard 6 (PS6; IFC 2012):

- Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition.
- Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.
- Critical habitats are areas with high biodiversity value, including:
  - Habitat of significant importance to Critically Endangered and/or Endangered species;
  - Habitat of significant importance to endemic and/or restricted range species;
  - Habitat supporting globally significant concentrations of migratory species and/or congregatory species;
  - Highly threatened and/or unique ecosystems; and/or
  - Areas associated with key evolutionary processes.

Based on the physical habitat and water quality conditions documented by NWEDC, NESS, SANS, and SWECO, the aquatic habitat in the Project Area meets the IFC's definition of Natural Habitat (IFC 2012). Although the concentrations of several metals (notably iron, manganese and zinc) as well as oil and grease were elevated during the monsoon period, the physical habitat in the diversion reach currently retains its natural ecological function and supports a viable aquatic community as demonstrated by the fish data collected by NESS and SWECO. With the exception of these isolated exceedances, the river water quality in the monitored stretch of the Trishuli River is generally good and not affected by industrial pollution. Although BOD_5 and COD concentrations demonstrated that the river is not pristine, impacts related to discharge of human waste remain relatively minor (NESS 2014).

The Upper Trishuli River does not meet the definition of Critical Habitat because it does not support any Critically Endangered, Endangered Species, endemic, or restricted range species; or any highly threatened or unique ecosystems; nor is it associated with any key evolutionary processes. The Upper Trishuli River does support migratory species (e.g. Common snowtrout), but does not support globally significant concentrations of these species.

6.2.2. Terrestrial Ecology

The Project is located in an area distinguished by large elevation changes and the presence of the Langtang National Park (LNP), the first Himalayan national park (gazetted in 1976) and the largest national park (1,710 square kilometres) in Nepal. The complex topography and geology combined with the varied climatic patterns associated with the elevation gradients provides conditions for a rich and varied biodiversity. Over a distance of approximately just 20 km,

biographical zones (generally related to elevation and climate) ranging from Alpine to Tropical can be found (Figure 6.2-4).

Although the Project lies in this transitional bioclimatic region, the presence of exposed bedrock, poor soil development, and human activities (e.g. collection of timber and firewood, livestock grazing) have been limited factors for good growth of forest vegetation. This is especially true on the west side of the Trishuli River, whereas the east side of the river lies within the LNP where human uses are restricted and the forest is much healthier.

The Project itself is located in the deep canyon formed by the Trishuli River with vegetation and wildlife associated with the Upper (elevations from 1000 to 1500 m) and Lower (elevations from 500 to 1000 m) sub-Tropical zones. Project construction will require 103.22 hectares (ha) of land, including approximately 79 ha of forest (including 2.6 ha from LNP) and 24 ha of crop land.

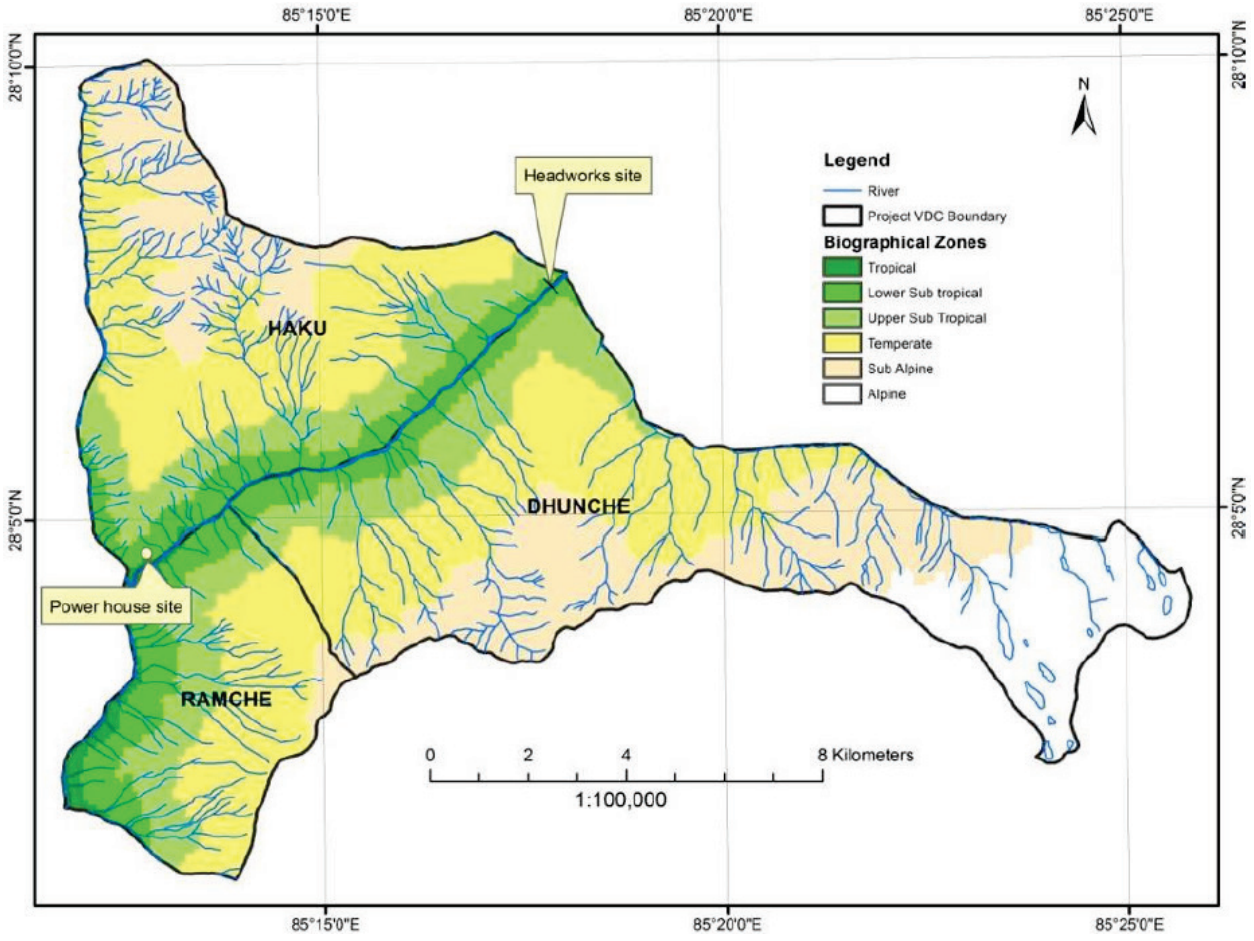


Figure 6.2-4: Biographical Zones of the Project Site

6.2.2.1. Terrestrial Habitats

The following forest types are present within the Environmental Area of Influence (NESS 2014):

- **Hill Sal Forest.** Sal (*Shorea robusta*) is the predominant species growing up to 1500 metres (m) on the outer foot hills. The common associates are Needlewood (*Schima wallichii*), *Terminalia spp*., Nepalese alder (*Alnus nepalensis*), and Chir pine (*Pinus roxburghii*).
- **Pine Forest.** Chir pine is dominant species in between 1000 to 2000 metres. The associated species include Needlewood, *Terminalia* spp., and Nepalese alder.
- **Alder Forest.** Nepalese alder often grows in place of Needlewood-Castanopsis forests in between 1000 to 2000 metres. It occurs prominently in the form of small isolated woods along the banks of rivers/streams and field margins and on unstable grounds.
- **Mixed Riverine Forest.** There is a mixed type of riverine forest in study area close to the bank of Trishuli River (900 to 1500 m). The most common species include the Nepalese alder, Chir pine, Needlewood, *Toona ciliata, Mallotous* spp., *Bauhinia purpurea, Albizia* spp.

The vegetation and flora surveys confirmed that most of the natural vegetation in the Project's area corresponds to forest under the management of community forests. The community forests showed evident signs of anthropogenic activities and of ecological degradation (i.e. patchy vegetation, smaller trees). Locals reported an increasing trend in forest degradation in recent years due to the increase demand for timber for house building and other purposes. Ineffective control (e.g. uncontrolled grazing) and management were also pointed out as other causes/contributors to the deterioration of the forest area. The observations of the field survey showed that the circumference at breast height (CBH) of the tree species found inside the community forests is small in comparison to the trees found in LNP.

6.2.2.2. Data Sources

The species inventories compile information from the following sources

1. Regulatory EIA submitted to the Government of Nepal in 2012 (NESS 2012): Biodiversity assessments were carried out in 2011 and 2012 through walk over surveys and consultation with local communities
2. Supplemental ESIA ((NESS 2014); Two biodiversity surveys were conducted during 2013 and 2014
3. The Integrated Biodiversity Assessment Tool (IBAT) proximity report (Site name: Trishuli; Lat/Long 28^{o} 3' 36" North, 85^{o} 13' 11" East) was also reviewed for the likely occurrence of threatened or restricted range species. The report did not indicate any threatened or restricted range species. As the report includes species found within a 50 km radius of the given coordinates, species found in the Langtang National Park are also included
4. ERM's assessment of the likely occurrence of species at the project's elevation and habitat type, based on its own experience in conducting biodiversity assessments at similar elevations in Nepal.

The conservation status of the species mentioned below were assessed from

1. IUCN red-list Version 2017-3

2. National Redlist of Mammals of Nepal (RLMN) (2012) (Jnawali, 2012)
3. National Redlist of Nepal's Birds (2016) (Inskipp et al. 2016).
4. Protected species as per the National Parks and Wildlife Conservation Act (1973).

6.2.2.3. Flora within the Environmental Area of Influence

Thirty-five species of trees, 37 species of shrubs, and 69 species of herbs were recorded. The dominant tree species reported were Sal, Nepalese Alder, Chir pine, Needlewood, and *Bauhinia purpurea*.

The dominant shrub species reported were *Achyranthes aspera*, *Ageratina adenophora*, and *Woodfordia fruticose*. While the dominant herb species were *Saccharum spontaneum*, *Arundinaria* spp., *Chrysopogon gryllus*, and *Drepanostachyum falcatum*. List of trees, herbs, and shrubs recorded from the EIA (NESS 2012) and Supplementary ESIA (NESS 2014) are provided in Appendix C, Flora within the Environmental Area of Influence.

Local threatened plant species include: Simal (*Bombax ceiba*), Sal (*Shorea robusta:* IUCN Red List LC, v 2017-3) and *Malaxis muscifera* (IUCN Red List VU, v 2017-3), *Calanthe puberula,* and *Satyrium nepalense* are included in the Appendix II of CITES (2017).All these species are protected by the Government of Nepal for their commercial value.

The Government of Nepal has legal responsibility under the Forest Act 1993 to protect 11 plant species in three categories. Category-I bans species for the collection, use, sale, distribution, transportation and export outside the country. Two species from the Project area fall in this category. Category-II bans the species for their export outside the country. There are six species in Category-II in the Project area. Category-III bans the transportation, export and felling of three tree species

The list of plant species of conservation significance and protected species under the above categories, are presented in Table 6.2-5.

Table 6.2-5: Plant Species of Conservation Concern

SN	Scientific name	Common name	Family	Protection Category	IUCN (2017)
1	*Bombax ceiba*	Simal	Bombacaceae	III	Not Assessed
2	*Calanthe puberula*		Orchidaceae	II	Not Assessed
3	*Malaxis muscifera*		Orchidaceae	II	Vulnerable
4	*Satyrium nepalense*		Orchidaceae	II	Not Assessed
7	*Shorea robusta*	Sal	Dipterocarpaceae	III	Least Concern

There were no additional threatened or endemic species listed in the IBAT proximity report.

6.2.2.4. Fauna within the Environmental Area of Influence

The thinly scattered trees, steep rocky terrain, agricultural fields, and villages make the Project area less favourable for wildlife as compared to nearby LNP. The key habitat for terrestrial wildlife, especially mammals, is found within the LNP.

Herpetofauna

Twenty-two species of herpetofauna including 9 species of amphibians and 13 species of reptiles were reported from the Project site and surrounding areas based on field studies in support of the Project (EIA (NESS 2012) and Supplementary ESIA (NESS 2014)) (Table 6.2-6). The reported herpetofaunal species are either Least Concern or are not assessed by IUCN. Among the species, only the Rat snake (*Ptyas mucosus,* Not assessed, IUCN v2017-3) is included in Appendix II of CITES (2017).

The IBAT report did not provide any additional threatened or restricted range species

Table 6.2-6: Herpetofaunal Species Reported from the Environmental Area of Influence

Sl No.	English Name	Scientific name	CITES	IUCN
1	Himalayan Toad	*Duttaphrynus himalayanus*		LC
2	Black Spined Toad	*Duttaphrynus melanoctictus*		NA
3	Marbled Toad	*Duttaphrynus stomaticus*		LC
4	Myanmar Pelobatid Toad	*Megophrys parva*		LC
5	Sikkimese Frog	*Ombrana sikimensis*		LC
6	Indian bull frog	*Haplobatrachus tigerinus*		NA
7	Liebig's frog	*Nanorana liebigii*		LC
8	Beautiful stream Frog	*Amolops formosus*		LC
9	Skittering Frog	*Euphlyctis cyanophlyctis*		LC
10	Common Garden Lizard	*Calotes versicolor*		NA
11	Kashmir agama	*Laudakia tuberculata*		NA
12	Saffron-bellied Wall Gecko	*Hemidactylus flaviviridis*		NA
13	Brahminy skink	*Eutropis carinata*		LC
14	Himalayan ground skink	*Asymblepharus himalayanus*		NA
15	Mountain Keelback	*Amphiesma platyceps*		NA
16	Asiatic Rat Snake	*Ptyas mucosus*	II	NA
17	Himalayan Keelback	*Rhabdophis himalayanus*		NA
18	Chequered Keelback water snake	*Xenochrophis piscator*		NA
19	Mountain Pit Viper	*Ovophis monticola*		LC
20	Eastern Red Sand Boa	*Eryx johnii*		NA
21	Himalayan Trinket Snake	*Gonyosoma hodgsonii*		NA
22	White lipped Pit Viper	*Cryptelytrops albolabris*		LC

Source: NWEDC 2012; NESS 2014

IUCN Red List (2017-1): LC: Least Concern; NA= Not Assessed

Note: CITES 2017: Appendix I lists species that are the most endangered among CITES-listed animals and plants. They are threatened with extinction and CITES prohibits international trade in specimens of these species except when the purpose of the import is not commercial for instance for scientific research. In these exceptional cases, trade may take place provided it is authorized by the granting of both an import permit and an export permit (or re-export certificate).

Appendix II lists species that are not necessarily now threatened with extinction, but that may become so unless trade is closely controlled. It also includes so-called "look-alike species", i.e. species whose specimens in trade look like those of species listed for conservation reasons. International trade in specimens of Appendix-II species may be authorized by the granting of an export permit or re-export certificate. No import permit is necessary for these species under CITES (although a permit is needed in some countries that have taken stricter measures than CITES requires).

Avifauna

A total of 79 species of birds were reported from the Project site and surrounding areas based on field studies in support of the Project (EIA (NESS 2012 and Supplementary ESIA (NESS 2014)) (Table 6.2-7). One IUCN Near Threatened species (Himalayan Griffon, *Gyps himalayensis;* IUCN v2017-3), which is also listed in the RLNB (VU), and two RLNB threatened species,

Ibisbill (*Ibidorhyncha struthersii;* RLNB, EN) and Red Junglefowl (*Gallus gallus;* RLNB, VU), were reported from the Project site and surrounding areas. The latter two species are Least Concern according to the IUCN v2017-3.

Among the recorded bird species, the peregrine falcon (*Falco peregrinus*) is listed in CITES (2017) Appendix I. Six species (*Asio flammeus, Otus spilocephalus, Bubo, Athene brama, Falco tinnunculus* and *Glaucidium cuculoides*) are listed in CITES (2017) Appendix II. All these species are LC in the IUCN Red List v2017-3

Table 6.2-7: Avifauna Species Reported from the Environmental Area of Influence

Sl No.	Common Name	Scientific Name	CITES	IUCN v2017-3)	RLNB
1	Red Junglefowl	*Gallus gallus*		LC	VU
2	Kalij Pheasant	*Lophura leucomelanos*	III	LC	
3	Fulvous-breasted woodpecker	*Dendrocopos macei*		LC	
4	Rufous bellied Woodpecker	*Dendrocopos hyperythrus*		LC	
5	Grey Headed Wood pecker	*Picus canus*		LC	
6	Great Barbet	*Psilopogon virens*		LC	
7	Golden Throated barbet	*Psilopogon franklinii*		LC	
8	Blue-Throated barbet	*Psilopogon asiaticus*		LC	
9	Common Hoopoe	*Upupa epops*		LC	
10	Large Hawk Cuckoo	*Hierococcyx sparverioides*		LC	
11	Indian Cuckoo	*Cuculus micropterus*		LC	
12	Eurasian cuckoo	*Cuculus canorus*		LC	
13	Asian Koel	*Eudynamys scolopacea*		LC	
14	Alexandrine Parakeet	*Psittacula himalayana*		LC	
15	Himalayan Swiftlet	*Aerodramus brevirostris*		LC	
16	Common Swift	*Apus apus*		LC	
17	Short-eared owl	*Asio flammeus*	II	LC	
18	Mountain Scops Owl	*Otus spilocephalus*	II	LC	
19	Eurasian Eagle Owl	*Bubo bubo*	II	LC	
20	Spotted Owlet	*Athene brama*	II	LC	
21	Rock dove	*Columba livia*		LC	
22	Snow Pigeon	*Columba leuconota*		LC	
23	Oriental Turtle Dove	*Streptopelia orientalis*		LC	
24	Spotted Dove	*Streptopelia chinensis*		NA	
25	Eurasian Woodcock	*Scolopax rusticola*		LC	
26	Black Kite	*Milvus migrans*		LC	
27	Himalayan Griffon	*Gyps himalayensis*		NT	VU
28	Hen Harrier	*Circus cyaneus*		LC	
29	Golden Eagle	*Aquila chrysaetos*		LC	
30	Common Kestrel	*Falco tinnunculus*	II	LC	
31	Peregrine Falcon	*Falco peregrinus*	I	LC	
32	Long-tailed Shrike	*Lanius schach*		LC	
33	Yellow Billed Blue Magpie	*Urocissa flavirostris*		LC	
34	Large Billed Crow	*Corvus macrorhynchos*		LC	
35	Eurasian Golden Oriole	*Oriolus oriolus*		LC	
36	Long-tailed Minivet	*Pericrocotus ethologus*		LC	
37	Black Drongo	*Dicrurus macrocercus*		LC	

Sl No.	Common Name	Scientific Name	CITES	IUCN v2017-3)	RLNB
38	Blue Whistling Thrush	*Myophonus caeruleus*		LC	
39	Dark Sided Flycatcher	*Muscicapa sibrica*		LC	
40	Snowy-browed Flycatcher	*Ficedula hyperythra*		LC	
41	Small Niltava	*Niltava macgrigoriae*		LC	
42	White Capped Water Redstart	*Phoenicurus leucocephalus*		LC	
43	Plumbeous water redstart	*Phoenicurus fuliginosus*		LC	
44	Common Stonechat	*Saxicola torquata*		LC	
45	Wallcreeper	*Tichodroma muraria*		LC	
46	Green Blacked Tit	*Parus monticolus*		LC	
47	Black-lored Tit	*Machlolophus xanthogenys*		LC	
48	Black Throated Tit	*Aegithalos concinnus*		LC	
49	Barn Swallow	*Hirundo rustica*		LC	
50	Striated Bulbul	*Pycnonotus striatus*		LC	
51	Himalayan Bulbul	*Pycnonotus leucogenys*		LC	
52	Mountain Bulbul	*Ixos mcclellandii*		LC	
53	Black Bulbul	*Hypsipetes leucocephalus*		LC	
54	Grey-sided Bush warbler	*Cettia brunnifrons*		LC	
55	Dusky Warbler	*Phylloscopus fuscatus*		LC	
56	Grey hooded warbler	*Seicercus xanthoschistos*		LC	
57	Variegated Laughingthrush	*Trochalopteron variegatum*		LC	
58	Black Throated Sunbird	*Aethopyga saturata*		LC	
59	House Sparrow	*Passer domesticus*		LC	
60	Tree Sparrow	*Passer montanus*		LC	
61	Yellow Wagtail	*Motacilla flava*		LC	
62	Olive Backed Pipit	*Anthus hodgsoni*		LC	
63	Slaty-headed Parakeet	*Psittacula himalayana*		LC	
64	Asian Barred Owlet	*Glaucidium cuculoides*	II	LC	
65	Ibisbill	*Ibidorhyncha struthersii*		LC	EN
66	Shikra	*Accipiter badius*		LC	
67	Common Buzzard	*Buteo buteo*		LC	
68	Pied Thrush	*Geokichla wardii*		LC	
69	Common kingfisher	*Alcedo atthis*		LC	
70	White-throated kingfisher	*Halcyon smyrnensis*		LC	
71	Brown dipper	*Cinclus pallasii*		LC	
72	Little forktail	*Enicurus scouleri*		LC	
73	Long-tailed minivet	*Pericrocotus ethologus),*		LC	
74	Great tit	*Parus major*		LC	
75	Oriental white-eye	*Zosterops palpebrosus*		LC	
76	Grey-hooded warbler	*Phylloscopus xanthoschistos*		LC	
77	Striated prinia	*Prinia criniger*		LC	
78	Nepal house martin	*Delichon nipalensis*		LC	
79	Bar-wing flycatcher-shrike	*Hemipus picatus*		LC	

Source: NWEDC 2012; NESS 2014; CITES 2017: Appendix I, II, and III

IUCN Red List (2017-1): LC = Least Concern; NT = Near Threatened; NA= Not Assessed

Based on the check-list of birds in the Langtang National Park (LNP) Management Plan (Langtang National Park 2012), there are likely to be some threatened raptors such as the steppe eagle (*Aquila nipalensis;* EN, IUCN Red List v 2017-3; RLNB, VU), the greater spotted eagle (*Clanga*; VU, IUCN Red List v 2017-3, RLNB, VU), the Eastern imperial eagle (*Aquilia heliaca,* VU, IUCN Red List v 2017-3, RLNB, VU)*,* Cinereous Vulture *(Aegypius monachus,*

NT, IUCN Red List v 2017-3, RLNB, EN) and the Red-headed Vulture (*Sarcogyps calvus;* CR, IUCN Red List v 2017-3, RLNB, EN) that may be occasionally found in the Project area. The park also has several migratory species notably the Eurasian griffon (*Gyps fulvus,* LC, IUCN Red List v2017-3) and several species of geese, teals and ducks.

The IBAT report indicates the likely presence of the following species under the IUCN or RLBN threatened categories

Critically Endangered (IUCN v2017-3 or RLBN)

White-rumped Vulture (CR, IUCN Red List v 2017-3, RLNB, CR)

Pallas's Fish-eagle (*Haliaeetus leucoryphus*) (EN, IUCN Red List v 2017-3, RLNB, CR)

Eurasian Curlew (*Numenius arquata*), (NT, IUCN Red List v 2017-3, RLNB, CR)

River Tern (*Sterna aurantia*), (NT, IUCN Red List v 2017-3, RLNB, CR)

Yellow-breasted Bunting CR (*Emberiza aureola*), (CR, IUCN Red List v 2017-3, RLNB, CR)

Endangered (IUCN v2017-3 or RLBN)

Saker falcon (*Falco cherrug*) (EN, IUCN Red List v 2017-3, RLNB, EN)

Egyptian Vulture (*Neophron percnopterus*), (EN, IUCN Red List v 2017-3, RLNB, VU)

White-throated Bushchat (*Saxicola insignis*) (VU, IUCN Red List v 2017-3, RLNB, EN)

Yellow-rumped Honeyguide (*Indicator xanthonotus*) (NT, IUCN Red List v 2017-3, RLNB, EN)

Vulnerable (IUCN v2017-3 or RLBN)

Common Pochard (*Aythya farina*) (VU, IUCN Red List v 2017-3, RLNB, NT)

Satyr Tragopan (*Tragopan satyra*) (NT, IUCN Red List v 2017-3, RLNB, VU)

Red-breasted Parakeet (*Psittacula alexandri*), (NT, IUCN Red List v 2017-3, RLNB, VU)

Near Threatened (IUCN v2017-3 or RLBN)

Alexandrine parakeet (Psittacula eupatria) (NT, IUCN Red List v 2017-3, RLNB

River Lapwing (*Vanellus duvaucelii*), (NT, IUCN Red List v 2017-3, RLNB, NT)

Amami Thrush (Zoothera major), (NT, IUCN Red List v 2017-3, RLNB, NA)

All these avian species are likely to fly over the project's area of influence or occasionally rest on the trees within.

Of the species in the IBAT report based on known distributions, the following CR and EN species can be confirmed to not occur in the project's area of influence.

Yellow breasted bunting (as per distribution provided in IUCN red-list)

White-throated Bushchat (as per distribution provided in IUCN red-list)

Yellow-rumped Honeyguide (as per distribution provided in IUCN red-list)

Mammalian Fauna

A total 24 species of mammals were reported from the Project site and surrounding areas based on field studies in support of the Project (Table 6.2-8), including seven species of mammals that are listed as threatened or near threatened in the IUCN red list:

- Asiatic Black Bear (*Ursus thibetanus);* VU, IUCN Red List v2017-3, RLNM EN)
- Common Leopard (*Panthera pardus;* VU , IUCN Red List v2017-1, RLNM, VU)
- Assamese macaque (*Macaca assamensis*; NT, IUCN Red List v2017-1, RLNM, VU);
- Terai Grey Langur (*Semnopithecus hector;* NT, IUCN Red List v2017-1, RLNM, LC*)*
- Himalayan goral (*Naemorhedus goral*; NT, IUCN Red List v2017-1, RLNM, NT).

Among the reported mammalian species, Terai Grey langur (*Semnopithecus hector*), Common Leopard, Himalayan goral, and Asiatic Black Bear are listed in CITES Appendix I (2017). Jungle Cat (*Felis chaus*) are included under CITES Appendix II (2017).

From the IBAT report the following threatened species are likely to occur in the area. The IBAT report also has several alpine species found at much higher elevations. These are omitted from the assessment.

Critically Endangered (IUCN v2017-3 or RLBN)

Chinese Pangolin (*Manis pentadactyla*) (CR, IUCN Red List v2017-1, RLNM, EN)

Gray Wolf (*Canis lupus*) (LC, IUCN Red List v2017-1, RLNM, CR)

Csorba's Mouse-eared Myotis (*Myotis csorbai*) ((DD, IUCN Red List v2017-1, RLNM, CR)

Endangered (IUCN v2017-3 or RLBN)

Dhole *(Cuon alpinus) (*EN, IUCN Red List v2017-1, RLNM, EN)

Vulnerable (IUCN v2017-3 or RLBN)

Sambar *(*Rusa unicolor*) (*VU, IUCN Red List v2017-1, RLNM, VU)

Near Threatened (IUCN v2017-3 or RLBN)

Himalayan Serow *(Capricornis thar) (*NT, IUCN Red List v2017-1, RLNM, DD)

Eurasian Otter (*Lutra lutra)*) (NT, IUCN Red List v2017-1, RLNM, NT)

Pallas's Cat (*Otocolobus manul*) *(*NT, IUCN Red List v2017-1, RLNM, NA)

Of the species in the IBAT report based on known distributions, the following CR and EN species can be confirmed to not occur in the project's area of influence.

Chinese Pangolin (as per distribution provided in IUCN red-list)

Csorba's Mouse-eared Myotis (as per distribution provided in IUCN red-list)

Table 6.2-8: Mammalian Species Reported from the Environmental Area of Influence

Sl No.	Nepalese Name	Common Name	Scientific Name	CITES	IUCN Global	RLNM
1	Timnyau	Assamese macaque	*Macaca assamensis*		NT	VU
2	Bandar	Rhesus macaque	*Macaca mulatta*		LC	
3	Terai langur	Terai Grey Langur	*Semnopithecus hector*	I	NT	
4	Bandel	Wild Boar	*Sus scrofa*		LC	
5	Chituwa	Common Leopard	*Panthera pardus*	I	VU	VU
6	Dumsi	Indian Crested Porcupine	*Hystrix indica*		LC	
7	Fyauro	Red Fox	*Vulpes vulpes*	III	LC	LC
8	Ghoral	Himalayan Goral	*Naemorhedus goral*	I	NT	NT
9	Kalo Bhalu	Asiatic Black Bear	*Ursus thibetanus*	I	VU	EN
10	Kharayo	Indian Hare	*Lepus nigricollis*		LC	
11.	Kalo Oat	Eurasian Otter	*Lutra lutra*	I	NT	NT
12	Malsapro	Yellow throated Marten	*Martes flavigula*	III	LC	
13	Ratuwa	Northern red Muntjac	*Muntiacus vaginalis*		LC	
14.	Shyal	Golden Jackal	*Canis aureus*	III	LC	LC
15.	Ban Biralo	Jungle cat	*Felis chaus*	II	LC	
16.	Nyauri	Brown Mongoose	*Herpestes fuscus*	III	LC	
17.	Sano Nyaurimuso	Small Indian Mongoose	*Herpestes auropunctatus*	III	LC	
18.	Dangsari	Small Indian Civet	*Viverricula indica*	III	LC	
19.	Chhuchundro	House Shrew	*Suncus murinus*		LC	
20.	Lokharke	Hoary-bellied squirrel	*Callosciurus pygerythrus*		LC	
21.	Muso	House rat	*Rattus rattus*		LC	
22.	Rato Rajpankhi Lokarke	Red Giant Flying Squirrel	*Petaurista petaurista*		LC	
23.	Lampurchre Khet Muso	Long Tailed Field Mouse	*Apodemus sylvaticus*		LC	
24.	Khaki-range muso	Fawn coloured mouse	*Mus cervicolor*		LC	
25.	Blandford ko Falahari Chameho	Blandford's Fruit Bat	*Sphaerias blandfordi*		NA	

Source: NWEDC 2012; NESS 2014; Jnawali et al. 2011.

CITES 2017: Appendices I: Species threatened with extinction; II: Species not yet threatened, but could become endangered if trade is not controlled; III: Species requiring international co-operation to control trade.

6.2.3. Habitat Classification

As described in Section 6.2.1.4, Habitat Classification, IFC Performance Standard 6 classifies habitat as natural, modified, or critical. The habitat on the western slope of the Trishuli River in the Project area is primarily community forest and cropland, which show evident signs of anthropogenic activities and of ecological degradation (i.e. patchy vegetation, smaller trees). Taking this into consideration, the western portion of the Environmental Area of Influence (i.e. west of the Trishuli River) can be classified as **Modified Habitat**. The eastern portion of the Environmental Area of Influence (i.e. east of the Trishuli River) is located within the LNP, is mostly natural forest in good condition, and can be classified as **Natural Habitat**.

According to the IFC Performance Standard 6, Critical Habitat is defined as "areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes (see Table 6.2-9). The potential presence of Critical Habitat is discussed below.

Table 6.2-9: Critical Habitat Assessment Criteria according to IFC PS6

Criteria	Tier 1	Tier 2
Criteria 1: Critically Endangered(CR)/ Endangered (EN) Species	a. Habitat required to sustain ≥ 10 percent of the global population of an IUCN Red-listed CR or EN species where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species. b. Habitat with known, regular occurrences of CR or EN species where that habitat is 1 of 10 or fewer discrete management sites globally for that species.	c. Habitat that supports the regular occurrence of a single individual of an IUCN Red-listed CR species and/or habitat containing regionally-important concentrations of an IUCN Red-listed EN species where that habitat could be considered a discrete management unit for that species. d. Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species. e. As appropriate, habitat containing nationally/regionally-important concentrations of an EN, CR or equivalent national/regional listing.
Criterion 2: Endemic and Restricted-range Species	a. An endemic species is defined as one that has ≥ 95 percent of its global range inside the country or region of analysis.	b. Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment.

Criteria	Tier 1	Tier 2
Criterion 3: Migratory and Congregatory Species	a. Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 percent of the global population of a migratory or congregatory species at any point of the species' life-cycle where that habitat could be considered a discrete management unit for that species.	b. Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species' life-cycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment. c. For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance. d. For species with large but clumped distributions, a provisional threshold is set at ≥5 percent of the global population for both terrestrial and marine species. e. Source sites that contribute ≥ 1 percent of the global population of recruits.
Criterion 4: Highly Threatened and/or Unique Ecosystems	No Tiered system is prescribed. Ecosystems that are at risk of significantly decreasing in area or quality; with a small spatial extent; and/or containing unique assemblages of species including assemblages or concentrations of biome-restricted species. Highly threatened or unique ecosystems are defined by a combination of factors which may include long term trend, rarity, ecological condition, and threat.	
Criterion 5: Key Evolutionary Processes	The criteria is defined by Isolated areas (e.g. islands, mountaintops, lakes) are associated with populations that are phylogenetically distinct. Areas of high endemism often contain flora and/or fauna with unique evolutionary histories (note overlap with Criterion 2, endemic and restricted-range species). Landscapes with high spatial heterogeneity are a driving force in speciation as species are naturally selected on their ability to adapt and diversify. Environmental gradients, also known as ecotones, produce transitional habitat which has been associated with the process of speciation and high species and genetic diversity. Edaphic interfaces are specific juxtapositions of soil types (e.g. serpentine outcrops, limestone and gypsum deposits), which have led to the formation of unique plant communities characterized by both rarity and endemism. Connectivity between habitats (e.g. biological corridors) ensures species migration and gene flow, which is especially important in fragmented habitats and for the conservation of metapopulations. This	

Criteria	Tier 1	Tier 2
	also includes biological corridors across altitudinal and climatic gradients and from "crest to coast." Sites of demonstrated importance to climate change adaptation for either species or ecosystems are also included within this criterion.	

6.2.3.1. Critical Habitat Assessment of all IUCN-listed Species

Table 6.2-10 assesses all CR and EN species (both from the IUCN red-list and the Nepal red-lists likely to occur in the Project's area of influence against the Critical Habitat Criteria in Table 6.2-9.

Table 6.2-10: Critically Endangered and Endangered Species

Species	Habitat Type Codes	Criteria	Record		Likely Critical Habitat in Project area	Assessment Rationale
			Direct	In-direct		
Mammals						
Grey wolf *Canis lupus*	NH			**X**	**No**	The grey wolf (IUCN, LC, RLNM, CR) is being assessed against Criteria 1 Tier 2a. The grey wolf has been recorded from Annapurna Conservation Area (Upper Mustang), Dolpa, Manaslu Conservation Area, Kanchanjunga Conservation Area and Dhorpatan Hunting Reserve. The Grey Wolf occurs in high-elevation scrubby lands. The Grey Wolf's diet mainly comprises of large ungulates including Blue Sheep, Tibetan Argali, Tibetan Gazelle, Himalayan Tahr and Kiang, all high altitude species (Jnawali et al 2012). Given the lower elevation of the project area and the lack of its preferred prey species it is unlikely to occur here. This criterion is therefore not triggered.
Asiatic Black Bear *Ursus thibetanus*	**NH/MH**	**1**	**X**		**No**	The Asiatic black bear (IUCN, VU, RLNM, EN) is assessed under Criteria 1 Tier 2 c and e. The species is widely distributed in South and Southeast Asia. Even though black bears are known to come out their forested habitats and raid garbage areas and agricultural fields in Nepal, thereby likely being recorded in the surveys, their numbers in the natural and modified Habitats of the Project's AoI are not nationally or regionally significant. This criterion is therefore not triggered.
Assamese macaque *Macaca assamensis*	NH/MH	1	**X**		**No**	The Assamese macaque (IUCN, NT, RLNM, EN) is being assessed against Criteria 1 Tier 2e. A subpopulation of M. assamensis is endemic to Nepal and relegated to a single population there; it is considered a possible new subspecies (M. Chalise pers. comm.). The species' Nepal population is threatened due to its restricted extent of occurrence of less than 2,200 square kilometres; its areas of occupancy of 914 square kilometres; and the continuing decline in area, extent, and quality of habitat; in the number of locations; and in the number of mature individuals. Given its restricted extent of occurrence, threats on its population and habitat, and small numbers in fragmented patches, the Nepal population of this macaque is categorized as Endangered (Boonratana et al. 2008). However, further taxonomic clarification is needed. Given the wide range of the species in South and Southeast Asia, and that the numbers

						in the Modified Habitat in the Project's AoI are not nationally or regionally significant, Criteria 1 Tier 2 e is not triggered.
Dhole *Cuon alpinus*	NH			**X**	**No**	The dhole (IUCN, EN, RLNM, EN) is being assessed under Criteria 1 Tier 2 c and e. It is a forest species rarely coming out into modified habitat. Dholes are reported from Bardia, Chitwan and Rara National Parks, Parsa and Shukla Phanta Wildlife Reserves. Outside the protected areas it has been observed in Udayapur in the 1990s. However, despite what seems like a potentially widespread distribution, sightings of this species are not common. A study in Chitwan National Park in 1991 found no signs of the species, yet it was widespread throughout the park in the 1970s. (Jnawali et al 2012). The Langtang National Park and Buffer Management Plan maintains that its occurrence here is "nebulous". It is thereby very unlikely to be found in the project area. This criteria is thereby not triggered.
Birds						
White-rumped vulture *Gyps bengalensis*	NH/MH			**X**	**No**	The white-rumped vulture (IUCN, CR, RLNB, CR) is assessed against Criteria 1 Tier 2c. The species was formerly a common and widespread resident up to 1000 m and regularly occurred up to 1800 m; it was also the most common vulture in Nepal. The population decreased by 91% by the mid-1990s and, although there are signs of recovery including increased breeding success in some areas, in response to conservation measures, it is now a patchily distributed resident, rare and local in the east and locally frequent in western and west-central Nepal. Poisoning by scavenging carcasses containing diclofenac, a drug used to treat livestock ailments, has been shown to be the major cause of the species' decline (Inskipp et al 2012). The Langtang National Park Management Plan does not report the presence of the species in the park and none of the surveys for the EIA and ESIA have reported the species, despite it being a very visible bird. The species is unlikely to be present in the project area. This criteria is therefore not triggered. Scavenging carcasses containing diclofenac, a drug used to treat livestock ailments, has been shown to be the major cause of the species' decline. As the species is rare in the east of the country and has not been reported in the Lantang National Park Management Plan or in the surveys carried out for the EIA (NESS 2012) and the Supplementary ESIA (NESS (2014)

						(being a very visible bird) it can be considered as not occurring in the project area. The criteria is thereby not triggered,
Red-headed vulture *Sarcogyps calvus*	NH/MH	**1**		**X**	**No**	The red-headed vulture (IUCN, CR, RLNB, CR) is assessed against Criteria 1 Tier 2c. The species was formerly a fairly common resident in west-central Nepal, and occasionally recorded in the east and mid to far west. The species has significantly declined and, although it is still a widespread resident in the mid-west to far west, and locally frequent there and in west-central areas, it is now virtually absent from most areas east of Kathmandu (Inskipp et al 2012). The species is therefore unlikely to be found in the project area, despite being reported in the Langtang National Par management plan. This criteria is not triggered.
Pallas's Fish-eagle *Haliaeetusleucoryphus*	NH/MH	**1**		**X**	**No**	The Pallas's fish eagle (IUCN, EN, RLNB, CR) is assessed against Criteria 1 Tier 2c. It is a very rare visitor mainly up to 305 m. The species is now chiefly found at Koshi Barrage/Koshi Tappu Wildlife Reserve, although it is seen less regularly than in the past (Inskipp et al 2012). It may occur in the project area but only as a passage migrant while flying through. This criteria is not triggered.
Eurasian curlew *Numenius arquata*	NH/MH	**1**		**X**	**No**	The Eurasian curlew (IUCN, NT, RLNB, CR) is assessed against Criteria 1 Tier 2c. It is a rare passage migrant. Most post-1990 records are from Koshi including Koshi Tappu Wildlife Reserve, where it sharply declined since the mid-1990s. There are also several post-1990 records from scattered localities from the west to central Nepal. Up to the 1980s there were records of passage migrants from several other localities (Inskipp et al 2012). It may occur in the project area but only as a passage migrant while flying through. It is unlikely to occur in the project area. . This criteria is not triggered.
Egyptian Vulture *Neophron percnopterus*	NH/MH	**1**		**X**	**No**	The Egyptian vulture (IUCN, EN, RLNB, VU) is assessed against Criteria 1 Tier 2c. The species is a widespread and locally fairly common resident in west-central and west Nepal, but is rare in east-central and eastern areas of the country. Up to at least 1990 it was fairly common and widespread throughout, although less widespread in the east-central and eastern areas. The species is widely distributed across the Indian sub-continent and locally abundant is some places (Inskipp et al 2012). Even if found in the project area, it does not hold nationally or regionally significant populations. This criteria is not triggered. Widespread and locally fairly common resident in west-central and west Nepal, but is rare in east-central and eastern areas of

						the country. Up to at least 1990 it was fairly common and widespread throughout, although less widespread in the east-central and eastern areas. The species is widespread across the Indian sub-continent with local abundance in certain areas. The project area does not hold regionally or nationally significant populations. The criteria is thereby not triggered.
Cinerous vulture *Aegypius monachus*	NH/MH	**1**		**X**	**No**	The Cinerous vulture (IUCN, NT, RLNB, EN) is being assessed against Criteria 1 Tier 2e. The species is a winter visitor and passage migrant; now very uncommon in the centre and west, and rare and very local in the east. There are recent records from Chitwan and Bardia National Parks. It has decreased in the east where it was recorded from several localities in the 1970s and 1980s. Almost all known post-1990 records in the east are from Koshi Barrage and Koshi Tappu Wildlife Reserve, but it has declined here from being fairly common in winter in 1990 to a rare and irregular visitor. It is unlikely to be found in the project area though reported in LNP by the Langtang National Park Management Plan. This criteria is not triggered.
Steppe Eagle *Aquila nipalensis*	NH/MH	**1**		**X**	**No**	The Steppe eagle (IUCN, EN, RLNB, VU) is assessed against Criteria 1 Tier 2 c. It is a fairly common and widespread winter visitor and passage migrant. The eagle occurs in most protected areas and was found to be widespread outside the protected areas' system pre- and post-1990. No significant changes in distribution or population have been noted (Inskipp et al 2012). The species may occur in the project area but given that it is widely distributed globally, will not occur in regionally or nationally significant numbers.
Ibisbill *Ibidorhyncha struthersii*	NH/MH	**1**	**X**		**No**	The ibisbill (IUCN, LC, RLNB, EN) is assessed against Criteria 1 Tier 2 e. It is a very uncommon altitudinal migrant, known to breed locally in Nepal, but wintering records are widespread from the west to the far east. The species' main known breeding area is in Langtang National Park, but this may have been damaged by the 2015 earthquakes (Inskipp et al 2012). It is however unlikely that the species nests in the project area, as an extension of its breeding range in the park. However given the presence of the species in the project area, this needs to be surveyed with emphasis on the 2.6 ha of natural habitat of the LNP. Accepting or rejecting this criteria should be contingent to this survey.
Saker falcon *Falco cherrug*	NH/MH	**1**		**X**	**No**	The saker falcon (IUCN,EN, RLNB, EN) is being assessed against Criteria 1 Tier 2c and e. It is a rare winter visitor and

						passage migrant. No surveys have been carried out; however, direct observations indicate the numbers must be small. It is likely to occur in the project area as a passage migrant flying through. However even if so, the numbers are not likely to be regionally or nationally significant. This criteria is therefore not triggered.

6.2.3.2. Protected Areas

LNP is an IUCN Category II protected area (Bhuju et al. 2007) and is recognized as an Important Bird and Biodiversity Area (Birdlife 2013). It is not a World Heritage Site or a Biosphere Reserve. IFC PS6 states that internationally and/or nationally recognized areas of high biodiversity value will likely qualify as Critical Habitat; examples include the following:

- Areas that meet the criteria of the IUCN's Protected Area Management Categories Ia, Ib, and II, although areas that meet criteria for Management Categories III-VI may also qualify depending on the biodiversity values inherent to those sites.
- The majority of Key Biodiversity Areas (KBAs), which encompass Ramsar Sites, Important Bird Areas (IBA), Important Plant Areas (IPA), and Alliance for Zero Extinction Sites (AZE).

Based on the above criteria, the LNP generally qualifies as Critical Habitat. The LNP, however, is divided into a "core area" and a "buffer zone," which is technically outside the park, but within the park boundary. Much of the buffer zone is developed with roads, villages, and farmland. In fact, more than 80,000 people were estimated to live within the park in 2012 (Langtang National Park and Buffer Zone Management Plan 2012). The buffer zone lands would need to be assessed on a case-by-case basis as to whether they would qualify as Critical Habitat.

The Project will disturb approximately 6.77 ha of land within the LNP boundary—2.61 ha for construction of the dam and 4.16 ha for the construction of the new worker camp (2.8 ha owned by the government and 1.36 ha privately owned). The new worker camp needs to be relocated from the previously approved Mailung School site for safety reasons in the aftermath of the 2015 earthquake. NWEDC obtained approval from the Government of Nepal for the 2.61 ha impact at the dam site as part of its original environmental authorization and obtained government approval for the revised worker camp location on 31 December 2017.

Both sites (i.e. the entire 6.77 ha) are designated buffer-zone land along the edge, but still within, the LNP (Langtang National Park and Buffer Zone Management Plan 2012). The LNP Management Plan recognizes the potential for development of hydroelectric projects near the LNP, specifically mentioning the Upper Trishuli Project, and encourages use of alternative energy as a buffer zone objective.

The 2.61-ha site required for the dam is forested and identified as Natural Habitat. This site, however, is designed buffer-zone land, which is isolated from the remainder of the LNP by steep cliffs and by the newly constructed Army Road. It does not provide habitat of significant

importance to Critically Endangered or Endangered, endemic, restricted range, or restricted-range species; does not support globally significant concentrations of migratory or congregatory species; is not a highly threatened or unique ecosystem; and is not associated with any key evolutionary processes. Therefore, we do not consider this site to be Critical Habitat.

Although these sites are not considered Critical Habitat, they are within the LNP and within proximity to the park's "core area." The 4.16-ha site required for the worker camp is disturbed and not forested and is classified as Modified Habitat. This site is also designated buffer-zone land, which is also isolated from the remainder of LNP by the Army Road. As with the 2.61-ha parcel, this site also does not meet any of the applicable criteria, so is not considered Critical Habitat.

Although these sites are not considered Critical Habitat and the Project will not directly impact any Critical Habitat, there is the potential for the Project to indirectly impact core areas of the LNP, which are considered Critical Habitat. This is less of a risk for the 2.61-ha site because the camp for the dam construction workers is on the west bank, with the Trishuli River and the extremely steep slopes on the east bank serving as a barrier limiting access to the LNP core areas.

The 4.16-ha site near the powerhouse, however, poses a greater risk because it will be used as the worker camp, and is located on the east bank of the river with roads providing easy access to the LNP's core areas. The introduction of this workforce in close proximity of Critical Habitat presents several risks, including illegal hunting/poaching or the collection or trade of natural or wildlife products. The recent construction of the Army Road along the east bank of the Trishuli River has greatly increased public access to previously very difficult to access portions of LNP.

6.3. SOCIAL RESOURCES

This section provides a brief socioeconomic baseline of the Rasuwa District, and the three Village Development Committees (VDCs) in the Project Area of Influence (AoI). The baseline is based on primary and secondary quantitative and qualitative data. Table 6.3-1 provides an understanding of the various sources of information used.

Table 6.3-1: Sources of Information for Baseline

Baseline Area	Source of Information
Rasuwa District	• Census Data 2011 • UT-1 Supplementary ESIA 2014
Project Area of Influence (Village Development Committee s / villages touched by the Project)	• Census Data 2011 • UT-1 Supplementary ESIA 2014 • Household Survey for Livelihood Restoration Plan (LRP) formulation 2015 • Household Survey for Land Acquisition and Livelihood Restoration Plan (LALRP) formulation 2017 • Focus Group Discussions Undertaken as part of LRP Formulation 2015 and LALRP formulation 2017

6.3.1. Updated Socioeconomic Baseline

6.3.1.1. Context

The adoption of a new national Constitution in 2015 has been accompanied by a change in the administrative structure of the Nepal. Previously, the Project was affecting 3 of the 18 VDCs in the district, now it is touching four of the five Gaunpalikas in the Rasuwa District (Table 6.3-2). This will also result in an increase in the population in the AoI. Census data is not available at the ward level; therefore, consolidation of information for the Gaunpalikas is difficult at this stage.

Table 6.3-2: New Administrative Structure

Name of Gaunpalika	New Ward Number	Former VDC	Former Ward Number	Population	Area (square metre)
UttarGaya	1	Haku	8, 9	8255	104.51
		DadaGaon	7-9		
	2	DadaGaon	1-6		
		ThulluGaon	8		
	3	ThulluGaon	1-7, 9		
	4	LaharePahuwa	4-7		
	5	LaharePahuwa	1-3, 9		
Kalika	1	Ramche	1-9	9421	192.54
	2	LaharePahuwa	8		
		Dhaibung	5-7		
	3	Dhaibung	1-4		
	4	Bhorle	6, 8, 9		
	5	Dhaibung	8, 9		
		Bhorle	1		

Name of Gaunpalika	New Ward Number	Former VDC	Former Ward Number	Population	Area (square metre)
Goasai Kunda	1	Thuman	1-9	7143	978.77
	2	Timure	1-9		
	3	Bridhim	1-9		
	4	Langtang	1-9		
	5	Safru	1-9		
	6	Dhunche	1-9		
Naukunda	1	Yarsa	5-8	11824	126.99
	2	Yarsa	1-4		
	3	Saramthali	6-9		
	4	Saramthali	1-5		
	5	Bhorle	4, 5, 7		
	6	Bhorle	2.3		
		Yarsa	9		
ParvatiKunda	1	Haku	3-7	5490	682.23
	2	Haku	1, 2		
		Gatlang	7, 8		
	3	Gatlang	1-6, 9		
	4	Goljung	1-9		
	5	Chilime	1-9		

Source: NRA 2017

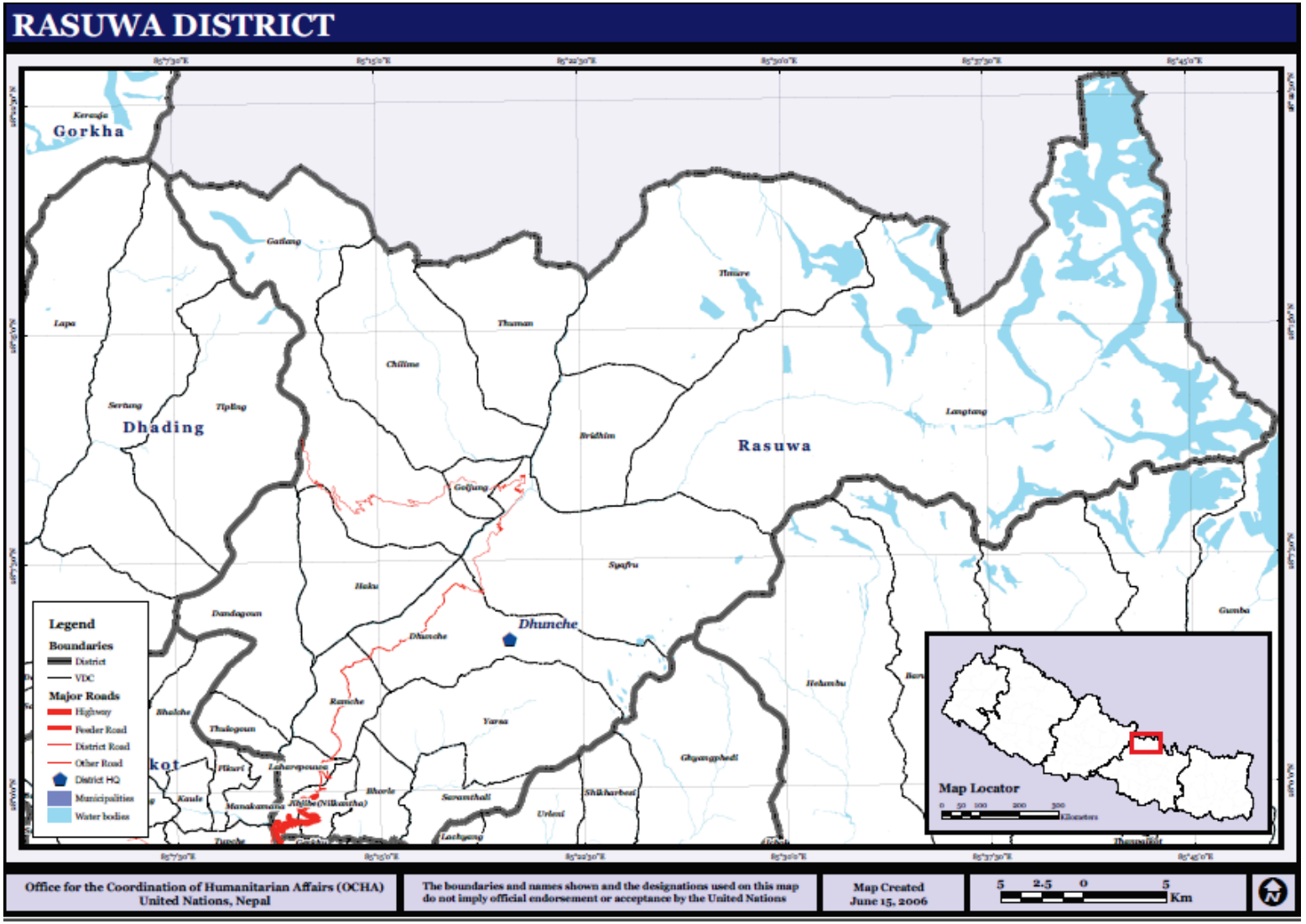
Note: The highlighted cells indicate VDCs previously within the Project boundary.

The socioeconomic information available for the district and VDCs/Project area is restricted to the Census Data of 2011 and the information collected during the Supplemental ESIA in 2014 (ESSA 2014). These data do not reflect the changed administrative structures and the implications of the same on the socioeconomic profile of the Project area. Thus, the socioeconomic profile is restricted to the old administrative structure of the VDCs. However, this is understood to be reflective of the larger trend in the area. Furthermore, the data presented in this section for the district and Project area does not necessarily reflect the post-earthquake scenario. Where possible, the same has been included based on the information made available during the consultations and Project Affected Families (PAF) survey undertaken in April to May 2017. The PAF survey targeted those families that have been affected by the Project land take, either through loss of land (private or Guthi land) and/or the loss of livelihood (economic displacement). At the time of the survey, 154 PAFs were identified, of which 129 were surveyed as part of the Land Acquisition and Livelihood Restoration Plan (LALRP) development. The PAF survey results described in this section are based on the survey of 129 PAFs, but are believed to be generally representative of the additional 13 PAFs.

6.3.1.2. Rasuwa District

Demographic Profile

The Rasuwa District is located in the north central part of Nepal with a population of 43,300 individuals and 9,778 households and is one of the districts with the lowest population in the country (see Figure 6.3-1 and Table 6.3-3). The district has an average household size of 4.43 individuals, and a sex ratio of 1,016 females per 1,000 males, which is comparable to the national average (1,050 females per 1,000 males).



Source: OCHA 2006

Figure 6.3-1: Rasuwa District Map

Table 6.3-3: Rasuwa District Demographic Profile

Variables	Value
Total Population	43,300
Total Area (square kilometre)	1,544
Population Density	53.6
Total Households	9,778
Sex Ratio	1016
Average Household Size	4.43

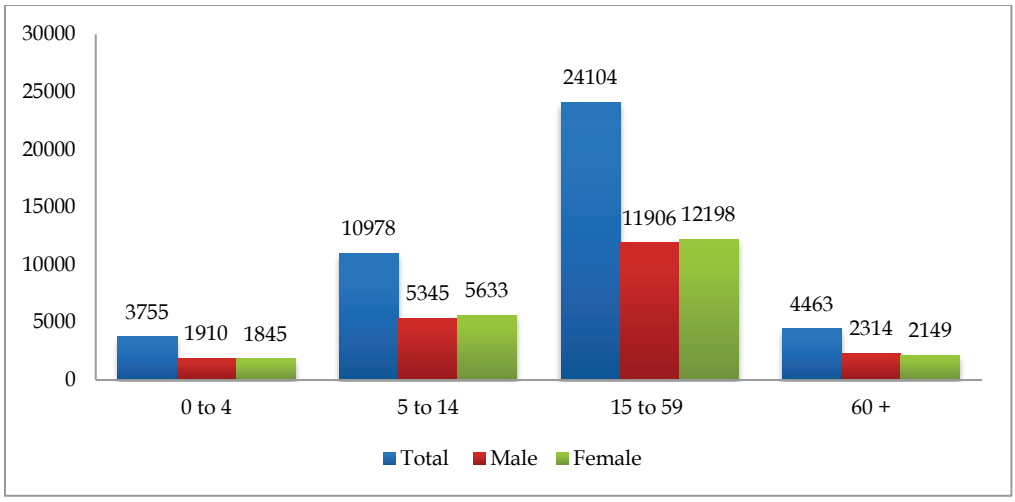
Source: CBS 2011

Post-earthquake, the district has not changed in terms of the overall population, average household size, and population density. As the government data suggests, 660 deaths occurred in the Rasuwa District during the 2015 earthquake (ICIMOD 2015). The people who were forced to relocate because of the earthquake and triggered landslides, mostly relocated to various VDCs within the Rasuwa District. In some cases, people have relocated to the nearby Nuwakot District, with the majority of outflux directed towards the areas of Batar, Betravati, and Satbise. Some people have migrated in search of employment, but their families still reside in the district.

The earthquake is expected to have increased the population and its density in the urban areas and in settlements in the valley. Similarly, families have split up post-earthquake (1) due to space issues in temporary housing, and (2) to gain maximum benefits from non-governmental organizations (NGOs). The number of families has been offset by the fact that some of the old age families who were able to be independent in native village conditions have come to depend on their offspring, thereby not resulting in a drastic change in the overall number of families.

The above-mentioned trend, however, is contradicted by the number of households who have applied for the housing grant (0.3 Nepalese Rupees [NPR] per family in case of loss of house and support required to construct home) from the government, which is apparently much more than what is evident on the ground presently. That reflects the fact that while families have decided to live together to deal with the livelihood challenges (and other challenges such as pressure of rent) temporarily, they do intend to settle separately once the situation improves.

According to the information available, 34 percent of the district is reported to be in the age group of 0-14 years, while the age group between 15 to 59 (the productive age group) represent 56 percent of the population. Figure 6.3-2 shows the age classification of the population in the district.

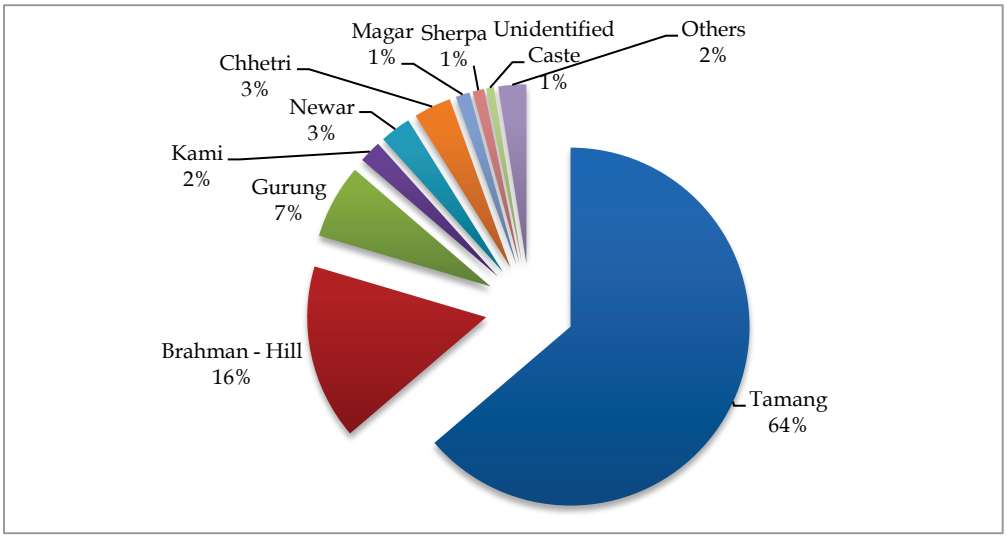


Source: CBS 2011

Figure 6.3-2: Classification According to Age Groups

Social Groups

The population in the district is reported to be comprised of 18 ethnic groups, with the Tamang (an indigenous group) comprising the majority of the population (64 percent). The other main ethnic groups in the area are Hill Brahman, Gurung, Kami, Newar, Chhetri, Magar, and Sherpas amongst others. Figure 6.3-3 provides an understanding of the ethnic composition of the district.



Source: CBS 2011

Figure 6.3-3: Ethnic Composition of the District

The main religion in the area is Buddhism (69 percent of the total population), followed by Hinduism (25 percent), and Christianity (4 percent). The other religions in the area include Islam, Kirat, Prakriti, and Bon. From the discussions with the local community, it is understood that over the last years, there has been an increase in the number of conversions to Christianity.

This is reported to be primarily the result of the presence of NGOs in the district and an increase in the number of children studying in Catholic boarding schools.

Nine languages are spoken in the district, the most prominent of which is Tamang (60 percent), followed by Nepali (32 percent). The other languages spoken in the area are Newari, Magar, Gurung, Sherpa, Maithali, Tharu, and Tibetan.

Gender Profile

While the female population constitutes 50.4 percent of the total population in the district, their access to education, property ownership, and participation in social organization and economic activities is lower than in the case of their male counterparts. Compared to the 61 percent male literacy rate, 47 percent of the women are reported to be literate and only 8 percent of the women have legal ownership of property. However, although the life expectancy of women (at 54 years) is lower, it is still comparable to that of men (at 55 years). Table 6.3-4 provides an understanding of the ownership of assets by women.

Table 6.3-4: Female Ownership of Assets

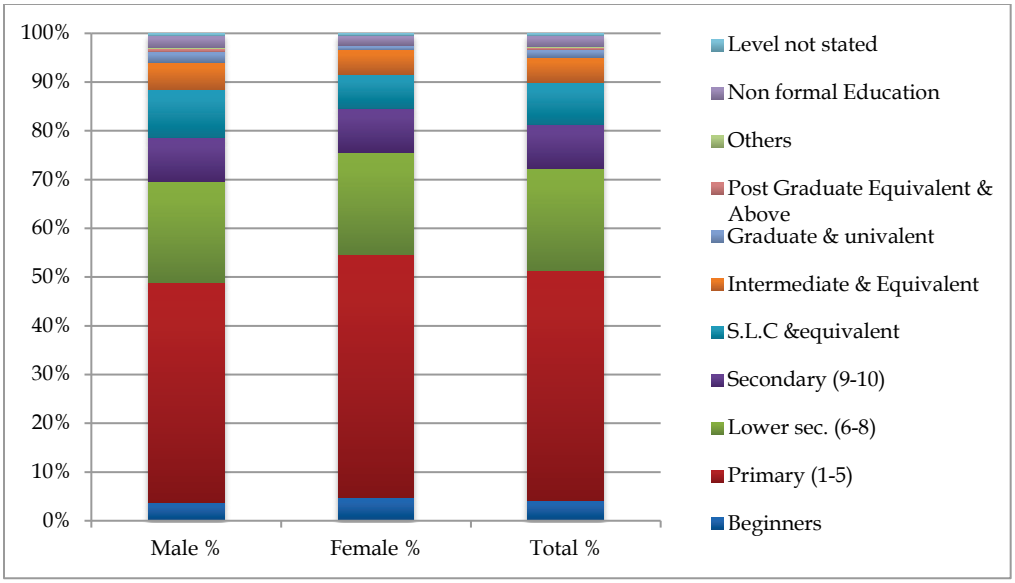
Asset	Number of Households	Percentage
Both House and Land	460	5
Land only	322	3
Neither house nor land	8892	91
Not stated	67	1
Total	9741	100

Source: ESSA 2014

Although some women are involved with income generating activities such as agriculture and small businesses, most women are reported to be mostly involved in household activities including childcare, animal husbandry, water fetching, and looking after the welfare of family members.

Education Profile

As previously mentioned above, the district is characterized by a literacy rate of 54 percent, with the male literacy rate being 61 percent and the female literacy rate being 47 percent. Of the literate population, 50 percent is reported to have education until the primary level, while only 16 percent of the population is reported to have received the School Leaving Certificate and only seven percent has education above the intermediate level. Figure 6.3-4 below shows the educational profile of the Rasuwa District.



Source: CBS 2012

Figure 6.3-4: Educational Profile for the Rasuwa District

This literacy profile of the district is undergoing a change in the post-earthquake scenario. This is reported to be in response to a larger population moving towards urban areas and thus having better access to educational infrastructure.

The district is reported to have 129 educational institutions, of which 123 are managed by the community and 6 are institutional. The primary education institutions comprise of 80 percent of the total educational institutions. Some of these educational institutions too have been impacted by the earthquake.

Livelihood Profile

Agriculture, with animal husbandry, is reported to be the main source of livelihood for 89 percent of the households. The other occupations include manufacturing, trade and business, transportation, and services.

However, despite the dependency of the majority of households on agriculture for livelihood, only 40 percent of these households meet their food input from their own agricultural production, while the remaining resort to loans, wage labour and outmigration (within and outside Nepal). Nearly 24 percent of the households in the district have at least one of their family members living outside the village. Approximately 36 percent of the household are reported to be marginal farmers (0-0.5 hectare [ha]) and 54 percent of the population is reported to live below the poverty line.

However, the dependence upon non-farm based activities is understood to have increased post-earthquake. This is because a part of the population lost (some temporarily and others permanently) access to agricultural land and livestock holdings. Furthermore, the increased proximity to urban areas and an increase in construction activities (due to repair and reconstruction) has resulted in a section of the population (especially youth) becoming involved

in construction and other low skilled based occupations. Another source of income that has grown considerably since the earthquake is stone breaking. Construction labour activities have also been supported and augmented by NGOs providing training in skills such as masonry, plumbing, and electricity.

Health Profile

The district has 18 health care facilities, including one hospital at Dhunche. In addition to this, there are 17 health posts and sub-health posts at the VDC level. Apart from this, there are 42 primary health care outreach clinics, 57 Expanded Program on Immunization clinics, and 24 female and child health volunteers. The predominant diseases in the district include skin diseases, respiratory problems, diarrhoea, parasitic infections, gastric disorders, and eye and ear infections.

While it is understood that the 2015 earthquake resulted in a loss of physical infrastructure, including damage to hospitals and health posts, exact information regarding the impacts on health infrastructure in the district was not available at the time of the assessment. The disease profile in the community is also reported to have changed post-earthquake, due to issues such as substantial portion of the population living in Internally Displaced Persons (IDP) camps, population moving towards valleys from elevated regions, and population getting concentrated in areas such as Dhunche and Battar. This has resulted in an increase in health issues related to sanitation.

Water Supply and Sanitation

In the district, 88 percent of the households are reported to be supplied with tap/piped water, while the remaining are primarily dependent upon nearby springs and rivers. The sources of the water supply in most of the cases are springs. Some villages impacted by landslides induced by the earthquake have reported loss of access to the springs. This loss is understood to have resulted from certain springs disappearing or changing course (due to a change in contours) and access to springs getting impacted due to landslides.

While 57 percent of the district is reported to have some type of toilet (predominantly being flush toilets with septic tanks) in their homestead, facilities for storm water drainage and wet sewage drainage do not exist in the district.

Energy Use

In terms of sources of energy, 98 percent of the households were reported to rely on firewood for cooking and other household purposes. The commercial supply of energy is reported to be limited to the district headquarters and those households connected by the main roads. Solar lighting is reported to be a source that is growing in importance within the district. As part of the relief support provided by NGOs, the impacted population was provided with solar lights and panels. This has resulted in an increase in the dependence on solar energy in the district.

6.3.1.3. Socioeconomic Baseline of the Project AoI

This subsection provides the socioeconomic profile of the Project AoI. As discussed in Chapter 5, the Project AoI is located across three VDCs (i.e. Dhunche, Haku, and Ramche). All the identified PAFs are from nine villages within the Haku VDC.

Demographic Profile

The three VDCs in the Project area are characterised by a total population of 1,646 households and 7,181 individuals (Table 6.3-5). The average household size in the Project area is 5.71 persons, which is higher than the average size in the Rasuwa District and higher than the national average.

Table 6.3-5: Demographic Profile of the VDCs in the Project Footprint

VDC	Households	Total Population	Male Population	Female Population	Sex Ratio
Dhunche	714	2,744	1,465	1,269	866
Haku	443	2,169	1,049	1,120	1068
Ramche	489	2,268	1,092	1,178	1079
Total	1,646	7,181	3,606	3,567	989

Source: ESSA 2014

As has been discussed previously, most of the villages in Haku VDC, including Gogone, Tiru, Haku Besi, Phoolbari, and Thanku were displaced due to the earthquake. Most of the population from the Haku VDC are presently living in IDP camps across the Rasuwa and Nuwakot districts. While a portion have returned to their original village, most are returning for short periods of time (e.g. agricultural purposes, including taking care of the livestock saved from the earthquake). However, most of the families are still living in the IDP camps.

The overall Project area is characterised by a negative sex ratio of 989 females per thousand males. However, the Haku and Ramche VDCs are characterised by a positive sex ratio of 1,068 and 1,079 females per thousand males, respectively. A possible reason for this sex ratio could be the men migrating for work; however, this could not be confirmed as part of the assessment.

Approximately 29 percent of the population surveyed in 2014 as part of the complementary baseline were reported to be below the age of 14 years, while more than 7 percent of the population was reported to be 60 years and above. The economically active section of the population (15 to 59 years) comprises approximately 63 percent of the population (Table 6.3-6).

Table 6.3-6: Age Structure of the Population (%) Surveyed in Supplemental ESIA Baseline

Age Group	Male	Female	Total
Below 5 years	7.5	7.8	7.5
5-14 years	21.7	21.5	21.6
15-59 years	62.9	64	63.4
60 years and above	7.9	6.7	7.4
Total	53.4	46.6	100

Source: ESSA 2014

The PAFs identified, due to land take, is 154. These PAFs are a subset of the larger population with 7 in the nine villages in the Project AoI, while these PAFs are directly affected due to the land take for the project, the larger community in the AOI is understood to be indirectly affected by the project activities. Of these 154 PAFs, 129 were surveyed as part of the LALRP preparation. The remaining 25 PAFs were unavailable for consultation in 2017 and will be surveyed during the LALRP implementation. The PAFs surveyed have a total population of 604 individuals and an average household size of 4.68 individuals per households (see Table 6.3-7). This average household size is lower than that of the Project AoI, which may be attributed to the separation of families, post-earthquake.

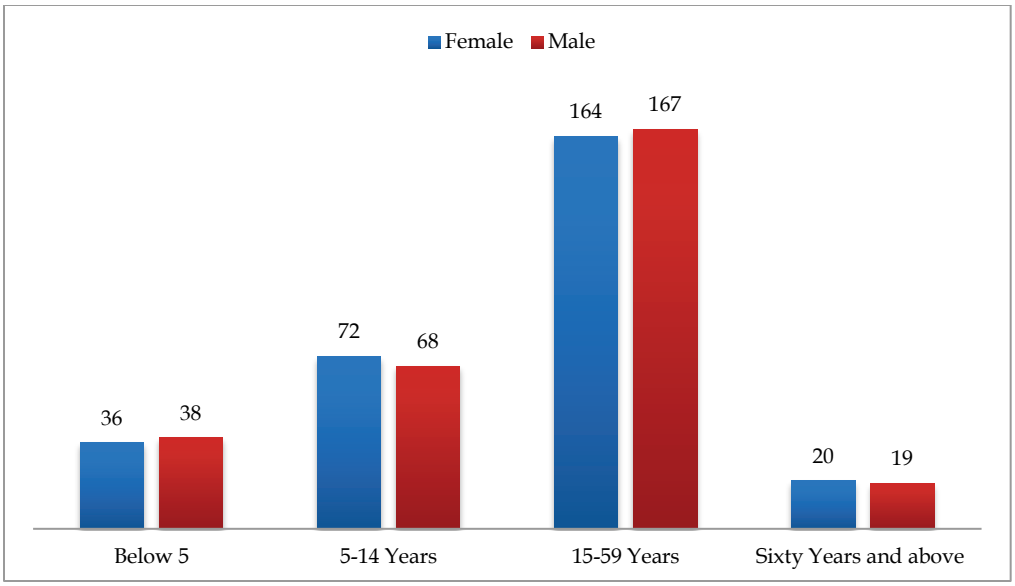
Table 6.3-7: Demographic Profile of PAFs Surveyed

Original Residence	Number of PAFs	Total Population	Female	Male	Sex Ratio	Average Household Size
Gogone	41	173	80	93	860	4.22
Haku Besi	26	122	64	58	1103	4.69
Mailung	34	159	74	85	871	4.68
Phoolbari	21	116	62	54	1148	5.52
Thanku	7	34	16	18	889	4.86
Grand Total	129	604	296	308	961	4.68

Source: ERM 2017

The overall sex ratio of the PAFs surveyed was reported to be 961 females per 1,000 males, which is lower than the sex ratio in the Project AoI, especially Haku and Ramche. Within the PAFs surveyed, only the PAFs from Haku Besi and Phoolbari were reported to have more females than males. These villages are understood to been historically characterised by a positive sex ratio.

Based on the most current LALRP survey and as can be seen in Figure 6.3-5, a majority of the PAF population (57 percent) are reported to fall within the economically active age group of 15-59 years. Furthermore, this age group and those below the age of 5 are reported to have a sex ratio of 982 and 947 females per 1,000 males respectively.



Source: ERM 2017

Figure 6.3-5: Age Wise Classification of the Population Surveyed during the LALRP Formulation

Social Groups

The ethnic groups in the Project AoI are Tamangs, Gurungs, Magars, and Newars. Of these, the Tamangs are in majority, comprising 94 percent of the population (surveyed during the Supplemental ESIA baseline), followed by Gurungs (1 percent) while the castes of Brahmins, Chhetri, Thakuri, and Sanyasi (BCTS) constituted about 4 percent of the population (ESSA 2014). The following box provides an understanding of the two main ethnic groups in the area.

Social Profile of the Tamangs

The Socioeconomic Context

The traditional occupations of the Tamang in the Project area have been livestock herding and growing maize and potato (subsistence economy). The agricultural production is declining due to lack of fertilizer and deforestation, which is leading to encroachment of wild animals from Langtang National Park (LNP). While the wild animals can easily approach all the crops cultivated by local people, due to the wildlife protection rules in place, the community is unable to take any measures to protect their fields or crops. Forests are a key part of the Tamangs livelihood and lifestyle since they are sources of fuel, fodder and pasture, and sacred places hosting nature spirits and deities.

Tradition, Culture, and Beliefs

The Tamang people are a mixed religion of animism and Tibetan Buddhism. Tibetan Buddhism has also integrated and legitimized the age-old tradition of indigenous healing practices and the use of medicinal plants. Therefore, healing is an integral part of the religion. Knowledgeable people in the communities are known as lamas and have the responsibility of curing illnesses believed to be the result of physiological as well supernatural disorders. Traditionally, the Tamang social and cultural practices have blended with Buddhist ideologies. The Tamang culture is characterized by various traditional social institutions such as Nangkhor, Gedung, Chokpa, and Ghyang. Tamang communities are organized, maintained, and regulated through these social institutions.

People of the Project AoI believe they live together with what they believe to be supernatural elements such as spiritual beings, sacred places, feared places, altars, and evils. Therefore, they perform Puija to pay respect to the

mother earth while opening a new road, building a new house, or ploughing a field before sowing, felling trees, performing marriage ceremonies, hunting, and eating new fruits. This ritual involves offering water, incense, grains, liquor, and prayers. They believe that human activities disturb the spirits of souls, and therefore some sort of compensation is required. Likewise, they also pay tribute to the mountains, water, and their ancestral land.

The healers classify the supernatural beings and ancestral sprits into three categories as below:

- The Lha (god and goddess category)
- The Ghost Category and the Bir
- Masan Category

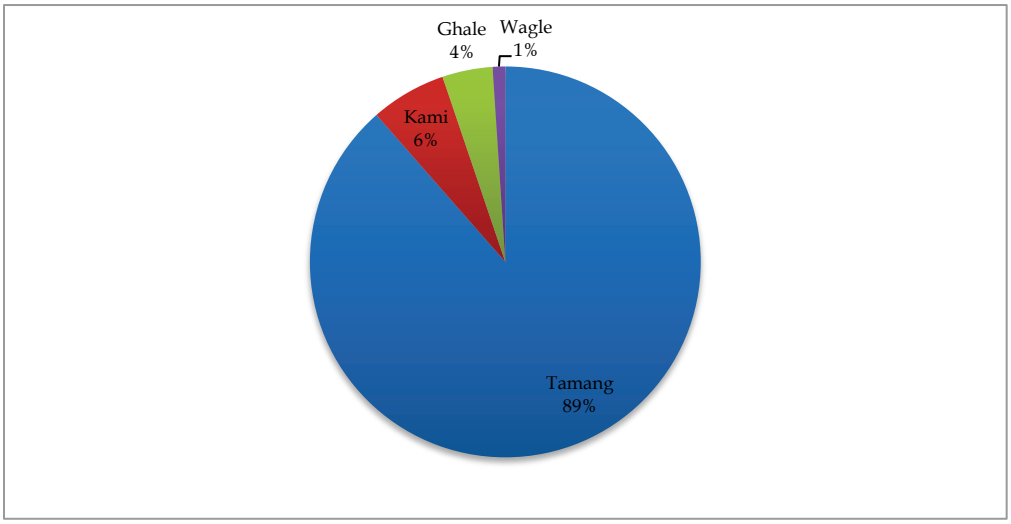
Similarly, the Tamangs exhibit some common practices, including:

Tattooing: making pictures by piercing in skin known as tattooing, which normally takes place in the event of starting a good work.

- Lama Pathi- a mode of payment to the Lama who performs different spiritual activities to save the community from the natural calamities.
- Tamang Taboos: activities prohibited by Tamang culture are called Taboos. For instance, Tamang restrict certain species of timber for construction, the area: Angeri, Longbede, Langpar, Banjh, and Khashru. Similarly, Ainjeru and Bilaune are not used as firewood.
- Liquor Production: Liquor (both fermented and distilled) making is one of the most essential chores of Tamang women. It is not only essential for their daily consumption but also is mot to perform their rituals.

Source: ESSA 2014

Figure 6.3-6 provides an understanding of the distribution of social groups identified amongst the PAFs.



Source: ERM 2015

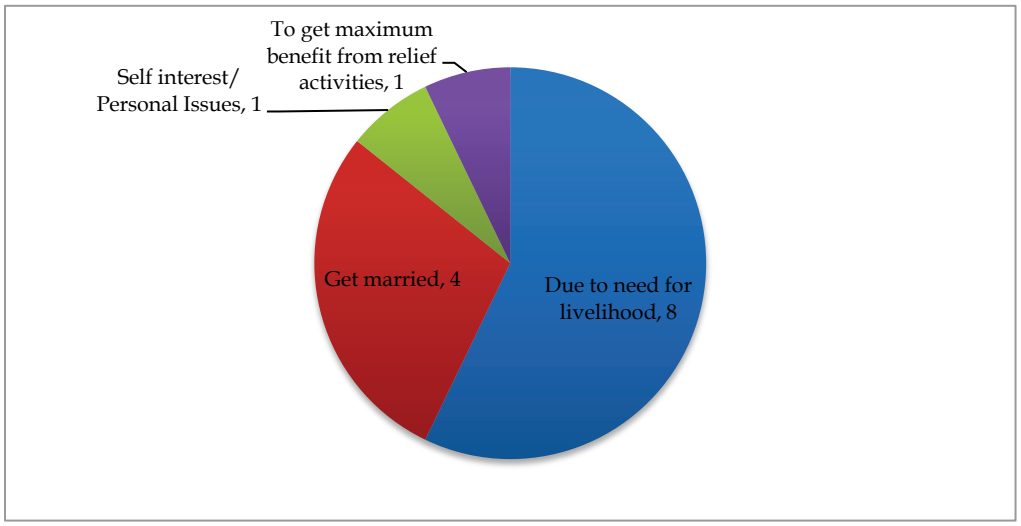
Figure 6.3-6: Social Groups amongst the PAFs

As can be seen from Figure 6.3-6, 89 percent of the PAFs belong to the Tamang community. In addition to this, 6 percent of the PAFs were reported to belong to the Dalit (Kami) group, and 4 percent and 1 percent of the PAFs were reported as Ghale and Wagle groups, respectively.

Family Structure

Seventy-nine percent of the households in the Project AoI were reported to live in nuclear families, while 21 percent reported to having adopted a joint or extended family structure. The number of nuclear households in the Project AoI is also expected to have further increased post-earthquake due to the younger population moving to a separate household from their parents. This may be due to the children getting married and establishing separate households or the family splitting up post-earthquake to get maximum benefits from relief work.

Approximately 83 percent of the PAFs were reported to live in nuclear families, while 17 percent were reported to living in joint families. In addition, approximately 12 percent of the PAFs were reported to having at least one member of the household living separate, post-earthquake. Figure 6.3-7 provides the reasons for the separation given by the PAFs.



Source: ERM 2017

Figure 6.3-7: Reasons for Separation of Household Members Post Earthquake

In terms of family size, the Tamangs are reported to have a higher family size in comparison to the Dalit household. This trend, however, could result from the uniqueness of the households surveyed as part of the LALRP formulation and may not be representative of the larger trend in the area.

Education and Literacy

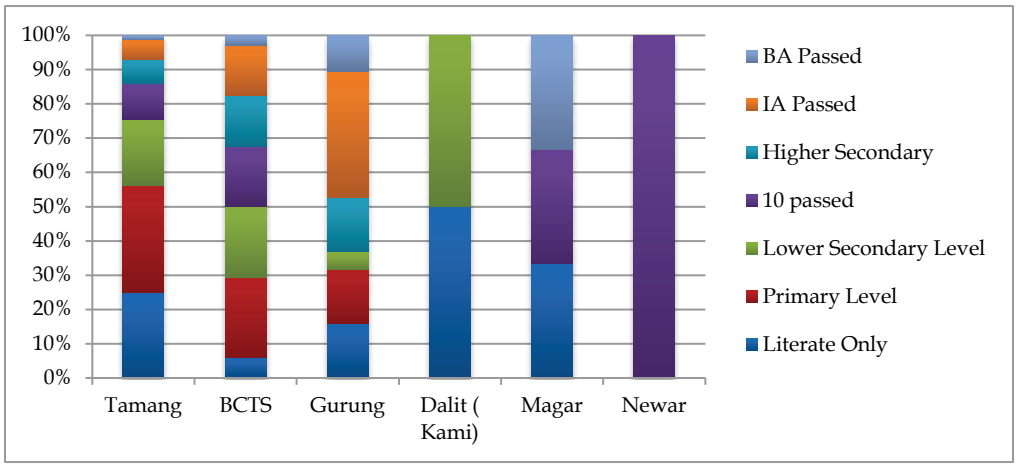
As can be seen from Table 6.3-8, 30 percent of the surveyed population in the VDCs is reported to be illiterate. The male literacy rate is reported to be higher (80 percent) than that of women (60 percent) in the VDCs. Amongst the ethnic groups; the Gurungs are reported to have the highest literacy rate at 95 percent, followed by the BCTS group and Magars.

Table 6.3-8: Educational Status of the Project AoI (% of Total Surveyed Population)

Categories	Illiterate			Literate			Total		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
Tamang	21.6	40.1	30.4	78.4	59.9	69.6	52.4	47.6	100.0
BCTS	3.6	35.7	14.3	96.4	64.3	85.7	66.7	33.3	100.0
Gurung		14.3	5.0	100.0	85.7	95.0	65.0	35.0	100.0
Dalit	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	100.0
Magar		50.0	25.0	100.0	50.0	75.0	50.0	50.0	100.0
Newar		100.0	50.0	100.0		50.0	50.0	50.0	100.0
Total	20.4	39.9	29.5	79.6	60.1	70.5	53.1	46.9	100.0

Source: ESSA 2014

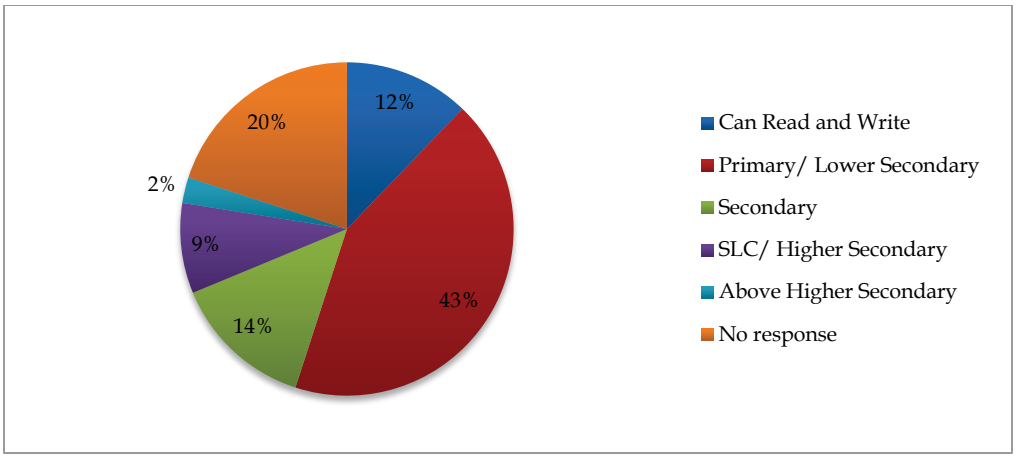
Of the literate population in the Project AoI, 24 percent are reported to have no formal education, but are able to write or read basic sentences. While 30 percent has only completed education until the primary level. Furthermore, 19 percent has completed lower secondary education and 10 percent have completed education until class 10. However, only 2 percent of the population is reported to have completed education until the Bachelors level (see Figure 6.3-8).



Source: ESSA 2014

Figure 6.3-8: Level of Education of the Project AoI (% of the Educated Population)

Similarly, 35 percent of the PAF population is reported to be illiterate. In terms of the literacy rate across gender, the male literacy rate is reported to be higher (54 percent) than that of women (48 percent). Figure 6.3-9 provides an understanding of the literacy level of those PAFs who were reported to be literate.



Source: ERM 2015

Figure 6.3-9: Educational Status of PAFs Surveyed (Those Reported to be Literate)

As shown on Figure 6.3-9, of the literate population amongst the PAFs, 12 percent reported to be able to read and write but not have any formal education while 43 percent has only completed education till the primary or lower secondary level. However, only 3 percent of the population is reported to have completed education until the Bachelors level or have completed a certificate course.

The literacy rates in the VDCs and PAFs are expected to be increasing in the post-earthquake scenario. This is primarily the result of the population moving towards urban areas and thus having greater access to educational infrastructure. In addition, the proximity to urban areas is understood to have increased the desire for education and adequate skill training amongst the younger generation, to allow them to realize maximum benefit from the available market conditions.

Livelihood Profile

As can be seen from Figure 6.3-10, a significant portion of the population (41 percent) within the economically active age group in the Project AoI reported agriculture as the key source of livelihood in the pre-earthquake scenario. Apart from agriculture, the other sources of income identified were as follows:

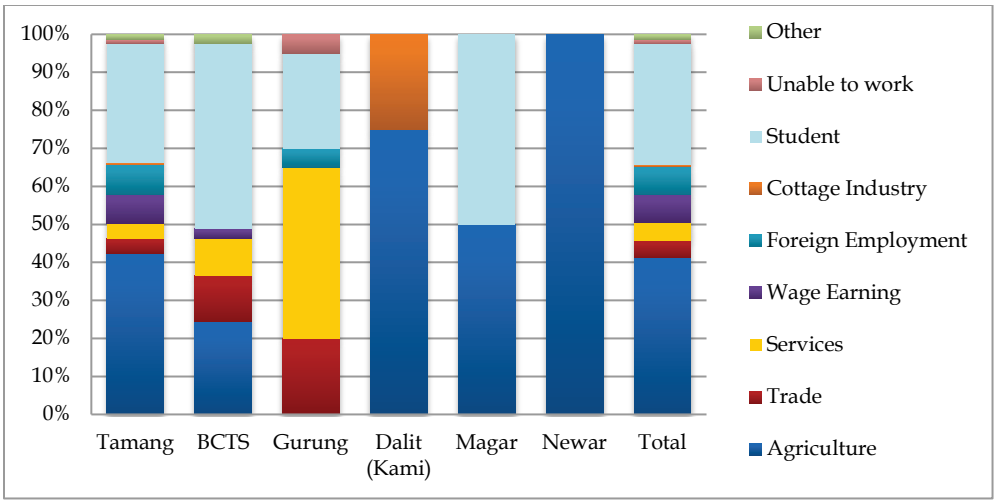
- Foreign employment (8 percent)
- Wage labour (7 percent)
- Business (5 percent)
- Service (5 percent)

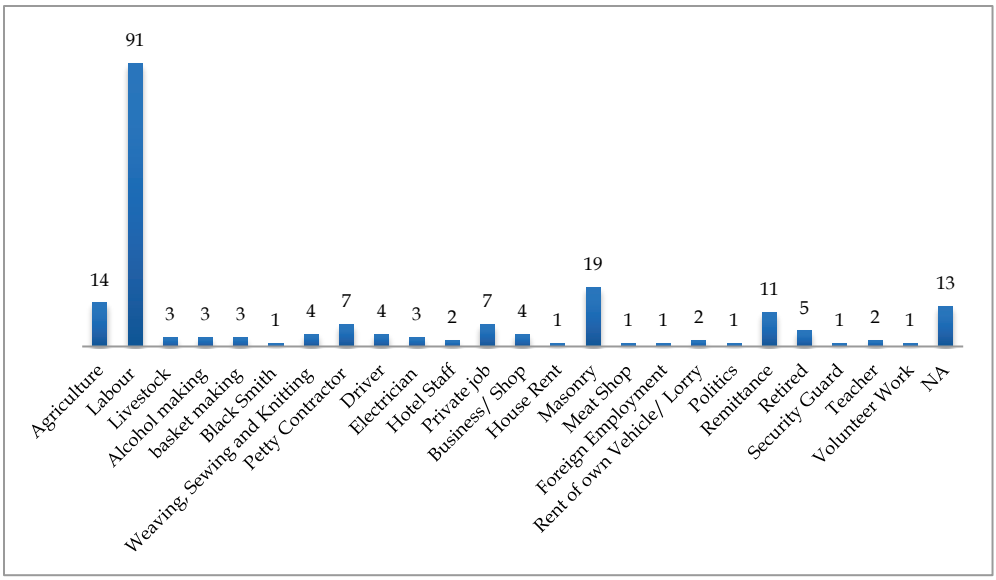
Wage earnings were reported to be primarily related to construction- related activities such as masonry, carpentry, construction work, driving, and bamboo basket making.

As can be seen from Figure 6.3-10, within the Project AoI, the social groups such as Kami, Magar and Newar were reported to have the highest dependence on agriculture. On the other hand, wage earnings and foreign employment were primarily undertaken by the indigenous groups of Tamang and Gurung.

From the discussions with the local community, it is understood that post-earthquake, the dependence on agriculture has been reduced due to loss of access to and damage to agricultural land. This has been accompanied by an increase in the dependence upon wage labour in construction sites and stone breaking.

Amongst the PAFs surveyed, the primary source of livelihood is reported to be labour (47 percent of PAFs) and Masonry (10 percent of PAFs). This is followed by Agriculture (7 percent of PAFs) and remittance (5 percent of PAFs). The remaining sources of income represent less than 5 percent of the total PAFs.





Source: ESSA 2014; ERM 2017

Figure 6.3-10: Livelihood Profile of the Project AoI and PAFs

According to the discussions with the PAFs, the present livelihood profile of the community is characterized by a larger variation and uncertainty associated with income sources. Of the 129 PAFs, 74 reported to having difficulty in finding stable sources of livelihood. Most of the PAFs involved in labour work reported being gainfully engaged for approximately 8 to 15 days in a month. This has also resulted in the PAFs diversifying their livelihood activities, with income from labour work, being supplemented by livestock/ poultry farming, agriculture, weaving, basket making and sale of homemade alcohol. Some of the reasons identified by the PAFs for having difficulty in finding stable sources of livelihood include fluctuations in the market, demand for a particular skill, lack of proper training, resources (access to money and land) technical expertise, and lack of access to government support. In addition, the PAFs have limited or no education, which impedes effective learning in groups comprising both literate and illiterate people.

The livelihood profile is also dependent on the current residence of the population. Twenty-eight percent of the PAFs expressed the desire to return to their original settlements and most of the remaining 72 percent reside in IDP camps, on rented private land, or on government land, which they may have to vacate. Thus, this livelihood profile and the present trends are likely to change again if the PAFs move to a different location.

In the pre-earthquake scenario, most women were engaged in agricultural or livestock farming activities. Currently, a larger number of women are engaged in wage-generating activities, primarily stone breaking because of the loss of agricultural land and livestock holding.

Another shift in the post-earthquake scenario has been the increased burden on the younger population. Prior to the earthquake, the elderly population could sustain themselves by sustenance agriculture or by taking care of the family's livestock holding. However, with the loss of access to agricultural lands and livestock holdings, they are forced to depend upon the younger generation for support. This, combined with the lack of skills or physical fitness to undertake wage labour makes the elderly population dependent upon their sons for maintenance and financial support, even if they are living in a separate household, in the IDP camp, or original village.

Wage-Based Labour

Fifty-four percent of the PAFs reported undertaking wage labour and masonry as their source of livelihood. This wage labour is primarily daily wage labour, and is both semi-skilled (masonry, plumbing, bag weaving, etc.) and unskilled work (stone breaking, labour in shops). The PAFs engaged in wage labour are largely concentrated in areas near Naubise and Bogetitar, where there is a heavy reliance on buying food from the market.

The people were trained on house construction by the NGOs under the "Food for Work" programme. This programme provided wage-based employment to several locals, who worked as skilled and unskilled labour. Those who have successfully completed the masonry trainings reported increasing their average earnings from 600 to 800 Nepalese Rupees (NPR) per day to 800 to 12,000 NPR per day. This amount is reported to be lower for those involved in agricultural labour, for which the daily rate is reported to be 500 to 600 NPR per day. Women report being paid less than the men for the same tasks. While women are paid 250 to 400 NPR per day, for the same task, men are paid 500 to 600 NPR per day.

According to the PAFs, the increase in the number of households undertaking wage labour since the pre-earthquake has resulted in a saturation of demand in the market and a shortage of work available. As a result, the PAFs reported working only 8 to 15 days a month[1]. Furthermore, in the survey and during focus group discussions, the PAFs noted that the construction of houses with NGO aid is nearing completion, and therefore the employment opportunities are gradually decreasing.

[1] This amounts to NPR 9,000- 18,000 per month for Masons and 7,500-9,000 NPR for agricultural laborers. This is in comparison to the minimum wage rate for Nepal, which is NPR 8,000 per month

Stone Breaking

A large number of members from the PAFs have reportedly been engaged in stone breaking activities, as a primary or secondary source of income. A large number of unskilled women and aged people (above 50 years) are involved in stone breaking activities, earning an amount ranging from 250 to 400 NPR per day, being paid on a piece per rate basis. Figure 6.3-11 captures photograph of stone breaking activities.

Source: ERM site visit, 2017

Figure 6.3-11: Stone Breaking Activities in IDP Camps

This activity is one of the most prominent sources of income because of its proximity to the IDP camps, especially near the Farm Camp and Pradhikaran Camp in Dhunche.

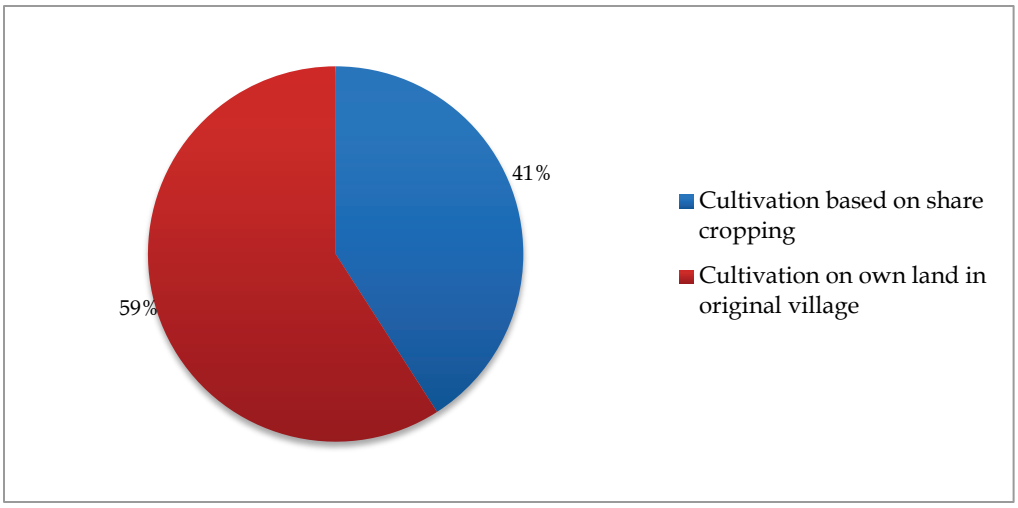
Agriculture

In the pre-earthquake scenario, agriculture was reported to be one of the most important sources of livelihood in the community.

However, due to the earthquake and the damage to agricultural land, there is a marked shift from agriculture to other sources of livelihood. Another reason, for the shift away from agriculture, is the increased proximity of the PAPs to urban areas and consequently non-farm based livelihoods. As discussed earlier, only 7 percent of the 129 PAFs surveyed, reported a dependence on agriculture as a source of livelihood over the last 2 years. In addition, these PAFs are reported to be undertaking agriculture solely for the purpose of self-consumption. The present agricultural practices are comprised of agriculture on rented land near the IDP camps and continued agriculture in native villages. The following sections provide an understanding of the agriculture being undertaken on rented land and on native land.

Of the PAFs who reported undertaking agriculture, 41 percent reported to be doing so as shared crops on rented land in the vicinity of the IDP camps (see Figure 6.3-12). This form of agriculture is most dominant amongst the PAFs from Gogone, Tiru, and Mailung where there is limited land available for cultivation within the IDP camps. There is saturation in terms of the agricultural land availability in proximity to the camps. Additionally, the land rates have soared due to plans of construction of a National Highway close to the camps. The aforementioned fact,

corroborated with the weak financial status of the displaced people, limits the ability of the PAFs to purchase new land around their camps for agriculture.



Source: ERM 2017

Figure 6.3-12: Location of Agricultural Activities

The survey undertaken in May 2017 highlighted that some PAFs are engaging in agriculture on a sharecropping basis in a group of 4 to 6 families. However, this places an additional burden on the PAFs in terms of expenses. Figure 6.3-13 shows photographs of agricultural activities in IDP camps in 2017.

Source: ERM site visit, 2017

Figure 6.3-13: Agricultural Activity in IDP Camps

Fifteen percent of the PAFs also reported a desire to rent/purchase land near the IDP camps for agricultural purposes instead of cultivating their land in the original village. The PAFs cited high rent and market value in the area, lack of available land due to high demand, and lack of available labour as reasons why they cannot rent/purchase near the IDP camps.

The PAFs who are undertaking agriculture on land in their original villages are primarily in Haku Besi and Phoolbari. This group of PAFs is comprised of those who are gradually shifting back to their original villages and others who are visiting the villages at regular intervals for

cultivation while staying near Dhunche. One prominent factor for this change is the relatively easier access to these villages from Dhunche in the post-earthquake scenario, as compared to the villages of Tiru and Gogone. The risk of landslides is also understood to be lower in these villages compared to Tiru and Gogone.

According to the discussion undertaken, it is understood that a larger number of PAFs will undertake agriculture in the coming monsoon. However, this is accompanied by issues of access to agricultural land in the original villages due to landslides, fissures on land, general safety in terms of accessibility and fear of further earthquakes or landslides.

Livestock Rearing

Prior to the earthquake, the PAFs had considerable livestock holdings, which provided dairy products, eggs, meat, etc. However, the earthquake resulted in loss or death of significant amount of livestock. Furthermore, while most have tried to rebuild their livestock rearing, 75 PAFs (58 percent of total) report a reduction in the total number of livestock heads owned, while only 4 PAFs (3 percent of total) reported to have same or increased livestock holdings. This is despite training and support being provided NGOs in poultry farming and boar farming as part of relief work post-earthquake. Figure 6.3-14 shows photographs of livestock holdings in IDP camps in 2017.

Source: ERM site visit, 2017

Figure 6.3-14: Present Livestock Holdings in IDP Camps

Some of the reasons for the PAFs not restoring their livestock holdings are as follows:

- Lack of monetary resources for purchasing and maintaining the livestock;
- Lack of space in IDP camps for keeping the livestock heads especially larger animals such as boars and cattle;
- Lack of grazing land, for goats and cattle/bovine especially in Nuabesi, Bogetitar, Satbesi, and Battar; and

- Reluctance by PAFs and community to keep larger number of livestock in IDP camps, due to issues such as bad odour and sanitation.

These issues are reported to have led to community conflicts initially and the giving up on animal husbandry or significant reduction of livestock holdings thereafter. However, NGO intervention in this area has helped in train people undertaking such activities in limited spaces, which has been seen implemented in the Nuabesi Camp. Two to three families in the Nuabesi camp have constructed mini-sheds and are maintaining small number of livestock (1 to 2 goats or cows per family) (see Figure 6.3-15).

Source: ERM site visit, 2017

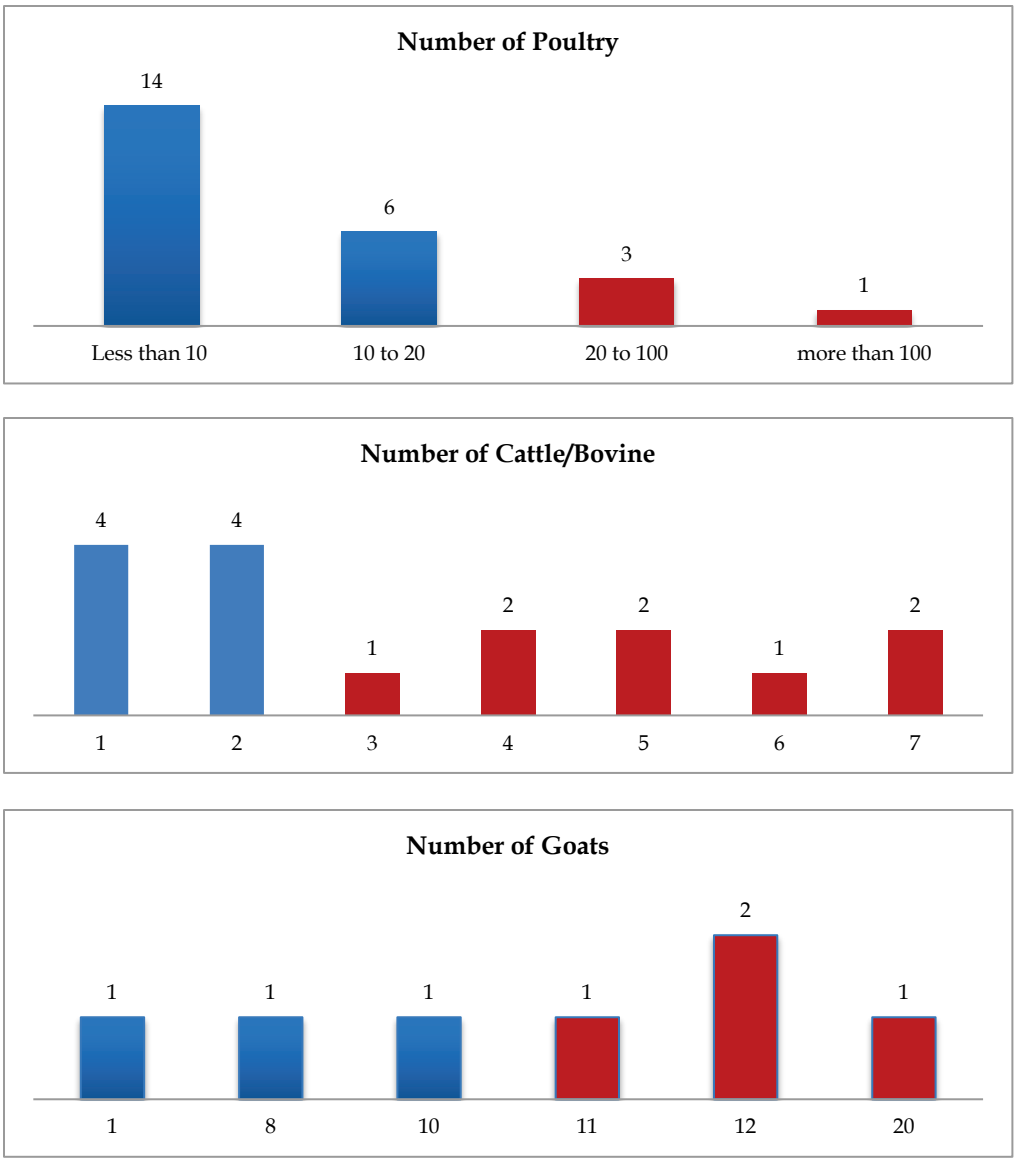
Figure 6.3-15: Livestock Cultivation in Limited Space in Nuabesi

There was also a remarkable shift in the climate (cooler on the mountains in Tiru and Gogone to warmer in the plains in Nuabesi, Bogetitar, Batar, and Satbesi), which led to the death of the livestock because they were unable to withstand higher temperatures. Thus, families whose elders/ distant relatives have relocated to Tiru maintained their livestock in their original villages.

In the case of PAFs from Haku Besi and Phoolbari who are residing in IDP camps, because of space constraints, they have either sold their remaining cattle post the earthquake or kept them in their original villages where there is sufficient grazing land and suitable climate. In case of these villages, since a sizeable number of PAFs have returned permanently or keep visiting regularly, the maintenance of livestock is managed easily be undertaking joint responsibilities with other neighbouring families. In the present scenario, livestock holdings are comprised of poultry, goats, cattle/bovine, and boars/pigs. Of the PAFs surveyed, only two PAFs reported owning boars. While one PAF reported owning one boar, the other PAF owns a pair.

As can be seen on Figure 6.3-16, most of the PAFs reported small livestock holdings. In terms of value of livestock holdings it is estimated that those PAFs owning less than 20 poultry, 2 cattle/bovine and 10 goats; are rearing the same for household purposes. The PAFs with more

than 20 poultry or 3 cattle and 10 goats (depicted in red) may be engaging in sale of products such as eggs, milk, and meat or have the potential to do so. However, it should be noted that only three PAFs reported an income from livestock holdings.



Source: ERM 2017

Figure 6.3-16: Types of Livestock Holdings across PAFs

Poultry Farming

Prior to the earthquake, some families maintained poultry in order to fulfil household needs of egg and chicken. However, the earthquake resulted in loss/death of poultry. Only the people with ample savings could replenish their poultry after earthquake. The NGOs played a role in training displaced people on poultry management and even provided the trainees with poultry, along with food supplies and support in vaccination. While some of the PAFs could gainfully utilise their

poultry training after withdrawal of NGO support, a large number of people trained on skills to manage poultry could not take it forward successfully because of:

- Limited space for poultry farm near camps;
- Lack of proper understanding of potential diseases and follow up on vaccinations;
- The needs for cooler temperatures for healthy growth and survival and the relatively hot climate of Nuabesi and Bogetitar camps;
- Lack of electricity and water facilities to maintain ambient temperature; and
- Limited understanding of active growth cycle of poultry.

Small Enterprises

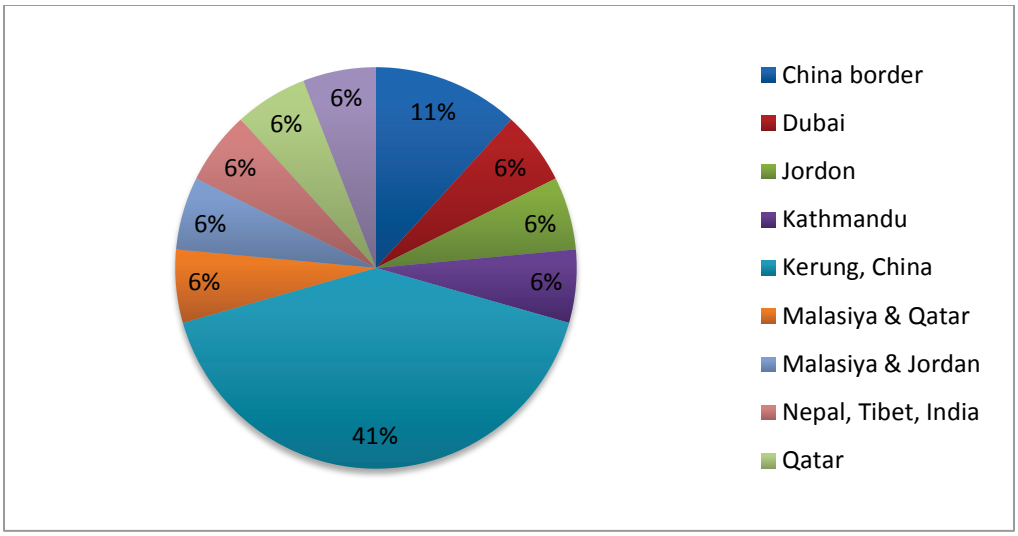
Several PAFs from Haku Besi and Phoolbari had small businesses, such as grocery shops, restaurants, tea shops, in their original villages prior to earthquake. It has also been understood from consultations that certain people from Haku Besi and Phoolbari villages have relocated to Dhunche after selling land to NWEDC prior to the earthquake, as well as post-earthquake. These people had bought land in and around Dhunche and had set up small shops in the newly purchased land or rented land being used for residence. These shops include meat shops, tea shops, and grocery shops. In this case, the prior experience of managing an enterprise and savings helped restart business enterprises in their new setting.

It has also been observed and understood through consultations that new enterprises are also being set up in the Nuabesi and Khalde camp areas, but the people venturing in these activities for the first time require some support in terms of technical knowledge of managing an enterprise in order to run their venture profitably.

Out Migration

It was understood during the survey and the consultations undertaken in May 2017 that the younger community members are increasingly interested in foreign employment. There was no change in the frequency and nature of migration in the household in 63 percent of the PAFs surveyed, for both pre- and post-earthquake scenarios. Consultations suggested that migration to other countries was existent earlier as well, but the number of people opting for and investing in this option is definitely on the rise with more people thinking around these options. Of the 129 PAFs surveyed, 17 (13 percent) reported having family members who were engaged in migrant labour and provided regular remittance. Apart from these PAFs, many PAFs also reported having family members who have gone to foreign countries for wage labour for a few years, and had saved money and subsequently returned to Nepal. Of the 129 PAFs, 11 reported having a member who had to return from foreign employment due to the earthquake.

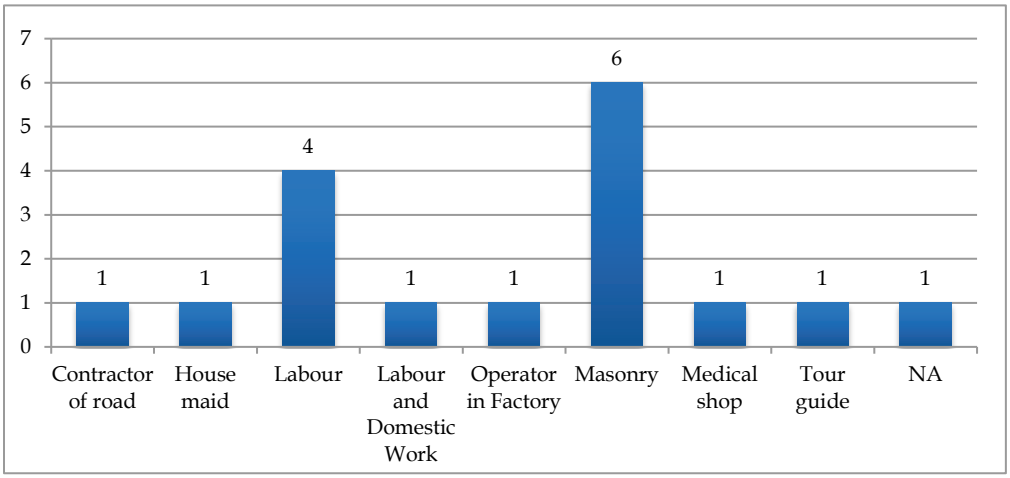
Figure 6.3-17 provides an understanding of the main countries reported for migration (includes migration to other areas of Nepal).



Source: ERM 2017

Figure 6.3-17: Countries for Migration

As can be seen from Figure 6.3-17, the most common country for migration presently is China (Kerung and China-Nepal border), for short duration of 3 to 6 months. Figure 6.3-18 shows the nature of work undertaken by those migrating for foreign employment. The most common nature of activity for migrant workers is as masons or labourers.



Source: ERM 2017

Figure 6.3-18: Nature of Activities Undertaken

It was also understood from consultations that the women of the Tamang community and especially the PAFs are also going to foreign countries for a period of 3 to 4 years. The primary objective of foreign employment is reported to be the savings from the salaries that can be brought to Nepal and put to productive uses like buying land, construction of housing, and buying assets like trucks.

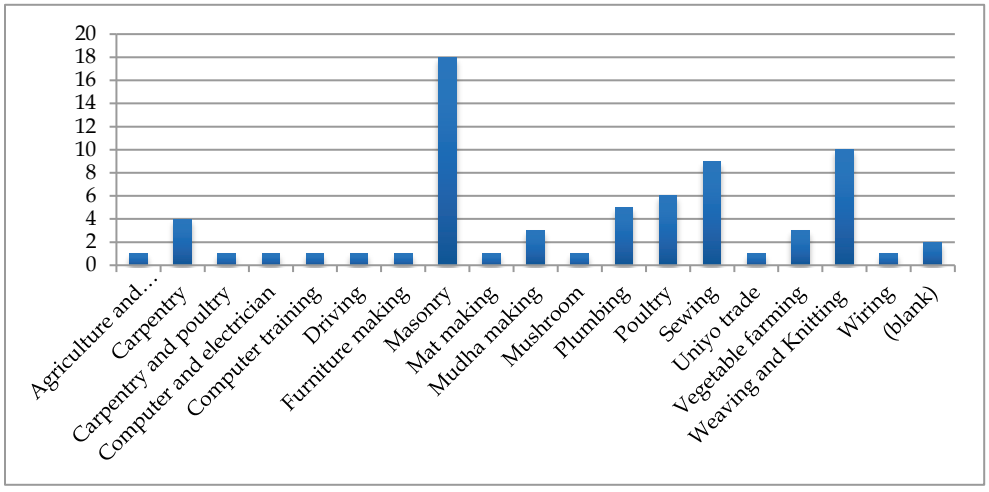
There are a number of manpower/staffing firms operating out of Kathmandu, which deal in sourcing Nepali locals and placing them in factories, restaurants, and beauty parlours/salons in countries like Malaysia, Dubai, Qatar, Jordan. They reportedly charge a lump sum fee of around 1.5 to 2 lakh NPR for males and approximately 60,000 NPR for females, which includes their travel cost. Lodging in the foreign countries is provided by the employer or the local contact of these employment firms, depending on the nature of work and type of agreement.

The beginners/untrained people start with a basic salary equivalent to 10,000 to 12,000 NPR and the same is upgraded based on expertise and experience of the employee. According to key informant discussions with PAFs who have been doing well, salaries can get as high as approximately 30,000 NPR and with limited expenditures on lodging and food, the people have reported savings of nearly 5 to 7 lakh NPR in a period of 3 years. Thus, foreign employment has become one of the major sources of livelihood in the area.

There have been people in the community, however, who have been lured into foreign employment with the promise of higher wages but the actual wages in the foreign country was much less than promised. Such people can end up in a debt because they had made the initial investment of 1.5 lakhs NPR from personal savings or loans and are not able to earn enough to save from the foreign employment. It was also understood during discussion with similar PAFs that the majority of the people opting for foreign employment for the first time are unskilled/ untrained, hence the lower wages. Therefore, basic skills training useful for foreign employment could mean a higher starting salaries.

Training Received

Sixty-four individuals from 51 PAFs have received livelihood and skill training as part of the relief activities by NGOs/ INGOs in the district (see Figure 6.3-19). Of these, 40 received trainings with completion certificates. The figure provides an understanding of the trainings received by the PAFs, in terms of the skill provided.



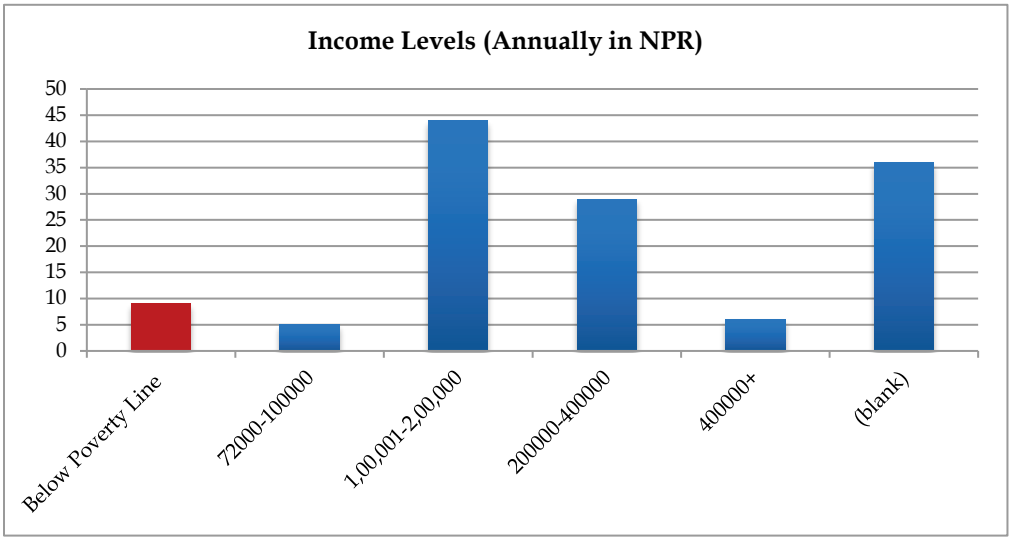
Source: ERM 2017

Figure 6.3-19: Trainings Received by PAFs as part of Earthquake Relief

As shown in Figure 6.3-19, the most common form of training received is masonry, carpentry, sewing, weaving and knitting, poultry farming and plumbing. While most men reported to have received training for masonry, carpentry and plumbing, the most common training for women was sewing, weaving and knitting, and poultry farming.

Annual Income and Expenditure

Figure 6.3-20 provides average income levels amongst the PAFs surveyed. As can be seen from the figure, 7 percent of the PAFs were reported to be below the global poverty line[2]. Most of the PAFs (34 percent) were reported to have an annual income of 100,001 to 200,000 NPR. Almost 5 percent of the PAFs were also reported to have an annual income of more than 400,000 NPR. However, it should be noted that these income levels are reported based on approximation and recall value by the PAFs and may not necessarily provide an accurate picture. Furthermore, 38 of 129 PAFs reported to have some form of savings, either in bank accounts or in cash.



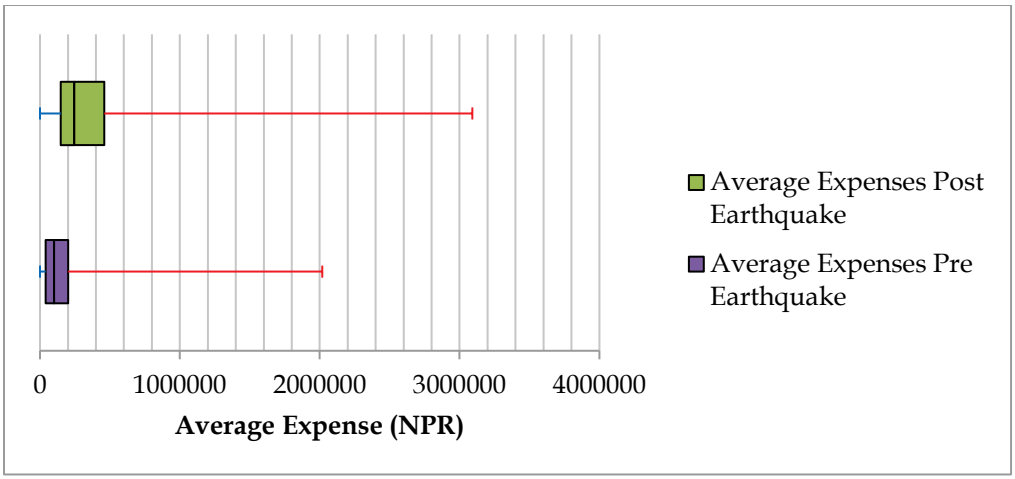
Source: ERM 2017

Figure 6.3-20: Income Levels in PAFs Surveyed

In terms of expenditure, the annual expenditure has increased significantly in the post-earthquake scenario, compared to pre-earthquake (see Figures 6.3-21 and 6.3-22). This can also be seen in the fact that median[3] as is seen in the following figure is reported to have shifted from 100,800 NPR pre-earthquake to 245,250 NPR post-earthquake.

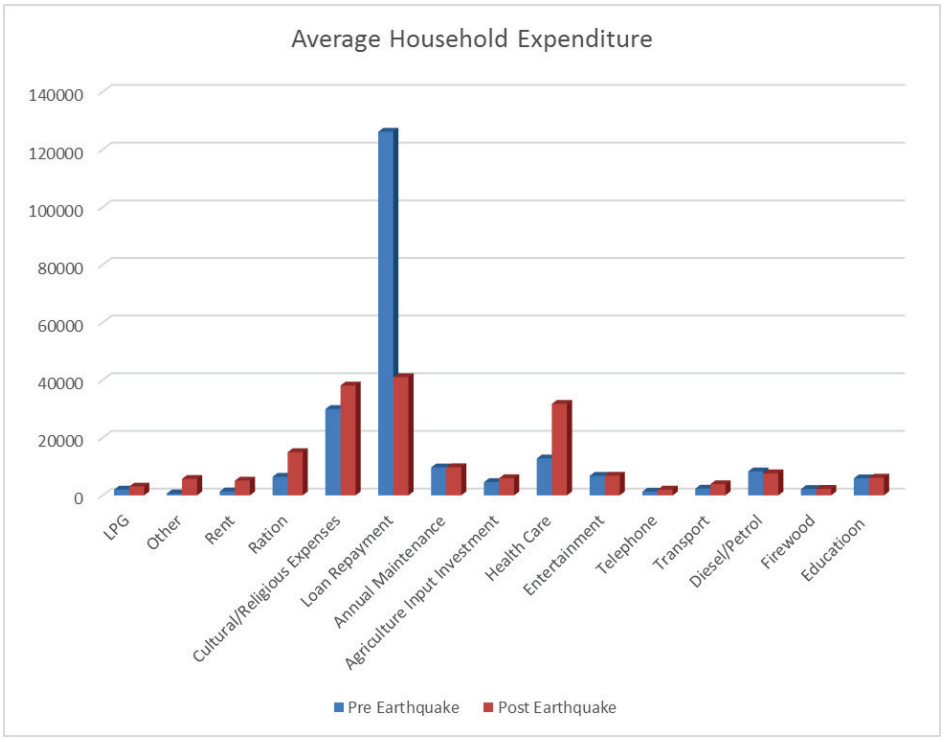
[2] The global poverty line, as identified by World Bank is at US $1.9 per day: http://povertydata.worldbank.org/poverty/country/NPL. This is equivalent to 195 NPR per day. On this basis, the annual poverty level can be established at 71,175 NPR per annum.

[3] The median denotes the value or quantity lying at the midpoint of a frequency distribution of observed values or quantities



Source: ERM 2017

Figure 6.3-21: Expenditure Levels in Pre-Earthquake and Post-Earthquake Scenario



Source: ERM 2017

Figure 6.3-22: Main Expenditure Heads Pre-Earthquake and Post-Earthquake

In addition, post-earthquake, there is reported to be a huge increase in the range of highest 25 percent of annual expenses. There is also a greater variation in expenses reported by the PAFs in the top 50 percent of the expense range (as can be seen in the third quartiles or red line in the Figure 6.3-21). This is in comparison to the shift in spending of the bottom 50 percent of the expense range (as can be seen in the first quartile or the blue line in the Figure 6.3-21, which does not show similar variation. This indicates that while there has not been a substantial change

in the spending of the bottom 50 percent of the PAFs (in terms of expenses), there has been a significant increase in spending by the top 50 percent. This is primarily attributed to the PAFs having moved closer to urban areas and subsequently having higher access/exposure to consumer goods and more expensive urban lifestyle.

On the other hand, the average annual expenditure is reported to have increased from 186,749 NPR in per-earthquake scenario to 420,444 NPR in post-earthquake scenario. This is primarily attributed to the following reasons:

- The spending on ration, healthcare, liquefied petroleum gas (LPG), maintenance, transport, telephone, rent, and cultural expenses has increased.
- New expenses have arisen in the post-earthquake scenario. For instance, prior to the earthquake, the primary fuel source was fuel wood, which was procured free of charge from the neighbouring forest. Now, in the post-earthquake scenario, the PAFs are dependent upon LPG and fire wood, which have to be purchased. Similarly, while earlier, the PAFs primarily consumed kodo millet[4] and vegetables grown in kitchen gardens, they are now dependent on rice and vegetables purchased from the market.
- While the dependence on agriculture as a source of livelihood has significantly reduced, the average expenditure by PAFs on agricultural input has increased post-earthquake.

The major current expenses are loan repayment followed by cultural expenses, healthcare, ration, and annual maintenance.

Post-earthquake, there has been a huge increase in the range of the highest 25 percent of annual expenses. There is also greater variation in expenses in the top 50 percent of the expense range as reported by the PAFs. This indicates that while there has not been a substantial change in the spending of the bottom 50 percent of the PAFs (in terms of expenses), there has been a significant increase in spending by the top 50 percent. This is primarily attributed to the PAFs having moved closer to urban areas and subsequently having higher access/exposure to consumer goods and more expensive urban lifestyle.

Health Facilities

Prior to the earthquake, the PAFs reportedly preferred the government hospital in Dhunche, followed by traditional healers, government health posts, and medicinal plants. Post-earthquake, the access to medical services has improved for the PAFs, which has been accompanied by a reduction in the dependence on traditional and natural medicine.

However, post-earthquake living conditions have increased diseases prevalent amongst the local community as a result of increased population density in the IDP camps, and issues of sanitation and cleanliness in the same. Another reason attributed to the increase in health issues is the relatively higher temperatures in the plain areas.

[4] A wild cereal grown in the mountainous regions

Electricity

The main sources of energy for lighting purposes in the Project AoI, pre-earthquake, were reported to be kerosene and electricity, with a majority of the households being connected to the Nepal Electricity Authority grid for electricity. The PAFs had reported a dependence on LPG and kerosene for electricity, with none of the PAFs reporting electricity as a source of energy. Apart from kerosene, LPG, and electricity, *Diyalo*[5] was report to be a key source of pre-earthquake lighting in the Project AoI.

However, in the present scenario, most of the PAFs are dependent on solar energy for lighting purposes. This source of energy is in the form of one or two bulbs connected to a small solar panel for each individual household. These solar panels and bulbs are reported to have been provided by NGOs as part of the relief activities. Only the PAFs who have returned to the original villages are likely to be using kerosene and *Diyalo*. Some of the houses have access to grid-supplied electricity; however, that was considered an extra cost and in some cases has already been discontinued. Some families had undertaken metered connection in a group, though after having failed to pay the amount were disconnected. Nonetheless, some of the families have access to individual metered connection, indicating their capacity to be able to bear that cost.

Water and Sanitation

In the pre-earthquake scenario, 45 percent of the PAFs reported having access to piped water at the community level. This water was brought in by laying pipeline from a nearby stream to a common location where the communities can collect water. On the other hand, in 2015, 39 percent of the PAFs were reported to be directly dependent upon the springs in the area for drinking water. Other PAFs reported dependence upon on the river, canal, ponds, or dug wells for their daily needs. According to the PAFs, most of the springs and streams used by the local community for household purposes and irrigation have dried up or disappeared post-earthquake. This has created a severe issue of water availability for those PAFs who wish to return to their original villages permanently.

In the IDP camps, the local community and PAFs, have access to water at the community level through different makeshift arrangements. Standposts could easily be seen across the road in Nuabesi; however, in Khalte where people have just relocated, there is still no access to piped water supply.

The PAFs were reported to have improved access to sanitation in the post-earthquake scenario, with all the IDP camps having community toilets and bathrooms. However, due to the high population density, these camps are often associated with diseases and sanitation problems. There were a few households who were reported to have individual toilets as well, but this number is scarce and limited to the households who were economically well off.

[5] Wooden strips of pine trees and firewood

Means of Communication

There has been a marked improvement in connectivity and means of communication for the PAFs and the local community in the post-earthquake scenario. While, in the complementary baseline, 88 percent of the surveyed PAFs had reported access to mobile phones, presently 100 percent of the surveyed PAFs have access to at least one mobile phone in the household. Furthermore, due to the proximity to roads and urban areas, the amount of time spent travelling to key urban centres such as Kathmandu, Dhunche, and Betrawati, has decreased.

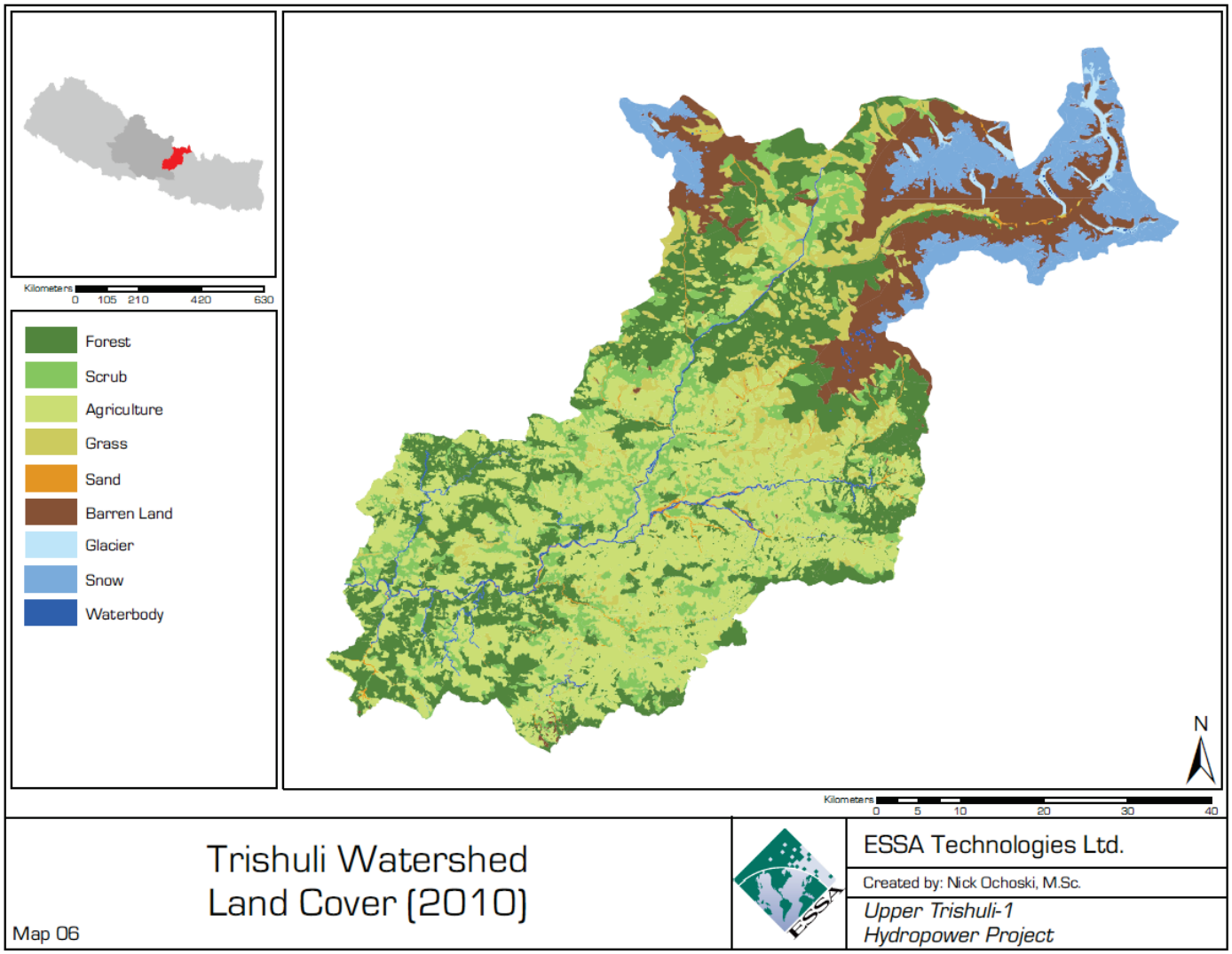
6.3.2. Land Use

This section provides an understanding of the land use in the AoI. As can be seen from Figure 6.3-23, in 2014, the land use in the area was characterised primarily by forestland, scrub, and agricultural land.

At a regional level, it should be noted that the Trishuli River is considered a naturally occurring corridor that provides critical linkages north-south of the landscape. The west side of the river is characterised by human settlements and land of economic use, including the settlements of Mailung, Gogone, Tiru, Haku Besi, Thanku, and Phoolbari.

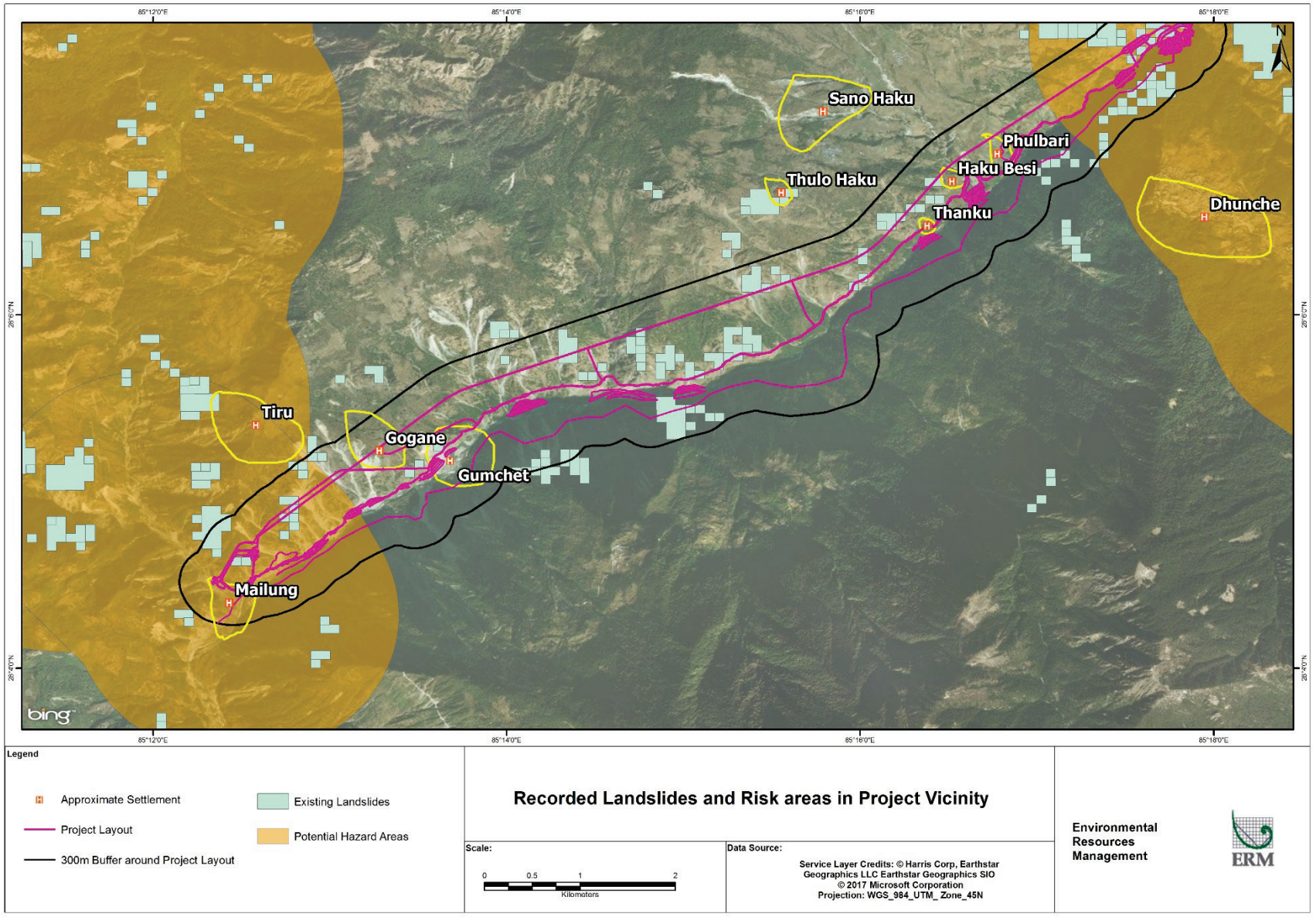
The east side of the river in the Project area is dominated by the Langtang National Park (LNP). This is a large conservation area that includes much of the forest cover in the Rasuwa District. The Trishuli River acts as the western border of the park. Project associated facilities (e.g., tunnel, access road) will be located on the east side of the river, outside of the LNP.

However, it should be noted that this land cover has undergone significant alteration since 2015 due to the Gorkha earthquake and the subsequent landslides of the last two years (Figure 6.3-24). This has resulted in damage to a significant proportion of forest cover and agricultural land due to creation of fissures and the deposition of gravel from landslides. According to discussions with the local community it is understood that the risk of landslide still exists in the area and is heightened during monsoons, with most of the local community choosing to reside in IDP camps during these months and visit/ return to their native villages only in the winter and summer months.



Source: ESSA 2014

Figure 6.3-23: Land Use Map for Trishuli Watershed



Source: OCHA 2017, EWF 2017

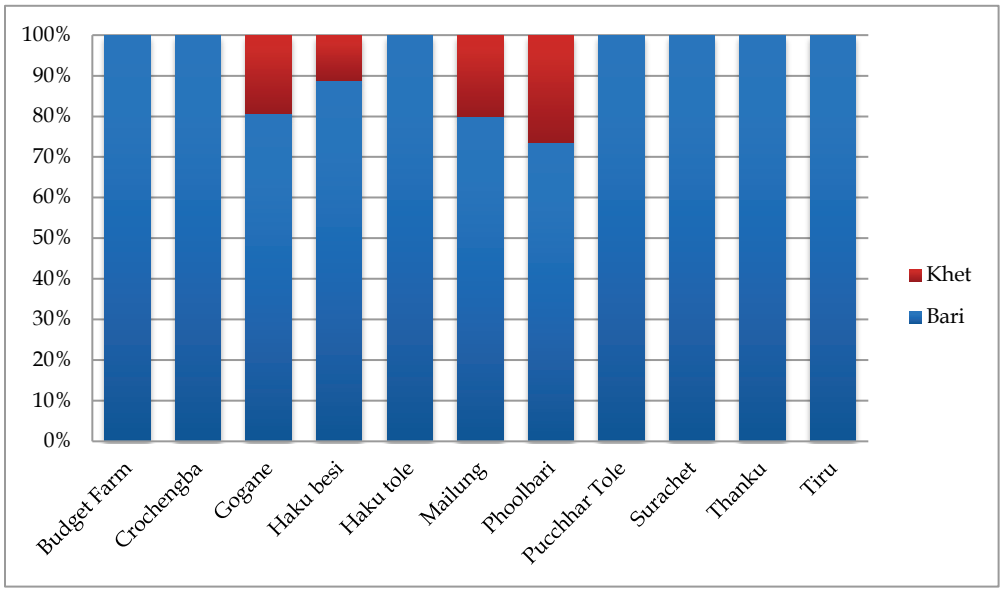
Figure 6.3-24: Earthquake Landslide Impacted Area in AoI

6.3.2.1. Agricultural land Use and Ownership

In terms of the private land holdings within the Project AoI, the following three land types have been identified:

- Bari or un-irrigated upland
- Khet or irrigated lowland
- Kharbari or marginal land

The majority of the households in the AoI (97 percent) reportedly own Bari (un-irrigated) land (see Figure 6.3-25). Only 18 percent of the households in the AoI reported owning Khet (irrigated) land, and 12 percent of the households own Kharbari (marginal) lands.



Source: ERM 2015

Figure 6.3-25: Land Ownership amongst PAFs

Of the PAFs surveyed (see Table 6.3-9), 86 percent reported to own land categorised as Bari or un-irrigated upland, which is lower quality in terms of fertility. On the other hand, 14 percent of the PAFs (in Gogone, Haku Besi, Mai lung, and Phoolbari) surveyed reported owning irrigated low lands or Khet, which are more fertile and appropriate for rice cultivation. Furthermore, 30 percent of the total PAFs (42 PAFs), primarily from Haku Besi, Phoolbari, and Thanku, also have access to Guthi Land as tenants.

Table 6.3-9: Land Holdings amongst the PAFs Surveyed

Tole Names	Average of Total Owned Land (hectare)	Average of Total Leased Land (hectare)	Marginalized Land Owners	Small land Owners
Budget Farm	0.53		1	1
Crochengba	1.02	1.02		4
Gogane	0.19	0.08	24	2
Haku Besi	0.57		2	7
Haku Tole	0.31		1	1
Mailung	0.23		5	
Phoolbari	0.41	0.81	11	8
Pucchhar Tole	0.66			1
Surachet	0.12		3	
Thanku	0.11		5	
Tiru	0.22		9	
Total	0.34	0.50	62	24

Source: ERM 2015

The average size of land holdings per household in the AoI (considering all land types: khet, bari, and kharbari) was 0.91 ha. This average size is slightly higher in the case of the Tamangs (0.92 ha) and lower among Dalit (0.68 ha). Similarly, women-headed households have the greater size of land holding (1.07 ha) compared to men-headed families (0.88 ha). The practice of renting land among the sample households is very limited.

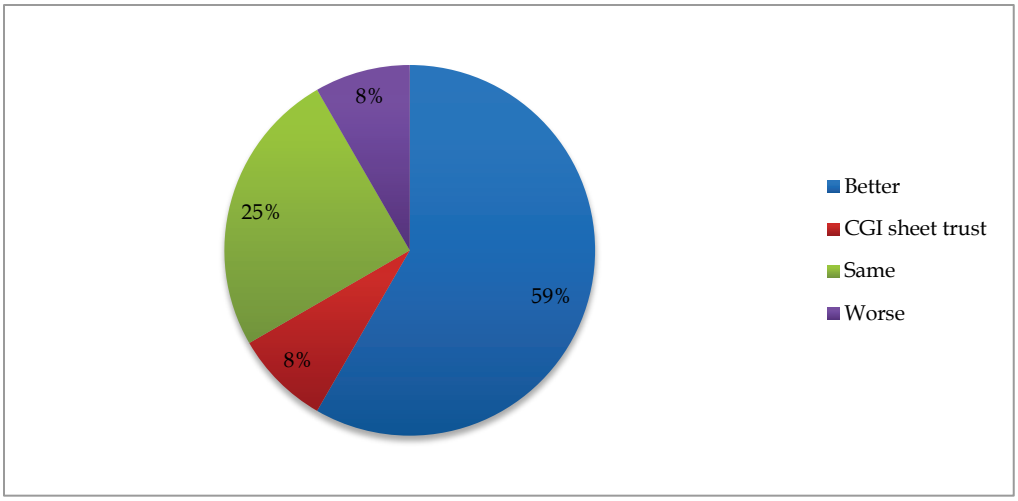
The average size of the land holdings per households amongst the PAFs is reported to be 0.34 ha of owned land and 0.50 ha of leased land. Only the Toles Crochengba, Gogane, and Phoolbari reported having leased land. The highest average land holding size was reported to be from the Toles Crochengba, Phoolbari, and Pucchhar, while the lowest land holding sizes were reported from Surachet, Thanku, and Gogane.

In terms of the size of the land holdings, 72 percent of the PAFs were reportedly landless or marginalized landowners (0.0 to 0.5 ha) while 28 percent of the landowners were small landowners (0.5 to 2.0 ha). All of these small landowners reported owning Bari land, while 19 percent of the marginalized landowners reported to owning Khet land (irrigated land). It should be noted that in many cases the PAFs included land that has been already transferred to NWEDC for the Project as available land. Therefore, the reported land availability may not be a correct reflection of available land in all the surveyed PAFs. This is especially important in case of Haku Besi, Phoolbari villages, where the land transferred to NWEDC was still available for cultivation, as the access road construction had not started in these places.

Especially in case of Gogone, the land ownership effectively does not mean anything as the land is either not available for cultivation or is not safe enough to reach and cultivate. Consultations with the Department of Urban Development & Building Construction at Dhunche suggested that the Government has decided to provide support to landless people who do not have land available for home construction. This support will be in the form of either replacement land or NPR 200,000 for purchasing land. It is understood that most people have chosen to receive the monetary support and then identify land for themselves.

Of the 129 PAFs, 21 PAFs purchased land with their compensation amount. The LALRP provides a detailed understanding of how each PAF has utilized the compensation amount

received. Of these 21, 16 PAFs purchased new land post-earthquake [residential plots of land ranging between 1 to 8 anna (0.003 to 0.03 ha)], including land in Batar (seven PAFs), Dhunche (six PAFs), and Betrawati, Ramche, Thade, and Kathmandu (one PAF each). As can be seen from Figure 6.3-26, 59 percent of the PAFs reported the value of land to be high. This high value is due to fact that the land is located in urban areas, such as Dhunche, Betrawati, and Kathmandu. According to the consultations undertaken, a proportion of the 16 PAFs have also purchased land for the purpose of investment, and are presently either not using it (no construction for accommodation or for business) or have leased it.



Source: ERM 2017

Figure 6.3-26: Value of Alternative Land Purchased

Furthermore, the residents of Haku Besi, Phoolbari, and Thanku who do not have a tenancy certificate to the Guthi land have applied for tenancy and are at various stages of receiving it from the government (see Section 7.5).

6.3.2.2. Dependence on Forest Resources

In the pre-earthquake scenario, an important resource for the community in terms of livelihood dependence was the natural resources derived from the forests. Common forest resources and uses include extraction of timber, firewood (household consumption and sale), foraging by livestock, collecting medicinal plants and Non Timber Forest Produce. However, in the post-earthquake scenario, the dependence on natural resources has been reduced to almost negligible due to the loss of access to the forests and the rivers from the IDP camps. The only use of natural resources is by people who have returned to their original settlements. Those living in the IDP camps have replaced natural resources with LPG, solar lighting, and modern medicines.

6.3.3. River Use

The Trishuli River in the AoI is used for fishing (sustenance and recreational) by approximately 13 PAF. The river stretch to be affected by the Project was also reported to be used in the pre-

earthquake scenario during the dry season for drinking water and for household needs such as washing of clothes and utensils, and feeding and bathing cattle. Another use of the river was for irrigation purposes. According to the information made available during the complementary baseline, it is understood that irrigation was being used at one location for the four ropani plots of land serving four households. The irrigation system was reported to be an earthen structure with no permanent diversion structure at the intake and was used for the cultivation of paddy during the monsoon. The diversion reach was previously used as a cremation site by eight Dalit households (50 people) from the Haku VDC at the foothill of Hakubesi-Phoolbari, but alternative sites are now reportedly preferred.

However, post-earthquake, the dependence of the local community on the river stretch affected by the Project is understood to have become negligible due to the relocation of the community to the IDP camps and the landslides, which have impacted access to the riverbank. In the post-earthquake scenario, none of the 129 PAFs surveyed, reported any fishing activities, although 13 PAFs identified in 2015 could not be located during the site visit in 2017. This is likely to be a temporary situation and there is a possibility that the use of the river may be resumed/initiated once the local community returns to their original villages.

6.3.4. Indigenous People

6.3.4.1. Indigenous People/Indigenous Nationalities in Nepal

The process of recognition of the rights of Indigenous Peoples (IP) in Nepal is progressing. Until 1990 IP's identities and concerns had been ignored by the ruling elites of Nepal. This position changed in early 1990s from overwhelming pressure from IPs, scholars, and academic groups who pointed at vast discrepancies between dominant groups and IPs.

The Self-Governance Act 1998 made provisions for IP representation in Village, Municipal, and District Development Councils. It is believed that this law later triggered the passing of a more specific law that defined and identified IP.

In 2002, the National Foundation for Development of Indigenous Nationalities Act (NFDIN 2002) defined *Adibasi Janajati* as a group or community with its own tongue and traditional customary practices, distinct cultural identity, social structure and oral or written history. A comparative analysis of this definition vis-à-vis the definition of the IPs as per ILO Convention No 169 and United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)[6] by several IP activists, scholars and representatives points to two points of departure. First, NFDIN 2002 does not recognize the 'self-identification' of IPs. It has identified 59 *Adibasi Janajatis* and set a process of constituting a committee, which will decide on such claims. Second, the existence of traditional political institutions is not a parameter for recognition of the IP.

[6] Convention No. 169 in Article 7 provides right to the indigenous and tribal people to decide their own priorities for the process of development. Article 12, 13, 14 and 15 safeguards rights of the indigenous people in the land and natural resources in territories traditionally occupied by them. The UNDRIP adopted in 2007 sets out the individual and collective rights of indigenous peoples, as well as their rights to culture, identity, language, employment, health, education and other issues . The goal of the Declaration is to encourage countries to work alongside indigenous peoples to solve global issues like development, multicultural democracy and decentralization.

Thus, NFDIN 2002 laid the foundation for identification of IPs in Nepal. The *Adibasi Janajati* is translated as 'Indigenous Nationalities' in Nepal contrary to the more popular term 'Indigenous Peoples'. This to several scholars and authors is indicative of the political aspirations and territoriality that is an integral part of the IPs movement in Nepal since the 1990s.

The strength of the IP movement in Nepal was so strong that Nepal was the first country in Asia and second in Asia-Pacific to ratify the ILO Convention No 169. Nepal ratified the ILO-169 on September 2007 and also voted in favour of UNDRIP in the UN General Assembly. The 20 points agreement between IPs and Nepal Government in 2007, which initiated the on-going political process, includes inclusion of the IPs in the process of restructuring the State and formation of Nepal's new Constitution. As a consequence, several IP organizations have participated in the Constituent Assembly election and have contributed to the Constitution finalization.

The Constitution guarantees the right to social justice and participation in the state structure based on the principle of social inclusion. Art 63.4.3(a) provides proportional representation of IP in the Constituent Assembly. There is an intense debate in the Constituent Assembly on recognizing autonomous states (11 states and sub-states) territorial claims of different ethnic groups within the federal democratic structure of Nepal.

The NFDIN 2002 not only identifies 59 *Adibasi Janajatis*, it also divides them into four geographic regions. The mountain region or Himalaya has 18, Hills have 24, Inner Terai has 6, and Terai has 11 IP groups. The Nepal Federation of Indigenous Nationalities (NEFIN), which is a non-profit organization representing indigenous peoples issues, makes a classification based on their social-economic status and vulnerabilities. The five categories are endangered groups, highly marginalized groups, marginalized groups, disadvantaged groups, and advanced groups.

6.3.4.2. Indigenous People in the Project AoI

As has been discussed in the socioeconomic baseline, the population in the Rasuwa District is comprised of 18 ethnic groups, of which the Tamang comprise the majority of the population (64 percent in the district). The other prominent social groups include the Brahmins, Gurungs, Kami, Newar, Chhetri, Magar, and Sherpa. The Project area is dominated by Tamangs, although a sprinkling of other ethnic groups such as Gurung and Dalits are reported. It is significant to note that the PAFs are comprised primarily of Tamangs (89 percent of the PAFs).

Demographically, Tamang constitute about 6 percent of the total population of Nepal (as per the 2001 Census estimate) and are the country's fifth most numerous ethnic group. They are located around the Kathmandu Valley and their ancestral territory encompasses Sinduli, Kabhre, Sindupalchok, Rasuwa, Nuwakot, Dhading, and Makawanpur Districts. They refer to their ancestral territory as Tamsaling. It is significant to note that the Rasuwa District is predominantly IPs territory, comprised of Tamangs and Gurungs.

Tamangs are identified as one of the 24 hill tribes as per NEFIN 2002 and are considered a marginalised group as per NEFIN's classification. An overview of the socio-cultural profile of Tamangs is provided in Table 6.3-10.

Table 6.3-10: Socio-Cultural Profile of Tamangs

Aspects	Current Status
Ancestral Territory	Majority of Tamangs still inhabit in their claimed ancestral territory.
Language	Tamangs have their own language though there are several dialects within it. There has been a strong promotional activity of their language and culture through radio and mass media. There is a strong trend of its revival and evolution of a common Tamang Language. Tamang Language is recognised by Nepal Government and it has been introduced at selected schools on a pilot basis.
Traditional Dress	The traditional dress is worn only by few and has nearly disappeared. Women dress in their traditional attire on festive occasions.
Festivals	They mostly celebrate the nationally known festivities along with other ethnic groups. However, there is a revival of a few rituals and festivals in recent years.
Ethno-history and Mythology	The ethnic history of the community is mostly preserved in oral traditions. The myths are influenced by Great Tradition of Buddhism.
Customary Laws	Customary laws are fully effective in the community and have a strong presence in their village life.
Traditional Socio-political Institutions	The traditional socio-political institutions are partially effective. *Choho* was recognized as a local leader who served voluntarily. He was selected by community members and was accepted as a leader at the clan level. He played multiple roles in the community including administration, judicial and spiritual leader. The new socio-political structure is fast replacing the traditional leadership structure.
Social Structure	Tamang community is a ranked society, which is organized into several clan groups.
Status of Tangible Cultural Heritage	Their tangible cultural heritage sites are partially safe. The community has a strong commitment to their preservation.
Indigenous Skills/ Knowledge	Tamangs have the following traditional skills or knowledge: • Kwan Raba- cloth making • Chhaige - baskets and rope making • Syosyo Shengba- handmade paper making • Sing Thaba- Wooden craft • Thangka- cultural paintings • Marcha- herbal yeast making • Bamboo products • Voltu - bread cooked in water • Baavar - a kind of bread cooked in oil or ghee

7. KEY PROJECT ENVIRONMENTAL AND SOCIAL IMPACTS, RISKS, AND MITIGATION

This chapter identifies the key project environmental and social impacts and risks, and describes the Project's proposed avoidance, minimization, restoration, compensation, and offset measures to mitigate these impacts, in accordance with the Mitigation Hierarchy.

7.1. AIR QUALITY AND CLIMATE CHANGE

This section describes the Project's effects on air quality and its contributions to climate change through the release of greenhouse gas (GHG) emissions. This section also describes the potential effects of climate change on the Project.

7.1.1. Effects on Air Quality

Project construction will involve use of construction vehicles for vegetation clearing, excavation, grading, drilling, blasting, and other activities; and various construction facilities (e.g. quarries, crushers, and batching plants). In addition, diesel generator sets will be used to provide power for the worker camps and other construction facilities. These construction activities will result in the release of fugitive dust and vehicular and power generation emissions. The Project is located in an area with generally good air quality, but is located adjacent to a national park, so any increase in pollution levels will be minimized to the extent feasible in accordance with the World Bank Group (WBG) Environmental, Health, and Safety Guidelines (WBG 2007a). Proposed management of fugitive dust and vehicular/power emissions are discussed below.

7.1.1.1. Fugitive Dust

Fugitive dust will be the most severe at the crushing plant, concrete mixing sites, quarries, along access roads, in the spoil disposal areas, and at the dam site where construction activities are concentrated. Landscape conditions (e.g. the gorge) will tend to limit the dispersion of fugitive dust, the duration of the impact will be temporary (i.e. construction period), and no communities are expected to be significantly affected, although access to the site via dirt/gravel roads could affect some households such as Mailung.

The Engineering, Procurement, and Construction (EPC) Contractor will be responsible for controlling fugitive dust through a variety of measures as required in the Construction Environmental and Social Management and Monitoring Plan (CESMMP) (i.e. Air Quality Management Plan, see Appendix B.2, Construction Environmental and Social Management and Monitoring Plan), including:

- Spray water as needed on dirt roads, cut area, soil stockpiles or fill material;
- Place gravel on access roads near communities to reduce generation of fugitive dust;
- Fit concrete batching plants, asphalt plants, and mixing stations with approved dust control devices;
- Use high-efficiency dust suppression system for crushers operated at the site;

- Enforce speed limits along dirt roads near communities; and
- Stabilize disturbed areas after construction with vegetation or other materials.

The application of these measures shall adequately manage fugitive dust.

7.1.1.2. Vehicular and Power Emissions

Vehicular use and power generation will generate carbon monoxide (CO), sulphur dioxide, nitrogen dioxide, and particulate matter (PM_{10} and $PM_{2.5}$). None of these point or fugitive sources of emissions will meet the criteria to be considered significant (see IFC Environmental, Health, and Safety Guidelines). These emissions will not result in the exceedance of international air quality standards (e.g. World Health Organization Ambient Air Quality Guidelines) and will be limited in duration to the construction phase.

The EPC Contractor will be responsible for controlling vehicular and power emissions through a variety of measures as required in the CESMMP (see Appendix B.2, Construction Environmental and Social Management and Monitoring Plan), including:

- Use low sulphur fuel diesel for diesel-powered equipment and vehicles, if available;
- Provide regular maintenance of vehicles in accordance with manufacturer specifications;
- Provide covering for material transport;
- Enforce appropriate speed limits within construction site; and
- Reduce vehicle idling time to a minimum.

The application of these measures shall adequately manage emissions from vehicles and power equipment.

7.1.2. Project Contributions to Climate Change

Hydropower projects can release GHG (i.e. carbon dioxide [CO_2], methane, and nitrous oxide) as a result of vehicular and power generation emissions during construction and the decomposition of cleared vegetation and organic matter. The Project is not expected to produce significant quantities of GHGs (as defined by the IFC as exceeding 100,000 metric tons of CO_2 equivalent per year [IFC 2007b]) because emission sources are limited and the relatively small footprint of the Project (e.g. only 2.1-hectare reservoir, so limited vegetation clearing).

GHG Emissions from Diesel Generators

As indicated in Table 7.1-1, annual GHG emissions from the 5 megawatt (MW) diesel generator for the Project, which will be the primary source of GHG emissions, will only total approximately 12,000 metric tons of CO_2 equivalent per year.

Table 7.1-1: Annual GHG Emissions from 5 MW Diesel Generators

Fuel	Generator Size (MW)	Operating Hours per Year	Annual Electricity Generation Capacity at Full Load (MWh/yr)	Emissions (metric tons/yr)			
				CO_2	CH_4	N_2O	CO_2e
Diesel	5	8760	43,800	11,684	0.47	0.09	**11,724**

Source: IPCC 2006

CH_4 = methane; CO_2 = carbon dioxide; CO_2e = carbon dioxide equivalents; MW = megawatts; MWh/yr = megawatt hours per year; N_2O = nitrous oxide

Avoided Greenhouse Gas Emissions

Once operational, the Project will be generating an estimated 1,456 gigawatt hours of clean renewable energy annually, which will help offset climate change by avoiding the GHG emissions associated with the equivalent amount of power generated from a fossil-fuel-fired power plant. An analysis of the GHG emissions avoided as a result of using power generated by the Project (scenario 1) against other reasonable and likely grid alternatives (scenarios 2, 3, and 4) has been conducted. The following four scenarios were evaluated:

- Scenario 1: GHG emissions from the use of energy (1,456 GWh/year) generated by the Project, which is a renewable energy project (i.e., assume 100% Nepal grid electricity);
- Scenario 2: GHG emissions from energy generation assuming that in the absence of the Project an equivalent amount of electricity would be generated by the Indian Grid annually;
- Scenario 3: GHG emissions from energy generation assuming that in the absence of the Project an equivalent amount of electricity is still generated; 85 percent of this electricity is generated by the Nepal Grid while 15 percent is generated by the India Grid. This alternative was derived on the basis of the existing electricity production in both countries and the potential for expansion using the existing grids with their current emission factors.
- Scenario 4: GHG emissions from diesel fuel generation, assuming that all domestic generation from the Nepal grid is consumed by domestic demand.

These GHG emissions are illustrated in Table 7.1-2. For Scenarios 1, 2, and 3, the table was constructed by considering the existing grids in both countries (India and Nepal) and their existing emission factors[1] applied to the total energy to be produced (the same energy for the four scenarios). Scenario 4 was based on the electricity GHG emission factors for diesel oil[2].The difference in emissions is caused by the difference in the grids emission factors and the diesel oil emission factors. Due to lack of available data at this stage of the Project, GHG emissions from production of concrete for the dam construction were not included in the calculations in Table 7.1-2 below. However, even if GHG emissions from concrete production were quantified, it would only reduce emissions during the short-term construction phase and its overall effects on the overall annual avoided GHG emissions would be minimal.

[1] Grid electricity GHG emission factors for Nepal and India were obtained from Econometrica (2011) - Electricity-specific emission factors for grid electricity, August 2011.

[2] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy.

Table 7.1-2: Summary of Annual GHG Emissions for Each Alternative Scenario and Avoided Emissions Due to Implementation of the Project Against other Reasonable and Likely More Carbon Intensive Grid Alternatives

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Total CO_2e Emissions (metric tons/year)	4,443	1,950,393	296,336	389,733
CO_2 Emissions Avoided due to the implementation of the project (scenario 1) (metric tons/year)	-	1,945,949	291,892	385,290

Since the Project uses renewable energy to generate electricity, it would provide the greatest opportunity for GHG emissions reduction. Any other grid related alternative would rely on more carbon intensive sources since the Indian Grid, which is more carbon intensive, would provide at least part of the energy as presented in the Table 7.1-3. Scenario 4 would rely totally on diesel fuel generation, which is also a carbon intensive source.

Table 7.1-3: Emission Factors for India and Nepal Grid and Diesel Fuel Oil

Greenhouse Gas	Emission Factor for Nepal Grid, EF1 (kg/kWh)	Emission Factor for India Grid, EF2 (kg/kWh)	Emission Factor for Diesel Oil, EF_3 (Kg/TJ)
CO_2	0.00304179	1.333174843	74,100
CH_4	0.0000001179	0.00001552287	3.0
N_2O	0.00000002358	0.00002010920	0.6
CO_2e	0.00305	1.340	74,354

Kg/kWh = kilograms per kilowatt-hour, Kg/TJ = kilograms per TeraJoule

Due to lack of available data at this stage of the project, GHG emissions from production of concrete for the dam construction were not included in the calculations. Water, sand, stone or gravel, and other ingredients make up about 90 percent of the concrete mixture by weight. The process of mining sand and gravel, crushing stone, combining the materials in a concrete plant and transporting concrete to the construction site requires very little energy and therefore only emits a relatively small amount of CO_2 into the atmosphere (NRMCA 2012 – Concrete CO_2 Fact Sheet)[3]. According to a survey of Portland Cement Association (PCA) members, an average of 927 kg of CO_2 are emitted for every 1,000 kg of Portland cement produced in the U.S. (NRMCA 2012). Assuming 10 metric tons of CO_2 would be required to produce concrete for the dam construction, this would equate to approximately 9.3 metric tons of CO_2. This amount is negligible compared to the avoided emissions discussed for the four scenarios above.

Nevertheless, Nepal Water and Energy Development Company (NWEDC) will minimize GHG emissions from the Project by:

- Regular maintenance of vehicles in accordance with manufacturer specifications;

[3] https://www.nrmca.org/sustainability/CONCRETE%20CO2%20FACT%20SHEET%20FEB%202012.pdf

- Reduction of vehicle idling time to a minimum; and
- Minimizing vegetation clearing to the extent practicable.

7.1.3. Effects of Climate Change on the Project

Climate change poses several potential risks to the Project, including:

- Changes in rain, snow, and snow melt patterns;
- Changes in streamflow;
- Increase in frequency and magnitude of extreme events, including floods; and
- Potential for increased landslides and river sedimentation.

A review of historical climate data for the Greater Himalayan region resulted in no statistically significant trends. The uncertainty in the historical trends is amplified in the future projections. The latest generation of climate projections from the Intergovernmental Panel on Climate Change (IPCC) shows a very large uncertainty in climate-change-related risks in the Greater Himalayan region. Predicted increases in precipitation and streamflow variability and the great uncertainty about future glacier meltwater availability indicate that the hydropower sector in Nepal continues to have greater climate change risk than most other sectors.

Climate change modelling was conducted for the Trishuli River Basin (Cloudwater 2016, see Appendix F), which suggests that future temperature increases of less than 3 degrees Celsius (°C) would result in increased streamflow as a result of increased snow/glacier melt; however, future temperature increases of more than 3°C would result in reduced streamflow because of increasing rates of evapotranspiration and diminishing water contributions from receding glaciers. The IPCC forecasts have less uncertainty in forecasted temperatures than with precipitation, with temperature increases of approximately 2°C. Based on this information, the climate change model projections predict either increases or no change in streamflow. Over the 30-year lifetime of the Project, the greatest climate risks appear to be related to the increased frequency and severity of floods, with the 5,000-year flood possibly increasing in magnitude by between 20 to 25 percent. The climate change model predicts an increase in the magnitude of low flows (defined here as the 7-day low flow), or in other words higher baseflows. For example, the 7-day low flow with a return period of 10 years is predicted to increase from 35 cubic metres per second (m^3/s) to 55 m^3/s. Table 7.1-4 summarises the key findings of the climate change risk assessment.

Table 7.1-4: Preliminary Assessment of Climate Change Risks

Risk	Cause of Concern	Level of Concern
Flood	Climate change may cause extreme streamflow to increase in volume and frequency	Low – NWEDC has increased the dam and spillway capacity
Sedimentation	Climate change may increase sedimentation rates due to increases in the intensity of precipitation	Low – sediment management strategy has been incorporated into Project design
Reduced Low Flow	Climate change may cause a decrease in streamflow during the low flow season	Very low – climate change modelling indicates that low season flows may increase

Risk	Cause of Concern	Level of Concern
Dam Stability	Increase in volume and frequency of extreme events	Low – NWEDC has modified dam design to account for climate change risk

Source: Cloudwater 2016

NWEDC = Nepal Water and Energy Development Company

7.2. FISH AND AQUATIC ECOLOGY

This section describes the Project's effects on the Trishuli River, including water quality, sediment transport, aquatic habitat, and fish.

7.2.1. Water Quality

The Project may impact water quality by land disturbance; spoil and muck disposal; rock cuttings and seepage from tunnel construction, solid and hazardous material use/waste disposal; wastewater discharges; and elevated water temperatures. Each of these potential impacts is discussed below.

7.2.1.1. Land Disturbance

Project construction will disturb approximately 100 ha of land, including Project components that will be located adjacent to the river, such as spoil disposal areas and the powerhouse, and require disturbance of the river bottom to construct infrastructure within the channel (e.g. temporary facilities like coffer dams during construction and permanent facilities like the dam and tailrace tunnel outlet). In addition, the Project will require approximately 120,000 cubic metres of aggregate material for construction purposes, which will be obtained from four quarry/borrow pits in the Project area (see Section 2.2.5). These aggregate materials will be stockpiled at various locations within the construction area. These land and water construction activities have the potential to cause erosion and sedimentation and increase turbidity in the Trishuli River.

The Engineering, Procurement, and Construction (EPC) contractor will be responsible for preparing and implementing a Clearing, Grading, Underground Excavation, and Sediment and Erosion Control Management Plan, a Landslide and Slope Stabilization Management Plan, a Stockpiles, Quarries and Borrow Pits Management Plan, and a Water Quality Management Plan. The overall Construction Environmental and Social Management and Monitoring Plan (CESMMP) (Appendix B.2, Construction Environmental and Social Management and Monitoring Plan Framework) identifies measures to control runoff, prevent erosion, and retain fine sediments onsite that will be included in these Management Plans. The application of these measures shall adequately manage water quality impacts from construction-related land disturbance.

7.2.1.2. Spoil and Muck Disposal

The Project will require the disposal of approximately 2.4 million cubic meters of rock cuttings, spoil, and muck in 9 spoil disposal areas (see Section 2.2.6). Most of these spoil disposal areas are located adjacent to the Trishuli River so as to avoid steep slopes and impacts to forest and agricultural land.

The EPC contractor will be responsible for preparing and implementing a Spoil Handling and Disposal Management Plan and a Water Quality Management Plan (Appendix B.2, Construction Environmental and Social Management and Monitoring Plan Framework). These Management

Plans require careful siting of the spoil disposal areas to ensure the sites are located in stable areas that will not be susceptible to erosion, not cause future landslides, will minimise the risk of damage to the spoil disposal area by future landslides, are outside the floodplain, and will avoid impacting any existing irrigation ditches.

These Management Plans identify measures to control runoff, prevent erosion, and retain fine sediments onsite. In specific, these Management Plans require the installation of retaining walls to prevent spoil from being washed into the Trishuli River during monsoon rains, interception ditches to divert upgradient flows around the disposal areas, and drains, as needed, to manage water levels within the disposal areas prior to the disposal of any spoils in the facilities. These Management Plans also require retention facilities to settle sediments before drainage/seepage water from the disposal areas is released to the Trishuli River. Finally, these Management Plans require the rehabilitation and stabilization of the disposal areas as soon as the disposal operations are complete.

The application of these measures shall adequately manage water quality impacts from spoil and muck disposal.

7.2.1.3. Rock Cuttings

The post-earthquake revised Project design involves significantly more tunnelling, with the headrace and tailrace tunnels and powerhouse all underground. At this time, no testing has yet been conducted of the future rock cuttings to determine if it may be potentially acid generating (PAG), although based on the geology of the Project area, as characterized by the drill cores collected to date, PAG rock is not anticipated. A Rock Cuttings Management Plan is included in the Construction Environmental and Social Management and Monitoring Plan, which will be prepared by the EPC contractor to manage the risk of acid rock drainage. This Management Plan will be used to evaluate the geologic formation through which the tunnelling will occur for the potential presence of sulphide and other PAG rock, pro-active testing of the rock to confirm the lack of PAG minerals, and will have a plan in place to manage any PAG rock that may be encountered.

7.2.1.4. Solid and Hazardous Material Use and Waste Disposal

The Project will use a variety of hazardous materials, including petroleum, oils, and lubricants, paints, cleaning materials, and explosives, and generate a variety of hazardous wastes. The improper handling, storage, or disposal of these materials could degrade water quality. Construction activities at the Project site will also generate both solid and hazardous wastes from both construction (e.g. debris, waste cement, packing materials, iron bars, waste oil) and domestic (e.g. food wastes) sources.

The EPC contractor will be responsible for preparing and implementing a Spill Prevention and Response Management Plan, a Waste Management Plan, and a Water Quality Management Plan. The overall CESMMP (Appendix B.2, Construction Environmental and Social Management and Monitoring Plan Framework) identifies measures to properly handle and store (including requirements for impervious flooring and secondary containment) these materials; and reuse,

recycle, and/or properly dispose of the generated wastes that will be included in these Management Plans. These measures include:

- Implementing a Spill Prevention and Response Plan;
- Appropriate storage, transport and use practices to recognized standards for fuels, chemicals, explosives, hazardous substances;
- Explosives, chemicals, and hazardous substances to be handled by authorized personnel;
- Diesel to be stored in truck tankers or in overhead tanks to a maximum of 5000 litres and on flat ground at least 50 metres (m) from a waterway;
- Dikes to capture 100 percent of fuel must be placed around fuel storage areas;
- All refuelling to be done on flat ground;
- Spill kits and emergency procedures shall be used and staff trained; and
- No deliberate discharge of oil, diesel, petrol or other hazardous materials to the surrounding soils and waterways.

At this time, NWEDC does not propose an on-site landfill; rather they will conduct an assessment of available and government approved waste management facilities. If it is determined that an on-site landfill is needed, NWEDC will go through the appropriate Management of Change process as described in the Construction Environmental and Social Management and Monitoring Plan (CESMMP, Appendix B) and obtain any necessary Nepal government approvals.

The application of these measures shall adequately manage water quality impacts associated with solid and hazardous materials and wastes.

7.2.1.5. Wastewater Discharges

Project construction will require a workforce of approximately 1,100 workers, while Project operations will require about 72 workers. These workers, and other activities at the worker camp (e.g. cafeteria), will generate black and grey wastewater. Other liquid wastes from the Project will include runoff from work areas (e.g. batch plant drainage typically has high pH) and tunnel drilling process water (e.g. water used to cool the drill bit and intercepted groundwater are typically very high in suspended sediments). If not properly treated, these wastewater streams could adversely impact the water quality of the Trishuli River.

The EPC contractor will be responsible for preparing and implementing a Wastewater Management Plan and a Water Quality Management Plan. The overall Construction CESMMP (Appendix B.2, Construction Environmental and Social Management and Monitoring Plan Framework) identifies measures to properly manage these wastewater streams that will be included in these Management Plans. These measures include the following:

- Domestic wastewater—provide an on-site package wastewater treatment plant or community septic system at each construction worker camp and for the operational work force;

- Stormwater runoff—use oil/water separators, provide engineered settling ponds to collect stormwater runoff from work areas (e.g. repair and maintenance areas, crusher and batch plants, quarries), monitor the water quality of the settling ponds, and treat the water if monitoring indicates the water does not meet standards; and
- Tunnel process water—collect, monitor, and treat, if necessary, tunnel process water.

Water discharged from these various wastewater streams should comply with the applicable standards in the World Bank Environmental, Health and Safety General Guidelines (2007). The application of these measures shall adequately manage water quality impacts associated with Project wastewater discharges.

During Project operations, the Operations Center wastewater treatment facility will discharge near the tailrace, so as not affect water quality in the reduced flow diversion reach.

Baseline water quality monitoring (see Section 6.2) found elevated fecal coliform concentrations in the Trishuli River, which was attributed to poor sanitation practices by local communities (e.g., open defecation). Although most of the diversion reach is in a canyon, with only a few small villages (e.g., Haku Besi) located high above the river, there is the potential for some domestic wastes to be washed into the river. NWEDC will provide an Environmental Flow (Eflow) to the diversion reach (see Section 7.2.3.2 below), primarily to maintain aquatic habitat, but which should provide flow to help dilute these domestic wastes. NWEDC will provide appropriate toilet facilities at each construction work site, include prohibition of open defecation by construction workers as part of the Worker Induction Training and Code of Conduct.

7.2.1.6. Elevated Water Temperatures

The Project will cause a slight increase in water temperatures in the reservoir, but since the Project will operate in a run-of-river mode and the residence time of the reservoir is quite short, the impact will be negligible.

The Project will cause increased temperatures in the diversion reach due to reduced flow, especially in the dry season, although the increase is predicted to be less than 1 degree Celsius (°C), so thermal impacts on fish and other aquatic biota is expected to be minor. This effect will diminish rapidly downstream of the powerhouse as slightly warmer water from the diversion reach mixes with discharges from the powerhouse. During the monsoon season there is predicted to be sufficient flow to prevent an increase in temperature in the diversion reach.

7.2.2. Sediment Transport

The Trishuli River is glacier/snow fed, resulting in a cold turbid water conditions, especially during the monsoon season (see Section 6.2). Hydropower projects can cause sediments to accumulate upstream of the dam, which deprives the diversion reach and tailrace of sediment. This can sometimes result in channel erosion downstream of a dam as the river attempts to re-establish its natural equilibrium.

In order to manage this risk, NWEDC will develop a Sediment Management Plan, which will provide details on the procedures and timing for flushing sediments from the desander and the reservoir to maintain the aquatic integrity of the Trishuli River.

Effective sediment management is especially critical for the diversion reach as it will experience both a reduction in flow (i.e., a reduction in sediment transport capacity) as well as receive the sediment flushed from the reservoir and the desander. The desander will be periodically flushed on an as needed basis several times a year. The Sediment Management Plan will specifically limit flushing of the desander to periods when spillage is occurring to supplement the sediment transport capacity of the Eflow. Based on the particle size of the sediment in the desander, the O&M Contractor will calculate the flow in the diversion reach required to transport the sediment through the diversion reach, and desander flushing will only be allowed when flows exceed this critical flow threshold. Sediment in the reservoir will be flushed by opening the gates. Reservoir flushing will only occur during the monsoon season when sediment loads are the highest, but also when flows should be sufficient to transport most of the accumulated reservoir sediment through the diversion reach.

Channel erosion is not expected in the diversion reach (because of the significant reduction in flow in this reach) or downstream of the powerhouse, where it will only be approximately 1 kilometre until the UT-3A Hydroelectric Project (HEP) reservoir headwaters. Erosion potential downstream of the UT-3A HEP will be primarily influenced by how that project manages sediment.

The overall effect of the Project on sediment transport is likely to be an exaggeration of the natural fluctuations in sediment movement and turbidity between the monsoon and dry seasons, characterized by longer periods between large sediment transport events and larger volumes of sediment being transported during those events than would occur without the Project.

7.2.3. Aquatic Habitat and Fisheries

The Project will impact aquatic habitat and fish differently upstream of the dam, in the diversion reach, and downstream of the powerhouse. This section summarizes the types of impacts that will occur in each of these river segments, as well as a discussion of Project impacts on each species of native fish found in the river, and how these impacts will be managed.

A preliminary DRIFT Model (2016) was used to evaluate the adequacy of the proposed Eflows to maintain aquatic habitat in the diversion reach and to maintain adequate water depths for fish migration through the diversion reach. Common snowtrout (*S. richardsonii)* was selected as the key indicator species for the Eflow assessment based on a combination of its dominance in the Project area, year-round presence, life history, anatomical factors, and sensitivity to habitat fragmentation. Due to similar habitat requirements, the Common snowtrout was presumed to be representative of other fish species including the Dinnawah snowtrout (see Section 6.2). The model also assumed that the Common snowtrout is a year round resident of the diversion reach

based on the field surveys.[1] This preliminary DRIFT model extrapolated data on snowtrout from similar Himalayan rivers in Pakistan and lacked good river hydraulics data. To strengthen the preliminary EFlows assessment, NWEDC is currently conducting a River Connectivity Assessment during the 2018 pre-monsoon season by collecting additional fish and invertebrate sampling, surveying the cross-section of the diversion reach, and using these data to develop a hydraulic model of the diversion reach to complement the DRIFT model. This analysis will enable a more robust assessment of the adequacy of the proposed Eflow releases to support Common snowtrout's upstream migration.

7.2.3.1. Upstream of the Dam

The Project should have negligible impacts on aquatic habitat upstream of the reservoir. No in-water construction will occur upstream of the dam that would modify riverine habitat, with the exception of the temporary coffer dam using to divert water around dam construction. The Project reservoir will only be 2.1 ha in surface area, which effectively limits the impacts on upstream aquatic habitat. Common snowtrout, which is by far the most abundant fish found upstream of the dam site (see Section 6.2), is known to inhabit lakes (Petr and Swar 2002; Petr 1999), and would be expected to colonize the small UT-1 reservoir, especially during the winter if the water temperatures of the reservoir are slightly higher than current ambient conditions.

The UT-1 dam has the potential to interfere with the ability of fish to move upstream or downstream past the dam, which could affect the abundance of Common (and possibly Dinnawah) snowtrout and its ability to reach upstream spawning grounds. NWEDC, however, proposes to construct a fish ladder at the UT-1 dam, which would allow Common snowtrout and potentially other species to move upstream past the dam. The magnitude of Project effects on Common snowtrout populations upstream of the dam will be largely dependent on the effectiveness of the proposed fish ladder in facilitating the movement of these fish from their over-wintering areas downstream of the dam to their breeding areas upstream of the dam. Fish passage upstream and downstream around the UT-1 dam, and the details of the proposed fish ladder, are described in more detail in Section 7.2.4.

7.2.3.2. Diversion Reach

The Project will divert up to 76 cubic metres per second (m^3/s) of flow from the 10.7-kilometre segment of the Trishuli River between the dam and the powerhouse (i.e. the diversion reach). This flow diversion will reduce the width, depth, velocity, and sediment transport characteristics of water in the diversion reach, thereby potentially impacting aquatic habitat and fish. During nearly six months of the year (November through April), this diversion would represent much of the Trishuli River flow.

[1] The temperature of the Trishuli River in the diversion reach during the winter approaches the tolerance threshold for the Common snowtrout, and it was initially thought that the fish would only be a seasonal resident of the diversion reach, moving downstream during the winter in search of warmer waters. However, the baseline studies found the Common snowtrout in the diversion reach during the winter, so we are assuming it is a year round resident of the diversion reach, but in a low population.

In Nepal, hydropower projects are required to release 10 percent of the minimum monthly average flow or an alternative Eflow recommended in the project's EIA, whichever is higher. The biodiversity purpose of the Eflow is two-fold: to preserve the minimum habitat required to support fish and other aquatic life in the diversion reach and to preserve flow continuity for fish movement/migration through the Project Area. As Table 7.2-1 shows, 10 percent of the minimum monthly average flow for the UT-1 Project would equate to a required minimum flow of approximately 3.9 m^3/s (i.e. 10 percent of 38.6 m^3/s, which is the average flow during the river's lowest flow months of February and March at the Project site).

NWEDC has proposed an Eflow that is higher than that required by Nepalese regulations during most months of the year, essentially providing 10 percent of the average monthly flow for each month, rather than 10 percent of the minimum monthly average flow. Actual flow in the diversion reach would typically be higher than this Eflow from May to October (e.g. the spring snowmelt and monsoon period) as river flow would exceed the hydraulic capacity of the Project and excess water would be spilled into the diversion reach. Table 7.2-1 below shows the existing, required minimum, proposed minimum, and the proposed actual diversion-reach flow regimes by month.

Table 7.2-1: Flows into the Diversion Reach Based on Mean Monthly Flows under Regulated and Unregulated Conditions

Flow Management Scenarios	Mean Monthly Flow (m^3/s) at the Intake Site											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing average river flow regime	43.7	38.6	38.6	49.5	87.5	230.4	487	557.8	370.8	160.4	79.9	54.6
Required (Nepal law) minimum diversion reach flow regime	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Proposed minimum diversion reach Eflow regime	4.4	3.9	3.9	5.0	8.8	23.0	48.7	55.8	37.1	16.0	8.0	5.5
Proposed actual average diversion reach flow regime[a]	4.4	3.9	3.9	5.0	11.5	154.4	411.0	481.8	294.8	84.4	8.0	5.5
% of mean monthly flow	10%	10%	10%	10%	13%	67%	84%	86%	80%	53%	10%	10%

Source: Modified from ESSA 2014

[a] Includes flows above the hydraulic capacity of the powerhouse (76 m^3/s) that would be spilled.

NWEDC proposes to release the Eflow as follows (SWECO 2018):

- Fish ladder – 1 m^3/s through the fish ladder
- Fish ladder attraction flow - 1 m^3/s from the top of the concrete roof that is covering the first two chambers of the fish ladder

- Flap gates - remainder of Eflow will be released through the flap gates into the pool at the entrance of the fish ladder

If the fish ladder is not operating (e.g., during periods when the snowtrout is not migrating), all the Eflow can be released from the flap gates.

Project Effects on Aquatic Habitat and Common Snowtrout in the Diversion Reach

The 2016 DRIFT Model evaluated the effects of five alternative flow scenarios for the diversion reach on aquatic habitat and on the Common snowtrout. The results indicate that the Project would have significant adverse effects on Common snowtrout in the diversion reach for all five flow scenarios. The overall ecosystem integrity scores for this reach would be reduced from a "B" rating (i.e. Slightly Modified condition) to a "D" rating (i.e. Largely Modified condition), which is primarily attributable to impacts of the low water flow on overwintering Common snowtrout populations in the diversion reach. The study concludes that the Common snowtrout may vacate the diversion reach during the winter primarily because of the low flows (assumed to be 3.9 m^3/s) provided by the Project. The preliminary DRIFT model results indicate that the release of more water by the Project during the winter would be needed to sustain a year round Common snowtrout population in the diversion reach (see Appendix E – Scenario-Based Evaluation of Flow Impacts on *S. richardsonii* in the Trishuli River).

While the 2016 DRIFT model understandably predicts negative impacts on the Common snowtrout and its habitat in the diversion reach, evaluation of the baseline fish data provide additional insight into the relative magnitude and likelihood of the impacts. The fish survey data indicate that the population of Common snowtrout overwintering (October through February) in the diversion reach is small, with the total number of Common snowtrout captured at three diversion reach monitoring stations representing only approximately 17 percent of the number of Common snowtrout captured at a single station downstream of powerhouse monitoring station (see Section 6.2). Thus the lower flow during the winter months will impact only a small percentage of the Common snowtrout population in the area. In addition, the lower flow and warmer temperatures of the diversion reach may create better conditions for the snowtrout, including pools and spawning sites, which could lead to an increased population of snowtrout within the diversion reach. The 2018 connectivity assessment will analyse this potential impact further. The project's Biodiversity Evaluation and Monitoring Program (BEMP) will closely monitor the conditions and fish population within the diversion reach and recommend adaptive management as needed to maintain fish habitat and population. Project Effects on Fish Migration through the Diversion Reach

Increasing flow and water temperatures are likely the cues for both snowtrout species to begin migrating upstream to spawn in early spring. The Project will have negligible effect on these cues downstream of the Project because of the true run-of-river operating mode (flow) and small reservoir/short detention time (temperature).

Section 6.2 summarizes the migration pattern of the Common snowtrout, which includes upstream migration of adults primarily in March-May and downstream migration of juvenile fish primarily in August-October. UT-1 will provide a fish ladder for upstream migration, and

mechanisms for downstream migration (see below). However, the Eflow must provide appropriate water depths and velocities for the Common snowtrout to be able to reach the fish ladder and the upstream spawning areas. The literature reports a range of minimum depths for the species. The preliminary DRIFT Eflows assessment for the Project reported a preferred depth for adults of 1 to 3 m (S.A.N. Engineering Solutions 2017) based on one study from the 1970s (Shrestha and Khanna 1976), but more recent studies indicate a minimum depth of 0.8 m for spawning adult Common snowtrout (Mathur and Kapoor 2015).

Table 7.2-2 compares the estimated flows, based on hydraulic calculations, required to provide average depth of 0.8 m through the diversion reach, assuming a trapezoidal channel and the average Trishuli River gradient through the diversion reach.

Table 7.2-2: Comparison of Minimum Flows Required to Achieve Critical Depths for Common Snowtrout (S. richardsonii) in the Diversion Reach

Depth (m)	Manning Coefficient (n)	Gradient (m/m)	Flow (m^3s)
0.8	0.04-0.08	0.03	3.45-6.90

The Project's proposed Eflow for the winter months (3.9 to 11.5 m^3/s, see Table 7.2-1 above) provides sufficient depth in the diversion reach for the minimum 0.8 m critical depth. With adaptive management implemented as needed, the proposed Eflow during March and April shall be adequate for the Common snowtrout, and other fish species to pass through the diversion reach. Obviously, the depth requirements will vary for different sizes of fish, with smaller fish likely to pass more easily through the diversion reach. Although the results of the 2018 Connectivity Assessment are not yet available, it should be noted that the spring 2018 field sampling in the Project area found evidence of successful Common snowtrout spawning in several tributaries of the Trishuli River (including the Mailung Khola) where water depths were much less than 0.8 m.

There are some uncertainties in this analysis, including the few studies establishing the 0.8 m critical flow depth required to support the upstream migration of Common snowtrout and estimates of the flow required to achieve this critical flow depth. Discussions with NWEDC indicate constraints on their ability to increase Eflows, especially during the critical early migration months, if monitoring indicates water depths are insufficient to allow the Common snowtrout to reach the fish ladder. These constraints include the terms of their Power Purchase Agreement and the economic impact of increasing Eflows, which means decreasing flows available for power generation during the peak demand months.

Adaptive Management Program

NWEDC has agreed to implement an Adaptive Management Program as part of the Biodiversity Management Plan (BMP) based on intensive monitoring through a Biodiversity Evaluation and Monitoring Program (BEMP) during the 5 years of construction and the Project's first few years of operation to ensure that upstream migrating Common snowtrout are able to reach the UT-1 fish ladder.

The Adaptive Management Program includes the following elements:

- Implement an intensive fish monitoring program during construction and the first few years of operation to ensure most upstream migrating Common snowtrout are able to reach the Project's fish ladder, especially during the early portion of the migration period (i.e. March and April) when the proposed Eflows are relatively low.
- If monitoring indicates that a meaningful percentage of Common snowtrout are not able to reach the fish ladder (i.e. sufficient to achieve the "no net loss" standard in IFC PS 6), then NWEDC will evaluate alternatives to effectively increase water depths and guide the fish to the fish ladder; including, in the following sequential order of action:
  - Constructing channel improvements to direct more flow to a primary channel in order to achieve critical water depths or to remove impediments to movement such as small cascades;
  - Increasing the required Eflow during the periods of upstream fish migration to achieve critical water depths. As indicated above, NWEDC is limited in its ability to modify these Eflows given the constraints of its Power Purchase Agreement, but it would be worth investigating the potential to reduce Eflows during the pre-migration winter (i.e., peak demand) months of December to February, and increase them proportionally during March and April so, as to better support fish migration while having no net change in power generation during the peak demand season;
  - Initiating a trap and haul program to capture upstream migrating Common snowtrout, transport by vehicle, and release them upstream of the dam;
  - Establishing a hatchery for Common snowtrout, possibly in combination with other hydropower developers in the area, and release sufficient numbers of hatchery-bred fish upstream of the dam to maintain fish populations in the Project area.
  - Management of sediment represents another potential risk to fish migration through the diversion reach. Although periodic sediment flushing from the desander and reservoir is unlikely to directly affect fish spawning, since nearly all documented spawning in the Trishuli River has been in the tributaries rather than the river itself, the flushing could result in sediment deposition within the diversion reach and affect channel morphology and critical water depths required for successful migration. As indicated in Section 7.2.2 above, the O&M Contractor will be required to develop a Sediment Management Plan that limits the flushing of the desander and the reservoir to periods when flows are sufficient to transport the sediment through the diversion reach.

Section 7.2.5 describes the process for establishing measurable targets and thresholds for implementing the Adaptive Management Program, which are linked to achieving the requirement for No Net Loss of Biodiversity in Natural Habitat. This Adaptive Management Program is incorporated into the Project's Biodiversity Management Plan (see Appendix B.1, Owner's Environmental and Social Management and Monitoring Plan). Implementation of this Adaptive Management Program provides assurance that Project effects on flow will not prevent Common snowtrout from reaching spawning grounds upstream of the UT-1 dam.

7.2.3.3. In addition to these measures, NWEDC's 2018 Connectivity Assessment, which will include an enhanced hydraulic analysis and DRIFT modelling of the diversion reach, will help evaluate Common snowtrout's upstream migration flow requirements. Downstream of the Powerhouse

Impacts on aquatic habitat and fish downstream of the powerhouse will be relatively minor for the following reasons:

- Flow—The Project will operate in a true run-of-river regime and should have no effect on flow downstream of the UT-1 powerhouse;
- Sediment—The Project is designed to periodically flush sediments using a desander and the dam gates. The timing of this flushing will be generally consistent with periods of natural high sediment transport (i.e., during the monsoon season and other times of high flows, see Sections 2.3.4, Sediment Management, and 7.2.2, Sediment Transport), although the flushing will be more episodic than under natural conditions;
- Physical Water Quality—The Project has a very small impoundment (2.1 ha) with negligible water retention, so the Project is not predicted to have any effect on physical water quality (e.g. water temperature, dissolved oxygen) that could affect downstream fishery habitat; and
- Chemical Water Quality—The Project will provide wastewater treatment for both its construction and operation workforce and other construction waste streams, ensure proper handling and storage of all hazardous materials, implement an emergency preparedness and response plan in the event of any spills of hazardous materials, manage slope stability and sediment control, and stabilize and landscape disturbed areas (see Appendix B, Project Environmental and Social Management and Monitoring Plan Framework).

The existing baseline ecological status of the Trishuli River downstream of the powerhouse is considered "Slightly Modified" (S.A.N. Engineering Solutions 2017). The DRIFT Model results confirm that the Project would have little effect on the overall ecological integrity of the Trishuli River downstream of the powerhouse, with the predicted ecological integrity remaining as "Slightly Modified," with only a slight impact on Common snowtrout populations related to the assumed effect the dam will have on upstream spawning and the return downstream of breeding adults and juveniles (see Section 7.2.4. for more details).

Overall, Project design measures and Management Plans will be adequate to ensure that the Project will not adversely impact fishery habitat downstream of the Project powerhouse.

7.2.4. Upstream and Downstream Fish Passage

The fish monitoring data clearly show adult Common snowtrout migrating upstream in the early spring and a larger downstream migration of predominantly small fish from May through September and increasing numbers of small fish downstream of the powerhouse from July through September (NESS 2016).

Fish Passage during Construction

NWEDC will maintain river connectivity during Project construction and reservoir filling. During construction, the NWEDC will maintain flow through two diversion tunnels (see Figure 2-2), which will support fish migration, or provide alternative temporary passage facility, as documented through monitoring. At the time of Project commissioning, the diversion tunnels will be closed and the reservoir filled. The EPC Contractor will prepare a Project Commissioning and Construction Close Out Management Plan (see Appendix B.2, Construction Environmental and Social Management and Monitoring Plan Framework). The Project reservoir is small, with a storage volume of only 198,437 cubic metres at its full pool elevation of 1255.0 m. Even during the low flow months of February and March with mean monthly flows of 38.6 m^3/s, it would take less than a day to fill the reservoir. So actual filling of the reservoir does not pose much risk to river connectivity, but more important will be ensuring the fish ladder can be operational shortly after reservoir filling. To the extent possible, Project commissioning will avoid the peak of the upstream fish migration period (i.e., March and April).

Upstream Fish Passage during Operations

NWEDC has committed to providing fish passage at the UT-1 dam, and contracted with SWECO, a Norwegian company with extensive fishery experience in Nepal, to develop a conceptual design for fish passage at the UT-1 dam. SWECO considered several options, including:

- A "natural" fishway (i.e. an artificial stream channel construction adjacent to the dam to mimic natural conditions in an unregulated river);
- A conventional fish "ladder" (i.e. an engineered series of stepped pools within an artificial sluice); and
- A "trap and haul" program, which unlike the other two options does not rely on fish moving though the passage facility of their own volition, but instead is based on capturing the fish and physically relocating them to the other side of the dam. This option is the simplest to implement, but will require a large and continuing investment in labour to operate (SWECO 2016). This method also interferes with the fish's natural migration and can result in fish injury or mortality during their capture and transport.

SWECO determined that available space at the UT-1 dam site was not sufficient to allow for construction of a natural fishway, and considers the trap and haul approach as a last resort, so has recommended a fish ladder approach to providing fish passage.

The fish ladder was designed to meet the size (e.g. required water depths) and swimming ability (e.g. water velocity, height of steps, spacing of resting areas) of the Common snowtrout, which is the dominant species found in the Project area and has an IUCN status of Vulnerable (SWECO 2018a). The fish ladder as designed, however, shall also be able to accommodate the very similar Dinnawah snowtrout (*S. progastus*), which is the only other migratory species found in the Project area (SWECO 2018b), as the hydraulic design was based on the swimming performance of the *Schizothorax* genus (SWECO 2017).

Based on the *Schizothorax's* size and swimming ability, SWECO proposed a fish ladder design with the following features (see Figure 7.2-1):

- Fish ladder flow of 1 m^3/s;
- An additional attraction flow of 1 m^3/s from a pipe discharging at the top of the concrete roof that covers the first two chambers of the fish ladder (see Figure 7.2-2);
- The remainder of the Eflow will be routed into the entrance pool at the base of the ladder;
- Entrance pool at the base of the ladder equipped with hiding places for fish and water velocities of less than 0.6 metre per second (m/s);
- Approximately 100 steps with an approximate height of 0.3 metre, based on a dam height of approximately 30 metres;
- Water velocity through the vertical slots connecting the various steps with a maximum velocity of 0.7 m/s (slightly higher velocities are allowed in the lowest nine steps;
- Exit from the fish ladder at the top of the weir will be located as far as possible from the powerhouse intake where water velocities are less than 0.3 m/s to minimize the risk of the upstream migrating fish being entrained into the turbines.

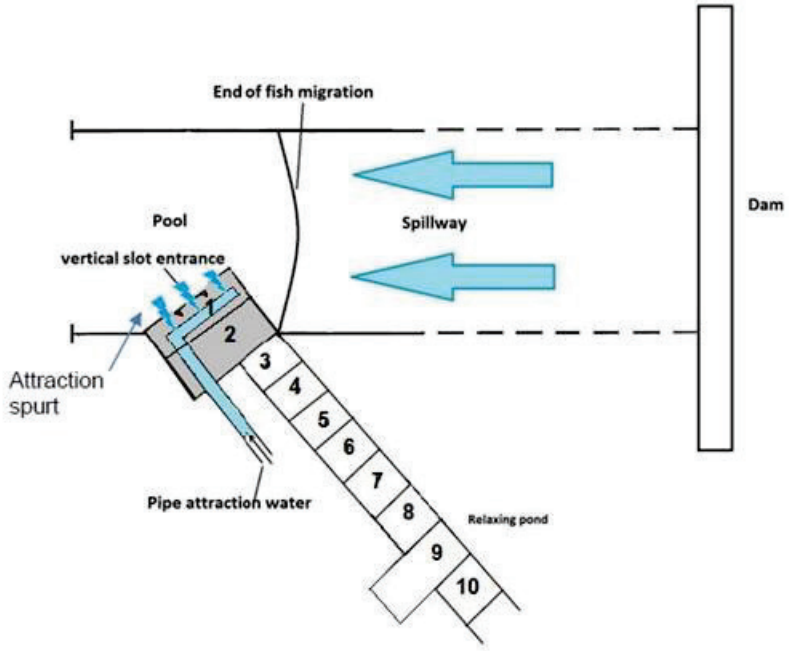


Figure 7.2-1: Fish Ladder Design

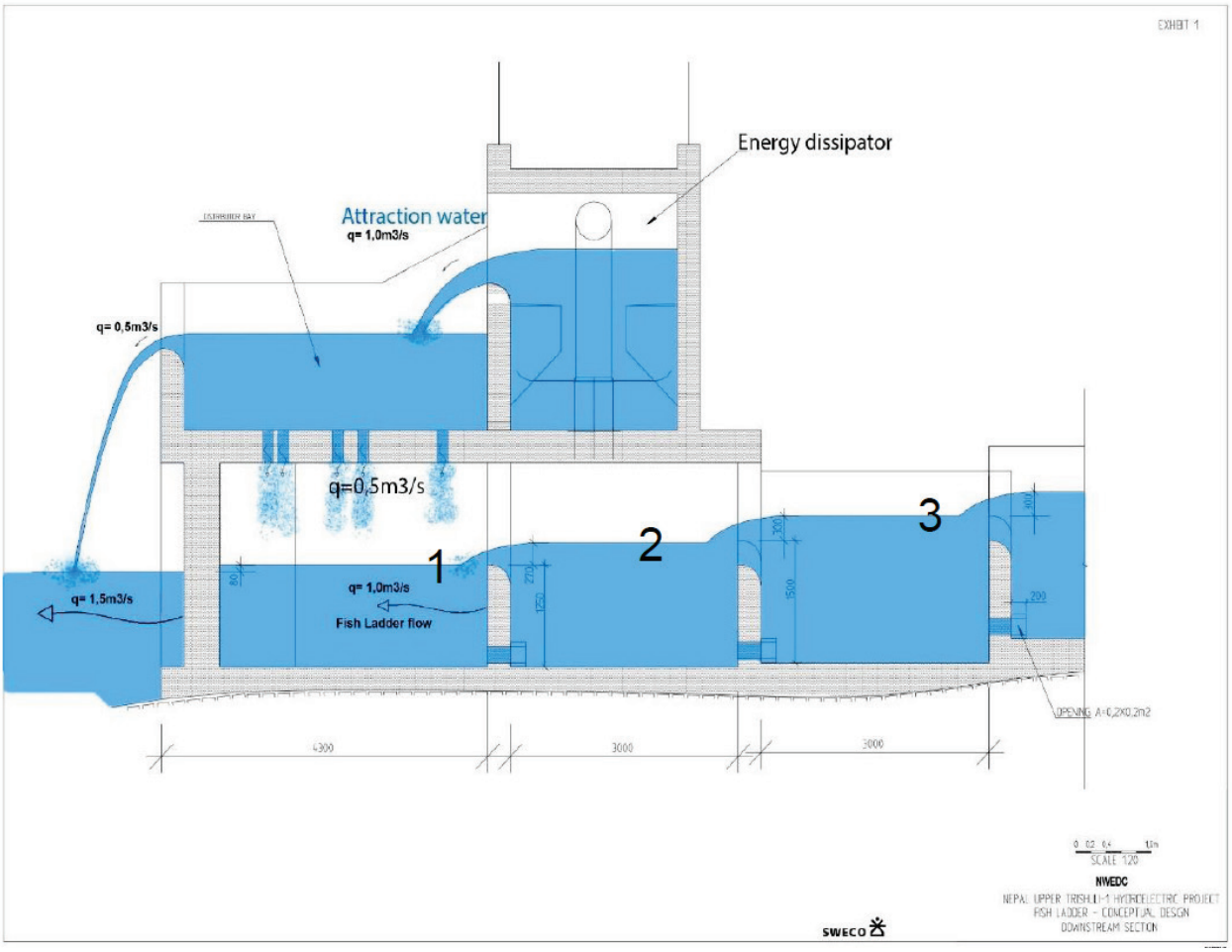


Figure 7.2-2: Fish Attraction Flow Visualization

Following recommendations from SWECO, NWEDC has agreed to:

- Ensure conditions at the powerhouse tailrace are such that the upstream migrating fish are attracted to the flow from the diversion reach and are not diverted to the powerhouse tailwaters;
- Ensure the channel in the river section just downstream of the dam leads the fish to the fish ladder entrance.
- Monitor flow and temperature (preferably on an hourly basis) to have the data needed to optimize fish ladder functionality; and
- Monitor fish movement to detect the beginning of the upstream migration period and ensure proper functioning of the fish ladder entrance.

Downstream Fish Passage during Operations

Facilitating the safe upstream passage of migrating Common snowtrout above the dam is important, but ensuring the safe downstream passage of migrating fish is equally important. Most adult and juvenile Common (and possibly Dinnawah) snowtrout will migrate downstream in late

summer and autumn as river temperatures gradually decline. In order to avoid fish being entrained into the powerhouse turbines, which, given the pressures associated with 327 m of head, would result in high levels of injury or mortality given the pressures associated with 327 m of head, NWEDC proposes to:

- Monitor fish movement to detect the beginning of the downstream migration period and ensure fish are guided away from the powerhouse intake.
- Provide a guidance mechanism to help direct adult and juvenile fish away from the powerhouse intake;
- Ensure a smooth spillway and a deep pool at the base of the dam to minimize injury to fish migrating through the flap gates with spillage water; and
- Preferably spill water via the spillway at the left side of the weir.

The fish ladder design has been peer reviewed by fish experts with the IFC (see Appendix D for the IFC fish expert's review). SWECO has provided advice and coordinated with the Project engineers on the fish ladder (SWECO 2018; see Appendix D.2, Design Advice on Fish Ladder and Associated Spillway Designs at the UT-1 Hydropower Project) to ensure its design is technically feasible and economically viable. This fish ladder design has now been incorporated into the overall dam design drawings.

Monitoring

As indicated by SWECO, additional monitoring is required to ensure the proper operation of the upstream and downstream fishways. NWEDC has committed to contracting an international fish scientist with expertise in Nepal fish to oversee the following actions:

- During Project construction:
  - Develop a fish monitoring plan, as part of an overall Biodiversity Evaluation and Monitoring Program (BEMP), which would begin to be implemented prior to the initiation of construction to provide a solid baseline against which to measure Project effects on fish populations, especially the Common snowtrout, and to help better understand the timing of Common snowtrout upstream and downstream migration, the extent to which Common snowtrout spawns in the Trishuli River mainstem versus tributaries in the Project area, and the relative population of Common snowtrout in the diversion reach;
  - Monitor the effectiveness of the Project's diversion tunnels in allowing upstream and downstream migration of fish;
  - Monitor construction of the fish ladder and dam to ensure it is consistent with the SWECO design; and
  - Develop a more detailed design for the fish guidance mechanism around the powerhouse intake.
- During Project commissioning and reservoir filling

- Ensure the fish ladder is ready to be operational before reservoir filling begins; and
- Oversee commissioning of the fish ladder.

- During the initiation of Project operations:
  - Inspect the diversion reach to ensure no barriers or obstacles exist to upstream migration under Eflow only conditions, and if any are identified, recommend and implement measures to mitigate them;
  - Ensure the channel in the diversion segment just below the dam leads the fish to the fish ladder entrance;
  - Establish a flow and temperature monitoring program to optimize fish ladder performance;
  - Develop a Biodiversity Evaluation and Monitoring Program and train NWEDC staff to monitor and report on the effectiveness of the fish ladder for upstream fish passage and the effectiveness of downstream fish passage guidance measures;
  - Establish a program and train NWEDC staff to monitor and report on the populations of Common (and possibly Dinnawah) snowtrout upstream of the dam, in the diversion reach, and downstream of the powerhouse relative to baseline conditions using tagging methods; and
  - Evaluate the effectiveness of the current Eflow program and determine whether further actions are warranted in accordance with the Eflow Adaptive Management Program, which is described in the Biodiversity Management Plan that is part of the Project Environmental and Social Management and Monitoring Plan Framework (see Appendix B).

This monitoring program will involve national fish experts in order to build capacity and involve participatory monitoring by local community residents. The monitoring results will be reported and disclosed on the Project website.

The BEMP will be designed to demonstrate that viable populations of native fish species are maintained and that no net loss of biodiversity is achieved in the Project area, as indicated by the following key metrics:

- Successful upstream migration of Common (and possibly Dinnawah) snowtrout to, and through, the fish ladder as documented by actual counts in the fish ladder;
- Successful natural reproduction of Common (and possibly Dinnawah) snowtrout upstream of the dam as documented by presence of juveniles;
- Successful downstream migration of Common (and possibly Dinnawah) snowtrout over or around the dam as documented by the presence of juveniles in the diversion reach (note that Common snowtrout is not believed to spawn in the diversion reach so the presence of juveniles in this reach should likely reflect their successful downstream migration); and

- Maintenance of viable populations of catfish and loach species as documented by maintaining catches similar to those found during the baseline fish surveys.

Cumulative Impacts of HPPS on the Trishuli River

There are several other hydropower projects under construction and proposed both upstream and downstream of the Project area. There is the potential that decreases in the numbers of migrating Common snowtrout passing through the UT-1 Project area, and the populations of Common snowtrout found in the Project area could occur, and not be attributable to the UT-1 Project, as has likely recently occurred with the Dinnawah snowtrout population in the Project area as a result of the UT-3A HEP (see Section 6.2). NWEDC is participating in a Trishuli River Basin Cumulative Impact Assessment funded by IFC, and has committed to participate in a Trishuli Basin Co-Management Platform to facilitate collaborate monitoring and management of cumulative impacts (see Section 7.12 for more details on Cumulative Impacts).

7.2.5. Summary of Project Effects on Key Fish Species

This section describes the effects of the Project on each of the key fish species documented in the Project area. Overall, the Project is not expected to substantially reduce the ability of the aquatic habitat in the Trishuli River to maintain viable populations of all seven species of native fish throughout the Project area as a result of mitigation measures focused on:

- Minimizing the conversion or loss of aquatic habitat;
- Ensuring fish access to habitats where the fish can reproduce, grow, and feed;
- Preventing excessive mortality as a result of entrainment through the turbines;
- Managing worker behaviour during both construction and operation phases.

Common and Dinnawah Snowtrout

The Common snowtrout is the most abundant fish species found in the Project area, and it is found throughout the Project area. The Dinnawah snowtrout have not been found in the Project area since 2011, which is attributed to construction of the downstream UT-3A HEP. The approved UT-3A HEP design does include a fish ladder, which was partially constructed before being damaged during the earthquake. If the UT-3A fish ladder is repaired, it is anticipated that the Dinnawah snowtrout would again migrate upstream through the Project area. As discussed in Section 7.2.4 above, the proposed UT-1 fish ladder, while designed specifically for the Common snowtrout, is expected to also be able to successfully pass the Dinnawah snowtrout if present. Table 7.2-3 summarizes the likely Project impacts on, and proposed mitigation for, the Common and Dinnawah snowtrout:

Table 7.2-3: Project Impacts and Proposed Mitigation on Common snowtrout

Potential Project Impact	Proposed Management and Mitigation Measures

Conversion or loss of aquatic habitat	• Operate in true run-of-river mode with a small Project reservoir • Provide Eflow to maintain limited wetted habitat and maintain primary function of diversion reach (i.e., upstream and downstream migratory transit) • Develop Sediment Management Plan, including timing sediment flushing to correspond with naturally high periods of sediment transport (e.g., monsoons and high flows), to avoid excessive deposition
Upstream migration	• Maintain flow through the diversion tunnel to enable upstream migration during construction or provide an alternative upstream passage facility • Provide Eflow and Adaptive Management Program to assure Common snowtrout can reach the fish ladder during operations • Provide fish ladder
Downstream migration	• Maintain flow through the diversion tunnel to enable downstream migration during construction • Ensure the main river current in the reservoir directs fish toward the spillway rather than the powerhouse intake; • Provide a downstream fish guidance mechanism to help direct adult and juvenile fish away from the powerhouse intake to minimize entrainment through the powerhouse; • Ensure a smooth spillway and a deep pool at the base of the dam to minimize injury to fish migrating through the flap gates with spillage water; and • Preferably spill water via the spillway at the left side of the weir.
Managing worker behaviour	• Establish Worker Code of Conduct that prohibits local fishing, • Provide environmental awareness training during worker induction, • Prohibit serving local fish at the worker cafeteria.

Overall, the Project is not expected to substantially reduce the ability of the aquatic habitat in the Trishuli River to maintain a viable population of Common snowtrout, and the Dinnawah snowtrout if it regains access, throughout the Project area.

Catfish Species

There are three catfish species found in the Project area, all of which are believed to be present upstream of dam, in the diversion reach, and downstream of the powerhouse. None of these

species are migratory, although they may move short distances within the river. Based on the fish baseline surveys, none of these species are abundant within the Project area, although they are relatively common and wide spread throughout the Himalayan region. The Project should have negligible effect on catfish populations above the dam; the proposed Eflow should be sufficient to maintain viable populations within the diversion reach; and the Project should not affect catfish populations below the tailrace. The catfish species are not typically used as a protein source. Overall, the Project is not expected to substantially reduce the habitat's ability to maintain viable populations of all three species of catfish throughout the Project area.

Loach Species

There are two loach species found in the Project area, both of which were only found downstream of the powerhouse in the warmer waters at the mouth of the Mailung Khola. Neither of these species are migratory. Based on the fish baseline surveys, neither of these species are abundant within the Project area, although they are relatively common and wide spread throughout the Himalayan region. The loach species are not used as a protein source. The Project should have negligible effect on loach populations below the tailrace and is not expected to substantially reduce the habitat's ability to maintain viable populations of these two loach species of catfish.

7.2.6. Aquatic Natural Habitat

Pursuant to the IFC Performance Standards, the goal for Natural Habitat is No Net Loss of biodiversity. As indicated above, the Project is predicted to impact aquatic habitat upstream of the dam and along the diversion reach, but not downstream of the powerhouse because the Project will operate in a true run-of-river regime. IFC's Performance Standard 6 requires Projects to avoid "significant" conversion of Natural Habitats unless:

- No other viable alternatives within the region exist for development of the project on modified habitat;
- Consultation has established the views of stakeholders, including Affected Communities, with respect to the extent of conversion and degradation; and
- Any conversion or degradation is mitigated according to the mitigation hierarchy.

The Project has been designed to take advantage of the generation potential offered by the specific set of hydrologic conditions at the Project site, so there are no other viable alternatives for the Project in Modified Habitat as it is currently designed. The Project proponent has also engaged with stakeholders and communities within the Project area as described in Chapter 8, Stakeholder Engagement. The major habitat impacts (e.g. minimal impoundment of riverine habitat, reduced flow, and fragmentation of the river) are inherent in the design of the Project and cannot be avoided without fundamentally altering the design and purpose of the Project.

The next step in the mitigation hierarchy is minimization. The fragmenting effects of the dam and the size of the impoundment (and the consequent loss of riverine habitat) are functions of the size of the dam necessary to generate a sufficient amount of electricity to make the Project

economically viable and cannot be minimized without jeopardizing the Project's economic viability. In this case, the Project reservoir is quite small. The loss of aquatic habitat in the diversion reach will be minimized through the Eflow as described above. As described in Section 7.2.3., the Common snowtrout has been selected as the indicator species for Eflow analysis; based on the available information on its habitat requirements, the Eflow is likely to be sufficient to maintain habitat connectivity through the diversion reach.

Mitigation follows minimization in the mitigation hierarchy. Common snowtrout are expected to persist in the reservoir, and may expand given the amount of new habitat that will be available within the reservoir and the slightly increased ambient temperature of the reservoir, so the loss of Natural Habitat upstream of the dam is negligible. Therefore, the critical issue upstream of the dam is the effectiveness of the fish ladder in passing upstream migrating fish.

Project impacts on the diversion reach relate to a net reduction in flow that will decrease available habitat for the Common snowtrout and other species. As discussed above, even under existing conditions, sampling data suggest the diversion reach only supports a small year-round population of Common snowtrout. Therefore, the impact of the Project on the value of aquatic habitat for resident fish in the diversion reach is likely small. The critical value of the diversion reach is as a migratory corridor to enable upstream migrating Common snowtrout to access the fish ladder. This aspect will be clarified further once the connectivity study is finalized. In any case, the implementation of the robust Eflow Adaptive Management Program as a key component of the Biodiversity Management Plan (Appendix B), if needed, shall be sufficient to assure the effective upstream passage of the Common snowtrout.

NWEDC will conduct further studies as part of the Biodiversity Evaluation and Monitoring Program (BEMP) on the timing of Common snowtrout upstream and downstream migration, the flow depth required to allow upstream migration, and their preferred spawning location (e.g., along the mainstem of the river or in tributaries). NWEDC will share these results with the government and other hydropower developers, along with the design and passage effectiveness of the fish ladder, to help minimize hydropower impacts on aquatic habitat in Nepal and throughout the Himalayan region.

The Project complies with the IFC's No Net Loss standard for Natural Habitat considering the relatively small footprint of the Project, the provision of Eflow and a fish ladder to maintain the ecological integrity and connectivity of the diversion reach, and NWEDC's commitments to:

- Contract with an international fish biologist to help monitor and protect aquatic ecology during Project construction and early operations;
- Develop and conduct a robust Biodiversity Evaluation and Monitoring Program (BEMP) and share any enhanced understanding of Common snowtrout biology with the Government of Nepal and other hydropower developers in the Himalayan region;
- Demonstrate No Net Loss of biodiversity with monitoring metrics;
- Apply an Adaptive Management Program to ensure Common snowtrout are able to successfully reach their spawning grounds upstream of the dam; and

- Implement the Project's Biodiversity Management Plan.

7.2.7. Effects of Climate Change on Trishuli River Streamflow

As discussed in Section 7.1.3, climate change modelling conducted for the Trishuli River Basin (Appendix F) predicts a slight increase in average river flow resulting from increased snow/glacier melt associated with a predicted air temperature increase of less than 3°C. If air temperatures were to increase by more than 3°C, there would be more evapotranspiration and diminished water contributions from receding glaciers, potentially resulting in decreased river flow.

The proposed Eflow regime is fixed as it was based on the ecological needs of the diversion reach, so the Eflow releases will not change because of climate change. If river flow was to increase because of climate change, the Eflow releases would not change, but there could be an increase in spillage at the dam and an associated increase in diversion reach flow during certain months of the year, which could enhance the ecological health of this river segment. If river flow was to decrease because of climate change, the Eflow releases would again not change, but there could be a decrease in spillage at the dam and an associated decrease in diversion reach flow during certain months of the year, which could degrade the ecological health of this river segment. The magnitude of any degradation resulting from climate change is limited by the Eflow release commitment.

If air temperatures increase in the Project area as a result of climate change, water temperatures would be expected to marginally increase as well. Since water temperature appears to be the primary factor affecting fish distribution in the Trishuli River, increases in water temperatures would be expected to result in an upriver extension of suitable habitat for some species, including the Dinnawah snowtrout. At this time, however, the UT-3A Hydroelectric Project (HEP) appears to be preventing the upstream migration of all aquatic species. Assuming that effective fish passage eventually will occur at the UT-3A HEP, it will be important that fish passage at UT-1 Project is also effective.

7.3. IMPACTS ON TERRESTRIAL ECOLOGY

This section evaluates Project effects on terrestrial ecology, including consideration of Natural, and Modified Habitat, and listed species. As indicated in Section 6.2, the Project will not affect any terrestrial Critical Habitat. The Project will directly impact approximately 107.8 hectares (ha) of land as summarized in Table 7.3-1.

Table 7.3-1: Project Effects on Land Cover and International Finance Corporation Habitat Classifications

Land Cover[a]	Area (ha)[a]	Natural Habitat	Modified Habitat	Critical Habitat
Forest	80.9	2.61	78.3	0
Cultivated Land	20.6	0	20.6	0
Cliff	0.8	0	0.8	0
River Banks (bagar)	5.5	0	5.5	0
Total	107.8	2.61	105.2	0

[a] The land cover/area affected by the Project is approximate as the exact location of some Project facilities (e.g. worker camps) are not yet known and some land covers have changed as a result of landslides from the earthquake.

The Project will directly impact biodiversity by the loss of vegetation and habitat and injuring wildlife; and indirectly by increased human activity (i.e. influx of workers, illegal hunting, plant collection, noise, vehicular traffic) and the loss of habitat connectivity. The transmission line will pose electrocution threats to bird species.

As a condition of its environmental authorization, and in compliance with Nepali law, Nepal Water and Energy Development Company Limited (NWEDC) and in compliance with IFC Performance Standard (PS) 6 the Project will:

- Plant trees on a 2:1 basis for each tree it clears using native species on cleared/degraded land and monitor the trees for several years until established; and
- Acquire an area of land to be annexed into the Langtang National Park (LNP) to offset the Project's use of parkland. This is to offset the 2.61 ha of park-owned land acquired for the Project.

7.3.1. Potential Impacts to Natural Habitat

Project construction and operation will directly impact approximately 107.8 ha of land, of which only 2.61 ha is considered Natural Habitat, as defined in the International Finance Corporation's (IFC) Performance Standards (PSs). This small area is located on the east bank of the Trishuli River near the proposed dam/headworks and is part of LNP.

In Natural Habitat, the IFC PS6 requires that the project sponsor not significantly convert or degrade Natural Habitats unless all of the following are demonstrated:

- No other viable alternatives within the region exist for development of the project on Modified Habitat;
- Consultation has established the views of stakeholders, including affected communities, with respect to the extent of conversion and degradation; and

- Any conversion or degradation is mitigated according to the mitigation hierarchy.

The ADB Safeguard Policy Statement requires that the project not significantly convert or degrade Natural Habitat, unless the following conditions are met:

- No alternatives are available.
- A comprehensive analysis demonstrates that the overall benefits from the project will substantially outweigh the project costs, including environmental costs.
- Any conversion or degradation is appropriately mitigated.
- The 2.61 ha of natural habitat will be converted for Project needs. However: The small impact to Natural Habitat associated with the Project cannot be avoided or further minimized because of engineering constraints.
- The project is a significant national priority given the energy shortage in Nepal. This has been discussed in depth in the EIA (NESS 2012). Furthermore there is an analysis of the socio-economic benefits of the project in Section 5.2
- In accordance with IFC PS, NWEDC is required to mitigate this residual impact to achieve no net loss. NWEDC will achieve no net loss by working with the District Forest Office and LNP to identify a suitable area of cleared/degraded land and reforest it using a 1:2 ratio (see details below). Species used will maintain parity with the impacted area.

7.3.2. Potential Impacts to Modified Habitat

The Project will impact approximately 105.2 ha of Modified Habitat, as defined by the IFC PSs. Modified terrestrial habitats on the west bank of the Trishuli River, where most of the Project components will be built, consist mostly of forest under management by local communities (78.6 ha) and agricultural or marginal lands. The forests are highly intervened and degraded by human activity (e.g. extraction of forests products, cattle grazing.

7.3.3. Potential Impacts on Listed Species

As indicated in Section 6.2, the Project area supports approximately 25 mammal species, 79 bird species, and 22 herpetofauna species. A few species are classified as Endangered (EN), Vulnerable (VU) or Near Threatened (NT) by the IUCN and the Red list of Nepal's mammals (see Table 7.3-2) triggering mitigation and management measures required by IFC PS6

Table 7.3-2: Mammal Species in the Project Area Classified as VU or NT by IUCN

Common Name	Latin Name	IUCN Status	\Red List of Nepal's Mammals
Assamese monkey	*Macaca assamensis*	NT	EN
Terai grey langur	*Semnopithecus hector*	NT	LC
Asiatic Black Bear	*Ursus thibetanus*	VU	EN
Himalayan Goral	*Nemorhedus goral*	NT	NT
Common leopard	*Panthera pardus*	VU	VU

Source: Jnawali et al. 2011

EN = Endangered; NT = Near Threatened; VU = Vulnerable

The Assamese monkey *(Macaca assamese)* is a species that will be affected by habitat loss within Modified Habitat. However, macaque species are highly adaptable and will either move to new areas (if competition from other neighbouring troops is limited) or adapt within the disturbed area, although with an increased likelihood of conflict with humans.

The Asiatic black bear (*Ursus thibetanus*) classified as endangered in Nepal and is thereby assessed under (IFC 2012) Criteria 1 Tier 2 e and may be found in the Modified Habitats for raiding garbage areas of agricultural lands, which are to be cleared preferring the more forested and remote areas in the LNP.

The common leopard (*Panthera pardus*) (classified as VU both in the IUCN red-list and in Nepal) is uncommon in this area. However, it is a highly adaptable species and avoids areas where habitat disturbance occurs and is unlikely to be impacted by the project footprint.

The Himalayan goral (*Nemorhedus goral*), classified as NT in both the IUCN red-list and in Nepal, is usually confined to scree slopes at higher elevations and rarely descends. It is unlikely to be impacted by the project footprint, though if not controlled, there could be some hunting pressure on the species from workers and staff from the project or increased demand for its meat, resulting in greater hunting pressures from local hunters.

The LNP provides habitat for several threatened species (e.g. at least five species of EN and VU mammals and several species of EN and VU birds) and endemic species (e.g. 21 species of plants). To date, no threatened or endemic reptiles and amphibians have been recorded in the park. The Project will not affect the habitat of any threatened mammals within the LNP as these species are only found in the alpine, sub-alpine, or temperate zones of the Park, whereas the small area of LNP affected by the Project is found in the sub-tropical zone (i.e. elevations between 1000 and 2000 metres).

Based on the checklist of birds in the LNP Management Plan, there are likely to be some threatened raptors and several migratory species, notably the Eurasian griffon, and several species of geese, teals and ducks, which could be found in the Project area, although none were observed during the Project's field studies. See Table 7.3-3 for possible threatened species in the Project area. All these avian species are only likely to fly over the Project area or occasionally rest on the trees within. The geese, teals, and ducks may use the Trishuli River just outside of the LNP. There are a few threatened passage migrants that may fly over the Project area. These include the Pallas's Fish-eagle, (*Haliaeetus leucoryphus*) (IUCN, EN, RLNB, CR), Eurasian curlew (*Numenius arquata*) (IUCN, NT, RLNB, CR) and the Saker falcon (*Falco cherrug)* (IUCN,EN, RLNB, EN).

Table 7.3-3: Threatened Bird Species Likely in the Project Area Classified as per IUCN Red-list Version 2017-3 and Red list for Nepal's Birds

Common Name	Latin Name	IUCN Status	National Red List of Birds of Nepal
Steppe eagle	*Aquila nipalensis*	EN	VU
Greater spotted eagle	*Clanga clanga*	VU	VU
Imperial eagle	*Aquilia heliaca*	VU	VU

Common Name	Latin Name	IUCN Status	National Red List of Birds of Nepal
Cinerous vulture	*Aegypius monachus*	NT	EN
Ibisbill	*Ibidorhyncha struthersii*	LC	EN
Red-headed Vulture	*Sarcogyps calvus*	CR	EN

Source: Inskipp et al. 2016

CR = Critically Endangered; EN = Endangered; NT = Near Threatened; VU = Vulnerable

Although the community forests affected by the Project do not provide habitat for any endangered species, a number of species with conservation significance were identified during the field surveys. Valuable local plant species include: the tree Sal (*Bombax ceiba*), which is protected by the Government of Nepal for its economic interest; *Pinus roxburghii*, which is classified as Least Concern (LC) by the IUCN and banned for exportation; and *Dioscorea deltoidea*, which is included in the Appendix II of CITES. These community forests also provide important ecosystem services for local communities.

Local wildlife will be affected by the loss of terrestrial habitat and by the disturbance and displacement during the various construction activities. The area around Hakubeshi will be the most impacted since it is where the head works will be located and the influx of workers is likely to be more intense. During operations, the reduction of flow in the diversion reach can have negative impacts on riparian habitats, on which some bird species depend.

Indirectly, the project could have impacts on the overall habitat availability and connectivity for terrestrial fauna in the area by fragmenting the river corridor and by hindering altitudinal migration due to the construction of the access road at mid-slope on the western slope.

In order to manage potential impacts to biodiversity, NWEDC has prepared a BMP (see Appendix B.1, General Environmental and Social Management and Monitoring Plan). This plan outlines the mitigation and management measures NWEDC will implement to minimize Project impacts on biodiversity, including:

Forest Lands

- Rehabilitate/reforest temporarily disturbed areas, especially community forestland.
- For the 27.2 ha of forest land permanently lost, the Project will comply with the Forest Guidelines from the Nepal Ministry of Forest and Soil Conservation (MOFSC) (May 17th, 2017) to mitigate the loss of forest land and trees on a 2:1 basis. Any additional impacts to forest land beyond those already authorized will be at the new ratio of 25:1.
- The new guidelines require the project proponent to provide an equivalent land as compensation if impacts of the project "permanently change the land-use of the forest land." There will be a contract between the party and the Department of Forests. The land will be suitable for forest development work, adjoin the nearby national forest and, where possible, be of similar land-form and in the same geographical location.
- For every tree felled, the proponents would be required to plant 25 seedlings in the land provided by them or in the forestland designed by the District Forest Office. They would be required to protect and manage the plantation sites for five years. At the end of five years, the trees will be handed over to the respective Forest Office.

However it was agreed with the MOFSC, that the UT-1 project would compensate trees on a 2:1 basis initially, but the 1:25 ratio will apply for additional trees lost, if required, due to project design modifications or unanticipated requirements during construction.

- The compensatory afforestation will focus on planting maximum number of protected species.

Threatened (IUCN and Nepal Red-List) and Protected Species of Mammals

Asiatic Black Bear (Ursus Tibetanus)

- Awareness programmes to construction workers for protection of black bears
- Black bear give birth to cubs from May to June in caves and hollows. These months are to be avoided while clearing trees
- Workers and staff found poaching black bear will be terminated and punished as per legal provisions of LNP.
- Hoarding boards will be provided in the buffer zone of the LNP at the weir site, to indicate that hunting and trade of black bear is a punishable offence. The conservation significance of the species will also be displayed.

Himalayan Goral (Namorhedus goral)

- Awareness programmes to construction workers for protection of goral
- Workers and staff found poaching goral will be terminated and punished as per legal provisions of LNP.
- Hoarding boards will be provided in the buffer zone of the LNP at the weir site, to indicate that hunting and trade of goral is a punishable offence. The conservation significance of the species will also be displayed.

Langtang National Park

- LNP will be supported in recruiting additional staff to increase monitoring and surveillance in the buffer zone at the weir site as well as the LNP area adjacent to the project construction site
- Hoarding boards will be kept at the weir site that these acts are illegal.
- Wildlife meat will be prohibited in the camp.
- NWEDC has agreed to adopt a Worker Code of Conduct that prohibits illegal hunting/poaching and the collection or trade of natural or wildlife products.
- The Biodiversity Management Plan (BMP) also identifies the following measures to minimise Project impact on LNP and Critical Habitat:
    - Construction workers, operations and maintenance (O&M) contractor staff, and site management staff will be informed that unauthorised entrance to the LNP or damaging natural forest areas is prohibited, and could result in the termination of their employment.

- Terms will be included in contracts with construction and O&M contractors indicating that entry into LNP and any exploitation of biodiversity resources will result in penal action.

Community Forests

- All Construction workers and staff will be prohibited from collecting firewood, timber and forest produce or illegally hunting and poaching from community forests in the Haku VDC and such acts will be termed illegal.
- Any project personnel found involved in such offenses will be terminated
- Hoarding boards will be placed in the Haku VDC mentioning the above acts are illegal.
- Construction workers will be subjected to awareness programmes on the issues of deforestation and afforestation to let them know the consequences and benefits of environment degradation and conservation.
- The construction workers will be provided with cooking fuels such as kerosene and LPG and firewood will be strictly prohibited in the construction camps for cooking and other purposes.
- Local forest user groups will be supported in surveillance for the conservation of forests and wildlife
- Wildlife meat will be prohibited in the camp.

Collision Risks to Threatened Birds

- Raise the transmission poles with suspended insulators in order to reduce the electrocution of bird species or fixing insulated caps made of plastic;
- Require bird-safe strain poles with insulating chains of at least 60-centimetre length;
- Check for vacuums or holes in the towers to avoid nesting by any of the birds; and
- Monitor bird carcasses electrocuted on a monthly basis and record any threatened or migratory species observed as part of the overall Biodiversity Evaluation and Monitoring Program (BEMP). Any spurt in mortality will need consideration of design modifications to reduce mortality

Biodiversity Offsets

In addition to the afforestation of degraded land as per the Forest Guidelines (2017), as 2.61 ha of Natural Habitat within LNP has been lost, a biodiversity offset is required as per IFC PS6 and the ADB SPS. The offset will comprise land adjacent to the Langtang National Park be annexed into the park. This complies with the Forest Guidelines (2017) where land should be suitable for forest development work and should adjoin the nearby national forest and, where possible, be of similar land-form and in the same geographical location. NWEDC will enter a contract with the Lantang National Park management to implement this offset by providing financial and technical resources.

The offset site will further be assessed to comply with the offset principles provided in BBOP (2012)[1] primarily to ensure equivalence of biodiversity values lost in the 2.61 ha, demonstrate additionality and avoid leakage of threats to biodiversity, ensure long term outcomes and be selected through stakeholder participation.

The timing of offset implementation will be based on the offset period required to demonstrate net loss. Project impacts cause immediate and certain losses, but conservation gains of an offset are often uncertain and may require many years to achieve. In this case it needs to be assessed the time needed for achieving net loss of habitats lost in the 2.61 ha.

The offset will also include a rigorous monitoring and evaluation plan where indicators for monitoring against achieving net loss are clearly defined and a monitoring plan is developed which specifies technical partners involved in the monitoring, monitoring procedures and schedules for monitoring. Considering the relatively minor impacts on terrestrial biodiversity, the proposed mitigation to achieve No Net Loss in Natural Habitat, and the proposed measures included in the BMP, the Project is not expected to have any significant residual impacts on terrestrial biodiversity.

[1] Business and Biodiversity Offsets Programme (BBOP). 2012. Standard on Biodiversity Offsets. BBOP, Washington, D.C.

7.4. COMMUNITY HEALTH AND SAFETY

This section describes the Project's induced impact on community health and safety including dam safety, muck and spoil management, access road stability, and natural hazards.

7.4.1. Dam Safety

Appropriate dam safety measures are essential to ensure the long-term operation and maintenance of the Project. The safety of the dam and appurtenant structures initially relies on a well-designed structure that meets international standards for dams of this size and type. Future safety relies on monitoring, inspection, reviews, training, and a dam operator who understands the workings of the Project such that potential deficiencies and defects can be recognised and repaired in a timely manner.

The Project has significant implications for safety during both construction and operation phases, especially considering the recent 2015 earthquake. The UT-1 Project is classified as a large dam (> 15 metres) under International Commission on Large Dams criteria. No inundation mapping is available to assess the direct impact that would be caused by a dam failure. There are not, however, many dwellings or structures downstream of the dam; the area is mostly composed of agricultural lands or community managed forests located along its river between the dam and the tailrace. Therefore, the damage in case of dam failure would probably be limited. Nevertheless, given the importance of this dam, its location in an earthquake-prone area, and the downstream agriculture and community forestland, the dam would be classified as a high consequence dam with commensurate values for inflow design flood and earthquake loadings.

The Project has performed a standard dam break study and has committed to constructing the dam in accordance to best industry practices. In light of the 2015 earthquake, Nepal Water and Energy Development Company Limited (NWEDC) and its engineers modified the Project design to take into account the better defined seismic hazards (e.g. the Lender's Engineer specified a Maximum Credible Earthquake of 0.83 g [acceleration of gravity] for a 3,000 year recurrence period based on a Deterministic Seismic Hazard Analysis), changes in landscape conditions (e.g. landslides), and upgraded the dam design to withstand a 10,000-year probable maximum flood event with a combination of spillway gates and an emergency spillway overflow (see Section 2.1.4). The revised dam design will be reviewed by both the Lender's Independent Engineer as well as the Project's Panel of Experts. NWEDC will also be required to prepare and implement detailed Emergency Preparedness and Response Plan, in consultation with potentially affected communities downstream.

During Project operations, NWEDC will be required to have the structural integrity of the dam regularly inspected by qualified experts. The common public safety risk associated with the sudden release of water from a hydropower dam is less in this case as the Project will be operated in a true run-of-river, rather than peaking, mode of operation. The overall Environmental and Social Management and Monitoring Plan (Appendix B.1, General Environmental and Social Management and Monitoring Plan) identifies measures for operational

staff to prepare for and respond to an emergency that will be included in this Management Plan. These measures include:

- An Operations and Maintenance (O&M) Manual shall be developed by the designer for the dam and powerhouse. The O&M Manual shall encompass all aspects of long-term operation and management of the dam and appurtenant structures.
- The O&M Manual shall detail the requirements for ongoing operation of the facilities including gates, low-level outlet, powerhouse, and all mechanical/electrical components. Maintenance requirements shall be established for all items requiring long-term maintenance to function correctly. Surveillance requirements, including reading of instrumentation, reporting of results and a schedule of visual site inspections, and independent dam safety reviews shall be established.
- Alarm, or normal range, levels shall be established for each instrument and variations outside the normal range shall be reported immediately. Instrumentation reports shall be prepared.
- An inspection schedule shall be established so that a field inspection is conducted on a regular basis by the site operator to ensure all Project facilities are in good working condition.
- Annual inspection shall be carried out by the dam operator and engineering staff from the Nepal Water and Energy Development Company/Operations and Maintenance Contractor. The results of each inspection shall be compiled into a report and recommended corrective actions shall be implemented.
- An initial dam safety review shall be carried out 2 years after construction is substantially complete and then every 5 years afterwards. Dam safety reviews shall be carried out by an internationally recognised, independent dam safety engineer who was not involved in the design of the Project. Normally, this review would look at previous inspections, instrumentation reports, and annual inspection reports, along with a comprehensive site inspection.
- Rates for permitted reservoir draw-down, downstream compensation flow requirements, reservoir operating rule curves, and flood operations will need to be developed during the final design phase and included in the O&M Manual.
- Appropriate staff training requirements shall be developed and implemented.
- Seminars on safety issues for local inhabitants shall be organised, to include emergency dam break and release procedures, risks from natural floods, and prevention of road accidents, drowning, and electric shock.
- Detailed emergency plan including anticipated emergencies (such as dam break and natural flooding) shall be developed and periodic mock drills to be conducted.
- Develop a detailed communications plan as part of the emergency plan to ensure downstream public safety during construction and operation. Communications shall include the use of signage, sound alerts, or other options.

The design changes and application of these measures shall ensure that dam safety is properly managed. In addition, the World Bank is working with the Government of Nepal to strengthen dam safety in Nepal, which includes recommendations regarding dam safety requirements, maintaining a dam registry, procedures for the review and approval of major repairs to existing dams, and periodic dam safety inspections (Hatch 2017).

7.4.2. Spoils and Mucks Management

The Project will require the excavation of approximately 2.7 million cubic metres of material, the reuse and/or replacement of approximately 0.3 million cubic metres, and ultimately the disposal of approximately 2.4 million cubic metres at selected spoil disposal sites (see Section 2.2.6). Improper collection, transport, and disposal of muck and spoil from Project activity will have the potential for various impacts to the environment, including potential impacts to water quality, contamination of land, and damage to roads, springs supplying water to villages, public and private properties, and agriculture land. In addition, if not properly designed and stabilized, the spoils could erode into the Trishuli River, thereby increasing the river's sediment load and turbidity levels, and degrading aquatic habitat.

The Engineering, Procurement, and Construction (EPC) Contractor will be responsible for proper collection, transport, disposal, and management of muck and spoil generated from the site through a variety of safeguard measures as required in the Construction Environmental and Social Management and Monitoring Plan (CESMMP). The Spoil Management and Disposal Plan (see Appendix B.2, Construction Environmental and Social Management and Monitoring Plan) includes the following requirements for spoil disposal sites:

- Use excavated material for road construction, aggregate, and backfilling of quarries and borrow pits to the extent possible and suitable.
- Locate spoil disposal sites above the flood line of the Trishuli River and avoid disturbance of agricultural land and forestland to the extent possible.
- Remove and retain any topsoil for use in rehabilitation at closure.
- Provide retaining walls/ wire-crates at each disposal site.
- Provide appropriate erosion and sediment control, including routing drainage through sediment traps prior to release.
- Prohibit the disposal of spoils and mucks at unauthorised locations.
- Conduct regular training and awareness programmes for drivers transporting muck and spoil to designated site.
- Stabilize, revegetate, and rehabilitate the spoil disposal sites once it reaches capacity using stockpiled topsoil to the extent possible (also see Appendix B.2, Construction Environmental and Social Management and Monitoring Plan).

With the implementation of these measures, the risks associated with spoil and muck disposal shall be adequately managed.

7.4.3. Access Roads Stability and Traffic Safety

The Project is accessed by the existing Betrawati to Mailung River Road. This road, however, was severely damaged by landslides triggered by the earthquake. The Government of Nepal is currently rehabilitating this road by removing landslide materials and constructing gabion and masonry walls to stabilize the hillsides. The proposed UT-1 Project involves construction of 11.84 kilometres of new access roads from Mailung Khola up to the Project dam. This road will be located in very steep slope valley areas susceptible to landslides (see Section 6.1.2). Construction of a highly stable access road is therefore an important aspect of Project. The EPC Contractor will be responsible for preparing a Landslide Stabilization Plan that assesses the geological hazards of constructing this road and includes measures for controlled blasting, temporary and permanent slope stabilization, and other appropriate measures to ensure the health and safety of construction workers and nearby communities.

Project-related construction and operation traffic can pose a safety risk to nearby communities. The EPC Contractor will prepare and implement a Transportation Management Plan that includes the following measures:

- Procedures to notify nearby communities of proposed traffic volumes and patterns.
- Provide educational materials to nearby residents and schools to inform children about traffic safety.
- Establish speed limits for all traffic, especially in proximity to villages;
- Provide training to all staff with driving responsibilities to sensitize them to potential safety risks such as children playing, livestock, and driver fatigue.
- Provide as needed warning sign and speed bumps to alert drivers that they are approaching sensitive receptors.

Dust from unpaved roads can also be a nuisance to local residents and degrade air quality. The contractor will spray unpaved roads as needed to minimize the production of dust, especially during the dry season.

With the implementation of these measures, risks associated with access road stability and traffic safety shall be adequately managed.

7.4.4. Community Safety

Hydroelectric Projects inherently pose some risks to the public near certain Project facilities and as a result of some Project operations (e.g., rapid changes in flow levels). NWEDC will implement the following measures to help protect the public from these risks:

- Prevent unauthorized access to high risk areas (e.g., several hundred metres upstream and downstream of the dam, intake structures, desander discharge, powerhouse, tailrace, and areas near the powerhouse, take off yard, and transmission towers, through the use of fences, walls, and signage;

- Establish and inform local communities of emergency notification procedures (e.g., use of sirens) when there will be sudden changes in water levels or other safety risks.

7.4.5. Natural Disasters

The Project is located in a geographic region prone to natural disasters because of active tectonic and geomorphic processes, young and fragile geology, and variable climatic conditions. Nepal is therefore geologically found to be vulnerable to various types of natural disasters such as floods, landslides, forest fires, earthquakes, avalanches, and glacial lake outburst flood (GLOF).

The baseline study conducted indicated that the Project site and surrounding area are seismically active with intense micro-seismicity activities. In addition, as per the latest seismic study conducted, the Project site and surrounding area are located in a high ground motion area with a high probability of earthquake occurrence. The area was also severely damaged by the latest earthquake in 2015 with a number of aftershocks. Considering the above, various Project structures including dam, tunnel, powerhouse, etc., were designed to withstand maximum credible earthquake.

The Project footprint and surrounding area are also located in a high landslide prone area and the occurrences of landslides were further accelerated by the 2015 earthquake. In addition, the loose exposed rocks due to landslides cause further risk, especially during monsoons. Considering this, the Project components have been modified relocating many underground.

The Project's Climate Change Risk Assessment (Cloudwater 2016) identified the potential for climate change to cause extreme flows, but NWEDC has revised its Project design to withstand a 10,000-year flood event. GLOF are rare with low potential within the Trishuli Watershed, but that could change with increases in temperature as a result of climate change. According to the climate risk assessment, the existing Project dam design are considered conservative enough to withstand any larger floods potentially caused by a GLOF.

The EPC Contractor will be responsible for preparing an Emergency Preparedness and Response Plan as part of the overall CESMMP (see Appendix B.2, Construction Environmental and Social Management and Monitoring Plans). This Management Plan shall address all reasonably foreseeable emergencies that may occur at the Project, including dam break, Glacial Lake Outburst Flood, natural flood, sudden unexpected release of water from the dam or powerhouse, earthquake, fire, landslides, tunnel collapse, hazardous material spills, hazardous gas concentrations in the tunnels, drowning, traffic accidents, and similar events. This Plan will also include an emergency communication and notification system to alert downstream communities of flooding and other natural disasters and coordination with upstream and downstream hydropower projects for monitoring and coordinated response to natural disasters. The Project Operator shall prepare a similar operations phase emergency response plan.

With the implementation of these measures, the risks associated with natural disasters shall be adequately managed.

7.4.6. Occupational Health and Safety

The Project is expected to employ approximately 1,090 skilled, semi-skilled, and unskilled workers over a 60-month construction period. Due to the nature of the Project as well as its location, safety risks to employees include traffic accidents, drowning, working at heights, works in excavation and confined spaces (e.g. tunnelling), and electric shock, among others.

The EPC Contractor shall prepare and implement an Occupational Health and Safety (OHS) Management Plan as part of the overall CESMMP (see Appendix B.2, Construction Environmental and Social Management and Monitoring Plans) to address matters regarding the health and wellbeing of construction workers, Project staff, and nearby communities during the construction phase. Key mitigation measures include providing health and safety training to all personnel, as well providing workers with appropriate personal protective equipment and clothing, such as goggles, gloves, respirators, dust masks, hard hats, earmuffs, steel-toed boots, and enforce their use.

7.4.7. Explosives Safety

The baseline assessment indicates that the steep mountainous terrain where the Project is located, combined with heavy monsoon rainfalls result in a high risk of landslides each year. As previously discussed above, these landslides risks have been further exacerbated by the 2015 earthquake and subsequent aftershocks, which have destabilized slopes, making the areas affected more susceptible to landslides during the monsoon than usual.

Excavation of material from the quarries, as well as excavation of the underground Project facilities (e.g. powerhouse, tunnels, transformer cavern) will require blasting. The estimated amount of explosives to be used is 7,800 tons. Blasting activities can pose a risk to areas that are already prone to landslides, thus increasing the risk to the communities around the Project as well as the Project personnel.

The EPC Contractor will be responsible for preparing a Blasting and Explosives Management Plan, as well as a Landslide and Slope Stabilization Management Plan, as part of the overall CESMMP (see Appendix B.2, Construction Environmental and Social Management and Monitoring Plans). These Management Plans will include requirements for assessing, identifying and flagging landslide area boundaries as well as continuous monitoring during blasting activities. In addition, Emergency procedures for landslide emergencies shall be included in the EPC's Emergency Preparedness and Response Plan (see Appendix B.2, Construction Environmental and Social Management and Monitoring Plans).

With the implementation of these measures, the landslide risks associated with the uses of explosives shall be adequately managed.

7.5. LAND ACQUISITION/LOSS OF STRUCTURE/ECONOMIC DISPLACEMENT

This section describes the impacts on the local community due to land acquisition for the Project. This section will provide a brief summary of the land requirement for the Project, the land-take process; the key impacts; and the number of landowners and Project Affected Families (PAFs) impacted.

7.5.1. Land Requirements for the Project

A total of approximately 107.79 hectares (ha) of land has been acquired for the Project. Table 7.5-1 provides a summary of the land requirement in keeping with the key Project components.

Most of this land (about 78 percent) was government-owned, including a small portion of Langtang National Park buffer land, with much of the remaining government land used as community forest by five Community Forest User Groups (CFUGs) representing 422 members (families). About 19 percent of the land was privately owned by 20 private land owners (5.05 ha) or was *Guthi*/Trust land (15.53 ha) owned by the Monastery at Swayambhu in Kathmandu, which was held by 18 tenants. These tenants were treated the same as landowners in the land acquisition process. The remaining 3.15 ha of land was recently acquired (February 2018) from the Mailung Hydroelectric Project (HEP) in order to relocate the powerhouse worker camp to a safer location, from a seismic and landslide perspective. Although owned by the Mailung HEP, this property still retained seven, partially damaged, leased residential structures.

NWEDC will only temporarily lease approximately 70 percent of the total land requirements, most of which is government and Mailung HEP owned land. All of the Guthi and most of the private land, however, is needed for Project facilities and would be permanently acquired. As a result of common ownership of several parcels, the 18 tenants of the Guthi land, and the Mailung HEP leases, land acquisition directly affected 154 families, referred to herein as Project Affected Families (PAF).

This land-take process has also resulted in the take of 36 structures, including 27 residential structures, eight sheds, and one water mill. The residential structures included 14 primary residences, five secondary residences (only used seasonally), and eight partially constructed houses (where the owners initiated construction to take advantage of compensation being offered by NWEDC). Although 14 primary residences were acquired (seven prior to the earthquake, and seven at the Mailung HEP site after the earthquake), only 12 PAFs were affected, as two families had their primary residence taken, but relocated to the Mailung HEP land, where their primary residence was subsequently taken a second time. It shall be noted that, although NWEDC did recently acquire the seven primary residences on the Mailung HEP site, the earthquake had damaged all of these structures and all of the families had already been displaced at the time of acquisition and were living in Internally Displaced Person camps.

Table 7.5-1: Land Requirements across Various Project Utilities

Project Component	Government Land (Community Forest Land)			Langtang National Park Land			Private Land			Swayambhu Guthi			Mailung HEP			Government Land (River and Floodplain)			Total		
	Temp	Perm	Total	Temp	Perm	Total	Temp	Perm	Total	Temp	Perm	Total	Temp	Perm	Total	Temp	Perm	Total	Temp	Perm	Grand total
Access Road	33.05	0	33.05	0	0	0	0	0	0	0	8.55	8.55	0	0	0	0	0	0	33.05	8.55	41.6
Batching Plant	0	0	0	0	0	0	0	2.34	2.34	0	0	0	0.98	0	0.98	0	0	0	0.98	2.34	3.32
Construction Camp (including base camp and 3 labour camps)	0	0	0	2.8	0	2.8	1.36	0	1.36	0	5.54	5.54	1.968	0	1.968	0	0	0	6.128	5.54	11.668
Intake	0	3.91	3.91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.91	3.91
Switchyard and Powerhouse Camp	0	5.53	5.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.53	5.53
Spoil Area	14.82	0	14.82	0	0	0	0	1.34	1.34	0	1.44	1.44		0		0	0	0	14.82	2.78	17.6
Construction Road	10.3	0	10.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10.3	0	10.3
Headwork (LNP[a])	0	0	0	0	2.61	2.61	0	0	0	0	0	0	0	0	0	0	0	0	0	2.61	2.61
Transmission line	1.932	0.02	1.952	0	0	0	0	0	0	0	0	0	0.096	0.01	0.106	0.036	0	0.036	2.064	0.03	2.094
Baily Bridge Abutment	0	0	0	0	0	0	0.0112	0	0.0112	0	0	0	0.1	0	0.1	0	0	0	0.1112	0	0.1112
Access Road for Surge Shaft	9.05	0	9.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.05	0	9.05
Quarry Area	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Submergence Area	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	69.152	9.46	78.612	2.8	2.61	5.41	1.3712	3.68	5.0512	0	15.53	15.53	3.144	0.01	3.154	0.036	0	0.036	76.5032	31.29	107.7932

Source: NWEDC 2014

LNP = Langtang National Park; Perm = permanent; Temp = temporary

7.5.2. Land Procurement Process

Nepal Water and Energy Development Company Limited (NWEDC) initiated the land acquisition process in 2010 before the involvement of international lenders and the process did not initially meet international standards. All land acquisition was based on negotiated settlements and cash payments. NWEDC did not consider *land for land* compensation a viable option because of the lack of suitable available land in the Project area. More importantly, the community preferred receiving cash compensation as it provided diversified options to the families for income generation and improvement in standards of living, which is evident from the choices already made by the PAFs for use of the compensation money.

Although NWEDC indicates that it has been able to acquire all land to date through negotiated settlements between the company and the land owners/tenants, NWEDC had the option to fall back on the Government to use the legal land acquisition process in case there was unwillingness to sell the land. Therefore, ERM considers the involuntary resettlement provisions of PS 5 to be triggered. ERM conducted a gap analysis of the process relative to PS 5 (Land Acquisition and Involuntary Resettlement) in 2015, and NWEDC has been working to fill the identified gaps.

At this time, NWEDC has completed the land take process for approximately 93 percent of the land required for the Project. Negotiations for about 4.85 ha of government-owned land and an additional 3.15 ha Mailung HEP-owned land are still ongoing. Similarly, NWEDC has completed the land take process for 81 percent of the structures required for the Project. Negotiations for the seven structures required for the new powerhouse worker camp near Mailung are still ongoing. The following subsections provide a summary of the land procurement process followed.

7.5.2.1. Private Land

NWEDC has completed the land-take process for over 100 ha of Project lands described above. Table 7.5-2 provides an understanding of the key timelines for the land-take process.

Table 7.5-2: Timeline of Private Land Take

Year	Process
2007	Land Identification for Powerhouse
2009	Land Survey for Powerhouse
2010	Land Finalization for Powerhouse and Initiation of land procurement Process
September –October 2012	Public Meetings at Mailung, Haku Besi, and Gogone
December 2012	Measurement of private land
January 2013	More meetings in the community
February 2013	Land price negotiations with landowners
March 2013	Community meeting and finalization of compensation amount
May 2013	Payment of compensation to remaining landowners
June 2013	Asset Evaluation
August 2013	Request to facilitate the land-take process for the families having internal problems with payment sharing
2014	Initiation of road construction activities and completion of complimentary ESIA

Source: Consultations undertaken during site visit 2015

The process for the private land take by NWEDC involved the following key steps:

- Surveys for land identification;
- Assessment of existing land value of the plots of land identified;
- Negotiations with the landowners for the rate of the land parcels;
- Payment of compensation amount; and
- Transfer of ownership and tenancy rights to NWEDC.

NWEDC compensated land owners for the acquired land at negotiated rates, which were higher than the market rate in the area. The compensation rates were generally consistent across the properties, although higher rates were paid, for the land located close to the main Betrawoti-Mailung-Syabrubesi Road

7.5.2.2. Guthi Land

The land-take process for the Guthi land included the transfer of tenancy rights based on negotiated settlements with the tenancy right holders (locally known as those with *Mohiyani Hak*). This process was undertaken on the principle that the *Guthi* land will be treated as equivalent to private land for the Project. This was based on the understanding that due to the long-standing dependence of the tenants on the land, the potential Project impacts were comparable to those on private landowners. Figure 7.5-1 provides an understanding of the land-take process followed in regards to the Guthi land.

NWEDC took certain steps to facilitate the land transaction:

- Paid the Guthi tenants 10 percent of the total compensation amount in advance to help resolve any tax and tenancy rights related issues associated with the land; and
- Paid compensation prior to taking possession of the land to facilitate purchase of alternative land and construction of houses by the tenants.

The access road construction, which is the activity requiring the acquisition of the Guthi land, had not reached the Guthi land at the time of the 2015 earthquake. The 18 Guthi tenants (representing 60 PAF) were all displaced by the earthquake. NWEDC has paid compensation to the owners of seven structures (4 primary residences and 3 cowsheds) and 17 of the tenants for their land. One Guthi tenant, however, has not been able to provide tenancy documents and has not yet received compensation.

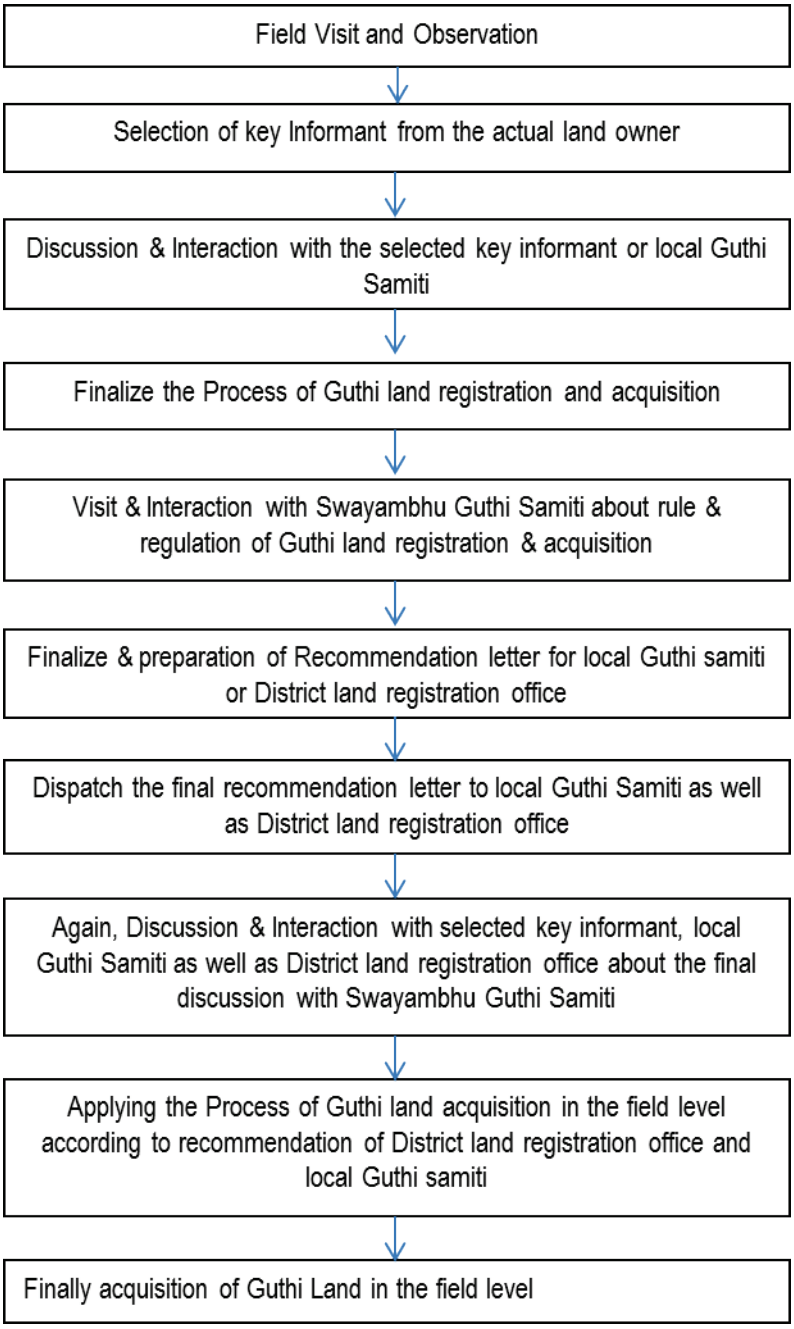


Figure 7.5-1: Process Followed for Transfer of Tenancy Rights in Case of Guthi Land

7.5.2.3. Government Land

The process of land take for government land is shown in Figure 7.5-2. As can be seen from this figure, the application for the land lease was filed with the Department of Electricity Development within the Ministry of Energy of the Government of Nepal. The application was then forwarded to the Land Reform Ministry for the assessment of the land and for its recommendations. Upon completion of the assessment and receipt of recommendations from the Forest Department, Guthi, VDC, and District Development Committee, direct negotiations were undertaken with the Department of Electricity Development for the finalization of the lease agreement.

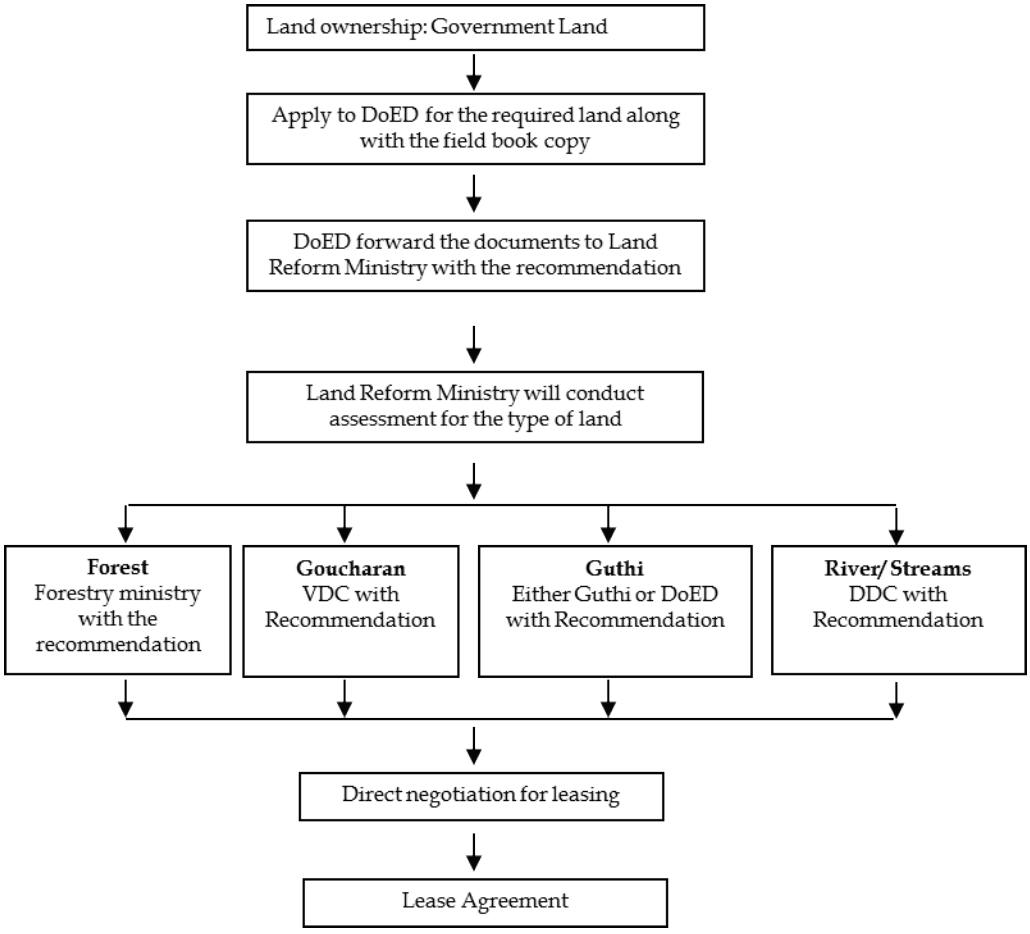


Figure 7.5-2: Process for Government Land Procurement (through Lease)

7.5.2.4. Community Forest

The process of leasing of Government-owned Community Forest was a government-led process, which was headed by the District Forest Office (DFO). Upon receiving the application for the forestland, the DFO called for a general assembly of each individual community forest group whose forest area was to be impacted. As part of these meetings, an understanding of Project land requirements and potential impacts was provided to the committee members and recommendations were sought from the members in regards to the process of land take. Based on

the feedback from these meetings, the DFO presented a report to the Ministry of Forest, which was then forwarded to the Council of Ministers for the review and approval of the lease agreement, which included payment for the loss of trees. The lease agreement for the community forests was signed at the district level, after the payment of the lease fee to the DFO.

7.5.2.5. Structure Valuation

NWEDC reached negotiated settlements with 20 of the 29 owners of Project-affected structures, relying on structure valuations conducted by the Nuwakot Division office of the Nepal Department of Urban Development & Building Construction (DUDBC). The structure valuation was based on unit rate (per square foot/cubic metre) from the District Rate Schedule for various aspects of the construction mentioned above. The District Rate Schedule is published annually, and captures the unit rate for raw materials included in the construction. This includes the transportation cost and labour types (e.g. skilled, semi-skilled, and skilled workers).

The seven PAFs that lost their primary residence have already constructed replacement houses in their villages or on alternative land in Thade and Dhunche with the compensation money. Unfortunately, the 2015 earthquake damaged or destroyed most of these replacement houses and most of these families are currently living in IDP camps.

There were some discrepancies in the structure acquisition process, including.

- NWEDC has not yet compensated nine structure owners, including owners of two cowsheds and seven families who initiated new house construction to take advantage of compensation being offered by NWEDC.
- NWEDC was inconsistent in compensating structure owners relative to the inclusion of scrap value and Value Added Tax.

NWEDC's recent acquisition of the Mailung HEP land, including seven primary residences, is complicated in terms of evaluating conformance with the requirements of PS 5. Mailung HEP acquired the land in question nearly 15 years ago, but allowed the families to remain on the land, essentially as tenants. During the 2015 earthquake, all seven houses on the property were damaged and the families left the area for safe accommodations (e.g., IDP camps). NWEDC entered into a long term lease agreement with Mailung HEP for this land in February 2018. At the time of the agreement, only a couple of families were sporadically using the Mailung HEP site, mostly to care for remaining livestock. Although Mailung HEP is the legal owner of the land and these structures have been damaged by the earthquake and are currently not occupied, these seven houses are understood to be the primary residence for seven PAFs. NWEDC has had DUDBC assess these structures, which will be used as the basis for providing compensation. NWEDC also intends to provide transition payments to the seven families to help them find secure safe housing.

7.5.3. Key Impacts and Mitigation Measures

7.5.3.1. Private and Guthi Land Loss/Economic Displacement

The land take of private and Guthi land parcels has resulted in a reduction of the total land holdings and agricultural land available for the PAFs. The parcels of private and Guthi land already acquired for the Project are characterised as either irrigated (khet) or rain-fed (bari) land. According to the information made available by the district land and agriculture departments, most of this land does not have high agricultural value. In most of the instances, the land was used as agricultural land; however, 4 to 5 households mentioned that they were not cultivating the land recently for various reasons including less productivity or general lack of access to resources (including manpower and financial resources). The land lost was compensated through payment of the negotiated monetised value of land at rates that were reflective of rates much above the market value in the area.

Several issues have emerged after the land-take process and post-earthquake, which are summarised below:

- One of the concerns of the landowners and Guthi land tenants was that the land lost to the Project was near to the river and was more fertile than any replacement parcels of land available for purchase by the landowner. This is so because the available replacement parcels were located uphill closer to the settlements, and the land parcels located in the valley were mostly unavailable for purchase. Thus, to obtain the same crop yield from these less fertile parcels of land, the landowners will be required to undertake cultivation across larger parcels of land or diversify their livelihood for replacing the lost agricultural production. This issue was further accentuated post-earthquake, where most of the land in the Project area has been damaged due to landslides and fissures. This has resulted in the reduction of land available for purchase. In terms of the land already owned by the PAFs, while most can be repaired for use, the PAFs are reportedly unable to afford the cost of the same.
- The other issue is to do with the reduction of the benefits through the division of land payment among the families. In cases, where the compensation amount has not seen much division, the conditions of the families have improved in terms of allowing the families to construct/purchase new houses or land in Kathmandu/Dhunche/Ramche and meet certain key expenses such as medical expenses, payment of debts and socio-cultural expenses such as marriages as well as allowing for a certain portion of the money to be saved for lean periods.
- Also in case of Haku Besi and Phoolbari people, despite presently cultivating the Guthi land, mention lack of access to ownership of such land, as they do not have the tenancy rights as per the records of the government.
- The land procurement was completed and people with access to ownership rights and supporting documents were paid as per the rates agreed for the project during community consultations and later validated by the compensation fixation committee at the district level. The remaining land was either forest land (including community forest land) or Guthi land (Guthi corporation lands reportedly have 51 percent Government ownership) without any leaseholders. In one or two instances, the cultivation was being undertaken without access to

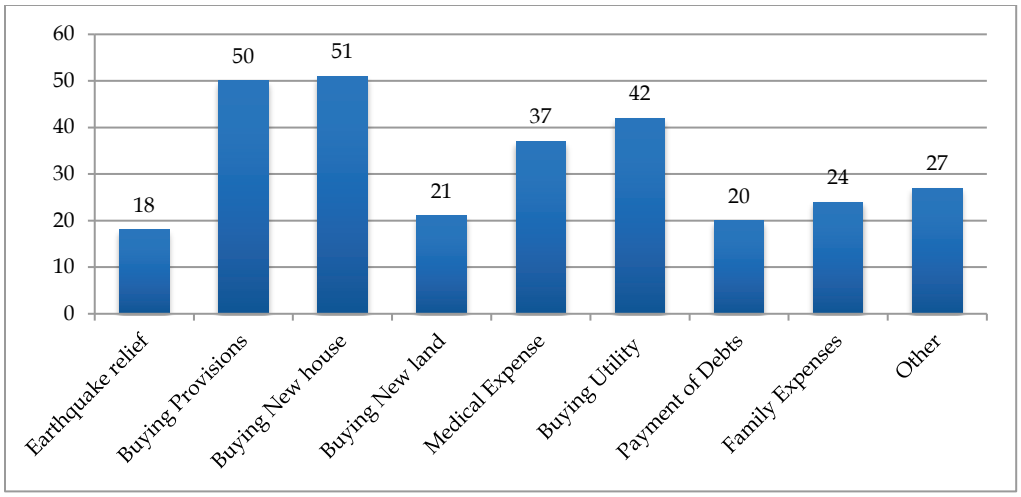
leaseholder rights. NWEDC has already paid for the leaseholding rights being transferred in its name. Following the earthquake of 2015, the government has provided extra support to the people residing on the Guthi land to get leaseholder rights, which may have potentially included some people who never claimed such rights before. Presently, there are some other four to five claims surrounding land parcels for which NWEDC has already paid the lease amount to either the Forest department or Guthi corporation. NWEDC understands that these issues will need validation by the Government to ascertain the real situation in terms of ownership or lease rights. NWEDC will consider these as grievances and as part of GRM, NWEDC will facilitate the intervention of the administration and the forest department. Based on the government decision on these claims, NWEDC will address these grievances based on the entitlement framework provided in the LRP.

However, from the consultations undertaken with the landowners it is evident that while the landowners and tenants were aware that there will be limited or no replacement land available for cultivation, they still were not averse to the idea of selling the land to the Project. The District rates were quite low at that time in comparison to what the Project offered, which substantially increased the income of the families. Community consultations suggested that people wanted the land to be taken on lease to ensure continued source of income, however this option was not provided to them.

The understanding of the way compensation amount has been put to use by the families and the reasons guiding such usage provides following understanding:

- Sale of land to the company opened up considerable opportunity, especially for some of the families that never had access to such disposable income. In cases where the compensation amount was high even after division in the family, lands were purchased in Kathmandu or Dhunche and in most of the cases put on rent partially or fully, further supporting the income of the family.
- In some cases, where the amount of land lost was small and a smaller disposable amount was received, the amount was further divided, leaving very little for the actual family engaged in cultivation on the land. *These households have reportedly struggled to put the money to any effective use, and have instead used the compensation amount to meet the daily household needs and to educate their children.*
- Pre-earthquake, most PAFs reported to have saved at least a portion of the compensation amount received. However, post-earthquake, some of the PAFs used the compensation amount for earthquake relief;
- About 40 percent of PAFs reported to have bought/constructed a new house in the original village with the compensation amount. However, most of these houses were severely damaged post-earthquake

Figure 7.5-3 provides an understanding of the utilization of the compensation received by the PAFs surveyed as part of the Land Acquisition and Livelihood Restoration Plan update.



Source: R&R Plan Household Survey, 2017, based on responses given

Figure 7.5-3: Utilisation of Compensation by PAFs

In addition, community consultations suggested that there was a common understanding in the community about potential development in the area with the construction of the access road and also employment opportunities with the hydropower development. It is understood that it was the expectation of these developments along with the compensation rates offered that resulted in the landowners and Guthi land tenants to agree to give their land to the Project. Therefore, despite the risk of losing fertile land, the landowners saw the possibility of alternative livelihoods to compensate that loss.

Nevertheless, NWEDC shall take the following additional mitigation measures to reduce the impacts:

- Address the additional claims on Guthi land through the project's grievance redressal process. NWEDC will consider these as grievances and as part of GRM, NWEDC will facilitate the intervention of the administration and the forest department. Based on the government decision on these claims, NWEDC will address these grievances based on the entitlement framework provided in the LRP;
- Grant preference to the PAFs for direct/indirect Project employment opportunities and livelihood restoration options; and
- Where the family is categorized as vulnerable, provide additional social and livelihood support.

In terms of structures, NWEDC will ensure conformance with the requirements of PS 5 by:

- Compensate the nine remaining uncompensated structures at replacement value, without deduction of depreciation cost and scrap value and inclusive of VAT; and
- Compensate the Mailung HEP structure owners at replacement value, without deduction of depreciation cost and scrap value and inclusive of VAT, in consultation with the DAO office and *Jan Sarokar Samiti*.

NWEDC has committed to completing the compensation process by June 2018.

7.5.3.2. Impacts on Use of Community Forests

The Project will impact 78.6 ha of government-owned land from five community forest user groups (CFUGs) from Dhunche and Haku VDCs, of which about 25.13 ha will only be temporarily taken. This land take will result in the cutting of 1617 trees and 2239 seedlings. These five community forests, which total approximately 707.14 ha, were used by approximately 422 households for timber, firewood (household consumption and sale), foraging by livestock, collecting medicinal plants and other Non-Timber Forest Products.

Consultation with the *ilaka* (sub-district) Forest official during LRP preparation suggested that the quality of forest in the project area was quite low. It was also mentioned grazing land was not adequate in the forest. In addition to this, the following reasons were identified by the CFUG members for why the impact of loss of community forest was restricted in nature:

- Non-Timber Forest Products species with high market potential were limited in the impacted area;
- The species in the community forest, varied according to the altitude. Most of the high value species were prevalent in the upper regions of the community forest, which were not impacted by the project land take;
- The individual dependence on the community forest was limited in nature;
- The land take for the project has resulted in an impact on only 11 percent (approximately) of the total community forest area for these CFUGs

Further, a significant portion of the community forest area was reported to be damaged due to the earthquake in April 2015. Consultations with the affected population in April 2017 also suggest that since the earthquake, the dependence on natural resources has reduced. This is primarily because many residents are in the Internally Displaced Persons camps or have relocated to other areas and no longer have access to the forests. The only current use of the community forests is by the limited number of residents who have returned to their original settlements either temporarily or permanently.

Nevertheless, the following mitigation measures were put in place to minimize and mitigate the impact on community forests:

- The exact number of trees and seedlings to be cut was identified for removal by the DFO Rasuwa.
- These trees and seedlings were removed only by the consent and order of the DFO. Such trees were fallen and stalked in the area as specified by the DFO at the cost of the Project and handed over to the concerned CFUG through the DFO. The earnings from the sale of timber of these trees were a direct earning of the CFUG members.
- In addition to handing over the fell trees/seedlings to the CFUGs, NWEDC has also provided monetary compensation for the trees/seedlings lost. This additional compensation has been

paid to the CFUGs to support the community forests. Table 7.5-3 provides an understanding of the compensation amount paid to the CFUGs.

- In keeping with the Ministry of Forest guidelines, the Project will also undertake compensatory afforestation of the felled trees, at a ratio of 25 seedlings for each lost tree. The area for compensatory afforestation will be in an area identified by the DFO.
- The other trees and plants in the community forest area are the property of the Government of Nepal and were identified for protection.

Table 7.5-3: Extra/ Additional amount paid to CFUG

Description	Quantity	Amount	Remarks
Dakshin Kali Community Forest Group / 1st Group			
Sal Tree	638 cubic feet	1,91,400	
Pine Tree	889.5 cubic feet	1,33,425	
Others	1008 cubic feet	75,600	
Fire Wood	2112.91 cubic feet	33,806	4.22 Chatta[a]
Total	4648.41 cubic feet	4,34,231	
Darnashila Community Forest Group / 2nd Group			
Sal Tree	507 cubic feet	1,52,100	
Pine Tree	61.27	9,191	
Others	2623.99 cubic feet	1,96,799	
Fire Wood	3249.73 cubic feet	51,995	6.49 Chatta
Total	6441.99 cubic feet	4,10,085	
Lumbu Danda / 3rd Group			
Sal Tree	0	0	
Pine Tree	10.5	1,575	
Others	879.5	65,963	
Fire Wood	1,105	17,680	2.21 Chatta
Total	1995	85,218	

Source: NWEDC 2015

[a] In Nepal, fuel wood is measured in *Chatta*; its dimension is 20 feet × 5 feet × 5 feet. A stack that is 5 feet × 5 feet × 5 feet is called *quarter chatta*.

During initial road construction activities, a number of trees in the Community Forest outside the lease area were damaged by blast debris and disposal of excavated materials, for which the CFUGs had not been compensated. Further, the construction worker camps in the area were sourcing firewood from the surrounding Community Forest without permission. In order to mitigate these unforeseen impacts, NWEDC has agreed to:

- Provide compensation for any trees damaged by construction activities outside the lease area in consultation with the CFUG members;
- Prohibit firewood collection by the construction workers and ensure there is provision of alternate fuels for cooking and heating;
- Adopt, provide training in, and implement a Worker Code of Conduct that clearly informs construction workers to avoid damaging the Community Forests;
- Conduct training and capacity building of the CFUGs for rejuvenation and management of community forest area;

- Provide financial support to the CFUG in managing and protecting the Community Forests; and
- Establish a Grievance Mechanism to ensure any CFUG concerns are quickly identified and addressed through grievance process of the Project.

7.5.3.3. Impact on Trees and Crop

Agriculture was one of the key sources of livelihood and sustenance for the community in the project area pre-earthquake. Most of the crops and vegetables produced on the land were for sustenance and were reported to be adequate for a period of 6 to 9 months in a year. For the remaining months, the families reported that they purchased the required produce from the local markets. Most of this land was reported to be partially or completely destroyed due to the earthquake. However, according to the discussions with the PAFs, most of this land can be cleared and repaired, with certain capital cost.

The trees in the land impacted by the project were reported to be primarily timber trees such as Sal, fruit-bearing trees such as Mango, and other trees for firewood. The importance of these trees lay primarily in the provisioning of firewood and for the collection of timber and fodder for the livestock in a limited number of cases. Approximately 2554 trees/saplings from 21 landowners (out of 38) were reported to be impacted by the land take for the project.

It was reported that some of the affected trees on the private land (already purchased by NWEDC) were damaged pre-earthquake due to the road construction activities, while a few remaining trees were destroyed by the earthquake. In case of Guthi land, most of the trees were destroyed by the earthquake. In total, 21 PAFs reported to have some number of trees on the land, though in some cases it was limited to very few trees.

As part of the sale/lease agreement with the landowners, it was agreed that they would be allowed to harvest standing crop at the time of the land take:

- As the landowners were allowed to harvest the standing crops, no additional crop compensation was provided for the same.
- It is assumed that the relatively higher rates provided for the land covered the longer-term loss of crops and related livelihood. In addition, the opportunity of harvesting the standing crops mitigated the loss to a great extent for the said year.

The NWEDC team communicated that the land sale agreement included any loss of trees that may be standing on the land at the time of purchase. The landowners were also allowed to cut the trees and take the timber post the sale of the land.

The crop loss is already captured in the compensation amount paid for the land. In some cases, especially in Haku Besi and Phoolbari, some of the households continued to grow crops even after receiving the payment. They are aware that no compensation would be provided as the landowners were asked to not plant any new crops on the land after the payment of compensation. However, most of the crops were damaged due to the earthquake even before the

Project allowed the harvest of the standing crop. Furthermore, the transition loss, while preparing a similar land for cultivation and getting crops from it, has not been accounted for presently.

During the consultations with the landowners, it was reported that the local community did not have a clear understanding of the tree loss being included in the compensation amount as per the agreement. While the agreement with the Guthi land tenants and Swyambhuguthi clearly states that the land value includes the loss of trees, there is no such clause in the private land agreements. Furthermore, it was reported that the landowners were not aware of the provision of cutting the trees and taking the timber as part of the sale agreement.

The mitigation measures for the residual impacts have been identified as part of the Land Acquisition and Livelihood Restoration Plan for the project. These mitigation measures include providing compensation for tree loss at replacement value and exploring the possibility of providing sampling of similar tree species to communities.

7.6. INDIGENOUS PEOPLES

This section summarizes the Project's potential impacts on Indigenous Peoples (IP) and the measures proposed to manage these impacts.

7.6.1. Indigenous People's Profile

The ethnic groups in the Project area are the Tamangs, Gurungs, Magars, and Newars. Of these, the Tamangs are in majority, comprising approximately 94 percent of the population (surveyed during the supplementary baseline survey). About 89 percent of the Project-affected families belong to the Tamang community. The other significant IPs community directly affected by the project is Gurung. There are 4-5 families of Newar in Haku Ward-3. Considering such a low presence of Newar, the significant IPs community in project area are Tamang and Gurung.

The Tamang group is one of the largest ethnic groups in the country (fifth largest) and is identified as an *Adibasi Janjati* by the National Foundation for Development of Indigenous Nationalities Act (NFDIN 2002). According to this Act, an Adibasi Janjati group is one with its own mother tongue and traditional customary practices, distinct cultural identity, social structure, and oral or written history. Tamangs are identified as one of the 24 hill tribes as per NFDIN 2002 and belong to a marginalised group as per NFDIN's classification. In keeping with this understanding, the Project lenders have identified the Tamang group as IP in keeping with the requirements of the International Finance Corporation (IFC) Performance Standards (PS).

Gurungs (call themselves as 'Tamu' which means horsemen in Tibetan language) live along with other ethnic groups in the middle hills and valleys along the southern slope of the Annapurna Himalaya in the mid-western Nepal. According to 2011 Census, the total population of Gurung in Nepal is 5,22,641. Gurungs use Tamukwyi, their mother tongue while communicating with each other and use Nepalese to communicate with other ethnic groups. The Gurungs wear colourful dress and are famous for their dance tradition. They perform Sorathi, Ghado, Ghatu and other forms of traditional dance. The social structure of the Gurung includes "char jat" which is divided further into several clans. The Char Jat categories are: 1) Ghale, "King; 2) Ghodane, "Minister"; 3) Lama, "Priest"; and 4) lamichane, "Councillor". The Char Jat as a whole is endogamous, while each of the four categories is exogamous.

Gurungs in Rasuwa District mostly practice agriculture and animal husbandry and many families have the tradition of serving in army or police force. They grow rice, maize, wheat, millet and potatoes in their farmland. Along with farming, they also practice sheep breeding for meat and wool. However, a major part of the family income comes from the salary or pensions of the members who served in army or police forces.

7.6.2. Conformance with International Standards for Indigenous Peoples

In accordance with the IFC PS 7 and other international standards, Project sponsors are required to:

- Anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimise and/or compensate for such impacts.
- Ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples.
- Promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner.
- Establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle.
- Respect and preserve the culture, knowledge, and practices of Indigenous Peoples.
- Ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this PS are present

We discuss Project conformance with these requirements below.

7.6.2.1. Avoid Adverse Impacts on Indigenous Peoples

As discussed in Chapter 4, Project Alternatives, Nepal Water and Energy Development Company (NWEDC) evaluated alternative locations for the UT-1 Project, but the proposed location was preferred taking into consideration technical, environmental, and social factors. The Tamang group is widespread in the Project area and finding a suitable location in the region that completely avoids affecting them would be very difficult.

The Project will require the acquisition of approximately 20 hectares (ha) of land from Tamang families; the loss of primary residence for 12 families (although several of these houses were damaged during the 2015 earthquake and were abandoned at the time of land acquisition - see Section 7.5); and the loss of approximately 78.6 ha of Government-owned land, which was managed by five Community Forest User Groups representing 422 members (families), and 90 percent of them are Tamang, 8 percent are Gurung and Kami and Newars constitute 1 percent each.

7.6.2.2. Engagement Process

NWEDC did engage with the Tamang and Gurung in a process that recognised their human rights, dignity, aspirations, culture, and natural resource-based livelihoods. The Indigenous Peoples Plan (IPP) (see Appendix H, Indigenous Peoples Plan) provides a social baseline to understand the cultural and socioeconomic setting of the Tamang and Gurung community, and documents the ICP process that was conducted. The Land Acquisition and Livelihood Restoration Plan (LALRP) also identifies provisions/entitlements for the purpose of preserving

and protecting the cultural elements of the Tamang community (see Appendix B.1 Owner's Environmental and Social Management and Monitoring Plan).

7.6.2.3. Free Prior and Informed Consent

There is no universally accepted definition of FPIC. As indicated in IFC PS 7, FPIC is intended to build on and expand the ICP process, as described in PS 1, and be established through good faith negotiation between the Project Sponsor and the affected communities of Indigenous Peoples. FPIC does not necessarily require unanimity and may be achieved even when individuals or groups within the community explicitly disagree.

The presence of IP triggers specific requirements under lender social safeguard policies. World Bank Group Performance Standard 7 (Indigenous Peoples) requires a client to seek the FPIC of affected IP communities under specific circumstances, including 'where a project impacts on land and natural resources subject to traditional ownership or under customary use.' Based on UT-1 Project impacts on Government-owned forest land communally administered by Community Forest User Groups (CFUGs), whose members belong to Indigenous Peoples communities including Tamang, Gurung and Newar, it is determined that FPIC is applicable to this Project.

The NWEDC has carried out the land acquisition process for both private and forest land as per provisions of the laws in Nepal. As Nepal does not have any specific law that mandates a FPIC requirement or defines how the process is to be carried out, the FPIC process was not carried out prior to the land acquisition process. However, several rounds of consultation process and disclosure of the project information has been carried out. The requirements of carrying out FPIC process is part of the NWEDC's effort to seek international finance and meet lenders requirement of FPIC process. Therefore, in the project-financing context for this specific project, the concept of seeking 'prior consent' shall imply seeking consent from affected IP communities for a draft package of proposed impact mitigation measures and benefits prior to the main phase of UT-1 project development (i.e. prior to the main construction phase). The proposed mitigation measures would incorporate any supplemental compensation and/or livelihood restoration measures needed to fully mitigate the impacts of completed land acquisition and resettlement efforts to date.

An FPIC process will be initiated in the first half of 2018, focusing on project-affected communities of IPs, primarily those formerly resident in nine main villages in or near the project footprint and their traditional representatives (if any) located elsewhere. The following broad approach is proposed, subject to detailed discussion with the IP communities and their representatives:

FPIC process proposed is a shared tripartite (NWEDC, community, local government) decision-making for the creation of an IPP and evolving a mechanism for joint management of IPP implementation and Grievance Redress Mechanism (GRM). The process will be carried out through following steps.

Step-1: Project Disclosure: ESIA and related plans disclosed to members of 9 project-affected villages (including those in IDP camps if any).

Step-2: Working Group (WG) Selection Process: Each partner selects participants to join in a collaborative Working Group to manage the IPP/FPIC process; separate meetings of each partner to formally select IPP Working Group representatives.

Step-3: First IPP Working Group Meeting: (i) receipt of IPP suggestions from all partners (including NWEDC draft Plans), (ii) determination of the consent process, (iii) determination of IPP Writing Team (WT) members [those WG members tasked with actually writing/revising IPP and FPIC document.

Step-4: Writing/revising of IPP and the disclosure of this draft IPP to communities.

Step-5: Consultations Round 1: Community Priorities: presentation by WG of possible mitigation, benefits and management structure in an IPP based on LBSP/IPP and other inputs; collection of concerns and requests for draft IPP.

Step-6: Drafting/revising of IPP by WT/WG based on community inputs. Disclosure of revised IPP to communities.

Language Policy for Information Disclosure and Consultation Process

The disclosure of the written documents will take place in a common language on which affected Tamang, Gurung and Newar community is proficient.

The consultations with a particular IPs community will be carried out in their respective mother-tongues/dialects for their easy comprehension. NWEDC will engage expert translators with adequate knowledge in Tamang, Gurung and Newar dialect/language.

Where participants in a consultation are heterogeneous, selection of the language will be done with mutual agreement.

Step-7: Consultations Round 2: IPP Confirmation: submission of detailed Plan with proposed components, management structure and budget to 8 villages by WG.

Step-8: Revision of Final Draft IPP by WT/WG based on community inputs. Disclosure of revised IPP to communities.

Step-9: WG Process Decision Point: determine if another consultation round is needed, or if facilitation/mediation is needed to resolve outstanding issues, or if the previously agreed upon consent decision process can now take place.

Step-10: Consent Process: The consent process is carried out and if consent is obtained for approval of i) IPP and ii) MoU document indicating Consent.

Step-11: IPP Implementation: If consent is obtained NWEDC would initiate IPP implementation under tripartite supervision and each party fulfils their commitments.

7.7. IN-MIGRATION

In addition to the influx of labour in the area, Project development may also result in the in-migration of general population seeking to take advantage of the economic and development opportunities created in the area, or worker families that relocate to the Project area. This in turn could result in impacts on the host communities in the area. This section provides an assessment of the host community's capacity to absorb this change, in terms of the existing population and resources available.

7.7.1. Present Host Community Profile

In terms of influx of labour and migrant population in the area, the highest risk villages are Mailung and Shanti Bazaar because of their proximity to the proposed worker camps. As discussed earlier, post-earthquake, most of the population from the Area of Influence evacuated the area and is presently living in internally displaced person camps across the district. Over the last year, few residents have returned (permanently or temporarily) to their settlements in Mailung, Haku Besi, and Shanti Bazaar. However, most of the local community is reported to be wary of returning to their original settlements due to the risk of landslides, especially during the monsoon seasons. Also, the younger population is reported to prefer living in internally displaced person camps, as they are closer to the urban centres and which provide better economic opportunities.

7.7.2. Key Potential Impacts and Mitigation Measures

The following potential impacts are identified on the host community:

- Increased competition for the direct and indirect economic opportunities created due to the Project;
- Increased pressure on and competition for resources and infrastructure in the area;
- Increased waste and sewage generation and possible community health and safety risks;
- Risk of social unrest and conflict due to increased presence of migrant population in the Area of Influence; and
- Risk of spread of communicable diseases, especially sexually transmitted diseases in the workers and local population.

As stated earlier, the local community did not report any issues with labour influx in the area in the past. However, the Project development may provide an incentive to the local community, especially the younger population, to return to their original settlements. This may be done through the creation of direct and indirect economic opportunities for the local community. The direct economic opportunities are likely to pertain to the employment in the Project as semi-skilled or unskilled workers. The indirect economic opportunities are likely to result from the creation of markets for small shops and businesses to cater to the Project and its workforce.

Furthermore, the construction of the Project access road will improve the access of the local community to urban areas such as Dhunche, Betrawati, Battar, and Kathmandu.

Nevertheless, to minimise the pressure on the host community, the Engineering, Procurement, and Construction contractor will be responsible for implementing mitigation measures as required by the Environmental and Social Management and Monitoring Plans (Appendix B, Environmental and Social Management and Monitoring Plans), and shall include the following:

- Prioritize the recruitment of local community residents in the Project;
- Provide benefits to the local community from the Project, in keeping with the benefit-sharing plans formulated as part of the Project Development Agreement requirements;
- Provide adequate training to the workers in the Project, especially in terms of interaction with the local community;
- Put in place a grievance redressal mechanism for the local community; and
- Ensure adequate and timely disclosure of information to the local community in terms of Project activities and available opportunities, in keeping with Stakeholder Engagement Plan formulated for the Project (see Appendix G, Stakeholder Engagement/Community Grievance Redressal Mechanism).

7.8. LABOUR INFLUX

This section provides an understanding of the labour requirement for the Project, the proportion of migrant labour expected, and the potential impacts of labour influx on the local community.

7.8.1. Project Labour Requirements

As discussed earlier, the Project is expected to employ approximately 1,090 skilled, semi-skilled, and unskilled workers over a 60-month construction period. The skilled workforce will be recruited either directly by the Nepal Water and Energy Development Company (NWEDC) or by its engineering, procurement, and construction (EPC) Contractor. The semi-skilled and unskilled workforce, will however, be subcontracted, and comprised of local Nepali subcontractors or small local contractors from the Project area. Table 7.8-1 provides a summary understanding of the workforce required for the Project, in terms of staff (skilled) and worker (semi-skilled and unskilled).

Based on the Project skill requirements and the present skill level of the local community, it is expected that most of the skilled workforce will be migrant populations from other districts of Nepal and expatriates. The semi-skilled and unskilled workforce is expected to be recruited locally from within the Area of Influence (AoI) and the Rasuwa district; however, most of the workers during access road construction came from other parts of Nepal.

Another factor that may influence the number of migrants hired by the Project is the cost implications. From the discussions with the local community, it is believed that small local contractors prefer to hire labourers from other parts of Nepal or countries such as India. This preference is primarily attributed to the lower wage rates for the migrant labourers in comparison to the local population. NWEDC estimates that 85 to 90 percent of the construction workforce is likely to be from outside the AoI.

Table 7.8-1: Workforce Requirement for Construction Phase

Description	**Manpower**	Year 1		Year 2		Year 3		Year 4		Year 5	
	Type	1 Half	2 Half	1 Half	2 Half	1 Half	2 Half	1 Half	2 Half	1 Half	2 Half
A. Engineering, Procurement, and Construction Contractor	Korean Staff	12	20	20	20	20	20	20	15	15	5
	Local Staff	20	30	30	30	30	30	30	25	25	15
1. Access Road	Skilled	5									
	Unskilled/Semi-Skilled	50									
2. Head Works	Skilled	40	45	45	45	45	50	40	40	20	
	Unskilled/Semi-Skilled	100	200	300	300	300	300	200	100	50	
3. Waterway	Skilled	40	45	45	45	45	50	20	10		
	Unskilled/Semi-Skilled	100	250	300	300	300	300	200	50		
4. Vertical Shaft & Power House	Skilled	40	45	45	45	45	45	40	40	20	10
	Unskilled/Semi-Skilled	100	150	250	250	250	200	150	100	50	20
5. Hydro Mechanical (PKG#5)	Skilled					10	15	20	20	10	5
	Unskilled/Semi-Skilled					20	40	50	50	30	20
6. Electro Mechanical (PKG#6)	Skilled						5	10	20	20	10
	Unskilled/Semi-Skilled						15	50	100	100	30
7. Transmission Line (PKG#7)	Skilled						5	10	20	20	10
	Unskilled/Semi-Skilled						15	50	100	100	20
Subtotal Skilled Workers		137	155	155	155	165	190	160	165	105	40
Unskilled/Semi-Skilled Workers		370	630	880	880	900	900	730	525	355	105
Total		507	785	1,035	1,035	1,065	1,090	890	690	460	145

7.8.2. Impacts due to Labour Influx and Mitigation Measures

This influx of labour into the AoI, especially considering the estimated 5-year construction period, may result in the following impacts:

- Risk of social conflict between the local community and the construction workers
- Increased risk of illicit behaviour and crime
- Influx of additional population (e.g. followers)
- Occupational health and safety risks to the workers,
- Effects on community dynamics
- Increased burden on and competition for public services
- Increase risk of communicable diseases and burden on local health services
- Gender-based violence
- Child labour and school dropout
- Local inflation of prices
- Increased pressure on accommodations and rents
- Increase in traffic and related accidents
- Inadequate and illegal waste disposal
- Increased wastewater discharges
- Camp-related land use, access roads, noise, and light
- Increased deforestation, ecosystem degradation, and species loss
- Increased use of/demand for natural resources

It should be noted that during the discussions with the local community, the representatives did not report any apprehensions or concerns regarding the presence of migrant workers in the area. The community appeared to appreciate the presence of migrant workers in the area as they allowed for economic opportunities. The representatives did not report any instances of conflict or violence due to the presence of migrant workers involved in the access road construction.

However, the size of the workforce for the access road construction was much smaller than what the UT-1 Project will require, and the workforce was present in the Project area for a much shorter duration that what the UT-1 Project will require. Also, due to the location of the labour camps, the labourers will be residing in close proximity to the local community, especially Mailung village (Main Project Camp) and two additional camps (at Phoolbari and Haku Besi). The World Bank has indicated that the labour influx risks identified above are the greatest when the capacity of the host community is low (e.g. no formal law enforcement presence) and when the ratio of the number of workers and community members is high, both of which will be the

case for the UT-1 Project (World Bank 2016). In this high risk setting, the World Bank guidance recommendations development of a specific labour management plan.

A Labour Influx Management Plan (see Appendix B.1, Owner's Environmental and Social Management and Monitoring Plan) has been prepared for the Project. This Plan identifies a number of measures to manage labour influx risk, including:

- Prioritise the recruitment of workers from the local community to the extent possibly by the Project;
- Put in place adequate provisions to ensure that no child labour is involved in the Project activities and appropriate terms and conditions are included in the various contract agreements;
- Provide induction training to the workers that discuss at a minimum risks associated with road accidents, drowning, works at height, works in excavation and confined spaces, and electric shocks
- Provide benefits to the local community from the Project so it can enhance its capacity to meet the needs of the community as well as the demands of the Project workforce, consistent with the benefit-sharing plans formulated as part of the Project Development Agreement requirements;
- Ensure the Project provides adequate labour accommodations consistent with the IFC's Workers' Accommodation Good Practice Note (IFC and EBRD 2009) with minimal disturbance to the neighbouring community;
- Provide adequate training to non-local Project workers, especially in terms of interaction with the local community;
- Establish and enforce a Worker Code of Conduct for the Project, include compliance with this Code in the EPC contract, and ensure all workers are trained and understand its requirements;
- Put in place a grievance redressal mechanism so the local community has a means to raise, and have addressed, concerns and complaints about the Project or its workforce; and
- Ensure adequate and timely disclosure of information to the local community in terms of Project activities and available employment or contracting opportunities, in keeping with the Stakeholder Engagement Plan formulated for the Project.

If these measures are properly implemented, the risk from labour influx should be minimized for the Project, but it is critical that worker conduct is carefully monitored and grievances are properly addressed.

7.9. CULTURAL HERITAGE

This section describes the potential effects of the Project on Cultural Heritage. Nepal Water and Energy Development Company Limited has consulted with affected communities and applicable government agencies regarding cultural heritage consistent with the requirements of International Finance Corporation Performance Standard 8.

7.9.1. Tangible Cultural Heritage

Table 7.9-1 provides an inventory of tangible religious and cultural sites identified in the Project Area of Influence. This consultation process has not identified any known critical cultural heritage sites that will be affected by the Project. During the ESIA consultation, one cremation site previously used by the Dalits is located on the west bank of the Trishuli River along the diversion reach between the dam and the powerhouse, but it has reportedly not been used in many years and other sites further downstream are now preferred.

Table 7.9-1: Inventory of Religious and Cultural Sites in the Area of Influence

Village Development Committee	Cultural Heritage	Cremation Sites
Haku	There are no built shrine structures in the area. Locals worship their local deities (demons, gods, natural powers) on open land close to the stream (Khola) near the village. They celebrate festivals like Dashain, Bhadra Purnima, Shrawne, and Maghe Sankranti, and Buddha Jayanti of the Hindu and Buddhist religion.	The dead are normally buried on the ground. Burial place is located in the upper part of the hills.
Dhunche	Menchyau Dupchyo is a scared place uphill from the village and Pasang Lamu Highway, which is about 3 hours walk within the Langtang National Park. There is a cave located there and springs originate from that place, where people usually bath in the month of Magh. Every year in the month of Magh, many pilgrimage from Dhunche, Ramche visit the site and bathe there. They believe that the many illnesses like scabies, wounds, headaches, and many others will be cured after the bath. The Tamangs worship Paiyu tree as a God.	The constructed structure at the burned place is called Purgam in Tamang language. At the locality, there are about eight Purgams.
Dhunche	Dupla Sambling Gumba is located near to the settlement. People offer prayer in each Dashain. Purnima and Aunsi in the Gumba. A special Mela organized at this site in Buddha Purnima (Baisakhi Purnima). Chenti Garpu, one of the Shrines is nearer to the settlement and people offer Bhumi Puja in the shrine in Fagu Purnima, Jestha Purnima, and Janai Purnima.	At the locality, there are about 16 Purgams.
Ramche	Most of the villagers celebrate Dashain, Tihar, Maghe Sankranti, Shrawan Sankranti but none of them celebrate Loshar.	Most of the locals use their own land as crematory sites for the dead. Lamas cremate their dead at the summit of the hill.

Source: ESSA 2014

7.9.2. Intangible Cultural Heritage

A significant majority of the population in the Area of Influence (AoI) is comprised of Tamangs. The Tamang people have a mixed religion of animism and Tibetan Buddhism. Traditionally, the Tamang social and cultural practices have blended with Buddhist ideologies. The Tamang culture is characterised by various traditional social institutions such as Nangkhor, Gedung, Chokpa, and Ghyang. Tamang communities are organized, maintained, and regulated through these social institutions.

The other key religious group in the AoI is the Gurungs. Forests play a key role in the Gurung lifestyle, traditions, and culture. The Gurungs have a long tradition of practicing natural healing arts, often combined with Western medicine when it is affordable. The Gurungs have a rich tradition of music and culture. They practice a social tradition called Rodi in which young people meet in the evenings to socialize, share music, dance, and find marriage partners. Rodi also has important economic functions. Lately, the practice of Rodi has weakened, partly as a consequence of formal education and outmigration of young locals. Gurungs practice a form of Tibetan Lamaism heavily influenced by a pre-Buddhist and largely animistic form of religion called Bön. Some characteristics of Bön are the belief in natural spirits, spirit possession, and in the existence of supernatural creatures in the forests. Each Gurung clan or village has their own local deities, which are believed to have considerable power over nature and influence in human life. In addition, despite being predominantly Buddhist and animistic, the Gurungs also traditionally observe major Hindu national festivals such as Dasain.

Although the Project will result in the construction of large structures along the Trishuli River (e.g. dam), and the temporary introduction of construction workers, overall the Project is not expected to impact intangible cultural heritage, such as religious practices, in the Project AoI.

7.9.3. Cultural Heritage Management Measures

Although no cultural heritage impacts have been identified, the Engineering, Procurement, and Construction contractor will be responsible for preparing and implementing a Cultural Heritage Management Plan (Appendix B, Environmental and Social Management and Monitoring Plans). This Management Plan will include the following measures to avoid any potential adverse impact on cultural heritage:

- Implement a Chance Finds Procedure in the event that an unknown cultural heritage site is found during construction;
- Ensure the Chance Find Procedure is widely socialised and understood by the Project contractors; and
- Allow local residents to report concerns associated with cultural heritage impact (e.g. loss of access) and loss of cultural values through the grievance mechanism.

7.10. ECOSYSTEM SERVICES

Ecosystem services are defined as the benefits that people, including businesses, derive from ecosystems (IFC 2012). These services are substantial and varied, underpinning basic human health and survival needs as well as supporting economics activities, the fulfilment of people's potential, and enjoyment of life. This section evaluates the potential effects of the Project on ecosystem services and identifies measures to manage these impacts.

7.10.1. Main Ecosystem Services

To provide a uniform basis to assess the status of all major global habitats across all of the word's bioregions, the United Nations Millennium Ecosystem Assessment (Millennium Ecosystem Assessment 2005) combined diverse ecosystem service typologies into a consistent classification scheme. There are four categories of ecosystem services defined in the Millennium Ecosystem Assessment as well as outlined in International Finance Corporation Performance Standard 6 (Table 7.10-1).

Table 7.10-1: Ecosystem Services in the Area of Influence

Type of Service	Description
Provisioning Services	• Food: wild caught fish • Food: wild meat • Food: cultivated crops • Food: herbs and plants • Livestock Farming • Timber for biomass fuel and wood products • Non-timber Forest Products • Medicinal Plants • Freshwater
Regulating Services	• Genetic Resources • Regulation of Air Quality and Climate • Regulation of Water Timing and Flow • Water Purification and Waste Treatment • Erosion Regulation • Fire Regulation • Pest Regulation • Pollination
Cultural Services	• Spiritual, religious or cultural values • Traditional Practices
Supporting Services	• Aesthetic Value • Natural Biogeochemical Cycles • Habitat Provision

7.10.2. Project Impacts and Management Measures

Social baseline surveys conducted by the Project have identified community dependence on natural resources and associated ecosystem services. However, in the post-earthquake scenario, the dependence on natural resources has been reduced due to changes in housing locations, at least in some of the villages like Gogone and Tiru. This is reported to have resulted from the loss of access to natural resources, such as access to community forest, while residing in the Internally Displaced Persons (IDP) camps. Table 7.10-2 provides an understanding of the present profile and dependence on ecosystem services, potential impacts, and proposed mitigation measures.

Table 7.10-2: Ecosystem Services Impacts and Proposed Mitigation Measures

Ecosystem Service	Beneficiaries	Description
Provisioning Services		
Food: wild caught fish	All communities	According to the discussions undertaken with the local community before the 2015 earthquake, 13 households were reported to be fishing in the river for sustenance and/or recreational purposes. These households did not depend on fishing as a primary source of income. However, the fishing activities were reported to play an important part during the 6 months when agricultural produce was not sufficient for sustenance. However, in the post-earthquake scenario, none of the local community was reported to be undertaking fishing activities. The 13 Project-Affected Families identified in 2015 could not be located during the site visit in 2017.
Food: wild meat	None	None of the local community members were reported to be undertaking hunting in the AoI
Food: cultivated crops	All communities	In the pre earthquake survey of 2015, agriculture was reported as the main source of livelihood for the local community in the AoI. However, in the post-earthquake scenario, the dependence on agriculture is reported to have reduced, due to loss or access to and damage to agricultural land. According to the information available, some of the local community, especially in the villages of Haku Besi, Thanku, and Phoolbari, intend to return to their original villages. Those who return are expected to undertake agriculture on their remaining land. In the IDP camps the avenue for agriculture is limited as the crop sharing agreements does not seem to be too encouraging for the people. Agricultural activities could be further impacted due to alteration of water resources/ quality due to Project activities and loss of land where the Project requires 20.6 ha of agricultural land
Food: herbs and plants	All communities	Prior to the earthquake, the communities were understood to supplement their diet with uncultivated resources during times of scarcity. Though this dependence has reduced post-earthquake, it is likely to pick up again if the communities return to their original villages. Loss of forest resources in the Project footprint area (76.7 ha) due to Project activities also affects the access to community forest; however it was reported to be only 11% of the total affected community forest.

Ecosystem Service	Beneficiaries	Description
Livestock Farming	All communities	Livestock farming was reported to be an important source of sustenance and livelihood in the pre-earthquake scenario. However, as a result of the earthquake, most of the Project-affected families lost their livestock holdings to a great extent. According to the discussions undertaken, it is understood that most of the households, aim to rebuild/restore their livestock holdings if they move back to their original villages. The community did not report major impact on the livestock due to diversion of the community forest land for the Project. Post-earthquake the community, (wherever accessibility to the native villages is feasible) trying to build up on remaining livestock. These livestock cannot be brought to the IDP camps as the livestock is not able to sustain the changed climate as well as access to grazing land is turning out to be limitation.
Biomass Fuel	All communities	The primary source of fuel in the villages in the AoI is firewood, collected at the household level from the surrounding forests. Loss of forest resources in the Project footprint area (76.7 ha) could thus have an impact on the availability of firewood for the community residing in the immediate vicinity. However, with the people shifting in the IDP camps the fuel source has changed. The mobilisation of labour during construction stage could put pressure on the community forest in case the cooking is done on firewood sourced from the community forest.
Timber and wood products	All communities	Timber and wood products are commonly used for construction, furniture, farming, fishing, and household utensils by local communities residing in the original villages. Loss of forest resources due to vegetation clearance (76.7 ha), inundation, or decreased water retention in soil could have an impact on dependent communities.
Non-timber Forest Products	All communities	Resin, leaves, grasses, and bamboo are commonly utilized non-timber forest products for domestic use and sale by the communities in the villages. According to the discussions it is understood that a few households, reside in the internally displaced persons camps, but make regular fortnightly trips to the forests in the AoI for collecting bamboo to make baskets.
Freshwater	All communities	Even though Eflow will be reduced, there is still likely to be adequate freshwater for the communities in the Trishuli River. However, there are several springs in the Project's AoI and 16 of the 45 identified are considered more vulnerable given their status of main sources for water supply for the communities in their vicinity. Some of these springs were reported to have gone dry post-earthquake; however the same could not be confirmed.

Ecosystem Service	Beneficiaries	Description
Regulating Services		
• Regulation of air quality • Climate Regulation: global • Climate Regulation: local • Regulation of water timing and flows • Water purification and waste treatment • Erosion regulation • Fire regulation • Pest regulation • Pollination	All communities	The Project footprint area comprises relatively degraded community forests and even though there may some impact on local climate regulation, these are likely to be low. Changes in water release timing and flow have been predicted to have some impacts on the blunt nosed snowtrout, *Schizothrax richardsonii,* a species that is harvested for sustenance. However, as indicated earlier, present fishing levels are low to absent and any impacts to fish numbers are unlikely to impact livelihoods. Given the steep slopes in the Project footprint area, vegetation clearing in the Project footprint area (76.7 ha) and the 2.6 ha of the Langtang National Park will impair erosion regulation and thereby runoff regulation which could impact water quality in the Trishuli River.
Cultural Services		
Spiritual, religious or cultural value	All communities	Villagers worship some forest-based deities in the AoI. Several tree species are considered sacred and components of many plant species are used in rituals and cultural festivals.
Traditional practices	All communities	Traditional places in the AoI include river banks that are utilized for cremation and religious practices. However, no cremation ground is expected to be impacted by the Project activities. Post-earthquake, the community living in IDP camps near Naubise have identified new burial place which will not be impacted by the Project.
Supporting Services		
Aesthetic value	All communities	The aesthetic value can be negatively affected by the loss of forest resources, decreased water flow and by Project development (e.g. powerhouse, transmission lines, base camp, construction, etc.).
Non-use value of biodiversity (e.g. existence, bequest value)	-	There are no obvious non-use values associated within the Project AoI.
Primary production Nutrient cycling Water cycling Soil formation	All communities	With lower Eflows the DRIFT modelling has indicated that algae concentrations upstream and downstream of the dam will increase. But due to continued flow, although reduced, this will not result in impacts to fish harvested for sustenance. There will be a decrease in primary production due to clearing of vegetation in the Project footprint area leading to decreased biomass for utilization by local communities and impacts to water and nutrient cycling and perhaps soil formation. These areas will thereby experience lower primary productivity in the future even if revegetation and rehabilitation of top soil were to occur, given that natural ecosystems, even though modified, have been replaced.
Habitat provision	All communities	Terrestrial habitats are not used by local communities for hunting and there is presently negligible extraction of aquatic fauna in aquatic habitats.

The Engineering, Procurement, and Construction Contractor will be responsible for implementing key measures for minimising and mitigating these impacts as required in the Construction Environmental and Social Management and Monitoring Plan (CESMMP) (see Appendix B.2), are as follows:

- Formulation and implementation of a livelihood restoration plan;
- Avoid culturally and religiously significant sites for the locals;
- The CESMMP shall be widely socialised and understood by the Project contractors and the local communities, so that there is all round confidence that vital ecosystem services will not be impaired in the long run even if there are any temporary disruptions to any of these services ; and
- Establish a grievance redressal mechanism for the local community.

7.11. TRANSMISSION LINE IMPACTS

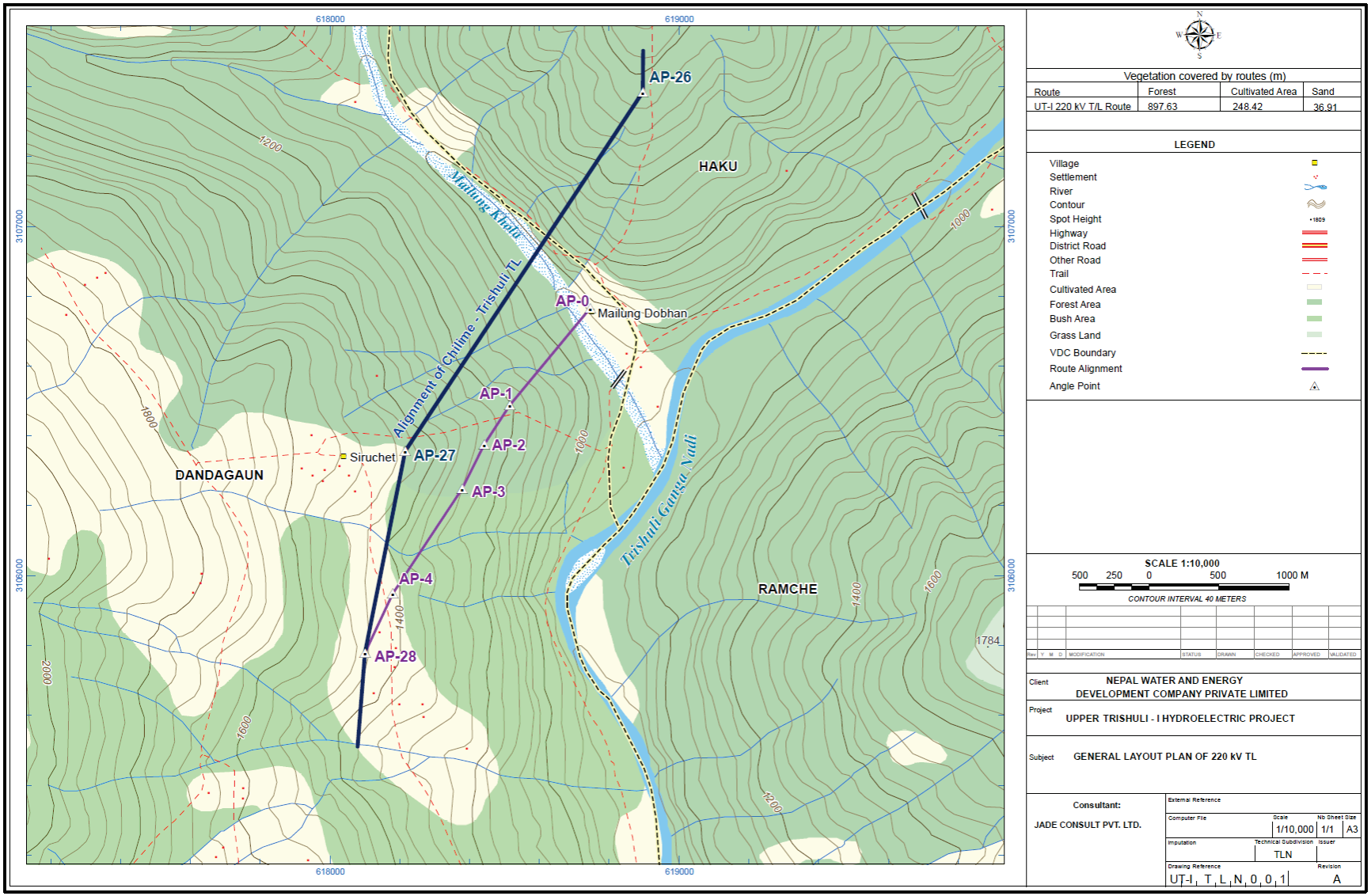
7.11.1. Understanding of the Transmission Line Route Alignment

This section describes the impacts associated with the Project's proposed 1.184-kilometre-long transmission line and associated substation needed to evacuate the electricity generated from the UT-1 powerhouse to the 220-kilovolt (kV) Chilime Trishuli transmission line and the Nepal electricity grid. The use of government lands for the transmission line trigger the need for Nepal Water and Energy Development Company Limited (NWEDC) to prepare an Initial Environmental Evaluation (IEE) for review by the government. The Terms of Reference for the IEE was approved by the Ministry of Energy on 11 February 2018, but the alignment was subsequently changed for technical reasons. NWEDC has requested authorization from the Ministry of Energy to proceed with the IEE based on the already approved Terms of Reference, but is awaiting that authorization.

This section is intended to provide an overview of the likely impacts associated with the construction of this short high voltage 220 kV transmission line spur. The Project will need to comply with any IEE environmental authorisation conditions as well as conform with the International Finance Corporation (IFC) Performance Standards (PS). Figure 7.11-1 shows the transmission line alignment, which includes five proposed towers, before connecting to the Chilime-Trishuli Transmission Line. The transmission line route passes through approximately 1.02 hectares of forest area. The transmission line will pass through Dandagaun Ward No. 1 of Uttaragaya Rural Municipality of the Rasuwa District. The nearest settlements include Mailung Dovan and Dandagaun.

7.11.2. Key Impacts and Mitigation Measures

Key potential impacts associated with the proposed transmission line and proposed mitigation measures during construction and operation phase of the Project are provided in Table 7.11-1. The Engineering, Procurement, and Construction Contractor will be responsible for implementing mitigation measures as required in the Construction Environmental and Social Management and Monitoring Plan (see Appendix B.2), including a land procurement process in conformance with IFC PS 5 in case of private land and forest clearance. For the towers, land will be procured on a permanent basis, while the right-of-way for the transmission line will be procured on a temporary basis.



Source: NWEDC

Figure 7.11-1: UT-1 Transmission Line Project

Table 7.11-1: Environmental and Social Management Plan for Transmission Line of UT-1 Project during Construction and Operation Phase

S. N.	Resources/Area	Mitigation Measures	Responsibility	Timelines/ Frequency of Monitoring
Construction Phase				
1	**Land Use**			
	• Impact on land use and disturbance to forest and agricultural activities • Loss of existing crop, trees and structures on impacted land • Limited access to the area under the towers • Loss of crop due to movement of workers and equipment	• The right-of-way shall be compensated in conformance with IFC PS 5. • The land procurement for the towers shall be undertaken based on replacement value of the land and shall take into consideration any crops, structures or trees existing on the land. • To the extent possible, the landowners shall be allowed to harvest the existing crop on the land. If that cannot be allowed, the value of the same shall be included in the compensation amount. • Landowners shall be allowed to salvage any materials from their assets. • Any dependence or use of the forestland shall be assessed and compensated for in discussion with the Forest Department. • The loss of trees on forestland shall be compensated for in discussion with the Forest Department. This may be in the form of a one-time compensation amount per tree cut or as compensatory afforestation on an equivalent amount of land. • During foundation and stringing activities, equipment and personnel to follow a predefined route and instructed not to wander in neighbouring areas unnecessarily. • In case of any additional damage to crops, structures, or trees, adequate compensation shall be provided based on a one-time negotiated settlement, in keeping with the applicable rules. • Construction to avoid key planting/ harvesting periods wherever possible especially cropping season.	NWEDC/EPC Contractor	At the time of land procurement Regularly
2	**Soil**			
	Soil Contamination due to spill of civil construction material	• Ensure secured storage of civil construction materials including paint, thinner, etc. • Remove empty containers/sacs/boxes etc. on daily basis and dispose of through authorised vendors. • In case of any spill, ensure clean up immediately.	NWEDC/EPC Contractor	Monthly

S. N.	Resources/Area	Mitigation Measures	Responsibility	Timelines/ Frequency of Monitoring
	• Dumping of construction material outside the Project construction foot print • Erosion and compaction	• All construction material to be kept within the footprint of the area acquired. • Loose construction material to be covered to avoid being carried into adjoining areas by wind. • Use of existing track for transport of man and material to the extent possible.	NWEDC/EPC Contractor	Monthly
3	**Air Quality**			
	Dust emissions associated with construction activities	• All vehicles delivering loose construction material to the construction site (or removing construction) debris to be covered to prevent any dust. • Speed limit of 15 kilometres per hour to be maintained by vehicles moving on non-graded/ unpaved roads and tracks. • Sprinkling of water on dust generating areas.	NWEDC/EPC Contractor	Monthly
4	**Ambient Noise**			
	Noise from construction activities	• Construction activity to be undertaken only during daytime. • Sequential arrangement of construction activities.	NWEDC/EPC Contractor	Monthly
5	**Natural Hazards**			
	Risk of tower failure or collapse	• Design and commissioning of tower to withstand the risk of earthquake, landslide, or any other natural hazards.	NWEDC/EPC Contractor	Pre-construction
6	**Ecology and Biodiversity**			
	Ecological impacts -Vegetation Clearance	• Vegetation disturbance and clearance shall be restricted to the Project footprint area. • Unnecessary disturbance of neighbouring vegetation shall be strictly prohibited. • Simultaneous revegetation on outskirts of Project activity shall be practiced for areas that are determined to have loose or unstable soil. • Local grass species shall be seeded in disturbed areas during monsoon. • Any disruption to flora to be kept to a minimum and restricted to only the essential area required for construction. • Wherever possible, mature trees to be avoided and use of existing gaps in vegetation maximised. • Education of the workers to respect the local flora and fauna. • Other measures to be taken to reduce dust, noise, control of surface run-off, waste management, etc.	NWEDC/EPC Contractor	Weekly/Monthly

S. N.	Resources/Area	Mitigation Measures	Responsibility	Timelines/ Frequency of Monitoring
	Disturbance to Flora & fauna	• Construction and transportation activities shall be avoided at night and in peak areas during dawn and dusk. • Areas with pre-existing burrows and ground roosting sites for birds shall be avoided when possible. • Avoidance of construction activities during the breeding season and other sensitive seasons or times of day. • Hazardous materials shall not be stored near natural drainage channels. • Efforts shall be made to minimize construction noise and the use of noise barriers shall be considered for high noise levels. • Waste materials shall be cleared in a timely manner and the use of artificial lights shall be minimized so as to not attract wildlife. • Vehicle movement shall be restricted to only when necessary in areas where wildlife is active. • Anti-poaching and hunting policy shall be strictly enforced. • General awareness regarding fauna shall be enhanced through trainings, posters, etc. among the staff and labourers.	NWEDC/EPC Contractor	Weekly/Monthly
		• Substation construction sites shall be fenced prior to the commencement of construction activities in order to prevent accidents involving wildlife or local inhabitants.	NWEDC/EPC Contractor	Pre-construction
7	**Occupational Health and Safety**			
	Risk of tower failure resulting in occupational and societal health hazards	• The design of the tower to be made as per the NEA regulations, which to ensure that a safety margin is included in the design to reduce the risk from any seismic activity, wind loads, etc. • Risks to general public during stringing activities to be mitigated by initial on-site training of workers and sensitisation of the local community. • Once the stringing is complete, notices (danger-sign boards) and anti-climbing devices to be put on all the faces of the tower.	NWEDC/EPC Contractor	Monthly
	Accidents during tower erection	• Ensure compliance of safe practices and implementation of safety manual • Provide and ensure use of personal protective equipment (PPEs) like, safety goggles, gloves, safety harness, helmets, gumboots etc. • Hoisting equipment shall be properly rated and maintained and hoist operators properly trained. • Signs and other obstructions shall be removed from tower prior to undertaking work. • Prior training of the workers regarding health and safety procedures, especially in terms of working at height.	NWEDC/EPC Contractor	Monthly

S. N.	Resources/Area	Mitigation Measures	Responsibility	Timelines/ Frequency of Monitoring
8	**Social Economic**			
	Impacts on Economic Opportunities	• To the extent possible, the labour requirements for the construction activities shall be met with local labour, depending upon the skill available, in keeping with the employment and skill training plan prepared for the Project.	NWEDC/EPC Contractor	Monthly
	Loss of crops or agriculture land	• During stringing process and tower erection process, compensation for crop loss, if any will be provided as per the required law. • All assets and crops to be valued at replacement value during land negotiations – allow harvesting of standing crops. • Landowners shall be allowed to salvage any materials from their assets. • Have provision to compensate adequately based on replacement value, any kind of damage to the assets/crops/other properties of the local incurred due to Project activities.	NWEDC/EPC Contractor	Monthly
8	Community Health and Safety	• The local community, and in particular children, will be sensitised to the dangers of construction sites prior to and during the works. • The landowners and local community will be given adequate notice in advance of the initiation of construction activities, the possible health and safety risks associated with it, and the safety measures to be followed. • Appropriate signage in the local language will be erected. • Excavation for foundations will be closed up as soon as practicable to prevent people or animals falling into the excavations. • The transport of heavy and abnormal loads will be undertaken out of normal working hours whenever possible.	NWEDC/EPC Contractor	Monthly
Operation Phase				
1	**Electric-Magnetic Field**			
	Passage of high voltage and potential health effects	• Potential exposure to the public to be maintained below the reference levels developed by the International Commission on Non-Ionizing Radiation Protection. • Provide adequate training to workers on the identification of occupation EMF levels and hazards.	NWEDC/O&M Contractor	Regularly
	Interference with Telecommunication systems and other lines	• Clearance from telecommunication and telegraph wires will be maintained.	NWEDC/O&M Contractor	Regularly
2	**Noise**			
	Noise from Overhead line due to Corona effect	• Use of conductors conforming to NEA standard to minimise corona effect during foul weather conditions.	NWEDC/O&M Contractor	Regularly

S. N.	Resources/Area	Mitigation Measures	Responsibility	Timelines/ Frequency of Monitoring
3	**Occupational Health and Safety**			
	Live Power lines	• Use of lock-out/tag-out procedure, before work is performed on, or in close proximity, to the lines. • Trained and certified workers shall be involved in installation, maintenance, or repair electrical equipment. • The worker shall be properly insulated from the energized part with gloves or other approved insulation prior to start of work. • Ensure proper use of special safety equipment and procedures when working near or on exposed energized parts of an electrical system • Fall protection shall be in place prior to working at towers and poles. • When operating power tools at height, workers shall use a second (backup) safety strap. • Signs and other obstructions shall be removed from poles or structures prior to undertaking work. • Approved tool bag shall be used for raising or lowering tools or materials to workers on structures.	NWEDC/O&M Contractor	Regularly
4	**Community Health and safety**			
	Community Health and Safety	• Grounding conducting objects (e.g. fences or other metallic structures) shall be installed near power lines, to prevent shock. • Fixing of permanent warning plates (danger-sign boards). • Fixing of anti-climbing devices on all faces of the towers. • The community in the immediate vicinity shall be informed of the possible risks associated with the transmission line, the measures put in place to ensure safety and the precautions to be taken by the local community for the same.	NWEDC/O&M Contractor	Regularly
5	**Ecological Impacts**			
	Birds roosting or nesting on transmission towers and lines and risk of electrocution of threatened species	• Bird safe strain poles with insulating chains of at least 60 centimetres in length shall be adopted. • Regular checking of vacuums or holes in the towers during breeding season shall be conducted. • Transmission poles shall be raised with suspended insulators to the extent possible.	NWEDC/O&M Contractor	Regularly

S. N.	Resources/Area	Mitigation Measures	Responsibility	Timelines/ Frequency of Monitoring
6	**Socioeconomic**			
	Loss of crop or agricultural field	• During maintenance activities, compensation for crop or tree loss, if any, will be in conformance with IFC PS 5.	NWEDC/O&M Contractor	Regularly

EPC = engineering, procurement, and construction; IFC = International Finance Corporation; NWEDC = Nepal Water and Energy Development Company; O&M = operations and maintenance; PS = Performance Standard

7.12 CUMULATIVE RIVER BASIN IMPACTS

7.12.1 Introduction

The International Finance Corporation (IFC) defines cumulative impacts as the combination of multiple impacts from existing projects and/or anticipated future projects that may result in significant adverse and/or beneficial impacts that would not be expected in the case of a stand-alone project. This chapter describes and evaluates the potential cumulative impacts of the Project along with other past, existing, or future actions/projects on the natural environment, social and economic conditions, and community health.

The Upper Trishuli-1 (UT-1) Project will be located in the Trishuli River Basin where other infrastructure projects are either being built or are planned, including multiple hydropower projects. An assessment of cumulative impacts was not included in the Project's original Environmental Impact Assessment (National EIA; NWEDC 2012); however, a Cumulative Impact Assessment (CIA) was included in a Supplemental ESIA (ESSA 2014). .

The IFC has funded a Trishuli River Basin Cumulative Impact Assessment (TRB CIA), which is currently underway and will help identify and manage potential cumulative impacts from the Upper Trishuli-1 Project and other hydropower projects in the Trishuli River Basin. This study is expected to be completed in the summer of 2018 and the preliminary results are summarized here.

The TRB CIA follows a six-step methodological approach based on international best practice; mainly the Good Practice Handbook on Cumulative Impact Assessment and Management for the Private Sector in Emerging Markets (IFC 2013). This approach uses a Valued Environmental and Social Components (VEC)-centred approach in which the focus of the analysis are the VECs that are impacted by multiple projects and developments and subject to the influence of various natural and social pressures/stressors.

The Trishuli River Basin has already been altered by anthropogenic activities, with six hydropower projects currently in operation (Government of Nepal DOED 2018). Existing cumulative impacts are evident not only in terms of aquatic habitat fragmentation, but also in terms of overall degradation of the catchment area (e.g. deforestation, erosion, multiple access roads, and transmission lines). According to the TRB CIA, commonly identified cumulative impacts include the following:

- Changes in land use
- Impacts on the local economy, demography and infrastructure in view of in-migration linked to hydropower development (and other stressors)
- Reduction of water flow along certain river stretches
- Increase in sediment loads to the watershed and alteration of the sediment dynamics
- Impacts on livelihoods of project affected persons and on communities dependent on altered ecosystem services (including downstream flows);
- Aquatic impacts, in particular for fish as a result of reduction of flow and barriers to migration by dams.

- Interference with migratory routes and/or dispersal of terrestrial wildlife caused by inundation and associated infrastructure such as transmission lines
- Erosion and run off into river caused by reduced soil stability as a result of access road construction.
- Loss of aesthetic, recreational, cultural and values

The most significant cumulative impacts relate to land use change; reduced water availability (locally along the river segments with reduced-flow); fragmentation (by the barrier effect of the dams) and degradation of aquatic habitats; and the increased risk of landslides.

7.12.2 Background

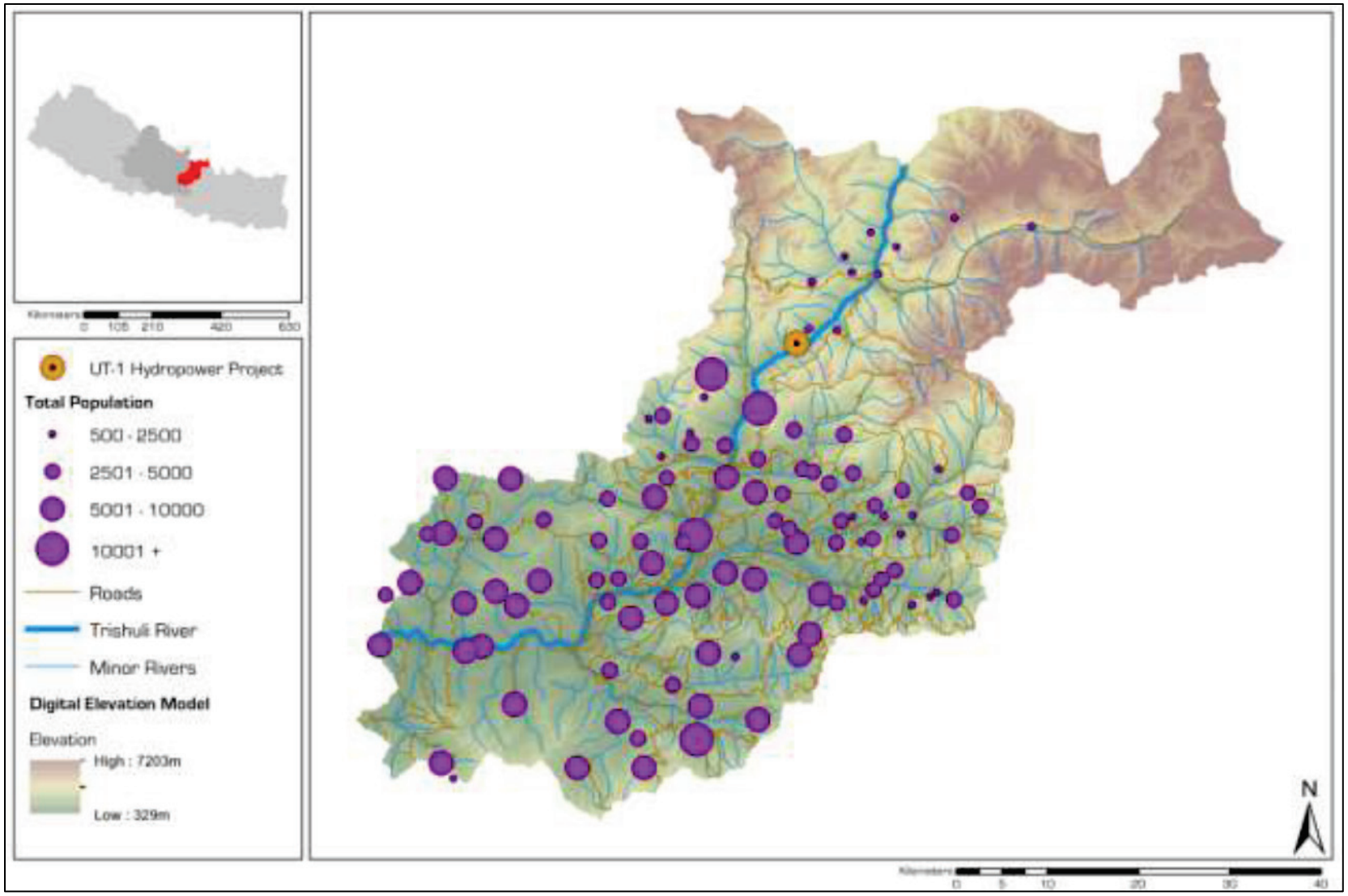
There are nine major river basins in Nepal (i.e. Mahakali, Karnali, Babai, Rapti, Gandaki, Bagmati, Kamala, Koshi, and the Kankai). The Gandaki watershed is located in central Nepal, originating across the border in China and extending through the southern border to India. The Trishuli watershed is one of eight sub-basins of the Gandaki River Basin, covering an area of 32,000 square kilometres (km²), approximately 13 percent of the total Gandaki area. Trishuli is located on the Eastern corner of the Gandaki basin within the physiographic Highland and Midland zones and characterized by average altitudes of 2,000 metres and high valley landscapes (ESSA 2014).

The Trishuli River originates in the Tibet Autonomous Region of the People's Republic of China, where it is known as Bhote Koshi. The catchment area of Bhote Koshi in Tibet is about 3,170 km^2 for a river length of 120 kilometres. The Trishuli River extends approximately 106 kilometres within Nepal, with high gradients in the initial 40 kilometres and rapids along its entire length.

Given the perennial nature of Nepal's rivers and the steep gradients of the topography, Nepal has a significant potential for hydropower development. According to the Supplemental ESIA CIA, in 2014 the installed capacity generated by the 38 operative hydropower facilities in Nepal was about 700 megawatts (MW). Hydropower made up approximately 90 percent of Nepal's power system with the rest met by multi-fuel plants, while only about 40 percent of Nepal's population had access to electricity. The 2015 earthquake damaged 14 existing hydropower projects in Nepal. According to the Nepal Electric Authority, the country's generating capacity fell to 354 MW as a result of the earthquake (Schneider 2015).

The main economic activities in the Trishuli Basin are forestry and small scale agriculture in the upper part of the watershed, and agriculture in the lower part (ESSA 2014). As previously mentioned, the upper part of the watershed is characterized by steep, difficult to access terrain and is predominately forest covered.

Prior to the earthquake, subsistence production was the typical form of agriculture in the region (ESSA 2014). Population densities in the area close to the Project are low due to the difficult terrain and lack of transportation-related infrastructure (see Figure 7.12-1).



Source: ESSA 2014

Figure 7.12-1: Population Density in the Trishuli Watershed Prior to the Earthquake

According to post-earthquake studies performed, the agricultural lands in almost all villages in the Trishuli River Basin have been damaged. Additional earthquake and landslide impacts include the major loss of livestock, loss of infrastructure, reduced access to health and education services, rising living costs, and increased demand for non-farm-based livelihoods (ERM 2016). Forests in the Trishuli River Basin are managed either by the government or by Community Forest User Groups (CFUGs). The Langtang National Park (LNP) is located on the eastern bank of the Trishuli River while community forests are located on the western bank. Forest density is much higher within the LNP compared to the community forests. The forest vegetation in the community forests along the western bank showed evident signs of anthropogenic activities and of ecological degradation. The local CFUGs protect and manage these forests and also conduct development activities, in accordance with a strict operational management plan approved by the District Forest Office (DFO).

From a conservational perspective, and within the broader Chitwan-Annapurna Landscape (CHAL) area, the Trishuli River is considered a naturally occurring corridor that provides critical linkages north–south in the landscape (ESSA 2014). Common biodiversity conservation issues affecting the CHAL region include deforestation, overexploitation of community forests, illegal harvest of non-timber forest products, hydropower development affecting freshwater ecosystems connectivity, poaching, and forest fires and landslides as commonly occurring natural hazards.

7.12.3 Current Development Status of the Trishuli Watershed

7.12.3.1 Hydropower Development

As previously mentioned, hydropower has been the main development activity in recent years in the Trishuli Basin, with six operating projects, seven projects under construction, and eleven projects planned (construction licenses have been given). Another 17 projects applied for or have already received survey licenses (Government of Nepal DOED 2018). Figure 7.12-2 shows all of the existing, under construction and planned projects in the Trishuli Basin.

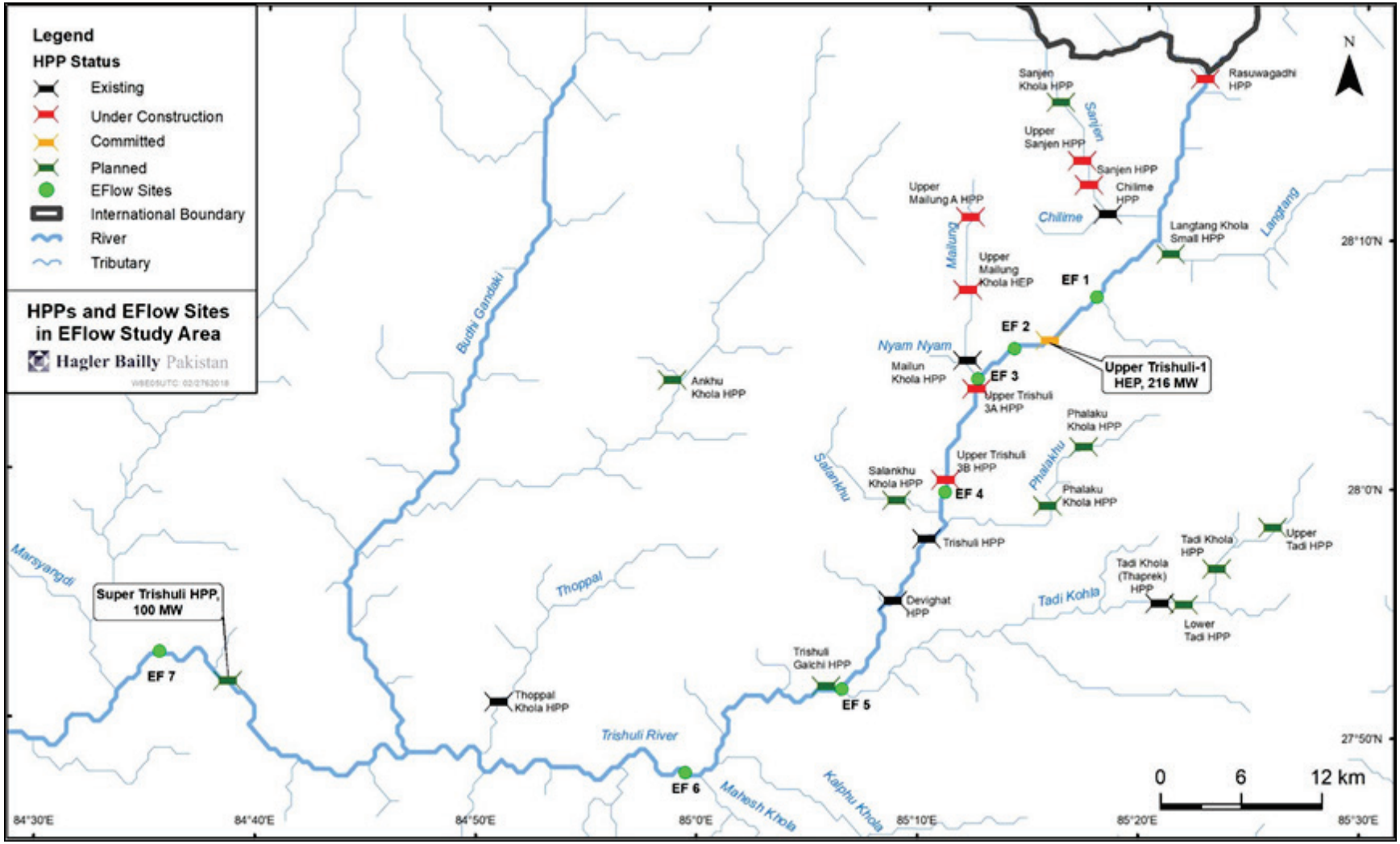
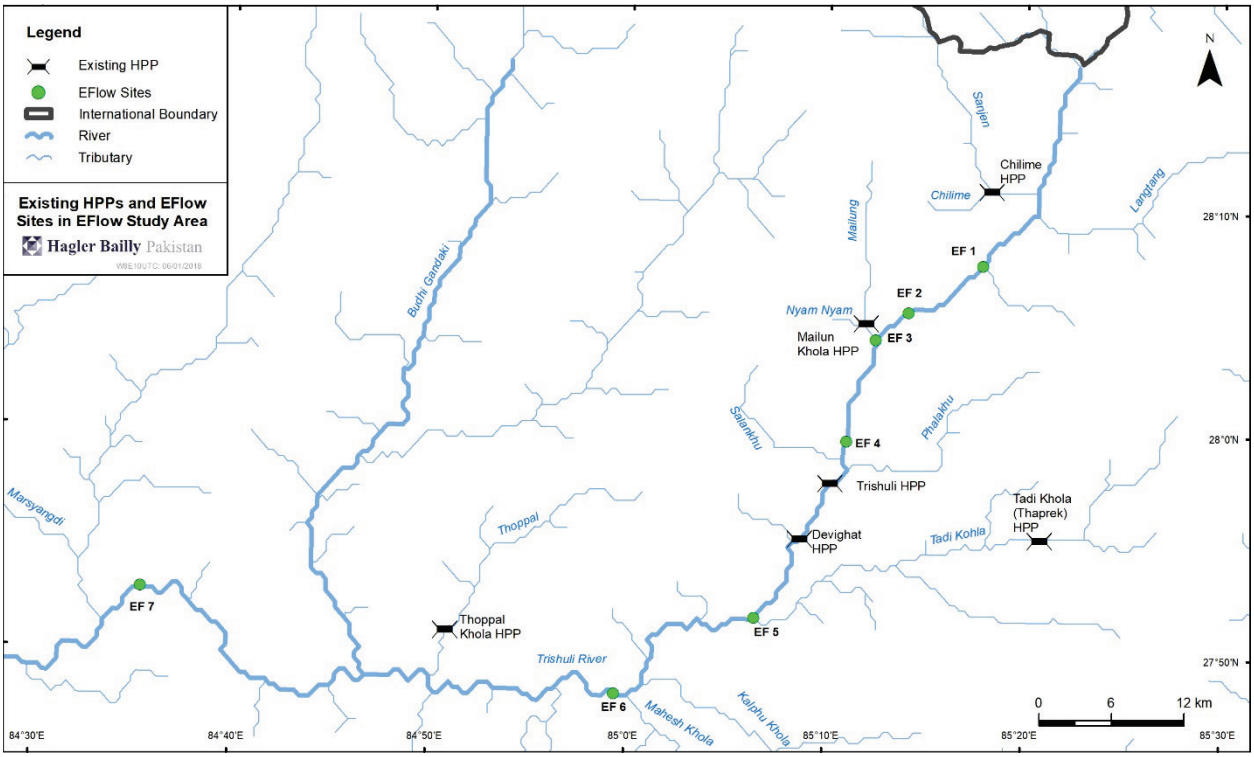


Figure 7.12-2: Hydropower Development in the Trishuli Basin: Existing, Under Construction and Planned Projects

In the Trishuli watershed, six hydropower facilities are currently in operation. The oldest facility, the Trishuli Hydropower Project with a capacity of 24 MW, is located in the middle part of the watershed, near Betrabati, and has been in operation since 1967. Figure 7.12-3 shows the operational hydropower projects and the road network in the Trishuli Basin.



Source: Hagler Bailly 2018

Figure 7.12-3: Operational Hydropower Projects and Road Networks in the Trishuli Basin

7.12.3.2 Existing Roads

Roads in the Trishuli are concentrated in the middle part of the watershed, where the population density is higher and the topography is more favourable. The development of hydropower projects in the upper part is driving the extension of the road networks into this region; however, construction of roads in this part of the watershed requires huge investments in both construction and maintenance because of the remote location and the harsh topography. Common adverse environmental impacts associated with road expansions in mountainous areas include landslides, slope instability, soil erosion, and roadside runoff.

The existing Betrawoti-Mailung-Syabrubesi Road (i.e., the "Army Road" because of the involvement of the Nepal Army with its construction) is currently being upgraded to the China border, potentially to serve as a segment of China's One Belt One Road Project.

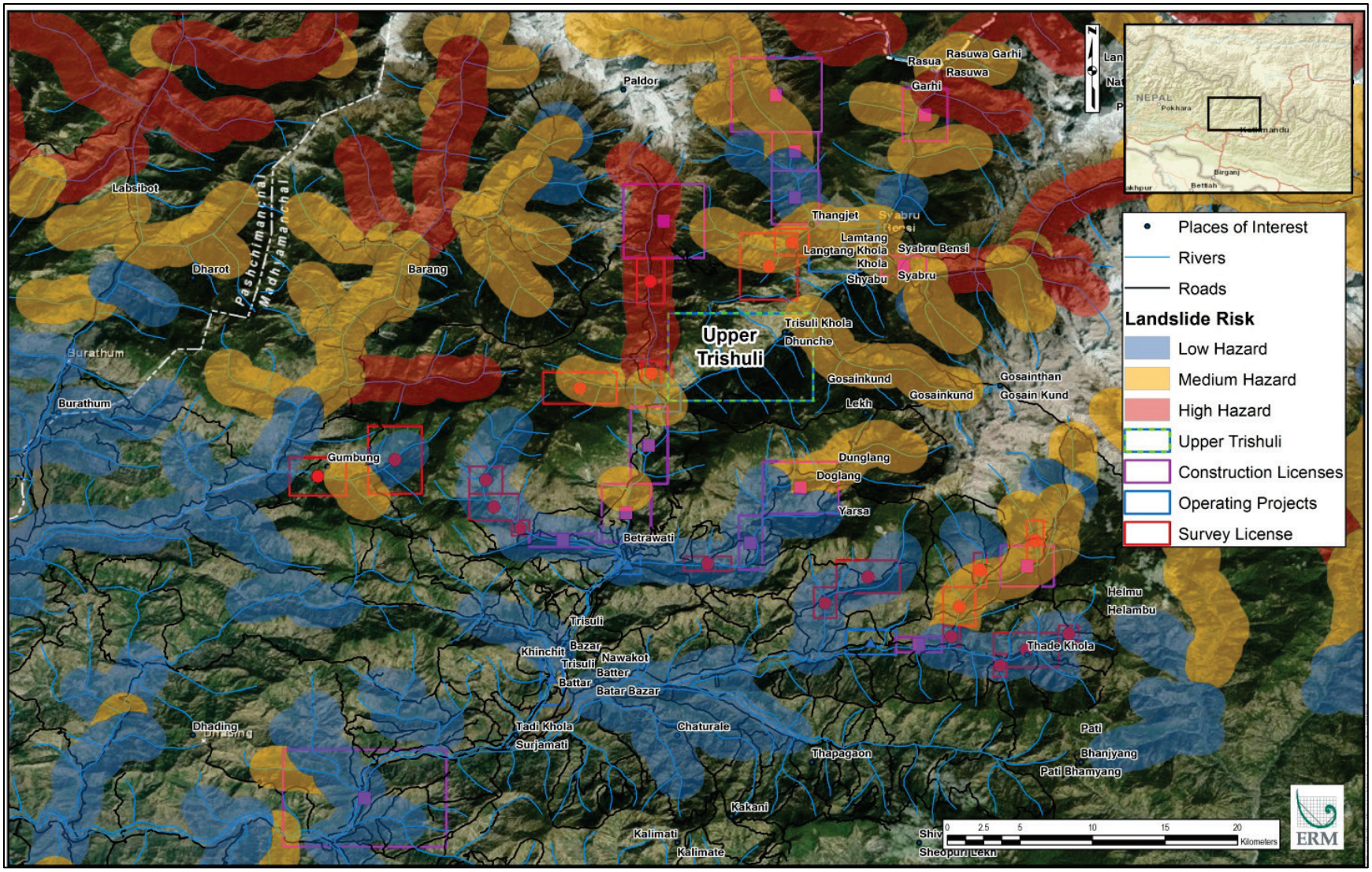
7.12.3.3 Other Existing Environmental and Social Stressors

Landslides

Landslides are the most important factor in land degradation in Nepal. Landslides occur almost every year, particularly in the sloping areas of high mountains and low hills during the monsoon season. Based on slope (> 45 degrees) and land cover, areas with high landslide potential were spatially identified in the Trishuli Basin (see Figure 7.12-4). The upper part of the basin is especially affected by this problem.

Both natural (e.g. high relief or steep slopes, unstable geology, and concentrated rainfall) and human factors (deforestation, improper land use, road construction, and agricultural activities on hill slopes) can induce landslides. The consequences of landslides include topsoil erosion; damaged and destroyed roads, trails, and bridges; loss of land, lives, and property; and siltation in low-lying areas resulting in unproductive land. About 1.8 million hectares (ha) (13 percent) of the land in the mountains is estimated to be severely degraded by landslides (ADB and ICIMOD 2006).

Representative communities consulted during the TRB CIA, indicated that building of access roads for village infrastructure has led to loss of soil stability, exacerbating landslides and loss of biodiversity. This has been compounded by deforestation caused by upstream communities.



Source: Data Source

Figure 7.12-4: Landslide Potential in the Trishuli Basin

Sand and Gravel Mining

Most of the downstream sections of the Trishuli River from Devighat are heavily mined for sand and gravel. Sand mines are also prevalent upstream on the Tadi Khola near its confluence with the Trishuli River. The mines are legal as well as illegal. Local communities believe that water quality and fish abundance is very poor downstream of these in-river mines.

Climate Change

In Nepal about 80 percent of the annual rainfall occurs during the monsoon season (June–September). Historic data shows annual precipitation, especially in the monsoon season, has declined and the Himalayan glaciers are rapidly melting and retreating, affecting streamflow seasonally and altering groundwater recharge patterns. Extended drought conditions have occurred since 2000 (USAID 2015).

Climate change is a threat to water resources, biodiversity, and vulnerable human communities. Nepal is projected to have higher temperatures (between 1°C to 4°C in 2060), drier winters and wetter monsoons, and to experience an increase in melting glaciers (World Bank et al. 2011; IDS-Nepal 2014). Climate change is estimated to result in a change in monsoon rainfall patterns, longer dry seasons, melting of the glaciers that provide dry-season water, reduction of groundwater and aquifer recharge, and an increase in flood frequency (including glacier lake outbursts) and droughts (World Bank et al. 2011; USAID 2015).

The major risks associated with climate change are (1) increases in extreme streamflows that could jeopardize the physical integrity of the headworks; and (2) decreases in low season flows that could jeopardize the success of the Project and adversely affect aquatic ecology.

7.12.4 Future Development Projections for the Trishuli Watershed

Future development in the Trishuli watershed can be broadly divided into three groups:

- Hydropower Development
- Transmission Lines

7.12.4.1 Hydropower Development

Seven hydropower plants are under construction on the Trishuli River itself, including one on the Bhote Koshi):

- The Rasuwagadhi Project (Bhote Koshi) – 111 MW capacity, upstream of the UT-1 Project (run-of-river)
- Upper Sanjen – 14.8 MW capacity on the Sanjen River upstream (run-or-river, design discharge of 11 m^3/sec)
- The Sanjen Project – 42.5 MW capacity on the Sanjen River upstream (run-or-river, design discharge of 12 m^3/sec)
- Upper Mailung A Project – located on the Mailung Khola, a tributary joining the Trishuli just downstream of the UT-1 Project;

- Upper Mailung Project - located on the Mailung Khola, a tributary joining the Trishuli just downstream of the UT-1 Project;
- Upper Trishuli 3A Project – 60 MW capacity, downstream of the UT-1 (run-of-river)
- Upper Trishuli 3B Project – 37 MW capacity, downstream of the UT-1 (run-of-river)

7.12.4.2 Transmission Line

The transmission lines for the UT-1 Project only extends for about one kilometre before connecting with the Chilime transmission line. Detailed information for proposed transmission lines related to the projects illustrated in Figure 7.12-2 is not available. For example a transmission line being constructed for UT 3A HEP follows the Trishuli River and then an alignment on forested hill slopes in the buffer zone of the Langtang National Park. There are however no details available on this. Likely impacts associated with the construction of transmission lines include land clearing and slope stabilization for which mitigation measures will be provided in the TRB CIA.

7.12.5 Cumulative Impact Assessment Spatial and Temporal Boundary Definition

7.12.5.1 Spatial Boundary

As previously discussed, the Trishuli watershed extends across Nepal's borders with a significant part of its river (120 kilometres) in Chinese territory (ESSA 2014). At this time, we are not aware of any existing or proposed hydropower projects in the Chinese portion of the Trishuli River Basin. This may be attributable to the poor vehicular access to this area. With the ongoing construction of the Army Road along the Trishuli River into China, access will be improved, which may generate more interest in this area from hydropower developers. The Army Road is also improves access to Langtang National Park and thereby increases the risk of encroachment, hunting, poaching, logging, collection of natural products, and other incompatible activities within the Park.

From a fishery standpoint, Common snowtrout were found during fish sampling for the Rasuwagadhi HEP, which is very near the Chinese border, although the Dinnawah snowtrout was not. The developer has indicated that there is an impassable barrier immediately upstream of the Rasuwagadhi HEP that prevents further upstream migration. This area is also approaching the elevation/temperature tolerance for the Common snowtrout. So provision for migratory fish passage at any hydropower projects upstream of Rasuwagadhi HEP is probably not needed. Development of a large storage or peaking hydropower project in the Chinese portion of the Trishuli River Basin could have impacts downstream in Nepal, but at this time, no projects have been identified.

The downstream boundary was delineated at the Super Trishuli Hydroelectric Project (HEP), downstream of the Trishuli River's confluence with the Budhigandaki River.

7.12.5.2 Temporal Boundary

Considering the constantly changing hydropower market in Nepal, a temporal limit of approximately 10 years in the future was established for hydropower projects to include in the analysis, and a typical 50 year life expectancy of most hydro projects. This temporal boundary was the basis for the identification of the 24 hydropower projects within the CIA's spatial boundary.

7.12.6 Description of Potential VECs

Based on stakeholder engagement, the potential VECs identified for the CIA analysis of the Trishuli River Basin are shown in Table 7.12-1.

Table 7.12-1: Potential VECs relevant for the TRB CIA

VEC	Comments	Pressure/Risk Indicator
Water Uses	• Major impacts associated with hydropower development, will be on hydrological variables and other users of the water resource. • Impacts in the flow-reduced stretch of the river (irrigation, water mills, sand and gravel mining, sacred sites such as cremation grounds) are a common concern for communities	• River under reduced flow • Competition with other users
Fish and Aquatic Habitats	• The main impact on biodiversity will be on aquatic habitats. • Fish and people whose livelihoods (or part of them) depend on fishing were consistently identified through consultations with local stakeholders	• River under reduced flow • Barriers for fish movement
Local Economy and Livelihoods	• Locals have expressed concern over land use changes and related impacts (reduction of agricultural land, less productivity, general non-availability of land, etc.). • Other major concerns for local communities include harvesting/illegal harvesting of trees, degradation of forest, and loss of forest products including non-timber forest products (NTFP).	• Indicators on economic vulnerability; • Changes in livelihood patterns; • Outmigration; • Changes in income streams • Pressure on forest use (percentage of forest land within the concession areas) • Pressure on agricultural land (percentage of agricultural land within the concession areas)

7.12.7 Cumulative Impact Scenarios

The following scenarios are used in TRB CIA

- **Pre-Project Baseline**: This scenario represents the conditions when there were no hydropower projects in the basin.
- **Existing Projects**: This scenario represents the present conditions in which six (6) of the existing projects as listed in 7.12-2 are operational.
- **Existing + Under Construction Projects**: This scenario represents the expected conditions in which six (6) of the existing projects and seven (7) of under construction projects as listed in 7.12-2 are operational.

- **Existing + Under Construction+ Committed Projects**: This scenario represents the expected conditions in which six (6) of the existing projects, seven (7) of under construction project, and the UT-1 project (which is the only project that has presently been committed) as listed in 7.12-2 are operational.
- **Full Development:** This scenario represents conditions in which all of the above and ten (10) planned projects as listed in Table 7.12-2**.**

Table 7.12-2: Hydropower Projects within Scenarios

	Existing/Operational	*MW*	*River*
1	Chilime (CHP)	22	Chilime
2	Devighat (DHP)	14	Trishuli mainstem
3	Mailung Khola HEP	5	Mailung Khola
4	Tadi Khola HPP	5	Tadi Khola
5	Thoppal HPP	2	Thoppal Khola
6	Trishuli (THP)	24	Trishuli mainstem
	Under Construction		
1	Rasuwagadhi (RGHEP)	111	Trishuli mainstem
2	Upper Sanjen (USHEP) (NEA SPV)	15	Chilime
3	Sanjen Hydro Project (SHEP) (NEA SPV)	42	Chilime
4	UT 3A HEP	60	Trishuli mainstem
5	UT 3B HEP	37	Trishuli mainstem
6	Upper Mailung Khola HEP (Molina Power)	14	Mailung Khola
7	Upper Mailung A HEP	6	Mailung Khola
	Committed		
1	UT-1	216	Trishuli mainstem
	Planned		
1	Super Trishuli HPP	100	Trishuli mainstem
2	Langtang Khola Small HPP	10	Langtang Khola
3	Lower Tadi	5	Tadi Khola
4	Phalaku Khola HPP	15	Betrabati Khola
5	Salankhu Khola HPP	2.5	Salankhu Khola
6	Tadi Khola Hydro Project (TKHP)	4	Tadi Khola
7	Upper Tadi HPP	11	Tadi Khola

	Existing/Operational	*MW*	*River*
8	Phalaku Khola HPP	5	Betrabati Khola
9	Sanjen Khola HEP (Salasungi Power)	78	Chilime
10	Trishuli Galchi HPP	75	Trishuli mainstem

7.12.8 Finalizing VECs and Assessing Cumulative Impacts

The TRB CIA is not yet completed and preliminary results are presented here if available.

7.12.8.1 Fish and Aquatic Habitats

A River Basin Environmental Flow (Eflow) assessment was conducted to evaluate the effects of multiple hydropower projects on the following native fish species:

- Snowtrout (*Schizothorax richardsonii)*, this is representative of other Snowtrout (Schizothorax) species of the Trishuli River.
- Golden Mahseer (*Tor putitora)*, this is representative of other Mahseer (Tor) species of the Trishuli River.
- Buduna (*Garra annandalei)*, this is representative of other Garra species of the Trishuli River.
- Indian Catfish (*Glyptothorax indicus)*, this is representative of other *Glyptothorax* species of the Trishuli River.

The first two are migratory species while the remaining two are non-migratory or resident species.

Construction of dams is likely to impact both the resident and migratory fish species. The migratory species will be affected by the barrier created by the dams as well as alterations in flows, while the non-migratory species will be affected by alterations in flows. Indicator species were also selected to cover the entire Eflow Study Area based on their temperature preference. Snowtrout is found in cold-cool water zone, Mahseer and Indian Catfish in cool water zone while Buduna is found in cool-warm zone. The following is an indicative delineation of these zones, as illustrated in Figure 7.12-5.

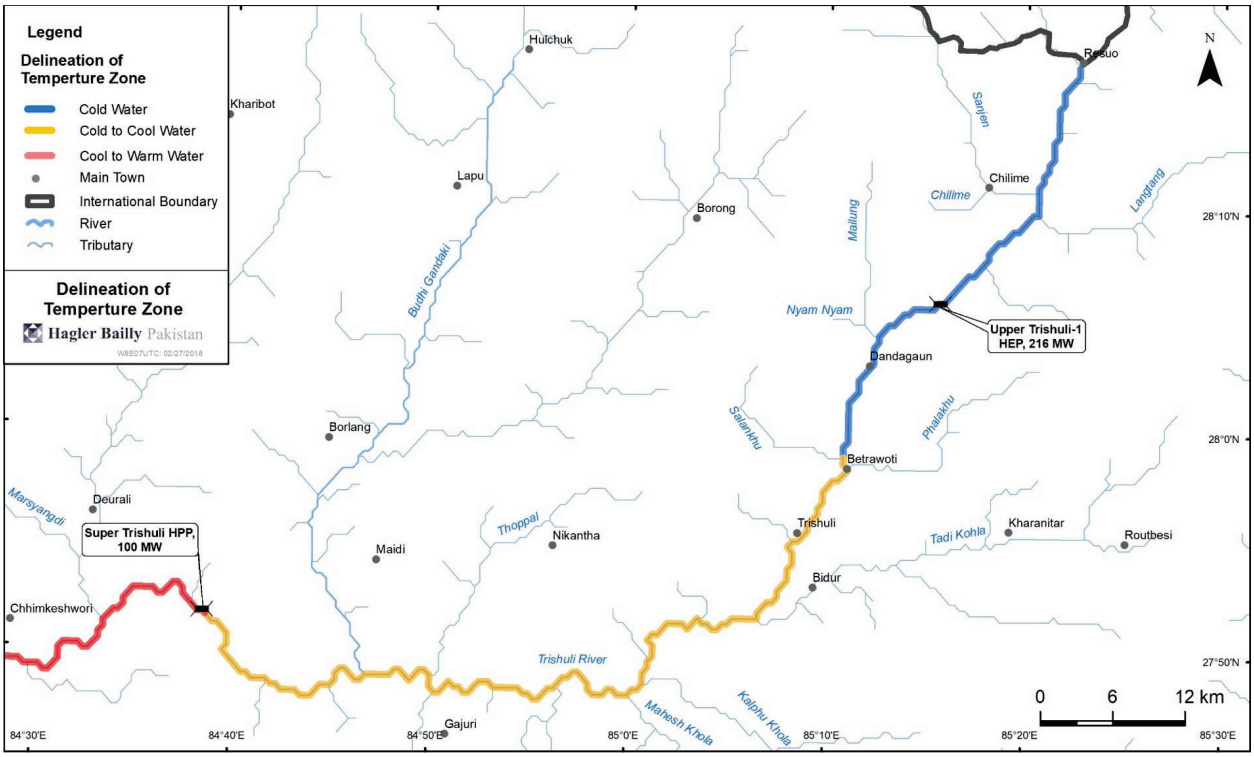


Figure 7.12-5: Delineation of Temperature Zone

- The Trishuli River upstream of the confluence with Salankhu Khola is cold water zone. Maximum summer temperature in this zone are estimated to range between 16°C and 18°C.
- The Trishuli River downstream of the confluence with Salankhu Khola and upstream of site of Super Trishuli dam is cold-cool water zone. Maximum summer temperature in this zone is estimated to range between 20°C and 22°C.
- The Trishuli River downstream of site of Super Trishuli dam is a cool-warm water zone. Summer temperature in this zone is estimated to range between 23°C and 26°C.

Figure 7.12-6 shows the regional distribution of the two migratory species selected as indicators for Eflow assessment, the Snowtrout and the Mahseer, and the Discrete Management Units (DMUs) in which these species are presently found. The range of Mahseer is limited to elevations of the order of 300 m to 1,100 m, while the Snowtrout covers the entire range of Mahseer and migrates further up the streams to elevations of the order of 500 m to 3,000 m.

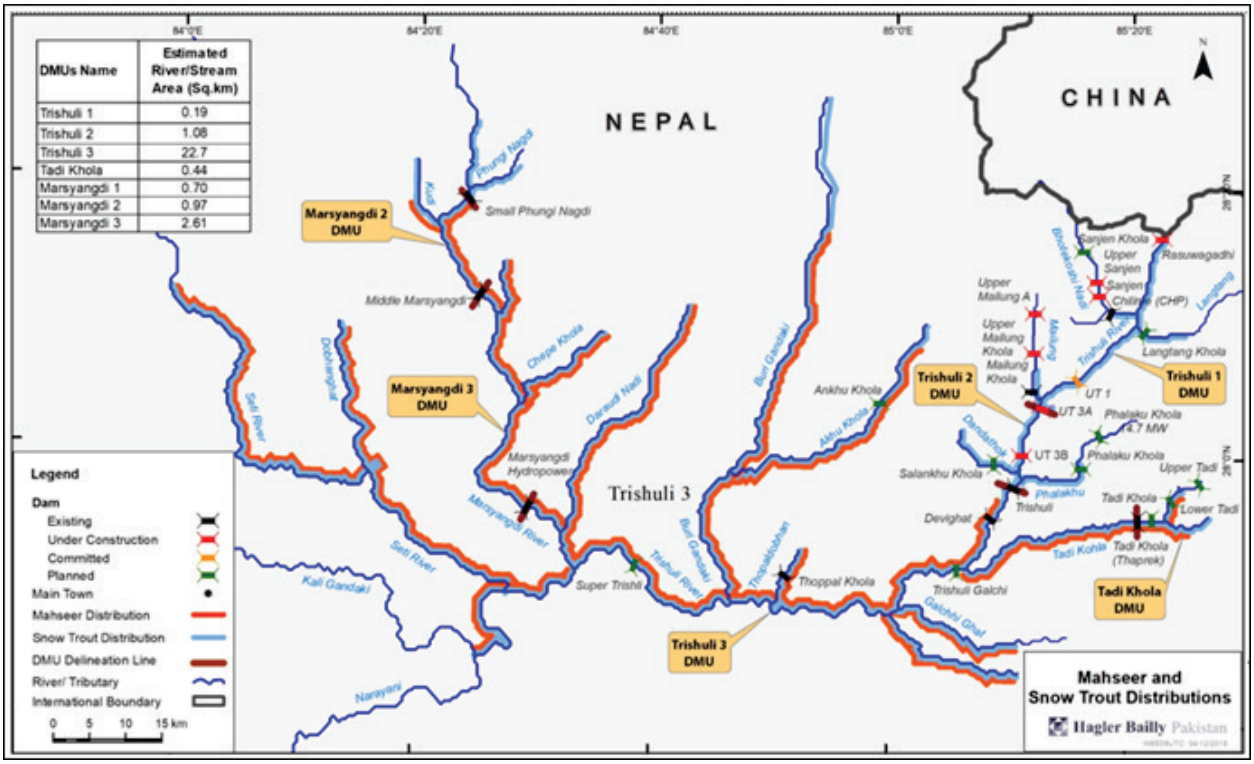


Figure 7.12-6: DMU delineation for Snowtrout and Golden Mahseer

Figure 7.12-7 illustrates the elevation profile of the Trishuli River, distribution of elevation and temperature zones, as well as location of Eflow sites. The upper reach of the Eflow Study Area from the Chinese border up to the Upper Trishuli-3B HPP is steep with an average slope of 3%. From Upper Trishuli-3B to just above the Tadi Khola confluence, the river is moderately steep with an average slope of 1%. From there downstream to the Super Trishuli HEP, the Trishuli River has a relatively mild slope with an average slope of 0.3%.

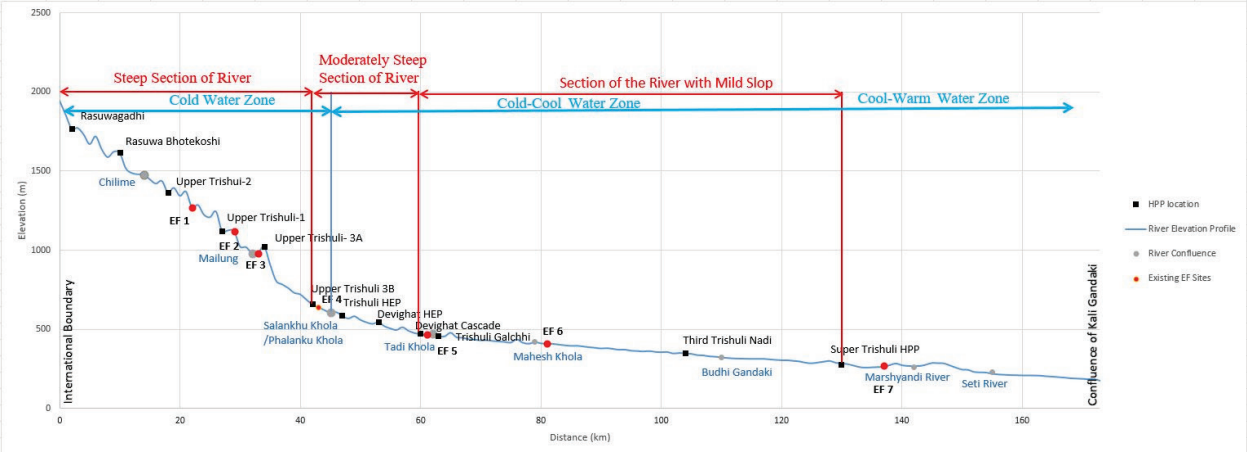


Figure 7.12-7: Elevation Profile of the Trishuli River with Slope and Division of Temperature Zones

Cumulative Impact Assessment for Indicator Fish Species.

Downstream Response to Imposed Flow Transformations (DRIFT) model is used for the Eflow assessment. The Eflow assessment team will qualitatively apply the lessons learned from evaluating eflows using the DRIFT model for other hydropower projects in the Trishuli Basin and elsewhere in the Himalayan region to assess the likely impacts of hydropower developments on river biodiversity and ecosystems, and make recommendations on management measures to minimize these impacts.

Indicators used

Seven Eflow Sites have been chosen on the main Trishuli River in the Eflow Study Area. Baseline and scenario hydrological daily time series data is being obtained for all seven Eflow sites. The hydrological record for the Trishuli River suggests that this is a flood-pulse system, with four well-defined seasons. Once the seasons are defined, DRIFT is being used to calculate a suite of ecologically-relevant flow indicators that are used by the specialists to determine the flow-related links to the ecosystem indicators. These indicators are provided in Table 7.12-3.

Table 7.12-3: Flow Indicators Used for the DRIFT Modelling

Indicator	Reason for selection as indicators
Mean annual runoff	Gives an indication of annual abstraction/addition of water, if any.
Dry season minimum 5-day discharge	Dry season minimum 5-day average flows influence available habitat area, fish movement, and winter temperatures (buffering)
Dry season onset	Onset and duration of seasons: • link with climatic factors • cues fruiting and flowering • cues migration/breeding • support life-history patterns.
Dry season duration	The dry season is typically the harshest season for aquatic life to survive. This is the time when flows are low, water quality influences potentially stronger and temperatures (either hot or cold) are most challenging. Increases in the duration of this harsh period can have significant influence on overall chances of survival.
Dry season average daily volume	Dry periods • promote in-channel growth • support larval stages • maintain intra-annual variability.
Wet season onset	Onset and duration of seasons: • link with climatic factors • cues fruiting and flowering • cues migration/breeding • support life-history patterns.
Wet season duration	Important for supporting life-stages, such as hatching and growth of young. The wet season is also when most erosion and deposition occurs due to the higher shear stress and sediment loads in the river.

Indicator	Reason for selection as indicators
Wet season flood volume	Floods: • dictate channel form • flush and deposit sediment and debris • promotes habitat diversity • support floodplains • distribute seeds • facilitate connectivity • control terrestrial encroachment.
Transition 1 and Transition 2 average daily volume	Dry-wet-dry transitions: • distribute sediments and nutrients flushed from the watershed • distribute seeds • support migration of adults and larvae

Ecosystem indicators are comprised of riverine components that respond to a change in river flow (or sediment) by changing their abundance; concentration; or extent (area). The ecosystem indicators that are selected to capture the response to changes in water flow and longitudinal connectivity as represented by the indicators in Figure 7.12-8 are the most influential in the life history of the fish species considered.

Eflow Sites	Site1	Site2	Site3	Site4	Site5	Site6	Site7
Geomorphology							
Bedload inflows	■	■	■	■	■	■	■
Suspended Sediment inflows	■	■	■	■	■	■	■
Suspended Sediment load	■	■	■	■	■	■	■
Exposed sand and gravel bars	■	■	■	■	■	■	■
Exposed cobble and boulder bars	■	■	■	■	■	■	■
Median bed sediment size (armouring)	■	■	■	■	■	■	■
Area of secondary channels, backwaters	■	■	■	■	■	■	■
Algae							
Algae	■	■	■	■	■	■	■
Macro-invertebrates							
EPT abundance	■	■	■	■	■	■	■
Fish							
Alwan snowtrout guild	■	■	■	■	■	■	■
Mahaseer guild				■	■	■	■
Garra guild				■	■	■	■
Glyptothorax				■	■	■	■

Figure 7.12-8: Ecosystem Indicators for DRIFT Modelling

For each of the ecosystem indicators a response curve, which are are drawn for a range of possible changes in each linked indicator, regardless of what is expected to occur in any of the scenarios is used. The response curves from the Neelum-Jhelum Basin in Pakistan have been utilized for modeling of Trishuli Basin, since both the river basins have similar species and are Himalayan Rivers.

Assumptions

Barrier Effects

The influence of the weir and reservoir of different HPPs on Snowtrout and Mahseer populations at the various sites is partially attributable to the barrier created to the movement of fish between breeding and feeding areas, or between the main stream and tributaries. To account for this influence, the DRIFT model will consider the influence of weirs on the movement of Snowtrout and Mahseer between the Eflow sites.

Within the DRIFT model, the barrier effect of water resource developments is modelled through specifying percentage reductions (or increases) in the "connectivity" between one site and another. Connectivity effects are specified per indicator and are considered for each of the five scenarios.

Peaking Impacts

The impact of peaking on ecosystem will be illustrated for a selected development scenario, taking into account design and operating configurations of projects for which information is available. A non-peaking or a baseload operation will be considered as a base case. Selected projects will be placed in peaking mode and a semi-quantitative assessment of impacts will be provided.

DRIFT Modelling to Assess Cumulative Impacts

The DRIFT model will brings together information on sites, scenarios, flow indicators, and ecosystem indicators to provide predictions of how the latter will change with changes in flow.

For the TRB CIA, the DRIFT model will indicate how ecological integrity ratings and mean % changes of all indicators will change with changes in flow across the five scenarios.

The preliminary results of the DRIFT modelling indicate that:

- Fish migration will be severely impacted by the up to seven likely hydropower projects along the main stem of the Trishuli River.
- The existing Devighat and Trishuli HEP do not have fish passage facilities and have already interrupted fish migration and fragmented the snowtrout population into separate populations
- If fish passage facilities are not provided on proposed hydropower projects, the migratory fish populations will be even further fragmented
- Provision of adequate Eflows is critical to both provide sufficient flow for upstream fish migration and maintaining a minimum level of ecological integrity for the diversion reach
- Extensive portions of the mainstem of the Trishuli River will be converted from free flowing river into a series of reservoirs and diversion reaches, likely converting the Trishuli River from Natural Habitat into Modified Habitat.
- Most of the projects are proposed with run-of-river operations. Maintaining relatively natural flows are critical for those river segments between projects.

Potential management and mitigation measures include:

- Coordinated monitoring to better understand migratory fish movement and the relative importance of tributaries as spawning grounds;
- Coordinate with the Government of Nepal to establish acceptable VEC indicators and manage the river basin to meet those indicators;
- Provide fish passage at all proposed mainstem hydropower projects (including repairing the damaged fish ladder at UT-3A HEP);
- Identify and protect important spawning grounds on tributaries to the Trishuli River as fish sampling from the Upper Trishuli has found most spawning occurs on the warmer and less turbid tributaries then on the snow fed Trishuli River mainstem;
- Provision of an Eflow at all proposed hydropower projects based on a holistic assessment of river ecology; and
- Development of an offset for the loss of natural habitat.

The Trishuli-1 Project's relative contribution to these impacts is relatively minor in that it will operate in a true run-of-river mode, have a very small reservoir, provide fish passage, provide Eflows/Adaptive Management Program adequate to maintain the primary ecological functions of the diversion reach, and conduct a robust monitoring program.

7.12.8.2 Social VECs

With respect to social VECs, ERM will utilize information made available in EIA and IEE reports in addition to stakeholder consultation at the national, state and basin-level to determine baseline conditions and obtain an assessment of potential stressors, impacts and suggestions for mitigation and management. Some of the key stakeholder groups are identified in Figure 7.12-9**.**

Figure 7.12-9: Emerging Stakeholders of Interest

ERM will seek to quantify impacts on social VECs based on the stakeholder engagement and data collection process that is presently ongoing (see Figure 7.12-10). Based on indicators of ecosystem services such as extent of dependence of communities on income from fishing and extraction of sand and gravel from the river, a sensitivity map for the socioeconomic dependence of communities on ecosystem services will be prepared to facilitate impact assessment. The results of the cumulative impact assessment on aquatic VECs will be considered in conjunction to the socio-economic sensitivity mapping described above. This assessment will indicate changes in habitats or species and provide indications on how the Affected Communities dependence on the former will be altered.

Identified VECs	Focus Indicators/Parameters to develop the VEC baseline (Based on existing EIA/IEE reports)
Local Economy and Livelihoods	• Demographic indicators (population density, household size, sex ratio etc.) • Total Land Footprint Affected (private, CFUG accessed, government); • Number of Affected Households: Physical Displacement; Economic Displacement; Both; • Type of Land Use; • Average Household income and break-up across different income streams; • Data on out-migration; • Average per hectare resettlement budget as committed under the EIA-EMP; • Impacted Eco system services with a linkage to livelihood patterns and income generation of local communities; • Non-land based livelihood sources, participation trends of local communities and income levels;

Figure 7.12-10: Indicators to Determine Baseline Conditions of Social VECs

7.12.9 Summary of Management Planning for the TRB CIA

There is the potential for at least 24 hydropower projects, and possibly as many as 40 hydropower projects, in the Trishuli River Basin, which collectively pose significant environmental and social risks to important VECs. The TRB CIA should result in the following:

1. Provide a Strong Technical Foundation for Action

The results of the TRB CIA should provide a solid technical foundation for key stakeholders (e.g., government agencies, hydropower developers, NGOs, affected communities) on the need for action and clearly demonstrate how unplanned development could irreversibly impact the Trishuli River Basin.

2. Highlight the Need for Enhanced River Basin Planning

Consultation with key government stakeholders have revealed that there are few policy frame-works that pertain to river basin planning in Nepal. Salient ones include:

- Ministry of Federal Affairs and Local Development (MOFALD): Environmental Friendly Local Governance Framework (EFLGF) - with the new federal structure and decentralization in the new constitution, the local governments needs to implement this framework and MOFALD is playing a role in facilitating and capacity building within the Rural Municipalities and Municipalities. Mitigation plans for cumulative impacts assessed through the TRB CIA could potentially align with this framework ensuring greater efficiency in their implementation through structured local government participation.
- Water and Energy Commission Secretariat (WECS); Water Resource Policy - while there are no river basin management plans for Nepal, the draft Water Resource Policy is presently being finalized and is presently tabled to the Nepal Cabinet. The new water resource policy considers Cumulative Impact Assessment as an important domain. It may therefore be possible to effectively communicate mitigation recommendations of the TRB CIA through relevant provisions of the Water Resource Policy.

There is a clear need for enhanced river basin planning for hydropower projects, ideally at the government level, so proposed projects are not simply evaluated on a piecemeal basis and the mitigation hierarchy can be fully used to manage environmental and social risks. NWEDC and Project lenders shall support development of a Trishuli River Basin Sustainable Development Plan.

3. Demonstrate the Need for a Trishuli River Co-management Organization

Since cumulative impacts typically result from the actions of multiple stakeholders, the responsibility for their management is collective. At times, cumulative impacts can transcend a regional/administrative boundary and, therefore, collaboration in regional strategies may be necessary to prevent, or effectively manage, such impacts. Where cumulative impacts already exist, management actions by other projects may be needed to prevent unacceptable cumulative impacts. These could include collaboratively adopting operational regimes (Eflow and peaking)

that ensure habitat and species integrity while being guided by standardized baseline assessments and data sharing and scientific monitoring and evaluation for adaptive management.

There is thereby a need for a platform or organization that can facilitate multi-stakeholder cooperation and commitment to collaborate in the monitoring and co-management of cumulative impacts in the Trishuli River Basin. This organization could serve as a template for other river basins in Nepal. NWEDC has taken an active role with the TRB CIA and shall continue to be an active supporter of any Co-management Organization that may be created out of the TRB CIA.

8. STAKEHOLDER ENGAGEMENT

Public consultation with, and the participation of, various stakeholder groups is a critical component of the impact assessment process. This chapter provides an understanding of Nepal Water and Energy Development Company Limited's (NWEDC) engagement activities undertaken for the Project, including during the:

- Land take process – 2009 to 2012 (Section 8.1);
- National Environmental Impact Assessment (EIA) and Supplementary Environmental and Social Impact Assessment (ESIA) process – 2012 to 2014 (Section 8.2);
- Livelihood Restoration Plan (LRP) formulation process – 2015 (Section 8.3);
- Earthquake relief process, including the Nepal Water and Energy Development Company (NWEDC) relief efforts – 2015 to 2016 (Section 8.4);
- Gap Assessment Process – 2016 (Section 8.5);
- Land Acquisition and Livelihood Restoration Plan (LALRP) formulation - 2017 (Section 8.6); and
- Free, Prior, and Informed Consent (FPIC) Process – 2017 ongoing (Section 8.7).

As indicated above, NWEDC has maintained regular engagement with local communities since 2009.

Finally, this chapter provides an overview of the Grievance Redressal Mechanism for the Project (Section 8.8).

8.1. LAND TAKE PROCESS ENGAGEMENT (2009 – 2012)

NWEDC undertook Project land identification and survey activities during 2009 to 2010. This was followed by public meetings held in the villages of Mailung, Gogone, and Haku Besi in 2012. These meetings, undertaken with landowners and other community representatives, were aimed at providing information about the Project to the stakeholders, the land requirement for the Project, including the community forestland and the proposed entitlements in lieu of the same. The final agreements on rates were reached in the presence of the Village Development Committee (VDC). It is noted that the terrain of the Project area is difficult and accessibility to some of the villages to conduct consultations was challenging during the land take process.

These meetings were followed by a public hearing after the completion of the EIA, held in March 2013 (discussed subsequently). The purpose of the public hearing was to provide a more detailed Project understanding and finalize the compensation amount for the land purchase.

NWEDC requested the intervention of the District Administration when ownership of the land was uncertain. NWEDC paid rightful compensation to the identified landowners after ratification of the rates through the Compensation Fixation Committee. The land take (tenancy rights transfer) was undertaken based on negotiated settlement with the tenancy right holders.

Two formal meetings were conducted in case of Guthi land. NWEDC representatives and local villagers of Haku Besi (Wards 3 and 7) met on 19 January 2013 to discuss the rates and terms of transfer of the tenancy rights. Subsequently a meeting was held at NWEDC's office in Kathmandu between Guthi land tenants of Haku Besi and NWEDC, in which 16 villagers were present. Subsequent to the meetings and the agreed rates, the monetised value agreed for the transfer of the tenancy rights was transferred in the tenant's accounts.

8.2. EIA AND ESIA PROCESSES ENGAGEMENT (2012 – 2014)

The key engagement activities undertaken as part of the EIA and ESIA process are discussed below:

- **Public Meetings, 2012:** In the months of September and October 2012, public meetings were held in the villages of Mailung, Haku Besi, and Gogone with various local stakeholders including the landowners and community representatives. As part of the meetings, the information regarding the Project was disclosed, including the location of the key facilities and the land requirement for the Project, including the requirement for community forestland and the potential benefits to the community in terms of compensation, employment, and training. As part of this meeting, the compensation rates for the land to be procured were also discussed.
- **Public Meetings, 2013:** In continuation of the public meetings, post the measurement of private land, consultations, and meetings were undertaken in February 2013 with the landowners, for the purpose of negotiations for the land purchase. Following this, after the completion of the EIA study, a public hearing was held in March 2013. The purpose of this public hearing was to provide an understanding of Project impacts. As part of the meeting, the final compensation package was agreed upon with the community and their signatures were taken as agreements. Apart from these consultations, meetings were also undertaken with the District Administration Office and the Department of Forest Research and Survey to finalize the compensation rates and the land procurement process.
- **Supplementary ESIA, 2014:** The Project engaged with the community as part of the Supplementary ESIA process to gain an understanding of the Project area's socioeconomic conditions, to help the community understand the potential Project impacts, and to understand the perception of Project by the community.

8.3. LRP FORMULATION ENGAGEMENT (2015)

Community engagement was also undertaken during the EIA and Supplemental ESIA process, consultations were undertaken as part of the LRP process. These consultations were undertaken amongst the key stakeholder group identified during the land procurement and impact assessment process. (Figure 8-1 captures photographs from the 2015 ERM site visit.)

Source: ERM site visit 2015

Figure 8-1: Engagement Undertaken as part of the LRP Process

The purpose of these consultations was to develop an understanding of the local stakeholder's perception of the Project and its activities, the impacts of the Project on the community, especially in terms of the impacts of land take, the adequacy of the compensation provided, and the possible livelihood restoration activities that could be introduced to support the Project Affected Families (PAFs). Table 8-1 provides a list and purpose of the consultations undertaken.

Table 8-1: List of Stakeholder Consultations Undertaken

S. No	Stakeholder Group	Village/ VDC	Date	Purpose
1	Community Forestry User Group	Mailung	18-11-2014	To understand the functioning of the CFUGs, the impact of the Pon, the guthi land, the compensation paid for the same and pending issues is any.
2	Jan Sarokar Samiti	Mailung	11-01-2015	To discuss the purpose and functioning of the Jan Sarokar Samiti
3	Community Forestry User Group	Haku Besi	13-1-2015	To understand of the functioning of the CFUGs, the impact of the Project on the guthi land, the compensation paid for the same and pending issues is any.
4	Tamangs	Haku Besi	12-01-2015	To profile the community, understand vulnerabilities and impacts from the Project and discuss community expectations.
5	Women	Haku Besi	13-01-2015	To understand the profile of women, their status on the Tamang family, and impacts specific to them and the range of livelihood activities they require.

S. No	Stakeholder Group	Village/ VDC	Date	Purpose
6	Tamangs	Haku Besi	13-01-2015	To understand the Tamang community in terms of their socio-cultural practices, economic profile, their relationship with the other social groups, and any impacts specific to them
7	Youth	Haku Besi	14-01-2015	To develop an understanding of youth's perception and expectations of the Project, the changing socioeconomic profile of the villages and the Project's impacts on youth.
8	Women	Mailung	10-02-2015	Understand the profile and socioeconomic status of women and their role in the society. Develop an understanding of their specific perceptions and expectations of the Project and the potential impacts of the Project on them.
9	Women	Mailung	11-02-2015	Develop an understanding of the role of women in the society in terms of livelihood generation and decision making at the community and household level. Also, to understand their perception and expectations of the Project and its potential impacts.
10	Forest Department	Mailung	12-02-2015	Understand the process of Community forestland acquisition, compensation, and other related issues.
11	Fishing Group	Karakchapul	12-02-2015	Understand the nature of the fishing activities in the area and the potential impacts of the Project on the same and the possible mitigation/ compensation measures that can be put in place.
12	Community Forest User Group	Mailung	12-02-2015	To develop an understanding of the working of the CFUGS, the impact of the Project on the Guthi land and the compensation paid for the same.
13	Assistant Chief District Officer	Dhunche	12-02-2015	To understand the land acquisition process in the district and the role of the government in the same and the policy towards hydropower projects.
14	Senior Agriculture Development Officer	Dhunche	12-02-2015	To develop an understanding of the agricultural activities in the district, the government programs and schemes being implemented and the identification of potential programs and activities that can be undertaken in collaboration with the Project proponents.
15	Mapi Department	Dhunche	13-02-2015	To develop an understanding of the land acquisition survey process.
16	Malpot Department	Dhunche	13-02-2015	To develop an understanding of the role of the department in the land survey and transaction

Source: ERM 2016

Since then, the Project has also recruited two Community Liaison Officers (CLOs), who are stationed at Dhunche, one of which is from a PAF for the Project. These CLOs are the local points of contacts for the PAFs and the local communities; they undertake regular informal engagement, play an important role in the process of information disclosure, and also serve as the first level of communication for the local community.

8.4. POST-EARTHQUAKE RELIEF ACTIVITIES AND ENGAGEMENT (2015)

Nepal was struck by a 7.8-8.1 magnitude earthquake called the "Gorkha Earthquake" on 25 April 2015. The Rasuwa District, where the UT-1 Project is located, was one of the worst affected areas. The earthquake damaged more than 80 percent of the houses and resulted in more than 200 deaths within the Area of Influence (three VDCs accounting for about 500 households), including 43 fatalities within the Project area, and compromised the Project's access road.

As a stakeholder in the region, the NWEDC proactively engaged to provide relief and rehabilitation support to the earthquake affected communities. As part of this engagement process, NWEDC, in partnership with the local government and community based organizations, undertook relief activities including immediate interventions/evacuations post-earthquake and long-term interventions. NWEDC provided support in terms of the following:

- Aid in search and rescue operations in Mailung, Gogone, Tiru, and Haku VDC, through which they rescued approximately 67 injured locals through helicopters;
- Immediate relief of food, tarpaulin sheets, blankets, toilet pans and utensils;
- Distribution of corrugated galvanized iron sheets (over 1550 tonnes) and bamboo (8 per family) for the construction of temporary shelters and toilets;
- Distribution of rice and cooking oil (a total of approximately 37.7 tonnes of rice and 1452 litres of cooking oil);
- Establishment of medical health camps and medicine support;
- Distribution of warm clothes to school children in Haku VDC;
- Provision of drinking water, water tanks and pipes; and
- Contribution of $50,000 as support for relief and rehabilitation of quake victims to Nepali Ambassador in Seoul by Korea South East Power Company Ltd. (KOSEP).

This relief support was focused on the villages of Mailung, Gogone, and Tiru, which were the most severely impacted. Within these villages, the priority relief support was given to the elderly, disabled, and injured people. It should be noted that as part of these relief activities, no distinction was made between the Project-affected and other households in the affected VDCs.

8.5. GAP ASSESSMENT PROCESS ENGAGEMENT (2016)

In 2016, ERM was recruited to undertake an environmental and social gap analysis and status assessment of the Project within the Area of Influence, in the post-earthquake condition. One of the key activities undertaken as part of this assessment was consultation with the internal and external stakeholders. Table 8-2 provides a summary of the consultations undertaken.

Table 8-2: Stakeholder Consultations Undertaken

Stakeholder Group	Location	Key Issues
NWEDC	Kathmandu	• Post-earthquake baseline studies being undertaken by NWEDC; • Possible design changes being made in the Project due to earthquake; • Status of ESMS, existing proposed organisational structure for implementation of the ESMMP, and HSE plan for the Project; • Status and understanding of the various relief activities being undertaken by the Project in IDP camps;
Local Community	Mailung	• Understanding of the impacts from the earthquake; • Status and understanding of the various relief activities being undertaken by the Project, NGOs and government in IDP camps; • Change in socioeconomic baseline in the Project area post the earthquake, in terms of social structure, livelihoods and access to infrastructure and services; • Key concerns of the local community in the post-earthquake scenario; • Key expectations of the community from the Project and the government
Local Community, in IDP Camp	Naubise	
Local Community, in IDP Camp	Bogetitar	
Land Owners in IDP Camps	Across IDP camps	
Local Community, in IDP Camp	Farm Camp	
Local Community, in IDP Camp	Kebutol	
Local Community, in IDP Camp	Pradhikaran	
Agriculture Department	Dhunche	• Status and understanding of the relief work and support being provided by the Department to the affected communities • Discussion on the possibility of involving the Department in the implementation of the mitigation measures to be identified as part of the gap assessment
Assistant Chief District Officer	Dhunche	• A discussion on the relief work being undertaken in the District • A discussion on the possibility of the affected communities returning to their villages • An understanding of the government's position and plans on the resettlement of the affected communities and the possible way forward
Forest Department	Dhunche	• The impact of the earthquake on the forest area and landslide potential • The impact from the earthquake in the Project area • The impact of the earthquake on biodiversity within the national park
Forest Ranger, LNP	Dhunche	• The impact of the earthquake on the forest habitat and biodiversity • The measures to be taken by the Department in response to reducing flow in the Project's diversion reach
Saman (Design Engineers)	Dhunche	• An understanding of the possible design changes being proposed in keeping with the health and safety concerns, environmental and social concern as well as from risk perspective

Stakeholder Group	Location	Key Issues
NGO, Samaritan Trust	Dhunche	• Status of the various relief activities being undertaken by the NGOs and government in IDP camps; • Change in socioeconomic baseline in the area post the earthquake, in terms of social structure, livelihoods and access to infrastructure and services; • Key community concerns and Project expectations in the post-earthquake scenario • Future activities planned by NGOs in the IDP camps and the possibility of the Project partnering with the NGOs in the implementation of the mitigation measures
NGO Manekor	Dhunche	
NGO Karuna	Dhunche	
NGO Lali Guras Samudayak Development Chamber	Dhunche	
NGO Parivartan	Dhunche	

ESMMP = Environmental and Social Management and Monitoring Plan; HSE = health, safety, and environmental; IDP = Internally Displaced Persons; LNP = Langtang National Park; NGO = non-governmental organization

8.6. LALRP FORMULATION PROCESS ENGAGEMENT (2017)

As part of the LALRP formulation process in 2017, focus group discussions and key informant interviews were undertaken with certain key stakeholder groups in April and May 2017 (see Figure 8-2 and Table 8-3). These discussions and interviews were aimed at supplementing and triangulating the information made available during the PAF survey and also for collecting additional qualitative data on certain key areas, such as non-governmental organization (NGO) activity in the area and livelihood restoration mechanisms.

Source: ERM site visit 2017

Figure 8-2: Stakeholder Engagement Activities Undertaken as part of LALRP

Table 8-3: Stakeholder Engagement as part of the LALRP Process

Stakeholder Group	Group Representatives	Summary of Consultations Undertaken
NGOs active in the Project area	Manekor	A discussion was undertaken on the activities and key learnings of the organizations in the post-earthquake scenario
	LaCCos	
	Lumanti	
Government Departments	National Reconstruction Authority (NRA)	A discussion on the role and purpose of the NRA, its key objectives, way forward and challenges being faced
	Ministry of Federal Affairs and Local Development (MoFALD)	A discussion on the process of grant disbursal for house reconstruction and the role of MoFALD in the same
	Department of Urban Development & Building Construction (DUDBC)	A discussion on the overall reconstruction process and the designs approved by the government
	Land and Revenue Department	A discussion on the role and key objectives of the agencies and the possibility of associating with them for the R&R process
	Veterinary Department	
	Chief District Officer (CDO)	
	Cottage Industry Department	
Local Community/ PAFs	Women group from Haku VDC	A discussion with the various stakeholder groups on the following aspects: • The impacts from the earthquake • Present livelihood profile • Role of the Project in earthquake relief • Present perception towards the Project • Present expectations from the Project in terms of R&R activities
	Women Group from Haku VDC	
	Tamang Women Group from Satbise	
	Mixed group in Nuabise	
	Mixed group in Bogetitar	
	Mixed Youth Group	
	Mixed Group from Farm Camp	
	Women Shop Owner in Nuabise	
	Women Shop Owner in Nuabise	
	Mixed Group in Khalte	
	Key Informant Interview, local Politician in Nuabise	
	Key Informant Interview, women returned from migrant labour	
	Men Group in Mailung	
	Men Group from Haku VDC	

NGO = non-governmental organization; PAF = Project Affected Family

Based on these consultations undertaken for the LALRP, the following key feedback or areas of concern were identified:

- Differences in access to relief support across the Internally Displaced Persons (IDP) camps. It was reported that, due to interventions of local political leaders, IDP camps such as Nuabise and Bogetitar received most of the relief support from numerous NGOs, while camps such as Satbise, with no strong political leader, did not receive any relief support from any NGOs. Others attributed the lack of relief support for Satbise IDP to the fact that most of the camp's residents are from Rasuwa District, while the camp is located in Nuwakot District.
- Community concerns about housing were paramount, with much uncertainty regarding next steps; PAF have an expectation that NWEDC will do something about the housing issue;
- The PAFs have a concern that the current Sarokar samiti for the Project does not have adequate representation of the people from Haku. While all the PAFs (land sellers or tenants on Guthi land) reside in Haku VDC and now in other IDP camps, the meetings of Sarokar

samiti for the Project do not have their participation. While they have lost the land, there is no preferential treatment for PAFs in getting the benefits in the Project;

- Some of the PAFs also had concerns regarding delays in the payment in the access road construction. It was mentioned that half of it was paid with NWEDC intervention, but a part of it is still pending. It was highlighted as a major concern that in future it will become a critical issue, as the daily wage is one of the key sources of income for the family. Without 7-day or 15-day payment cycles, it will become really difficult for the PAFs to become engaged in the construction work.
- Most PAFs indicated that they have had a good relationship with non-local workers in the past, because the labourers will buy materials from the locals; however, some PAFs voiced concern that non-local workers will accept lower wages and reduce wage rates for everyone.
- The women focus groups indicated that most of the trainings in the IDP Camps provided to women were geared towards household skills (e.g. sewing, tailoring, vegetable gardening) and not livelihoods or income generation. Furthermore, while some women received trainings, such as making Pangi, no market linkage was provided as part of the trainings. This resulted in most of the women only sporadically using the skills obtained from the training, and for mostly for meeting household needs only.
- Some of the PAFs and youth representatives indicated that the NGOs provided trainings on skills such as masonry in all of the IDP camps, resulting in an oversupply of masons and a reduction in their pay. Furthermore, over the last few months, there has been a reduction in the number of masonry or construction labour related jobs available because most of the post-earthquake reconstruction activities post-earthquake have been completed. Further, the masonry focused on local materials rather than working with cement and concrete, which has limited their opportunity to find employment in urban areas.
- Many of the local community residents took the training that was available, which often was in areas that had little interest, and therefore were not using the skill gained.
- Local community representatives reported various issues associated with residing in IDP camps and the uncertainty associated with their residence. These issues included lack of space, health, and sanitation issues. In addition, many households have been unable to establish a stable source of income or initiate a business activity (such as livestock farming or setting up a small shop) because of the lack of space and uncertainty on how long they will remain in the IDP camps;
- Several PAFs were provided at the IDP camps with a basic poultry farming training and 200 chicks for starting their own farm. However, most of the households did not have an adequate understanding of the kind of diseases prevalent in poultry and the process of vaccination. As a result of this, most of the chicks died within the first few months. Very few households were able to sustain their holdings. Furthermore, poultry farming requires consistent supply of electricity, which was not always available in the IDP camps and villages.

- In Gumchet Village (approximately 6-8 households), there were complaints of structural damage to households and a school as a result of the road construction. NWEDC is aware of the issue which shall be addressed through the Grievance Redressal Mechanism.

8.7. FPIC PROCESS ENGAGEMENT (2017 - ONGOING)

About 90 percent of the PAFs are Tamang, an Indigenous People native to Nepal. Although the circumstances triggering the requirement for FPIC did not exist for this Project, the lenders have decided to apply FPIC, on a precautionary basis, which triggered the need for the development of an Indigenous Peoples Plan (IPP) (see Appendix H, Indigenous Peoples Plan) and conducting an FPIC engagement process.

The FPIC process to be followed for this is as described below:

- Through the social survey and LALRP formulation process, there have already been intensive consultations and participatory assessments with the Tamang community, aligning with the requirement of an ICP process.
- The nontechnical executive summaries of the Social Impact Management Framework and other management plans will be translated into the Tamang language. These executive summaries will be disclosed to the local community and local administration (for advisory role) by NWEDC by providing copies in strategic locations and notifying the community about this through appropriate and diverse channels. The local community shall be provided with at least 15 days to review the disclosed summaries.
- Open consultations with the local communities in various Internally Displaced Persons camps/villages will be conducted to provide them with clarifications and additional information on the content of the disclosed summaries.
- After at least 7 days of these consultations, NWEDC will undertake two large public meetings in Dhunche and Mailung for the Tamang community impacted by the Project. The purpose of this meeting shall be to gather feedback from the community on the findings of the ESMMP and Social Impact Management Framework.
- Assuming that a broad consent is received, the LALRP and the Indigenous Peoples Plan shall be updated, based on the feedback received during these various engagement activities.

Disclosure and consultation process shall be done in a culturally appropriate manner. The guiding principle for such a process includes:

- Conduct the process in the Tamang language;
- Ensure the participation of the traditional leaders and regional representatives of Indigenous Peoples Organizations;
- Ensure the disclosure is made at the village and district levels;
- Provide adequate opportunity to community members for responses and suggestions; and
- Document the outcome of the process in terms of commitments, duties, and accountabilities by different parties.

The disclosure and documentation of consent over the Project impact management and benefit sharing shall be carried out by an independent agency with appropriate expertise.

The management plans shall be subsequently updated based on the feedback received during their various engagement activities. The LALRP and IPP will also provide summaries and documentation (photographs) of each of these consultations undertaken.

8.8. GRIEVANCE REDRESSAL MECHANISM

As part of the LRP, an external stakeholder Grievance Redressal Mechanism (GRM) was put in place for the Project in 2016. The purpose of GRM is to provide a forum for the community and other stakeholders to voice their concerns, queries, and issues with the Project. Such a mechanism provides the stakeholders with a single channel through which concerns can be raised and timely responses received. The GRM was aimed at being accessible and understandable for all stakeholders in the Project and for the entire Project life.

The GRM contains the following:

- Grievance definition, categories, and principles;
- Some of the key emerging grievances based on records review and consultations with NWEDC and community ;
- Institutional mechanism for GRM implementation; and
- The process of receiving, documenting, addressing, and closing grievances.

While the ESMMP provides the detailed GRM for the Project, the process of receiving, addressing and closing the grievances is depicted in Figure 8-3 below.

Any grievances can be sent to the Project's Grievance Office, Project Manager, Community Liaison Officers, or the Social Manager. Although the GRM process is in place, currently the only construction activity is the removal of landslide debris from the portion of the access road that was constructed at the time of the earthquake, and many of the local residents are still residing in IDP camps, so few grievances have been filed to date.

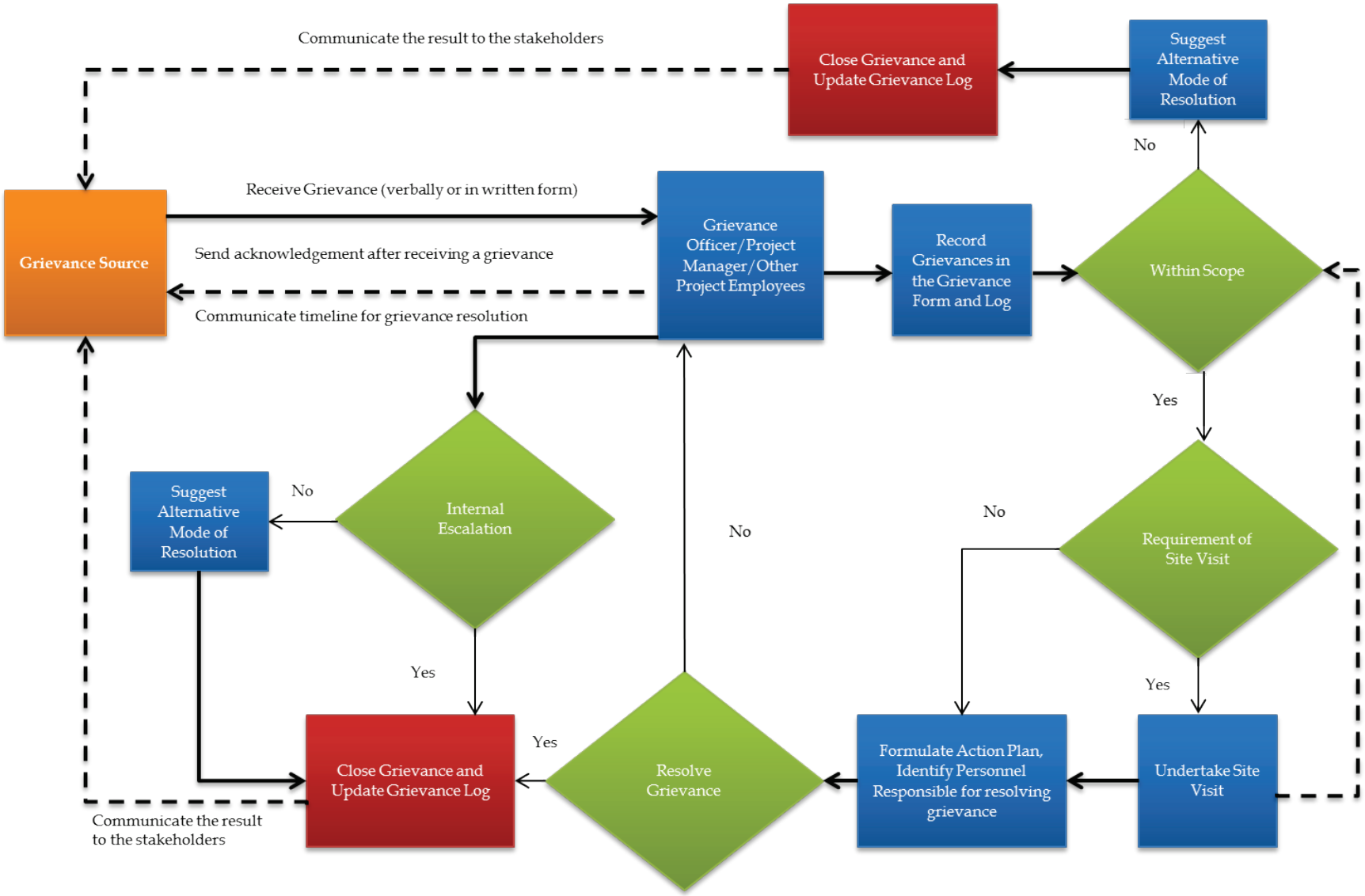


Figure 8-3: External Stakeholder Grievance Redressal Mechanism Schematic Representation

9. ESTIMATED ENVIRONMENTAL AND SOCIAL MITIGATION COSTS

This chapter provides a list of proposed and recommended mitigation measures and provides a preliminary estimate cost for their implementation. This list (see Table 9-1) excludes the costs associated with avoidance and minimisation measures (e.g. costs associated with a run-of-river versus a peaking operations regime) and costs included in the Construction Contract Bid Document (e.g. cost of a wastewater treatment plant, installation of sediment control measures) and focuses on the costs associated with mitigating unavoidable impacts. Tables 10-1 and 10-2 summarize the list of avoidance, minimisation, and mitigation measures committed to by Nepal Water and Energy Development Company Limited.

Table 9-1: List of Proposed Mitigation Measures and their Estimated Cost

Resource	Mitigation Measure	ESIA Section Reference	Estimated Cost (US$)
Water Quality	Monitor rock cuttings for acid generating potential	7.2	$50,000
	Conduct a waste audit to identify permitting waste management facilities in Nepal	7.2	$25,000
Aquatic Biodiversity	Provide fish ladder and guidance measures	7.2	$500,000
	Provide environmental flow requirement (capital cost for providing flow and monitoring; cost of lost water not included)	7.2	$100,000
	Provide Adaptive Management (framework)	7.2	$25,000
	Hire Fish expert to lead fish monitoring, mitigation and adaptive management through construction and initial operations	7.2	$200,000
Terrestrial Biodiversity	Comply with reforestation requirement, including acquiring land/ seedlings, planting, and 5 years of maintenance	7.3	$200,000
	Acquire and donate land equivalent to government land acquired to Langtang National Park	7.3	$400,000
	Install protective fencing around the dam site to prevent access to Langtang National Park	7.3	$20,000
	Provide awareness program to construction workers and signage regarding Langtang National Park, protected species, and community forests	7.3	$30,000
	Provide funding to Langtang National Park to recruit additional staff to monitor UT-1 construction activities	7.3	$50,000
	Provide funding to local forest user groups for monitoring and surveillance to protect forest and wildlife	7.3	$30,000
Community Health, Safety and Security	Survey structures located within 250 metres of tunnels and access road to document structural condition	7.4	$5,000
	Install siren network/notification system in case of sudden releases of water	7.4	$25,000
	Provide compensation for structures damaged by blasting or other Project activities (budgeted cost)	7.4	$5,000
	Provide financial assistance to District Police Office for increased security personnel	7.4	$15,000

Resource	Mitigation Measure	ESIA Section Reference	Estimated Cost (US$)
	Provide financial assistance to schools receiving children of Project workers	7.4	$15,000
	Provide financial assistance to local health institutions	7.4	$15,000
	Provide awareness training for non-local workers regarding respect for local traditions, culture, and religious practices.	7.4	$15,000
	Conduct community awareness program on sexually transmitted diseases and female trafficking for Project staff and local villages	7.4	$10,000
	Conduct community awareness program and signage related to traffic safety	7.4	$20,000
Land Acquisition	Already completed	7.5	--
Indigenous Peoples	Conduct Free, Prior, and Informed Consent process	7.6	$100,000
General	Provide benefit sharing to local community from the Project in accordance with Benefit Sharing	NA	Cost to be determined
General	Implement robust Biodiversity Evaluation and Monitoring Program (assume $100,000/year for 5 years of construction, plus $50,000/year for 30 years of operations)	NA	$2,000,000
General	Hire international advisor to assist NWEDC in developing detailed ESMS and finalizing the Owners ESMMP (e.g., Biodiversity Management Plan)	NA	$150,000

NA = not applicable

10. CONCLUSIONS AND RECOMMENDATIONS

The UT-1 Project will generate approximately 1,456 gigawatt hours of clean, renewable electricity for domestic use and could reduce greenhouse gas emissions by up to two million tons of carbon equivalents annually. Through careful Project siting and design, Nepal Water and Energy Development Company Limited (NWEDC) has effectively applied the Mitigation Hierarchy to avoid many potential impacts (e.g. no involuntary resettlement or impacts to any International Finance Corporation-defined Critical Habitat). The proposed true run-of-river operating mode, higher than required Eflow, the provision of a fish ladder, and commitment to an Adaptive Management Program to ensure migratory fish reach their spawning grounds upstream of the Project dam collectively help minimize impacts to aquatic habitat and fish. NWEDC has generally acquired land and compensated affected landowners in accordance with international standards. Where residual impacts exist, NWEDC has proposed measures to restore or offset these impacts (e.g. offset Langtang National Park land take, comply with Nepal Ministry of Forestry reforestation requirements). Further, NWEDC has committed to developing or implementing a range of Construction and Operation Environmental and Social Management Plans to ensure remaining impacts and risks are properly managed.

Tables 10-1 and 10-2 summarizes the key avoidance, minimization, mitigation, and management measures proposed by NWEDC to manage the Project's environmental and social risks and conform with international standards for the Project's construction and operation phases, respectively. Taking into consideration NWEDC's efforts at avoidance, minimization, restoration, and offsetting of impact, the Project's residual impacts are minimal, and much less than would be expected from alternative 216 MW sources of power.

With the proper implementation of the Construction and Operation Environmental and Social Management Plans and development of a robust monitoring program, the UT-1 Project should be in conformance with the IFC Performance Standards, other lender requirements, and has the opportunity to set a new standard for other hydropower projects in the Trishuli Basin and elsewhere in Nepal.

Table 10-1: Project Construction Phase Environmental and Social Risk Management Measures

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Air Quality	Fugitive dust	• Spray water on disturbed surfaces as needed • Place gravel on access roads near villages • Cover truck loads • Provide dust control at crushing and crushing plants • Use high-efficiency dust suppression system for crushers operated at the site • Enforce speed limits along dirt roads near communities • Stabilize disturbed areas as soon as possible after construction with vegetation or other materials	• Air Quality MP • Blasting and Explosives MP	Minor	EPC Contractor
	Vehicular and Power Emissions	• All Project vehicles will comply with national emission standards • Use low-sulphur fuel diesel for diesel-powered equipment and vehicles to the extent available in Nepal • Provide regular maintenance of vehicles in accordance with manufacturer specifications • Provide covering for material transport • Enforce appropriate speed limits within construction site • Reduce vehicle idling time to a minimum	• Air Quality MP • Maintenance MP	Minor	EPC Contractor
Climate Change	Green House Gas Emissions	• Regular maintenance of vehicles in accordance with manufacturer specifications • Reduction of vehicle idling time to a minimum • Minimizing vegetation clearing to the extent practicable • Burning of biomass is prohibited in the worker camps	• Air Quality MP	Minor	EPC Contractor
Noise and Vibration	Noise and vibration	• Procure low noise generating compressors and diesel generating sets • Provide regular maintenance of vehicles and equipment in accordance with manufacturers specifications • Install noise control device at adit portal ventilators • Prohibit above ground blasting and construction activities at night • Assess structures near blasting areas and along Project Private Road before and after blasting • Notify local communities before blasting • Restrict use of horn near school and residential areas by placing signage • Place equipment generating vibrations on strong foundation • Practice controlled blasting near structures	• Noise and Vibration MP • Blasting and Explosives MP • Maintenance MP	Minor	EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Water Quality	Land Disturbance Spoil and Muck Disposal	• Avoid spoil disposal sites in floodplains, on unstable land that could can cause future landslides, affect drainage or irrigation ditches, or present risk of failure of spoil washing into watercourse • Construct spoil sites that are stable and not susceptible to erosion (e.g. use gabion structures) • Implement appropriate sediment and erosion control • Construct drainage system surrounding disposal sites to control surface runoff • Provide drains as needed within and around the spoil disposal site to manage water levels within the cells • Use spoils for construction purposes to the extent possible to reduce disposal requirements • Dispose of spoil only at authorized disposal sites, no spoil will be disposed in the Trishuli River or tributary streams, steep slopes, farmland, or forest areas • Rehabilitate spoils sites as soon as the disposal operations are complete with native vegetation(e.g. *Alnus nepalensis*)	• Clearing, Grading Underground Excavation, Sediment and Erosion Control MP • Stockpiles, Quarries, and Borrow Pit MP • Spoil Management and Disposal MP • Water Quality MP	Minor	EPC Contractor
	Rock Cuttings	• Evaluate the geologic formation through which the tunnelling will occur for the potential presence of sulphide and other PAG rock • Periodically test the rock to confirm the lack of PAG minerals • Have a plan in place to manage any PAG rock that may be encountered	• Rock Cutting MP	Minor	EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Water Quality	Solid and Hazardous Material Use and Waste Disposal	• Establish a system for collection, segregation, and disposal of solid waste in the worker camps • Provide training for recycling and reducing waste • Conduct an audit to identify available and appropriately permitted waste management facilities for Project wastes • Apply appropriate storage, transport and use practices to recognized standards for fuels, chemicals, explosives, hazardous substances • Waste storage facilities shall be located away from the Trishuli River and tributaries and be designed to prevent wastes from being washed away during the monsoons or other high flow periods • Explosives, chemicals, and hazardous substances to be handled by authorized personnel • Diesel to be stored in truck tankers or in overhead tanks to a maximum of 5000 litres and on flat ground at least 50 metres from a waterway • Dikes to capture 100 percent of fuel must be placed around fuel storage area • All refuelling to be done on flat ground • Spill kits and emergency procedures shall be used and staff trained • Collect and store liquid wastes (e.g. lubricants, paints, cleaning, chemical, and oil-based materials) in a suitable storage tank with concrete floor for ultimate disposal at an authorized disposal facility; • Prohibit deliberate discharge of oil, diesel, petrol or other hazardous materials to the surrounding soils and waterways.	• Materials Handling and Storage MP • Spill Prevention and Response MP • Waste MP • Wastewater MP • Water Quality MP	Minor	EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
	Wastewater Discharges	• Provide an on-site package wastewater treatment plant or community septic system to treat domestic wastewater at the worker camps • Use oil/water separators for drainage from repair and maintenance facilities • Provide settling ponds to manage runoff from work areas (e.g. crushing and batching plants) • Collect, test, and treat if necessary tunnel process water • All wastewater discharges (e.g. domestic, stormwater runoff, tunnel process water) will comply with the IFC General EHS Guidelines and Ministry of Environment standards	• Wastewater MP • Water Quality MP	Minor	EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Biodiversity	Aquatic Habitat and Fisheries	• Provide environmental flow • Construct fish ladder for upstream fish migration • Provide guidance mechanisms for downstream fish migration • Provide awareness training and prohibit fishing, or fish trapping/killing activities by construction contractors • Implement Connectivity Assessment, fish studies and continual monitoring of fish species and quantities • Hire international fish specialist to oversee construction and initial operation of the fish ladder and Eflow Adaptive Management Program • Terminate any employees found trapping or fishing in the diversion reach	• Biodiversity MP	Moderate	NWEDC/EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
	Terrestrial Habitat	• Primarily sited in Modified Habitat • Establish clearing limits • Demarcate in the field the approved limits of clearing • Collect and store topsoil for use in restoration • Stabilize and rehabilitate/reforest temporarily disturbed areas • Acquire, reforest, and donate area equivalent government land required for project to LNP • Mitigate the loss of trees on a 2:1 basis in accordance with Ministry of Forest requirements for all trees identified during the regulatory EIA process, and on a 25:1 basis for any additional trees which may be affected during the course of project implementation. • Provide awareness training and prohibit hunting, fishing, or poaching by construction contractors • Display of hording boards showing illegal acts (poaching, hunting, etc.) in consultation with LNP. The conservation significance of black bear will be also displayed in the hoarding board. • Install fencing around the dam site and the worker camp on the LNP side to prevent unauthorized worker access to LNP forest • Provide awareness program to construction workers regarding LNP and protected species • Inform contractor staff that unauthorized entrance to the LNP or damaging natural forest areas is prohibited and could result in the termination of their employment • Terminate any employee found collecting firewood, timber, or other forest products from the local community forests or LNP • Provided workers with adequate quantity of cooking fuels such as kerosene and LPG • Train workers about fire hazards and provide fire extinguishers • Provide staff to monitor activities in the LNP buffer zone at the dam site and in community forests to ensure no illegal activity by construction workers, to identify and discourage any encroachment by camp followers; and to report to LNP and coordinate with park patrol authorities etc.	• Biodiversity MP • Restoration and Revegetation MP • Spoil Management and Disposal MP	Minor	NWEDC/EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
	Impacts to Wildlife	• Provide awareness training and prohibit hunting, fishing, or poaching by construction and operation contractors • Terminate any employees found illegally hunting, poaching or trading protected species • Include terms in contracts with EPC and O&M contractors indicating that exploitation of biodiversity resources will result in penal action. • Use signage and speed humps in areas where wildlife crossing is likely. • Train vehicle drivers regarding the driving risks through biodiversity sensitive areas and along remote roads. • Prohibit wildlife meat at the worker camps	• Biodiversity MP	Minor	NWEDC/EPC Contractor
Biodiversity	Impacts to Birds related to Transmission Lines	• Raise the transmission poles with suspended insulators • Require bird-safe strain poles with insulating chains of at least 60 centimetres length. • Check for vacuums or holes in the towers to avoid nesting by any of the birds; • Monitor bird carcasses electrocuted on a monthly basis and record any threatened or migratory species observed	• Biodiversity MP	Minor	NWEDC/EPC Contractor
Community Health, Safety, and Security	Dam Safety	• Modified Project design to account for better defined seismic hazards and climate change predictions • Dam design to be reviewed by Project's Panel of Experts and Lender's Independent Engineer • A siren network will be installed to inform those in the dewatered portion in case of a sudden release of water	• Emergency Preparedness and Response MP	Minor	NWEDC/EPC Contractor
	Seismic Hazard and Risks	• Maintain a 0.39 g seismic acceleration coefficient for concrete structures, and use prefab for other light structures	• Emergency Preparedness and Response MP	Minor	EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
	Landslide Hazard	• Assess geologic hazard of access road alignment, including pegging and flagging of landslide area boundaries • Survey structure located within 250 metres of tunnels and access road to document conditions of these structures • Install temporary and permanent slope stabilization using appropriate civil structures (e.g. gabions, concrete, benches) • Provide for both vertical and horizontal drainage to avoid erosion and safely divert water from steep slopes • Maintain slopes at less than the angle of repose to the extent possible • Control blasting and use of explosives, especially near landslide susceptible areas • Provides compensation to structures damaged by blasting or other Project activities • Stabilize disturbed areas using bioengineering techniques where feasible and rehabilitate the site with native species	• Landslide and Slope Stabilization MP • Quarry Management Plan	Moderate	EPC Contractor
Community Health, Safety, and Security	Spoils and Muck Management	• Use excavated material for road construction, aggregate, and backfilling of quarries and borrow pits to the extent possible and suitable • Locate spoil disposal sites above the flood line of the Trishuli River and avoid disturbance of agricultural land and forestland to the extent possible • Remove and retain any topsoil for use in rehabilitation at closure • Provide retaining walls/ wire-crates at each disposal site • Provide appropriate erosion and sediment control, including routing drainage through sediment traps prior to release • Prohibit the disposal of spoils and mucks at unauthorized locations • Conduct regular training and awareness programmes for drivers transporting muck and spoil to designated site • Stabilize, revegetate, and rehabilitate the spoil disposal sites once it reaches capacity using stockpiled topsoil to the extent possible •	• Emergency Preparedness and Response MP • Spoil Handling and Disposal MP	Minor	NWEDC/EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Community Health, Safety, and Security	Traffic	• Access Roads Stability and Traffic Safety • Procedures to notify nearby communities of proposed traffic volumes and patterns • Provide educational materials to nearby residents and schools to inform children about traffic safety • Establish speed limits for all traffic, especially in proximity to villages • Provide training to all staff with driving responsibilities to sensitize them to potential safety risks such as children playing, livestock, and driver fatigue • Provide as needed warning sign and speed bumps to alert drivers that they are approaching sensitive receptors	• Emergency Preparedness and Response MP • Traffic Management Plan	Minor	NWEDC/EPC Contractor
Community Health, Safety, and Security	Natural Disasters and Accidents	• Project components have been modified relocating many underground • Provide a first aid health facility at the campsite and emergency rescue procedures if needed. • Provide protective equipment to all workers as per the nature of their work • Project design to withstand a 10,000-year flood event • Include an emergency communication and notification system to alert downstream communities of flooding and other natural disasters • Coordination with upstream and downstream hydropower projects for monitoring and coordinated response to natural disasters • Develop an Emergency Preparedness and Response MP in consultation with local health care providers, hospitals, and community leaders. • Provide traffic safety awareness training to both construction workers and local residents, including signage	• Emergency Preparedness and Response MP • Site Safety and Security Management Plan • Occupational Health & Safety MP • Blasting and Explosives MP • Worker Accommodations MP	Minor	NWEDC/EPC Contractor
Social	Land Acquisition	• Minimized Project physical resettlement requirements • Provided compensation for loss of land, structures, crops, and other forms of economic displacement in accordance with the requirements of IFC Performance Standard 5 and Government of Nepal • Provide counselling services to Project Affected Families on the effective use of their compensation payment	• Land Acquisition and Livelihood Restoration Plan	Minor	NWEDC

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
	Forest Land Loss	• Support to the community forest management initiatives as agreed to with the Nepal Ministry of Forest • Provide payment for extra losses of tree during the access road construction or during further construction • Implement a Grievance Redressal Mechanism • Prohibit firewood usage by the construction workers • Provide training and capacity building of the Community Forest User Groups	• Land Acquisition and Livelihood Restoration Plan	Minor	NWEDC/EPC Contractor

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Social	Labour and Labour Influx	• Established Grievance Redressal Mechanism • Provide benefits to the local community from the Project, in keeping with the benefit-sharing plans formulated as part of the Project Development Agreement requirements • Prohibit child labour • Adopt a Worker Code of Conduct • Notify local law enforcement in the case of any prostitution activity • Provide community awareness program on sexually transmitted diseases and girl trafficking • Prioritize Project employment of Project Affected Families • Maximize use of local labour • Provide support to local schools receiving children of Project workers • Provide a health clinic for use by construction workers at the worker camps and require regular health check-ups • Provide equal employment opportunities for both men and women • Provide financial assistance to local health institutions • Provide water supply and wastewater treatment to meet Project demands without affecting local community systems • Provide financial assistance to the local District Police Office to maintain security in the Project area • Provide awareness training for non-local workers regarding respect for local traditions, culture, and religious practices • Provide fencing around the worker camps and not allow access to any unauthorized person • Organize Social and Corporate Responsibility programs and interaction with local communities to build awareness between the workforce and local inhabitants	• Labour Influx MP • Site Safety and Security Management Plan • Worker Accommodations MP • Local Benefits Sharing Plan • Nepal Employment and Skill Training MP	Minor	NWEDC/EPC Contractor
Indigenous and Vulnerable Peoples	Indigenous and Vulnerable Peoples	• A formal FPIC process will be implemented • Support preservation of Tamang traditions, culture, identify, and traditional occupations • Prioritize employment for Dalit group in accordance with their skills and capacities	• Indigenous and Vulnerable Peoples Development Plan	Moderate	NWEDC – for FPIC process EPC Contractor – for other measures

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Management Plan	Residual Risk	Responsibility
Cultural Heritage	Impacts to cultural heritage sites	• Minimized impacts on known cultural and religious sites • Implement a Chance Finds Procedure during construction and ensure it is widely socialised and understood by the Project contractors; and • Establish a grievance redressal mechanism to allow local residents to report concerns associated with cultural heritage impact (e.g. loss of access) and loss of cultural values	• Cultural Heritage MP	Minor	EPC Contractor
Cumulative Impacts	Cumulative Impacts	• Participate in the Trishuli River Cumulative Impact Assessment funded by the IFC		Moderate	NWEDC

EHS = environmental, health, and safety; EPC = engineering, procurement, and construction; FPIC = Free, Prior, and Informed Consent; IFC = International Finance Corporation; LNP = Langtang National Park; MP = Management Plan; NWEDC = Nepal Water and Energy Development Company Limited; O&M = operations and maintenance

Table 10-2: Project Operation Phase Environmental and Social Risk Management Measures

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Operations Management Plans	Residual Risk	Responsibility
Air Quality	• Fugitive dust • Vehicle Emissions • Climate Change	• Enforce speed limits along dirt roads near communities • Regular maintenance of vehicles in accordance with manufacturer specifications • Reduction of vehicle idling time to a minimum	• Air Quality MP	Minor	NWEDC
Noise	• Noise	• Provide regular maintenance of vehicles and equipment in accordance with manufacturers specification • Restrict use of horn near school and residential areas by placing signage • Employees working within powerhouse shall be provided with earplugs and other required PPE.	• Noise and Vibration MP	Negligible	NWEDC
Water Quality	• Solid and hazardous wastes • Wastewater • Sediment	• Manage sediments by periodic flushing of desanders • Manage solid waste generated from the powerhouse, dam, and accommodations areas through proper collection system and stored at designated locations. • Maintain vehicles, machineries, and equipment's in designated areas. • Lubricants, oils, grease, chemical shall be stored at designated area with impervious surface and a secondary containment system. • Ensure hazardous waste (used oil, transformer oil, and oil soaked cloths) is properly labelled, stored onsite at a location provided with impervious surface, shed and secondary containment system, and ultimately transported offsite to an approved disposal facility. • Spill Prevention and Response Plan shall be implemented for immediate cleaning of spills and leakages. • Sludge generated from a wastewater treatment plant shall be used in garden and landscaping. • Discharge of all sanitary and process wastewater to waterbodies must meet IFC EHS Guidelines and Government of Nepal standards.	• Water Quality Management Plan • Sediment Management Plan	Minor	NWEDC

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Operations Management Plans	Residual Risk	Responsibility
Biodiversity	• Flow • Habitat • Species	• Operate in true run-of-river mode • Operate fish ladder and fish guidance system to guide fish to the fish ladder and away from the turbine intake • Provide required Eflow at all times • Monitor Common snowtrout upstream migration and implement the Adaptive Management Program if needed • Monitor the fauna, flora and specific habitats within the impact areas • Monitor bird carcasses electrocuted on a monthly basis and record any threatened or migratory species observed along the transmission line route • Enhance riparian vegetation by developing a Riparian Vegetation Restoration Program • Designate vehicular routes to avoid soil compaction in other areas. • Provide signage and speed bumps where wildlife crossing are likely • Inform contractor staff that unauthorized entrance to the LNP or damaging natural forest areas is prohibited and could result in the termination of their employment • Install fencing around the dam site to prevent unauthorized worker access to LNG forest • Provide staff to monitor/patrol activities in the LNG buffer zone at the dam site and powerhouse worker camp to ensure no illegal activity by construction workers • Terminate any employee found collecting firewood, timber, or other forest products from the local community forests or LNP • Provide awareness training and prohibit hunting, fishing, or poaching by construction and operation contractors • Terminate any employees found illegally hunting, poaching or trading protected species • Prohibit trapping or fishing in the diversion reach	• Biodiversity MP • Sediment MP	Moderate	NWEDC

Resource	Activity/ Impact	Avoidance, Minimization, and Mitigation Efforts	Applicable Operations Management Plans	Residual Risk	Responsibility
Community H&S and Security	• Dam Safety • Landslide Hazard • Traffic • Natural Disasters	• Monitor structural stability of tunnels • Maintain drainage and slope stabilization structures • Install a warning siren network along the diversion reach to provide warning of any sudden release of water • Provide training and exercises to ensure Project is prepared to respond to any natural hazards or accidents in accordance with the Emergency Response and Preparedness Plan • Implement Employee Code of Conduct • Ensure access to a grievance redressal mechanism for employees and the local community. • Ensure adequate and timely disclosure of information to the local community in terms of Project activities and available opportunities, in keeping with Stakeholder Engagement Plan formulated for the Project. • Security personnel will be posted around the site to ensure that there are no unauthorised personnel within the Project site.	• Community Health, Safety and Security MP • Occupational Health and Safety MP • Employee Code of Conduct • Grievance Redressal Mechanism	Minor	NWEDC
Labour Influx		• Control hiring practices to limit labour influx	• Labour Influx MP	Minor	NWEDC
Indigenous Peoples		• Comply with requirements of the Indigenous and Vulnerable Peoples Development Plan	• Indigenous and Vulnerable Peoples Development Plan	Moderate	NWEDC
Cultural Heritage	• Intangible Heritage	• Grievance Redressal Mechanism	• Grievance Redressal Mechanism	Minor	NWEDC
Cumulative Impacts	• Cumulative Impact management	• Participate in a future Trishuli Basin Co-Management Platform to collaboratively monitor and manage impacts.	• Cumulative Impact Management Plan	Moderate	NWEDC

Langtang National Park; MP = Management Plan; NWEDC = Nepal Water and Energy Development Company Limited

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Appendix A
Environmental and Social
Management System Framework

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ATTACHMENTS

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ACRONYMS AND ABBREVIATIONS

CESMP	Construction Environmental and Social Management Plan
CSE	Construction Supervision Engineer
E&S	environmental and social
EHS	environmental, health, and safety
EIA	Environmental Impact Assessment
EPC	engineering, procurement, and construction
ESHS	environmental, social, health, and safety
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management and Monitoring Plans
ESMC	Environmental and Social Management Cell
ESMS	Environmental and Social Management System
EST	Environmental Supervision Team
ESST	Environmental and Social Supervision Team
GIIP	Good International Industry Practice
GM	General Manager
IFC	International Finance Corporation
NWEDC	Nepal Water and Energy Development Company
O&M	operations and maintenance
OE	Owner's Engineer
PMO	Project Management Office
SEO	Safety and Environmental Officer
SOP	Standard Operating Procedure

1. INTRODUCTION

1.1. PURPOSE

This Environmental and Social Management System (ESMS) Framework has been prepared for Upper Trishuli-1 Hydropower Project (Project) for the purpose of defining standards, protocols, and procedures at the project level for managing environmental and social risks and opportunities associated with the project construction and operation activities. This ESMS Framework establishes the Project's commitment to put in place an adequate management system to manage the environmental and social (E&S) impacts and associated risks arising from the Project, as well as to ensure that the Project is developed and operated in a sustainable manner. The applicable administrative and regulatory context against which this ESMS Framework has been developed included national, international, and lender regulations, which have been included in Chapter 5, Applicable Legal and Lender Requirements.

NWEDC will need to take this ESMS Framework and develop a detailed ESMS through which it can operationalize all of its commitments, lender requirements, and government approval conditions. The first step will be to develop an overall Project Commitments Register, and then develop a detailed set of actions required to assure appropriate implementation of all Project commitments. NWEDC will contract with an international consultant to assist in the development and initial implementation of a detailed ESMS.

1.2. OVERVIEW

The ESMS developed by Nepal Water and Energy Development Company (NWEDC) for the Project defines the environmental, social, health, and safety (ESHS) principles, objectives, and protection measures that ensure the project does not cause any harmful impacts. Contractors, including engineering procurement and construction (EPC) contractor and operation and maintenance (O&M) contractor, will follow the ESMS. NWEDC retains ultimate responsibilities for the environmental, health, and safety (EHS) performance of all contractors.

This ESMS will be updated and/or revised as necessary to address the prevailing conditions and stage of the Project. Responsibilities for implementation of identified mitigation or management actions are outlined in the Environmental and Social Management and Monitoring Plans (ESMMP) for the Project. NWEDC's Environmental and Social Management Cell (ESMC) along with the Owner's Engineer (OE) will oversee and monitor the implementation of relevant ESMMP elements by the EPC/O&M contractors and subcontractors. ESMC and OE will monitor, audit, and assess the compliance of the EPC contractor's implementation of the relevant aspects of the ESMMP during the construction phase and ensure that corrective actions are taken when necessary to maintain EHS performance in line with international standards and Good International Industry Practice (GIIP).

This ESMS should be read along with the ESMMP and update accordingly, should there be relevant changes to the Management plans.

2. COMPANY ESHS POLICY

NWEDC adopted an Environmental and Social Policy Statement on 19 December 2016, which was formally executed by its Chief Executive Officer, Bo Seuk Yi (see Attachment 1).

3. COMPANY EHS STAFFING

The Project will establish an organisational structure at the corporate and site level to manage environmental, health, safety and social impacts and to aid in meeting their respective goals and objectives as well as implementing the Project's commitment through their respective policies. Figure 1 highlights the Project's development and management organisational structure.

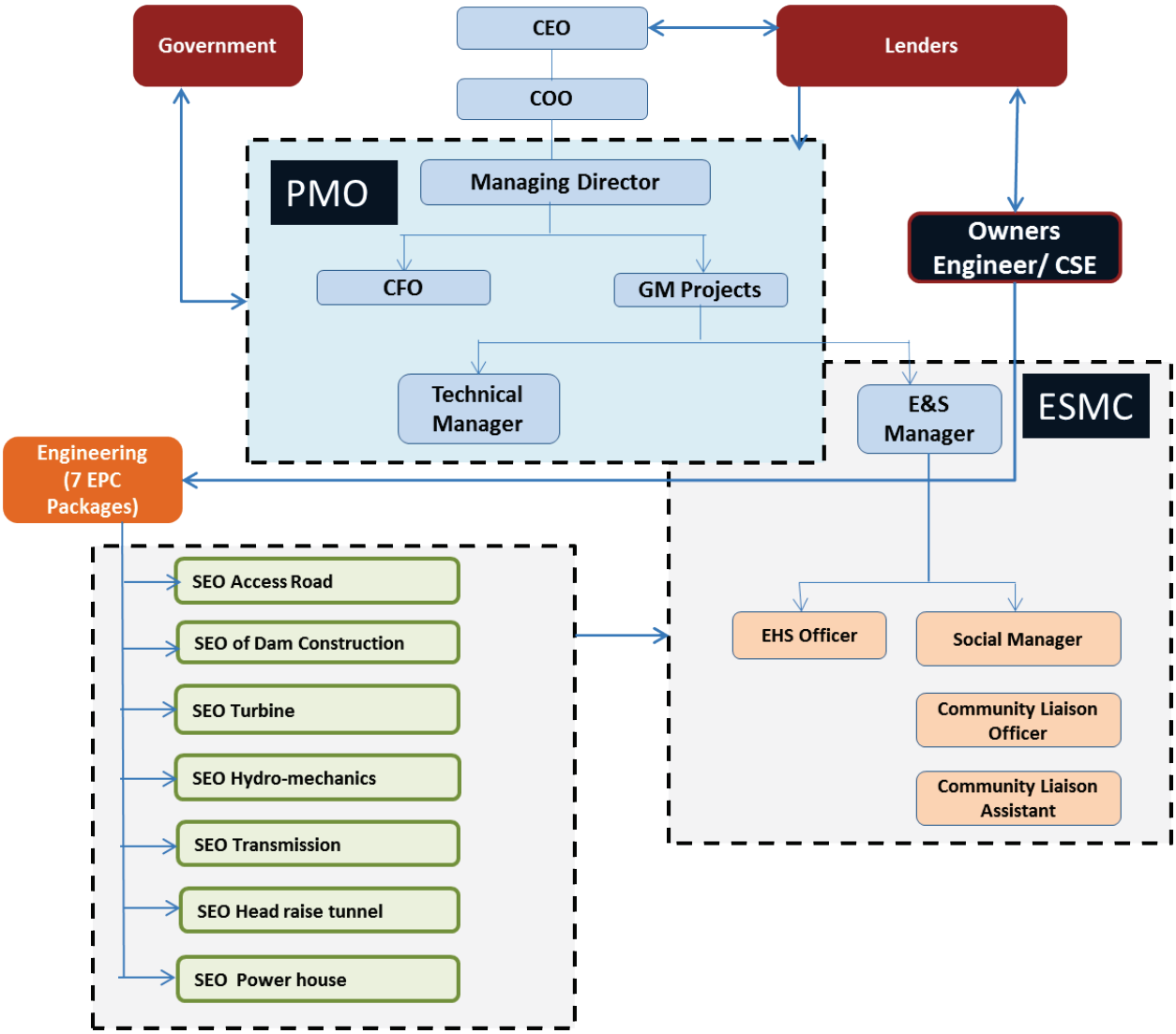

Figure 1: UT-1 ESMS Implementation Organisational Chart

3.1. KEY STAKEHOLDERS FOR ESMS IMPLEMENTATION

The Project Management Office (PMO) has the ultimate responsibility for the Project and is supported by the ESMC in managing the environmental and social impacts. The ESMC will be responsible for the overall implementation of the ESMS and for ensuring the Environmental Impact Assessment (EIA) recommended mitigation and monitoring actions are implemented, monitored, assessed, evaluated, and disseminated to project stakeholders for feedback and improvements. The ESMC will consist of the following personnel:

- An Environmental and Social (E&S) Manager at the corporate level (already appointed);
- One Social Manager supported by two community liaison officers at the site level; and
- Two to three E&S officer (already appointed).

3.2. ROLES AND RESPONSIBILITY

3.2.1. Construction Phase

See Table 1 for the various departments and personnel that will play an integral role in the implementation of the ESMS. In addition to the various departments and responsibilities presented in Table 1, the Corporate E&S Manager will present the key observations, findings, and issues as well as the findings of the external consultant/OE's findings to the Board on a monthly basis.

Table 1: Department Roles and Responsibilities in the Construction Phase

Designation	Description	Responsibilities (not limited to)
Project Management Office (PMO) ESMS committee (PMO and Environmental and Social Manager)	The PMO will comprise of the General Manager (GM) Projects, Chief Financial Officer, MD and other personnel who the MD might authorize. The PMO has the overall responsibility to ensure management of the environmental and social impacts of the project.	• Remove the Contractor's representative or any employee(s) from the site or work or suspend the representative or employee if the Contractor or his employees fails to implement Environmental and Social Management and Monitoring Plans (ESMMP) until the matter is remedied. • Submit performance reports to the Lenders as per an agreed upon frequency, detailing the progress of the ESMS and any other issues therein. • Approve the qualifications and criteria for members in the Environmental and Social Management Cell (ESMC) and the Environmental Supervision Team. • Along with the E&S Manager, act as the ESMS Committee and meet once a month to discuss on the key aspects of ESMMP implementation for the Project based on the reports from Environmental and Social Management Cell (ESMC) and Owner's Engineer (OE).
Environmental and Social Management Cell (ESMC)	The ESMC will consist of community liaison officers, Environmental Health and Safety Officer, Social Manager, and one Environmental Manager. The Environmental Manager at corporate leads the ESMC.	• Ensure that the Environmental Impact Assessment (EIA) recommended mitigation and monitoring measures are being implemented, monitored, assessed and evaluated. • Obtain the necessary compliances and permits for the Project. • Provide progress/performance reports to the PMO in the ESMS committee meetings. • Stop construction in emergency situations where consultation with the Construction Supervision Engineer (CSE) or the Environmental Supervision Team (EST) is not immediately possible. • Conduct periodical inspection of construction site. • Consult and/or communicate with the local communities, project-affected people, regulatory agencies, and other stakeholders during the project preparation and construction to ensure that they have full knowledge of project progress, potential issues and mitigation actions, and to listen and respond to their concerns, suggestions and demands for environmental and community protection. • Maintain open and direct lines of communication with Contractors, CSE/OE and the Environmental and Social Supervision Team (ESST) with regard to E&S matters.
Site-level EHS Team, ESMC	Will be located on-site and will report directly to the E&S Manager. They form a part of the ESMC.	• Monitor the environment health and safety activities of the Contractors on-site against the requirements in the ESMS and Management Plans. • Supervise the baseline, compliance, and impact monitoring of construction contractor's activities and advice the on-site engineers of needed actions at the site during regular environmental management meetings. • Provide needed corrective action as per the field requirements to minimize impacts. • Analyse and review the environmental monitoring report of the project construction and forward to the Corporate E&S Manager for review by stakeholders.

Designation	Description	Responsibilities (not limited to)
Site level Community Liaison Officers, ESMC	Community Liaison Officers will work in close proximity to the affected communities and settlements near the Project site. Community Liaison Officers must include a female Tamang Speaker They will report directly to the Social Manager and form a part of the ESMC.	• Handle community grievances. • Implement the Livelihood Restoration Plan and the Project Development Agreement requirements related to community development and benefit sharing. • Maintain direct communication with the community on matters related to the project. • Understand the concerns of the community and communicate to the E&S manager.
Owner's Engineer (OE)/Construction Supervision Engineer (CSE)	OE/CSE will verify the ESMMP implementation and provide support as necessary. OE/CSE will be responsible for monitoring EPC contractor's compliance to the environmental issues listed in the ESMMP. The OE/CSE will report to the PMO/ESMS committee through E&S manager; The OE/CSE will supervise construction works according to the provisions of EIA, the Environmental and Social Specifications for Contractors and direct the construction contractor in consultation with the environmental engineers for the environmental improvement	• Preside over monthly Environmental Management and Health and Safety Meetings of the supervision engineers, contractors and Environmental Engineers. • Supervise the Contractor's compliance with contract specifications, including the implementation and operation of environmental mitigation measures and ensure their effectiveness, and other aspects of the ESMMP Implementation Plan. Major noncompliance by the Contractor will be cause for suspension of works and other penalties until the non-compliance has been resolved to the satisfaction of the ESMC. Contractors are also required to comply with national and municipal regulations governing the environment, public health and safety. • Instruct the Contractor(s) to take remedial actions within a specified timeframe and carry out additional monitoring, if required, according to the contractual requirements and procedures in the event of non-compliances or complaints. • Supervise the Contractor's activities and ensure that the requirements in the ESMMP and contract specifications are fully complied with. • Instruct the Contractor(s) to stop activities which generate adverse impacts, and/or when the Contractor(s) fails to implement the ESMMP requirements / remedial actions instructed by the ESMC. • Participate in the joint site inspection with ESMC. • Order site protection and report to the relevant authorities and the ESMC if the Contractor discovers cultural relics by chance. • Request and monitor Contractors' felling of trees and vegetation and ensure they are strictly in accordance with the pre-determined area, numbers, species, etc. • Engage a qualified staff, preferably a landscape architect, to review and monitor the Contractor's submitted Clearing, Revegetation and Restoration Management Plan (included in Contractor's environmental specifications), and to supervise the Contractor's landscaping works. • Monitor noise levels at sensitive receptors by use of portable noise monitoring kit. Monitoring will take place during intensive construction activities, such as excavation, piling, power generation, material transport and night time construction and will be conducted near villages, schools, and other sensitive receptors along the project alignment.

Designation	Description	Responsibilities (not limited to)
		• Conduct visual inspections to check for air-borne dust during demolition, bulk material handling and storage, and transportation routes near the villages; • Conduct visual inspections to check water quality in receiving rivers, fish ponds, and lakes affected by the construction activity. Check for turbidity, odour, colour, fish kills, etc., at discharge points in water bodies adjacent to construction sites and construction camps. • Prepare reports for environmental monitoring data and site environmental conditions. • Adhere to procedures for carrying out grievance and complaint investigations. • Review and approve relevant Standard Operating Procedures (SOPs) prepared by the Safety and Environmental Officer (SEO) and EPC Contractor in coordination with ESMC.
Sustainability and External Relations Director	Company EHS personnel	• Must speak Korean • Coordinate HR/Community Relations/H&S/E&S aspects of the project reporting directly to NWEDC's Managing Director
EHS personnel of OE/CSE	OE/CSE is expected to have EHS personnel to look after the E&S performance of the project.	• Carry out environmental site inspections to assess and audit the Contractors' site work practices, equipment, and work methodologies with respect to pollution control and adequacy of environmental mitigation measures implemented. • Monitor compliance with environmental protection measures, pollution prevention, and control measures and contractual requirements. • Investigate complaints and recommend any required corrective measures. • Advise the Contractor on environment improvement, awareness, and proactive pollution prevention measures. • Complete start-up, weekly, monthly, and site-closure checklists. • Follow the procedures in the ESMMP and recommend suitable mitigation measures to the Contractor in the case of noncompliance. Carry out additional monitoring of noncompliance within the specified timeframe. • Submit Contractor's ESMMP Implementation Plan reports to the ESMC and relevant administrative authorities, if required. • Keep detailed records of all site activities that may pertain to the environment. • Supervise construction works where environmental management is a key aspect (e.g. in sensitive areas, with high environmental risk, etc.). • Keep a photographic record of progress on site from an environmental perspective. • Keep a register of complaints in the site office and recording and dealing with any community comments or issues. • Keep a record of on-site incidents and accidents and how these were dealt with. • Implementing the BMP with the support of the ESST
EPC Contractor and contractors for separate work packages	Key responsibility for implementation of the requirements of the mitigation	• Develop a project specific CESMP and elaborate other parallel sub plans. • Provide a construction site layout plan that identifies key activity area including laydown, accommodation and parking etc. prior to commencement of works.

Designation	Description	Responsibilities (not limited to)
	activities in the construction ESMMP. The EPC contractor will be responsible for subcontractor(s) performance including subcontractor(s) adhere to the requirements of the Construction Environmental and Social Management Plan (CESMP).	• Produce detailed method statements relating to key activities that include specific reference to requirements of the plans contained herein during the Project progression. • Provide all training necessary to oversee and implement ESMMP requirements. • Be responsible for producing comprehensive suite of EHS management and coordination procedures. • Identify a full-time person on site with dedicated EHS responsibilities to oversee works on site (SEO). • Ensure that all subcontractor(s) have dedicated EHS staff to implement the CESMP and monitor and manage this on an on-going basis. The subcontractor(s) staff will be required to liaise closely with the EPC contractor EHS staff, including the provision of monthly reports and participation in weekly construction review meetings. • Comply with relevant legislative requirements governing environment, public health, and safety. • Work within the scope of contractual requirements and other tender conditions. • Organize representatives of the construction team to participate in the joint site inspections undertaken by the ESMC. • Carry out any corrective actions as instructed by the ESMC or the OE. • Provide information to and update the OE regarding works activities that may result in adverse environmental conditions. • In case of non-compliances/discrepancies, carry out investigation and submit proposals on mitigation measures, and implement remedial measures to reduce environmental impacts. • Stop construction activities that generate adverse impacts upon receipt of instructions from the ESMC or OE. Propose and carry out corrective actions and implement alternative construction method, if required, to minimize environmental impacts. Major noncompliance by the Contractor will be cause for suspension of works and other penalties until the noncompliance has been resolved to the satisfaction of the ESMC.
Workplace Safety and Environmental Officer (SEO) of each of the seven packages	To be appointed by each of the EPC contractors for relevant work packages.	• Oversee the Contractor's internal compliance with the ESMMP requirements and ensure that the environmental specifications are adhered to. • Carry out regular environmental site inspections to monitor compliance with the environmental protection measures • Submit the Contractor's ESMMP Implementation Plan to the ESMC, EST, PMO, and other relevant authorities as required. • Prepare relevant SOPs as required, detailing the step-by-step actions, responsibilities, and the monitoring mechanism and get it approved with ESMC. • Investigate complaints and recommend any mitigation measures. • Prepare relevant reports and submit to the ESMC and OE/SCE as per pre-identified frequencies; • Inform both OE/SCE and ESMC about any incidents/accidents within 12 hours. • Work in close coordination with ESMC's site team. • Take prime responsibility for practical implementation of the environmental management.

Designation	Description	Responsibilities (not limited to)
		• Oversee and ensure the implementation of the CESMP and parallel management plans (with support from the EPC contractor EHS Expert and Construction Manager and ensure all contractors and subcontractors are in compliance with the CESMP requirements. • Review and report performance to the EPC contractor Construction Manager. • Review subcontractors' environmental protection/mitigation measures to ensure compliance with the CESMP. • Report any CESMP noncompliances to the EPC contractor Construction Manager on a daily basis. • Carryout regular environmental awareness sessions and assist personnel in applying environmental standards on site. • Conduct regular audits/inspections to check that committed impact mitigation measures are being implemented. • Act as the first point of contact on environmental matters for the EPC contractor, for the government authorities, other external bodies and the general public
ESST (Environment and Social Supervision Team)	ESST on-site comprising of EPC site head and SEO, OE/CSE Engineer and E&S person (representatives of ESMC) and site head	• Meet once a month to discuss on E&S aspects and ESMMP implementation. • Carry out audits as relevant. • Monitor the implementation of the BMP. • Discuss on correction actions required. • Agree on key decisions to be taken. • Report to the PMO the minutes for approval of any key decisions and/or sanctions.
International Consulting Firm	Key responsibility is to assist NWEDC	• Development, set up, and implementation of the Owners ESMMP, CESMMP, and the O&M ESMMP

3.2.2. Operations Phase

The proposed operations phase organizational structure is shown in Figure 2. The Environment and Social Supervision Team (ESST) will be comprised of the O&M site head and SEO, representatives of ESMC, and site head, and will meet once in a month to discuss on the overall E&S performance, ESMMP implementation, and take key decisions as relevant. The Minutes of the Meeting will be sent to the PMO at the corporate level for approval and sanctions as necessary. Also many of the OE functions during the construction phase will be taken over by the ESST during the operations phase as the accident/incident analysis etc.

The roles and responsibility will be similar to construction stage apart from the CSE/OE which will cease to exist beyond two years of operations stage; i.e. the period from which NWEDC awards Provisional Acceptance Certificate (PAC) to EPC contractor to the time NWEDC awards Final acceptance certificate (FAC).

An external consultant should be hired by NWEDC to monitor the progress on a six-monthly basis in the operations phase depending upon its internal monitoring requirements or lenders requirement.

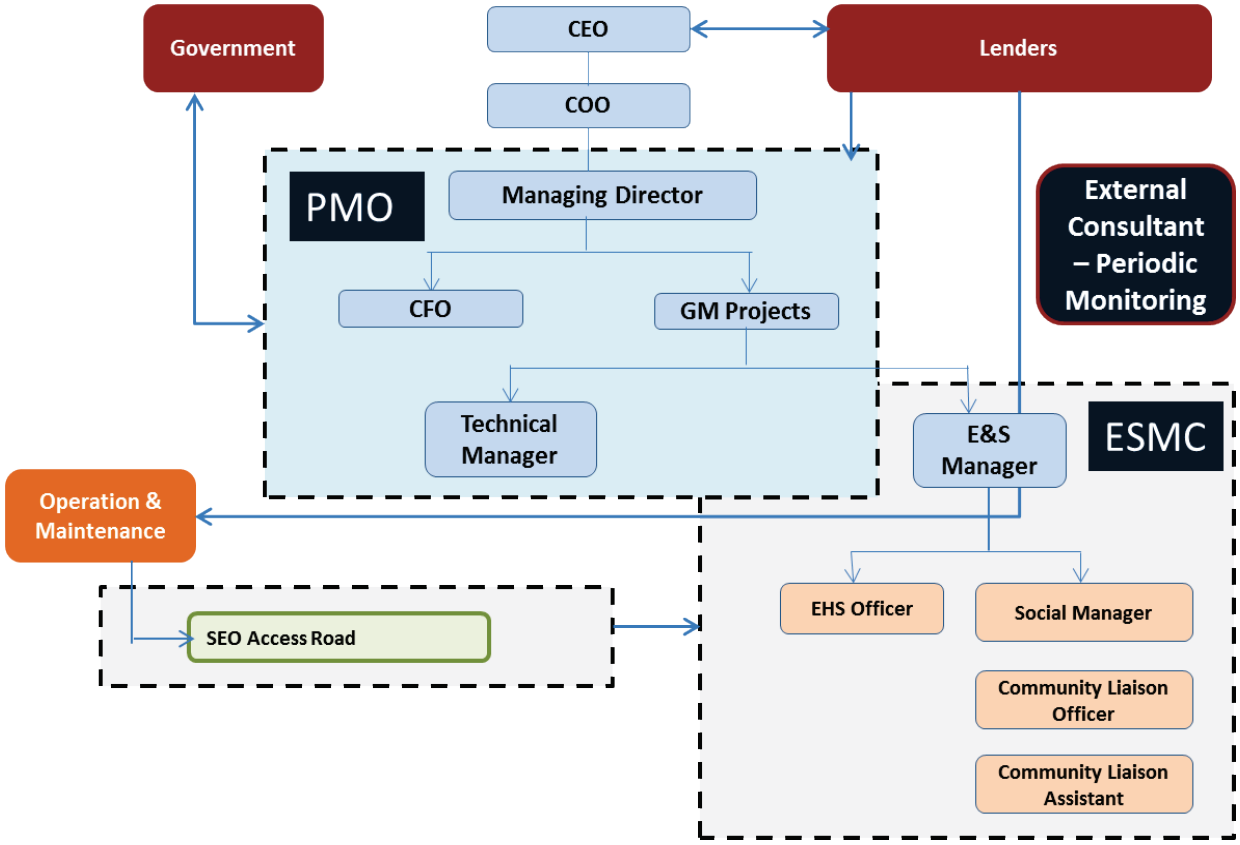

Figure 2: UT-1 ESMS Implementation Organisational Chart (Operation Stage)

4. CODE OF CONDUCT

A major concern during the construction of large hydroelectric projects is the potential negative impacts that might arise from the interaction of outside workers with local communities. For this reason, it is required that NWEDC establish a Code of Conduct that emphasizes the importance of appropriate behaviour, respect for local communities and customs, and compliance with relevant Nepalese laws and regulations.

All contractors of NWEDC should sign and follow the Code of Conduct. Each NWEDC and Contractor employee working on the Project shall be informed of the Code of Conduct once she/he has signed the contract to work for the Project. The Code of Conduct should be available to local communities at the Public Information Centres established for the Project.

The Code of Conduct should address at least the following topics:

- All the workers/labourers shall comply with the laws and regulations of Nepal;
- All illegal substances, abuse of drugs and alcohol, carrying of firearms, as well as pornographic material and gambling shall be prohibited;
- Fighting (physical or verbal), creating nuisances and disturbances in or near communities, or disrespecting local customs and traditions shall be prohibited;
- Smoking shall only be allowed in designated areas;
- Workers shall follow appropriate standards of dress and personal hygiene while visiting local communities and in the accommodation quarters; and
- Workers visiting the local communities shall behave in a manner consistent with the Code of Conduct.

5. APPLICABLE LEGAL AND LENDER REQUIREMENTS

The ESMS has been prepared in compliance with the identified reference framework, which includes both applicable environmental and social regulations of Nepal as well as international standards such as the International Finance Corporation (IFC) Performance Standards, in keeping with the Lender requirements. Table 2 provides a brief overview of the regulations. Detailed analysis of the reference framework governing the project is provided in Chapter 3, Legislative and Regulatory Framework, of the Summary Environmental and Social Impact Assessment (ESIA).

Table 2: Applicable Reference Framework

S.No	Reference Framework	
1	Nepal Laws and Act	• Constitution of Nepal 2072 BS (2015 AD) replacing the Interim Constitution of Nepal, 2007 AD • Environmental Protection Act, 1997 • Nepal Environmental Policy and Action Plan 1993 • The Water Resources Act 1993

S.No	Reference Framework	
		• Water Resource Regulation, 1993; Local Self Governance Act, 2055 BS (1998 AD) • Wildlife Protection Act, 1958 (2015 BS) • National Park and Wildlife Conservation Act, 1973 • Aquatic Life Protection Act, 1961 and First Amendment, 1998 • Soil and Watershed Protection Act, 1982 • Solid Waste Management and Resource Mobilization Act, 1987 • Forest Act, 1993 • Hydropower Development Policy, 2056 (2001) • Electricity Act, 2049 BS (1992) AD • Explosives Act, 1961 • Local Self Governance Act, 1998 • Land Acquisition Act, 2034 (1977) • Agriculture (New Arrangements) Act (1963) • Land Administration Act (1963) • Land Reform Act, 2021 (1964) • The Land Revenue or Malpot Aien (Land Administration and Revenue) Act 2034 BS (1977) • Land (Survey and Measurement) Act, (1963) • The Land (Measurement and Inspection) Act, 2020 BS (1962, as amended) • Land Acquisition, Resettlement and Rehabilitation Policy for Infrastructure Development Projects, 2071 BS (2015 AD) • The Guthi Corporation Act, 2033 BS (1976) Second Amendment 1993.
2	Nepal Rules and Regulations	• Environmental Protection Rules, 1997 • Forest Rule, 1995 • Local Self Governance Regulations, 1999 • Electricity Rules, 1993 • National Park and Wildlife Conservation Rules, 1974 • Agricultural Perspective Plan, 1995 • Forest Sector Master Plan, 1988 • Nepal Biodiversity Implementation Plan, 2003 • Revised Forest Policy, 2000 • National Conservation Strategy, 1988 • Poverty Reduction Strategy, 2002 • Water Resources Strategy, 2002.
3	International Treaties and Conventions	• Convention on International Trade of Endangered Species • Convention on Biological Diversity 1992 • Ramsar Convention, 1971 • International Tropical Timber Agreement, 1983 • Basel Convention, 1992 • Biodiversity Convention, 1992 • ILO 169: Convention on Indigenous People
4	Guidelines	• National EIA Guidelines, 1993 • EIA Guidelines for Water Resource Sector 1994 • EIA Guidelines for Forest Sector, 1995 • Community Forest Guidelines (2001) & Inventory Guidelines (2005) • Guidelines of Use of Forestland for Other Purposes, 2006 (2063 BS) • National Health Care and Waste Management Guideline, 2002 • Guidelines on Environmental Management Plan, Monitoring and Auditing Published by MoEST, 2006 • Environmental Management Guidelines, (Road),1997 • Forest Product Collection and Sales Distribution Guidelines, 2000 (2057 BS)

S.No	Reference Framework	
		• Buffer Zone Management Guidelines, 1999
5	International requirements	• IFC Performance Standards (PS 1-8), 2012 Edition • IFC/WB General EHS Guidelines (April 30 2007) • EHS Guidelines for Electric Power Transmission and Distribution (2007) • ADB Safeguard Policy Statement, 2009 • World Bank Operational Policies • OP 4.01: Environmental Assessment • OP 4.04: Natural Habitats • OP 4.10: Indigenous People • OP 4.11: Physical Cultural Resources • OP 4.12: Involuntary Resettlement • European Investment Bank's Statement of Environmental and Social Principles and Standards, 2009

EHS = environmental health and safety; EIA = Environmental Impact Assessment; IFC = International Finance Corporation; ILO = International Labour Organization; WB = World Bank

5.1. RISK MANAGEMENT

A Regulatory EIA (June 2012) and a Supplementary ESIA (December 2014) have been undertaken for the Project, per IFC Performance Standards. These documents identify the major environmental, ecological, and social impacts due to the construction and operation of the project. A Cumulative Impact Assessment was also carried out considering the all the project in the entire Trishuli watershed.

The studies assessed the impacts based on duration, extent, and magnitude during the construction and operation phases, and proposed mitigation measures that will need to be implemented. In addition, an impact assessment is presented in Chapter 7, Key Project Environmental and Social Impacts, Risks, and Mitigation, of the Summary ESIA.

Based on the measures identified, construction and operation phase management plans have been developed to ensure the impacts are managed and the appropriate mitigation measures are in place. These plans include the following management plans for construction and the operations phase. See Appendix B, Environmental and Social Management and Monitoring Plans, for a detailed discussion of these management plans.

5.1.1. Construction and Phase Management Plans

The following management plans have been developed for the construction phase of the project:

- Air Quality
- Blasting and Explosives
- Cultural Heritage
- Emergency Preparedness and Response
- Excavation, Slope Stability, Sediment and Erosion Control
- Materials Handling and Storage
- Noise and Vibration Control

- Occupational Health and Safety
- Site Security Site
- Rehabilitation and Landscaping
- Spill Prevention and Response
- Spoil Management and Disposal
- Traffic
- Waste Management Plan
- Wastewater management
- Water Quality
- Worker Accommodations
- Stockpiles, Quarries, and Borrow Pits Impact Management
- Maintenance Management Plan

The following management plans have been developed for the operations phase of the project:

- Key Highlights of Operation Phase Mitigation Measures
- Environmental Flow Management Plan

The following general management plans have been developed for the project:

- Biodiversity Action Plan
- Stakeholder Engagement/Grievance Redress Mechanism
- Land Acquisition and Livelihood Restoration Plan
- Indigenous and Vulnerable Peoples Development Plan
- Labour Influx Management Plan
- Plans Required by the PDA
- Cumulative Impacts Management Plan; and
- Environmental and Social Management and Monitoring and Reporting Plan.

These management plans will be implemented during the pre-construction, construction, and post-construction phases of the Project development. The Contractors must be made aware of these management plans and sufficient training on implementation of the same must be provided to the workers as planned by the ESMC and agreed upon with EPC and O&M contractors.

Regular monitoring of the management plan implementation will need to be conducted by the SEO and verified by EHS personnel of OE/ESMC. The schedule of monitoring will be agreed upon with the Lenders and in keeping with the requirements in the management plans, if any.

5.1.2. Operation Phase Management Plan

During the operation phase of the project, the main impact will be due to the improper management of environmental flow in the area, which will lead to deterioration of water quality and will subsequently impact aquatic habitat. Hence, the major management plan for implementation during this phase is the Environmental Flow Management Plan. Additionally, the O&M Contractors will need to implement key mitigation measures to ensure protection of environmental and socioeconomic conditions of the project site

The site EHS team within the ESMC will be in charge of ensuring that the Contractors comply with the specifications as set in the Management Plans. In addition, SEO will also ensure monitoring of management plan implementation during the project activities.

Progress reports tracking the performance of the ESMP will be sent by the ESMC for review by the Lenders, and any changes required will be submitted for review and approval. ESMC will also consolidate the findings and observations of the OE. ESMC will rely on its site level E&S staffs.

If the Contractor or his employees fail to implement the ESMMP, the PMO can have the Contractor's representative or any employee(s) removed from the site or stop work or suspended until the matter is remedied.

External consultants should also be hired on annual basis to track the performance of the ESMS implementation, including the ESMMP implementation and E&S status of the Project. These reports should be shared with the PMO and lenders and action taken based on the same to meet the gaps.

6. ESHS TRAINING

Training is one common method of supplying individuals with additional skills and knowledge. To be successful, training programs need to be thought out carefully and systematically. A robust social, environmental, health, and safety training plan is important for effective implementation of an ESMS.

An annual training calendar must be developed by the E&S manager and approved by the PMO for external trainings. Sector specialists from within the organization or from the EPC/O&M contractors or OE organization may provide the training. Training records will be maintained by the ESMC, especially internal trainings, and by NWEDC's Human Resource department, which will keep track of both internal and external trainings.

6.1. E&S-RELATED CAPACITY BUILDING FOR THE SITE-LEVEL ESMC STAFF

The ESMC staff, especially site-level staff, is required to undergo training for capacity buildings. The same should be done through both in-house and external trainings. This will ensure that they have adequate capacity for implementation of the ESMMP.

6.2. EHS-RELATED TRAINING FOR THE EPC AND O&M WORKERS/STAFF

The SEO, along with relevant personnel in the EPC/O&M team, will ensure that EHS induction and job-specific training are identified based on the existing capacity of project personnel, relevant site activities, and job assigned to an individual. The EPC/O&M SEO will also be in charge of ensuring that the trainings are provided as required and records of the same are maintained if required for review. Table 3 provides a list of trainings that should be carried out on routine basis.

Table 3: Project Operations Training Requirements

SN	Type of Training	Implementation Authority	Frequency	Documentations
1	Workshops to integrate ESMS requirements, including ESMMP with contractors' work plan	ESMC with EPC Contractor	Prior to site mobilization for construction activities	The outcome should be to clearly define the requirements/ frequencies from the EPC: Plans, SOPs, records, reports, etc., to be developed/ maintained by EPC
		ESMC with O&M Contractor	Prior to site mobilization for O&M	The outcome should be to clearly define the requirements/ frequencies from the EPC: Plans, SOPs, records, reports, etc., to be developed/ maintained by O&M.
2	Induction Trainings related to EHS and site	EPC Contractor with SEO	Prior to start of construction with quarterly refreshers as staff gets inducted	Records of person inducted and training provided
		O&M Contractor with SEO	Prior to start of O&M and as staff gets inducted and quarterly refreshers	Records of person inducted and training provided

SN	Type of Training	Implementation Authority	Frequency	Documentations
3	Job-specific safety training	EPC Contractor with SEO and relevant department	On the job prior to start of work	Records of type of training
		O&M Contractor with SEO and relevant department	On the job prior to start of work	Records of type of training
4	Environment, occupational health and safety, including PPE, fire safety, etc.	EPC Contractor and SEO	Regularly (bi-monthly) during construction	Records of training
		O&M Contractor with SEO	Monthly during operations phase	Records of training
5	Emergency response preparedness	EPC Contractor with SEO and ESMC	Regularly (bi-monthly) during construction	Records of trainings, mock drills, etc.
		O&M Contractor with SEO and ESMC	Quarterly during operations phase	Records of trainings, mock drills, etc.
6	Ecology/biodiversity conservation training	EPC contractor with SEOs and ESMC	Quarterly during construction	Records of training
		O&M contractor with SEOs and ESMC	Six- monthly during operation phase	Records of training
7	Handling community engagements and grievances	SEO, EPC and ESMC with HR	Quarterly during construction	Records of training
		SEO, O&M and ESMC with HR	Six- monthly during operation phase	Records of training
8	Training for security staff	EPC contractor with SEOs and ESMC	Quarterly during construction	Records
		O&M contractor with SEOs and ESMC	Six- monthly during operation phase	Records of training
9	Driver training	EPC contractor with SEOs and ESMC	Quarterly during construction	Records of training
		O&M contractor with SEOs and ESMC	Six- monthly during operation phase	Records of training
10	Operational trainings	O&M Contractor with SEO	Operations phase	Annual calendar with type of trainings planned
11	Environmental and social management training	EST	Throughout construction and operation phases.	Records
12	Internal training for capacity building of ESMC staff	Corporate E&S manager and personnel from relevant department	As decided	Records
13	External training for capacity building of ESMS staff	External agencies	As decided	Records
14	Others as identified			

ESMC = Environmental and Social Management Cell; EPC = engineering, procurement, and construction; O&M = operations and maintenance; PPE = personal protective equipment; SEO = Safety and Environmental Officer

Any other applicable training will be identified and implemented during the project life cycle as part of mitigation measure and also capacity building of the staffs. Also, general environmental awareness will be increased among the Project team and workers to encourage the implementation of environmentally sound practices and compliance requirements of the Project. This will help in minimising adverse environmental impacts, ensure compliance with the applicable regulations and standards, and achieve performance beyond compliance. The same

level of awareness and commitment will be imparted to the contractors and subcontractors prior to the commencement of the project. To ensure the competency of the employees, the Contractor will establish and maintain procedures to ensure that employees and workers are aware of the following:

- The significant environmental aspects and safety risks, actual or potential, of their work activities and consequences and the benefits of improved personal performance;
- Their role and responsibility in meeting policy and procedure requirements and health, safety, and environmental arrangements, including emergency preparedness and response requirements; and
- The potential consequences if operating procedures are not followed.

7. REPORTING AND MONITORING

The E&S Manager will overlook the reporting and monitoring program of the Project. The objective of the reporting and monitoring program will be:

- To track performance of the project and compare it against the established benchmarks or requirements as set in the ESMS;
- To record information to track performance and establish relevant operational controls;
- To establish key quantitative and qualitative measures for social, environment, ecology, health, and safety indicators;
- To verify compliance against the applicable reference framework and progress towards the desired outcomes; and
- To identify any necessary preventive and corrective actions that will need to be updated into the ESMS.

The E&S Manager will receive periodic performance reviews of the effectiveness of the ESMS from the ESST on site. Based on the results, the ESMC will take necessary actions to ensure effectiveness of the ESMS. The ESMC will be presenting these reports in the ESMS committee on a monthly basis.

7.1. INTERNAL AND THIRD-PARTY REPORTING PROTOCOL

An internal reporting system shall be established to periodically monitor the effective implementation of the ESMS. Inspection and audits finding or any other informational requirements from the project shall be communicated by the SEO of EPC/O&M Contractor to the site-level ESMC on a regular basis. The site-level ESMC staff will report to the E&S Manager, who will then discuss these reports with the PMO in the ESMS committee meeting. As mentioned in Section 1.3.2, the PMO will also work as the corporate-level ESMS committee with inclusion of the E&S Manager.

The communication from the project level will be obtained by the site-level ESMC staff from the different SEOs of the seven EPC Contractors: access road construction, dam construction, hydro-mechanics, transmission line, etc.

The on-site activities will be monitored through the following mechanisms:

- SEOs of the EPC/O&M contractors;
- Site-level ESMC personnel;
- CSE/OE along with its EHS personnel during the construction Phase;
- E&S Manager/ESMC;
- Overall supervision and decision making by ESST; and
- PMO (through ESMC, EST as well as CSE/OE).

The reporting mechanisms are discussed below.

7.1.1. Contractor's Reporting Protocol

The Contractors and subcontractors on-site will be required to follow the environmental and social specifications as mentioned in the management plans for the construction and operation phases of the Project. The activities carried out will be supervised by the SEO and EHS personnel of CSE/OE and any deviations/noncompliances reported to ESMC and further to ESST and PMO.

The EPC Contractor's SEO will report directly to the CSE/OE during the construction phase and the O&M contractor's SEO will directly report to the ESMC. The contractor will be required to provide regular reports to the CSE/OE and ESMC regarding the following:

- Weekly/daily safety meeting and activities undertaken;
- Attendance for EHS trainings undertaken;
- Details and activities undertaken as part of the monthly environmental meetings;
- Attendance sheet on-site;
- Status report on ESMMP implementation;
- All the above might be consolidated into weekly/Monthly EHS monitoring report from contractor;
- Any major accident/incident on site and steps undertaken to manage it (these reports need to be submitted within 24 hours); and
- Collect and report on data as requested by ESMC;

7.1.2. CSE/OE Reporting Protocol

The CSE/OE is in charge of supervising the various construction works such as civil work, electric installation work, etc. The EHS personnel of OE/CSE will also monitor the

implementation of the environmental, health and safety measures as specified in the management plans. The CSE/OE will review and approve the SOPs to be used by the Contractors during the construction activities of the Project. Any monitoring reports/checklists prepared by the CSE/OE will be reviewed by the ESMC before being sent to PMO.

Additionally, the CSE/OE will supervise and head monthly environmental meetings to discuss any major environmental and social issues that have been faced during the project development. The CSE/OE will maintain a record of the topics discussed during these meetings and any corrective actions taken based on the outcome of the meeting discussion. The CSE/OE will provide the following reports to the PMO and Corporate E&S Manager who will be presenting it to corporate ESMS committee (including all PMOs):

- Monthly/periodic status report of E&S aspects on site covering only key issues and findings from reviewing and supervision activities;
- The OE shall also collect and report on data as requested by the PMO/ESMC;
- Immediate information on any incidents/ major deviations from the SOPs;
- Analysis of any incidents/major deviations within an agreed time frame;
- At the end of the commissioning, the OE/CSE shall prepare a final report summarizing the key findings from their work, the number of infringements, resolutions, etc., as well as advice and guidance for how such assignments should be conducted in the future.

7.1.3. Environmental and Social Management Cell's Reporting Protocol

As a minimum the ESMC shall prepare the following written reports and submit to the E&S Manager, ESMC.

Site Level

- Weekly report of non-compliance issues;
- Summary monthly report of key issues and findings from auditing activities;
- Summary monthly report of key issues arising from CSE/OE supervision activities during construction phase;
- Consolidated summary report from Contractor's monthly report; and
- Collect and report on data as requested by corporate ESMS committee;

Corporate Level

- Monthly summary of the E&S status on site to PMO; and
- Final report summarizing Project's environmental performance as desired by corporate ESMS committee.

7.1.4. Environmental and Social Supervision Team's Reporting Protocol

The ESST will meet once a month during the construction phase and quarterly during the operations phase, and in case of any emergencies as required:

- Minutes of meeting to corporate ESMS committee highlighting any key issues with respect to ESMMP implementation and E&S performance;
- Any decisions/approvals required from corporate ESMS committee; and
- Analysis of any incidents/major deviations within an agreed time frame especially during operations phase;

A list of records to be maintained by the ESST is included in Table 4.

Table 4: List of Environmental and Social Records to be Maintained during Construction Phase

Category	Record
General	• Environmental training records (e.g. attendance records for environmental awareness training, topics covered) • Environmental permits and licenses • Site inspection records • Construction program and schedule • Records identified to be maintained in the SOPs prepared by EPC/O&M • Records as per requirements under various E&S Management Plans; • Equipment maintenance and repair records • Correspondence with concerned parties and other parties in relation to environmental matters • HIV/AIDS information • Meeting minutes
Noise control	• Updated list of powered mechanical equipment currently on site • Details of examination periods and the results if any environmental sensitive receivers such as local schools, hospitals, resident villages may be affected. • Records of noise levels near sensitive receptors
Water pollution control	• Records of quantities of collected spent bentonitic slurries and/or drilling mud for reuse, reconditioning and disposal • Records of maintenance and cleaning schedules for sediment and oil/grease traps • Records of toilet sewage disposal (where connection to existing sewer is not undertaken) • Records of the wastewater final discharge quantity and the pollutants concentration • Plans of construction site drainage
Waste management	• Copies of relevant valid licenses as provided by employed waste haulers and waste collectors • Records of quantities of reused and recycled waste • Waste disposal records
Atmosphere	• Route and the program of the construction material transportation • Mitigation measures on the atmosphere effect such as sprinkling • The monitoring results of the atmosphere quality
Culture property	• Drawings of the identified culture property sites (if any) • Log of construction near culture property sites (if any) • Records of discoveries during construction (if any)

Category	Record
Land contamination	• Preliminary analysis results of materials suspected to be contaminated (if any)
Ecological resources	• Records of sensitive ecological resources locations and associated protection plan
Storage of explosives, chemicals, and hazardous substances	• Drawings of storage facilities • Logs of inventory and consumption • Material data sheets of all substances kept on site
Emergency/accident/incident	• Emergency accident/incident records • Investigation Reports
Grievance	• Records of Grievance registered
Corrective and preventive action plan	• Corrective and preventive action request records and forms
Other records	• As per regulatory requirement from different authorities

E&S = environmental and social; EPC = engineering, procurement, and construction; O&M = operations and maintenance

7.2. EXTERNAL REPORTING FOR REGULATORY COMPLIANCE

The main regulatory bodies for obtaining permits/approvals/licenses during the Project lifecycle include:

- The Ministry of Science, Technology and Environment
- Ministry of Energy/Department of Electricity
- Ministry of Forest and Soil Conservation
- Department of Forest and its district offices

The ESMC will be responsible for obtaining the required environmental, ecological, and social (mainly land) approvals and licenses from the regulatory authorities. They will prepare any necessary documents that need to be submitted on a regular basis, such as air/noise/water monitoring results to assess the performance of the project against environmental and social parameters. The ESMC will also be responsible for organising any visits to the site or consultations with the local communities if required by the regulatory authority.

The ESMC team should consolidate list of reports to be maintained as part of the Regulatory compliances and submit the same to the regulatory authorities as per the desired frequencies. The data for the same may be taken from the EPC/O&M contractors as relevant.

Some of the reports that can be maintained internally by the project team for review of project performance are shown below in Table 5.

Table 5: Reporting Matrix

Key Report to be Generated	Reporting To	Responsibility for Report Preparation	Frequency
Internal and Third-Party Reporting			
EHS Monitoring report with details regarding: Safety meetings; EHS Training details; ESMMP Implementation status report.	ESMC	EPC SEO	Weekly/monthly
		O&M SEO	
Accident/incident report	ESMC	EPC SEO	As applicable
		O&M SEO	

Key Report to be Generated	Reporting To	Responsibility for Report Preparation	Frequency
Report on noncompliance issues	ESMC Manager	ESMC	Weekly
Key issues and findings report	ESMC Manager	ESMC	Monthly
Summary of Contractor report	ESMC Manager	ESMC	Monthly
Summary of E&S Status	ESMC Manager	ESMC	Monthly
Minutes of environmental meeting	PMO	ESST	Monthly during construction phase and quarterly during operation phase
Accident/incident analysis	PMO	ESST	As applicable
Summary E&S status reports of the supervision activities	PMO and Corporate E&S Manager	OE/CSE	Monthly/as agreed
Immediate information on any incidents/ major deviations from the SOPs	PMO and Corporate E&S Manager	OE/CSE	As applicable
Analysis of any incidents/major deviations within an agreed time frame;	PMO and Corporate E&S Manager	OE/CSE	As applicable
Final report summarizing the key findings from their work, the number of infringements, resolutions, etc., as well as advice and guidance for how such assignments should be conducted in the future.	PMO and Corporate E&S Manager	OE/CSE	At the end of commissioning
External Reporting for Regulatory Compliance			
Compliance reports: As per Project approvals/permits as per regulatory requirements from Ministry of Science, Technology and Environment Ministry of Energy/Department of Electricity, Ministry of Forest and Soil Conservation/ Department of Forest and its District Office/Other government authorities as relevant	Relevant authorities	ESMC	As required by the regulatory authority
Lender's Reporting Requirements			
Environmental and Social Performance Reports, which will summarise: • Environmental and social impacts observed and progress as per the ESMP, RAP, or any other management plans under implementation; • Any areas of noncompliance or other issues; • Performance review of the effectiveness of the ESMS; • Any new/unreported environmental, ecological or social impacts observed on-site; and • Reports of any third party audits/studies.	Lenders	PMO	Based on the frequency as agreed upon with the Lenders

7.3. LENDER'S REPORTING REQUIREMENTS

The ESMS committee will review, approve, and submit environmental and social performance reports at the frequency agreed upon with Lenders, with respect to the project operations. The reports will be sent to the ESMS committee by the E&S Manager of the ESMC team. These reports will summarize the following:

- Environmental and social impacts of projects observed by the project proponent, including progress as per the Environmental and Social Management plan, Resettlement Action Plan, or any other similar management plans under implementation;
- Any areas of non-compliance or other issues arising from the implementation of the suggested environmental and social safeguards;
- Performance review of the effectiveness of the ESMS ;
- Any new/unreported environmental, ecological or social impacts observed on-site and which need to be included in the ESMS; and
- Reports of any third party audits/studies.

8. CONTRACTOR MANAGEMENT

Contractors refer to the teams appointed by NWEDC to undertake the construction activities as well as O&M for the Project. The Contractor(s), its subcontractor(s), and employees shall minimise impacts that may result from Project construction and operational activities, and comply with the mitigation measures set forth in the ESMMP to prevent harm and nuisances to local communities. The duties of the contractor(s) and subcontractor(s) include but are not limited to:

- Compliance with relevant legislative requirements governing environment, public health and safety;
- Work within the scope of contractual requirements and other tender conditions;
- Comply with the ESMMP requirements as mentioned in the ESIA;
- Organise representatives of the construction team to participate in the joint site inspections undertaken by the ESMC;
- Carry out any corrective actions as instructed by the ESMC, OE/CSE, and/or ESST;
- Provide and update information to the OE/CSE and ESST regarding works activities that may result in adverse environmental conditions;
- In case of noncompliances/discrepancies, carry out investigation and submit proposals on mitigation measures, and implement remedial measures to reduce environmental impacts;
- Stop construction activities which generate adverse impacts upon receipt of instructions from the OE/CSE, ESMC, or ESST;
- Propose and carry out corrective actions and implement alternative construction/operational method, if required, to minimize environmental impacts; and
- Major noncompliance by the Contractor will be cause for suspension of works and other penalties until the noncompliance has been resolved to the satisfaction of the ESMC and OE/CSE.

8.1. MINIMUM ENVIRONMENTAL AND SOCIAL STANDARDS TO BE MET BY CONTRACTOR

The contractor must comply with the minimum environmental and social standards presented in the Attachment 2 Minimum E&S Standards to be met by the Contractor, for the Project.

9. MANAGEMENT OF CHANGE

The procedures provided here will be applicable for instances when there are changes to the facilities (equipment, operation procedures, materials, and operating conditions) as well as changes to the organisational structure or designated person due to operational necessity. To ensure that the ESMS is adaptive to the changes that will be faced during the Project lifecycle, the following actions will need to be implemented by the ESMC and monitored by the PMO:

- The ESMMP will be reviewed and amended in accordance to the Project design and status as it evolves. Key information about changes to the Project design will be regularly reviewed and site visits will be undertaken by the ESMC staff in coordination with SEOs and relevant personnel to ensure the same and to identify any environmental, social or ecological impacts to the Project.
- The ESMC and PMO will have the authority to select the staff to oversee the environmental and social activities of the Project. During change in management of the Project, the new staff will obtain the induction training, that will cover, but not be limited to, the following aspects:
  - General health and safety training;
  - Briefing on the E&S performance of the Project;
  - Training regarding the project policies and objectives;
  - Regular audits that need to be conducted; and
  - Reporting protocol to be followed.
- The ESMMP implementation will be monitored regularly throughout the lifecycle of the Project to assess its effectiveness during project operations. Evaluation will be undertaken through continuous communication with the relevant stakeholders, namely contractors, subcontractors, workers, community, etc. Additionally, this will be supported through the data obtained from the monitoring audits and reviews conducted on a regular basis.
- The ESMMP will be changed or updated based on the feedback obtained from the contractors as well as from the data obtained through reviews and audits. The areas of improvement will be identified and mitigation measures for the same will be integrated into the ESMS, after approval from the PMO and lenders.

ATTACHMENT 1

NWEDC Environmental and Social Policy Statement

ATTACHMENT 2

Minimum E&S Standards to be met by the Contractor

The contractor should develop plans, SOPs, formats, maintain records, and submit reports as agreed upon with the Nepal Water and Energy Development Company. These should be set out clearly and agreed upon during pre-mobilization workshops for construction and operations and maintenance phase. The following table indicates a list of minimum environmental and safety standards to be met by the contractor.

Issues	**Key Principle / Mitigation Standard**	**Minimum Mitigation Method**
Unemployment of local labour	Villagers shall not be disadvantaged by the influx of outside workers	• Have a Human Resources Policy • Hire local labour as much as possible • Encourage women to work in the Project
Workers intruding on village life and disrespecting traditional cultural values.	Workers shall respect local traditions and culture	• Education and orientation of outside workers to local culture and social norms before the start of work • Have an environmental training program for workers
Health issues	Contractor to present a Health Management Plan	• The Health Program shall be made available to the communities • Implement a vaccination program • Provide education program on sexually transmitted diseases HIV/AIDS, tuberculosis and other illnesses • Provide periodical health check to construction workers • Implement measures against malaria if applicable
Workers' Camps and Work Sites		
Water supply affecting ecology or village water supply	Camp to provide its own water supply that does not affect village water supply	• Any water supply sources should be located so that it does not adversely affect the villages supply • The intake of water from streams for water supplies should leave residual flows in the watercourses • Storage tanks should be used to buffer water supplies
Wastewater discharges affecting water quality	Wastewater to be treated prior to discharge	• Sewage disposal methods should be designed to the standards outlined by the Nepalese government
Solid waste polluting the environment and causing health hazards	No waste to be burnt or buried on site	• All solid waste shall be removed from site and disposed of at a municipal landfill or at an approved disposal site
Camps using local services and resources, at the expense of villagers	Camps shall not affect local resources, infrastructure, utilities	• Locations of camps shall be approved by ESMC and local authorities • Provide adequate housing to outside workers with potable water and proper medical and sanitary facilities • Camps shall be self- sufficient in resources and services • Camps to be secure and discourage workers from leaving the camp

Issues	Key Principle / Mitigation Standard	Minimum Mitigation Method
Village Impacts		
Deterioration of current quality of life and traditional livelihoods	Villagers should have the ability to communicate issues to ESMC, EST, SEO, and Contractors. Villagers have the expectation that issues will be addressed and resolved by negotiation. Meetings shall be undertaken to ensure villager's concerns are recorded and addressed. Villagers shall be adequately informed of all potential hazards to health and safety.	• Set up a communication network for discussing issues with ESMC, EST, SEO, Contractors. Complaints should be directed to the ESMC full-time safeguards staff • ESMC to manage a grievance mechanism, and have staff on site at all times to manage grievances • The Contractor's Health Management Plan shall be made available to the communities • Developing village protocol that could serve as a guideline for outside workers • A complaints record shall be kept of all issues raised by villagers in response to construction activities as well as the remedial actions taken and the turnaround time for the response and actions noted
Health and safety risks from such activities as increased traffic, blasting, operation of heavy machinery, etc.; traffic causing safety risks to villagers	Safety risks shall be minimised. Villagers have the expectation that issues will be addressed and resolved by negotiation.	• OHS management in Chapter 11
Nuisance issues such as noise, dust and vibration	Nuisances shall be minimised. Villagers have the expectation that issues will be addressed and resolved by negotiation.	• Noise management in Chapter 11
Sediment affecting river water uses	Sediment discharges to the river shall be minimized	• Erosion and sediment control in Chapter 11
Construction Issues		
Construction of access roads can affect cultivated areas, sensitive areas and cause noise, dust and erosion	New access roads should not disrupt village life and affect ecosystems, and agricultural land	• Design and location of access roads shall be approved by a road engineer and ESMC • Follow erosion and sedimentation procedures, and noise and dust procedures as explained below • Avoid constructing access roads in sensitive areas and agricultural land. • Build an appropriate drainage system
Erosion and sedimentation caused by the construction activities	Erosion and sedimentation have to be maintained to a minimum to avoid changes in water flow patterns, loss of productive land, landslides, and destruction of surface vegetation	• Protect all areas susceptible to erosion by installing necessary temporary and permanent erosion and sediment control structures. • Conserve as much vegetation as possible • Initiate revegetation after completion of construction works

Issues	Key Principle / Mitigation Standard	Minimum Mitigation Method
Noise and vibration associated with construction activities, excavation and blasting	Noise must not unreasonably intrude on traditional village life	• Keep a current list of all noise and vibration producing machinery • Machinery operation to occur only during designated hours (to be confirmed by Contractor in agreement with villagers) • Blasting to occur at the same time each day, and / or a warning siren should sound prior to blasting • Use of complaints register and procedures to address issues as they arise • Work to be carried out in daylight, in typical working hours • Concrete batching plants and other noisy equipment to be located as far as practical from villages
Dust generation from construction activities	Dust must not cause a hazard or nuisance to village life	• Dust generating operations to occur only during designated hours (to be confirmed by contractor in agreement with villagers) • Use of complaints register and procedures to address issues as they arise • Concrete batching plants and other dusty equipment to be located as far as practical from villages
Increased utilization of roads by traffic associated with construction activities	There should be no significant increased risk to local populations from traffic associated with the Project	• Road upgrades, including signage, speed humps, re-grading • Wetting of roads to reduce dust during the dry season, and as necessary • Training of locals regarding the hazards of traffic • Training of vehicle drivers regarding the driving risks through villages and along remote roads • Use of complaints register and procedures to address issues as they arise
Pollution risk activities occurring on site	Develop appropriate storage, transport and use practices for storage and handling of mixed classes of dangerous goods in packages and intermediate bulk containers. There shall be no solid or liquid waste disposal directly or indirectly to any water course (whether flowing or not).	• Keep a current list of all potentially • Contaminating materials used onsite • Develop and implement appropriate storage, transport and use practices to recognized standards • Solid waste disposal shall be taken off site

Issues	Key Principle / Mitigation Standard	Minimum Mitigation Method
Clearing, Revegetation and Restoration of Construction Sites		
Loss of productive land, disturbance of soil profile, loss of habitats for animals. Lack of appropriate compensatory planting at the end of construction or use of non-native species	Clearing activities shall allow the existing usage of land to continue as long as is practicable. Avoid discharging sediments and vegetation material into watercourses cultivated land, an irrigation canals. Initial revegetation of exposed areas as soon as possible.	• Clearing shall take place in a phased matter to retain vegetative cover as much as possible • Areas not approved for clearing shall be kept undisturbed and demarcated by construction fencing • Save as much topsoil as possible • Appropriate local native species of vegetation shall be selected for the compensatory planting and restoration of the natural landforms. • Establish a method for timber salvage with participation of local communities • All affected areas should be landscaped and any necessary remedial works should be undertaken without delay including revegetation and reforestation.
Earthworks, Fill Slopes, Cuts, Borrow Pits, Quarries, Disposal Sites, Stockpiles		
Generation of suspended solids from bare ground and runoff into watercourses	Construction activities should not give rise to storm water containing elevated suspended solids. Provide treatment to achieve 75% reduction in suspended solids.	• No direct discharge of sediment laden water without treatment • Earthworks and land clearance should be minimized and phased • Storm water should be diverted around exposed areas • Any discharges to watercourses should occur during high flow and / or discharged as close to the outfall as possible to maximize mixing • Stockpiles, borrow pits, quarries, disposal sites should be located at least 50 metres from a watercourse and avoid sensitive areas • Timing of works around the drier seasons where possible • Provision of storm water cut off drains wherever possible
Introduction of invasive species	Fill material should not contain invasive species.	• The use of imported fill shall be minimized • Machinery should be cleaned prior to working on site to reduce the opportunity of the spread of weeds
Disturbance of natural habitats for spoil alluvial material.	Soils should be reused where possible in the development – to reduce the need for spoil sites and the need to import fill.	• Limit extraction of material to approved and demarcated quarries and borrow pits • Stockpile and reuse soils before excavating new soils / alluvium • Stockpiles should be compacted as much as practical and not be exposed for extended periods • Stockpiles should be reused as soon as practicable • Storm water should be diverted around stockpiles
Efficiency of control measures over time	Control measures should continue to work appropriately throughout the construction period	• Earthworks control measures should be inspected and maintained in efficient operating condition over the construction period

Issues	Key Principle / Mitigation Standard	Minimum Mitigation Method
Work in Watercourses		
Sediment discharges arising from working in and near the river	Work in the wetted area of the riverbed should be minimized, and only in relation to the construction of the power house, weir and intake structure or to insert culverts for stream crossings	• Stabilize works at the end of each working day and prior to storm events • Do the work during low flow periods • Works shall be minimized • Diversion of the river around the work area where possible • Culverts shall be placed in access tracks where they cross streams more than 3 metres wide and 0.5 metre deep
Tunnels		
Contaminants in water discharged from tunnels during construction	No direct discharges of tunnels water to any water course. Provide treatment prior to discharge to achieve 75% reduction in suspended solids.	• Settlement ponds and /or sediment infiltration devices • Monitoring immediately upstream and 50 metres downstream of the discharge with a clarity tube to estimate any effects on clarity; for nutrients to detect explosives residue and for pH • Any discharges to watercourses should occur during high flow and / or discharged as close to the outfall as possible to maximise mixing • Spill kits and emergency procedures should be used for spills of chemicals, fuels and oils and staff trained
Concrete, Cement		
Contaminants in water discharged from concrete manufacturing, including a rise in pH	No direct discharges of concrete batching water to any water course. Provide treatment prior to discharge to achieve 75% reduction in suspended solids.	• Settlement ponds and / or sediment infiltration gallery • Monitoring immediately upstream and 50 metres downstream of the discharge with a clarity tube to estimate any effects on clarity; for pH to detect alkali discharges • Any storm water discharges to watercourses should occur during high flow and / or discharged as close to the outfall as possible to maximise mixing • Water to be reused where possible in the process • Procedures for handling of unhydrated cement material and wet cement to avoid spills
Community nuisances	Noise and dust must not unreasonably intrude on traditional village life	• Concrete batching plants and other noisy / dusty equipment to be located at least 100 metres from villages
Material Handling, Use and Storage		
Pollution risk associated with the storage and use of fuels, chemicals, explosives, hazardous substances	No oil, lubricants, fuels or containers should be drained or dumped to ground or waterways. Accidental spills shall be minimized, and procedures put in place to clean up the environmental damage.	• Keep a current list of all chemical and hazardous substances stored on site • Keep the Safety Data Sheet of all hazardous materials used on site • Develop appropriate storage, transport and use practices to recognized standards • Explosives, chemicals and hazardous substances to be handled by authorized personnel • Diesel to be stored in truck tankers or in overhead tanks to a maximum of 5,000 litres • Diesel to be stored on flat ground and 50 metres from a waterway

Issues	Key Principle / Mitigation Standard	Minimum Mitigation Method
		• Dikes to capture 100% of fuel must be placed around fuel storage areas • All refuelling of vehicles and plant to be done on flat ground • All significant vehicle and plant maintenance shall be undertaken offsite where possible • Spill kits and emergency procedures should be used and staff trained • There shall be no deliberate discharge of oil, diesel, petrol or other hazardous materials to the surrounding soils and waterways
Maintenance of Construction Equipment and Working Areas		
Reduction of air quality due to emission from poorly maintained equipment and vehicles Risk of pollution of vegetation and watercourses due to improper disposal of used lubricants and fuels	Equipment and vehicles shall not reduce air quality. No oil, lubricants, fuels used for the maintenance of equipment should be drained or dumped to ground or waterways. Construction debris shall be disposed at approved disposal sites	• Maintain all equipment in good working conditions • Establish spill prevention procedures • Ensure that maintenance activities are carried out in approved areas • Establish and enforce daily site clean-up procedures, including maintenance of adequate disposal facilities for debris • Onsite burning of debris and wastes shall be prohibited
Safety Issues		
Health and safety risks from such activities as increased traffic, blasting, operation of heavy machinery, etc.	Health and safety risks to villagers and workers shall be minimized	• Provide personal protective equipment and clothing (goggles, gloves, dust masks, hard hats, steel-toed boots, etc.,) for construction workers and enforce their use • Follow national regulation on blasting • Inform villages one week in advance of the blasting event blasting is prohibited during night-time hours • Establish a methodology to be followed in case of fire • Remove workers from tunnels and underground construction in case a hazardous gas is present • Respond to emergencies in a prompt matter
Traffic causing safety risks to road users	Construction traffic will be managed to minimize the impact on existing road users	• Signage to be used to identify current risks to road users • EST and Contractors to discuss • major traffic issues with village representatives • Establish pedestrian routes • Heavy traffic to avoid the hours when school children walk to and from school
Archaeological and cultural site disturbance		
Finding and disturbance of previously unknown sites	No sites shall be disturbed once identified	• Chance find procedure in Chapter 11

Issues	Key Principle / Mitigation Standard	Minimum Mitigation Method
Flora and Fauna		
Wildlife populations may be adversely affected by direct losses of individuals (e.g.: mortality, injury) or modification of habitat. Destruction of native vegetation and land outside proposed working areas.	Sufficient trainings on ecological protection and mitigation measures shall be provided to construction workers and site management staff	• Demarcate natural habitats for sensitive, rare, threatened and/or endangered species before the commencement of construction activities • Ensure that no hunting, fishing, trapping, shooting, poisoning or otherwise disturbance of any fauna takes place • Delineate with temporary construction fencing the vegetation to be preserved • Ensure that the vegetation to be preserved is kept undamaged • Prohibit use of fire wood and the burning of vegetation • Install sediment control measures to prevent siltation of water courses

ESMC = Environmental and Social Management Cell; EST = Environmental Supervision Team; SEO = Safety and Environmental Officer

NWEDC
NEPAL WATER & ENERGY
DEVELOPMENT COMPANY

Nepal Water & Energy
Development Company Pvt. Ltd.
3rd Floor, Four Square Complex,
Narayan Chaur, Naxal, Kathmandu. Nepal
Tel: 014412257 | 014412557

Environmental and Social Policy Statement

Nepal Water & Energy Development Company Pvt. Ltd. (NWEDC) declares that a core value in the management of our company is environmental protection and social responsibility. NWEDC commits to comply with national and good international industry practices in the hydropower industry in the construction and operation of all our projects, and further commits to:

- Comply with all applicable environmental and social regulations and World Bank Group Performance Standards on Environmental and Social Sustainability without compromise;
- Promote a working environment to provide women with opportunities for gainful employment and advancement in the workplace;
- Provide a safe and healthy working environment to all employees and contract workers;
- Adopt mitigation strategies to avoid, reduce, or compensate environmental degradation, pollution and adverse social impacts, and adapt to the impact of climate change of our projects;
- Provide benefits to the communities affected by our projects that promote the enhancement of their livelihoods;
- Identify, avoid or actively manage all project related risks to the health, safety and security of affected communities;
- Minimize land acquisition and involuntary resettlement and ensure that affected households are fairly compensated and actively assisted to restore and improve their livelihoods and living conditions;
- Foster biodiversity conservation and sustainable management of living natural resources, minimize our environmental footprint, and reduce the depletion of bio-diversity and ecosystem services by applying the latest technology in combination with local knowledge and practice;
- Recognize the values of indigenous peoples living within the areas of influence of our projects and take appropriate actions to address and satisfy their concerns;
- Understand and respect the culture, heritage and religious beliefs of the communities living within the areas of influence of our projects;
- Disclose all relevant project information to stakeholders in a timely and inclusive manner and to maintain open lines of communication with stakeholders throughout the life of a project; and
- Organize, train and equip our project management teams to identify and address environmental and social issues throughout the life of a project.

NWEDC is committed to continuous improvement in the management of the environmental and social impacts of our projects through monitoring, evaluation and implementation of appropriate corrective actions whenever needed. The Management of NWEDC understands that responsible environmental and social performance is a priority for our company.

Bo Seuk Yi
Chief Executive Officer

NWEDC
NEPAL WATER & ENERGY
DEVELOPMENT COMPANY

19.12.2016

ATTACHMENT 2

Minimum E&S Standards to be met by the Contractor

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The contractor should develop plans, SOPs, formats, maintain records, and submit reports as agreed upon with the Nepal Water and Energy Development Company. These should be set out clearly and agreed upon during pre-mobilization workshops for construction and operations and maintenance phase. The following table indicates a list of minimum environmental and safety standards to be met by the contractor.

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Water supply affecting ecology or village water supply	Camp to provide its own water supply that does not affect village water supply	• Any water supply sources should be located so that it does not adversely affect the villages supply • The intake of water from streams for water supplies should leave residual flows in the watercourses • Storage tanks should be used to buffer water supplies
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Construction of access roads can affect cultivated areas, sensitive areas and cause noise, dust and erosion	New access roads should not disrupt village life and affect ecosystems, and agricultural land	• Design and location of access roads shall be approved by a road engineer and ESMC • Follow erosion and sedimentation procedures, and noise and dust procedures as explained below • Avoid constructing access roads in sensitive areas and agricultural land. • Build an appropriate drainage system
Erosion and sedimentation caused by the construction activities	Erosion and sedimentation have to be maintained to a minimum to avoid changes in water flow patterns, loss of productive land, landslides, and destruction of surface vegetation	• Protect all areas susceptible to erosion by installing necessary temporary and permanent erosion and sediment control structures. • Conserve as much vegetation as possible • Initiate revegetation after completion of construction works

Issues	Key Principle / Mitigation Standard	Minimum Mitigation Method
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Increased utilization of roads by traffic associated with construction activities	There should be no significant increased risk to local populations from traffic associated with the Project	• Road upgrades, including signage, speed humps, re-grading • Wetting of roads to reduce dust during the dry season, and as necessary • Training of locals regarding the hazards of traffic • Training of vehicle drivers regarding the driving risks through villages and along remote roads • Use of complaints register and procedures to address issues as they arise
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Issues	Key Principle / Mitigation Standard	Minimum Mitigation Method
Clearing, Revegetation and Restoration of Construction Sites		
Loss of productive land, disturbance of soil profile, loss of habitats for animals. Lack of appropriate compensatory planting at the end of construction or use of non-native species	Clearing activities shall allow the existing usage of land to continue as long as is practicable. Avoid discharging sediments and vegetation material into watercourses cultivated land, an irrigation canals. Initial revegetation of exposed areas as soon as possible.	• Clearing shall take place in a phased matter to retain vegetative cover as much as possible • Areas not approved for clearing shall be kept undisturbed and demarcated by construction fencing • Save as much topsoil as possible • Appropriate local native species of vegetation shall be selected for the compensatory planting and restoration of the natural landforms. • Establish a method for timber salvage with participation of local communities • All affected areas should be landscaped and any necessary remedial works should be undertaken without delay including revegetation and reforestation.
Earthworks, Fill Slopes, Cuts, Borrow Pits, Quarries, Disposal Sites, Stockpiles		
Generation of suspended solids from bare ground and runoff into watercourses	Construction activities should not give rise to storm water containing elevated suspended solids. Provide treatment to achieve 75% reduction in suspended solids.	• No direct discharge of sediment laden water without treatment • Earthworks and land clearance should be minimized and phased • Storm water should be diverted around exposed areas • Any discharges to watercourses should occur during high flow and / or discharged as close to the outfall as possible to maximize mixing • Stockpiles, borrow pits, quarries, disposal sites should be located at least 50 metres from a watercourse and avoid sensitive areas • Timing of works around the drier seasons where possible • Provision of storm water cut off drains wherever possible
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Issues	Key Principle / Mitigation Standard	Minimum Mitigation Method
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Contaminants in water discharged from tunnels during construction	No direct discharges of tunnels water to any water course. Provide treatment prior to discharge to achieve 75% reduction in suspended solids.	• Settlement ponds and /or sediment infiltration devices • Monitoring immediately upstream and 50 metres downstream of the discharge with a clarity tube to estimate any effects on clarity; for nutrients to detect explosives residue and for pH • Any discharges to watercourses should occur during high flow and / or discharged as close to the outfall as possible to maximise mixing • Spill kits and emergency procedures should be used for spills of chemicals, fuels and oils and staff trained
Concrete, Cement		
Contaminants in water discharged from concrete manufacturing, including a rise in pH	No direct discharges of concrete batching water to any water course. Provide treatment prior to discharge to achieve 75% reduction in suspended solids.	• Settlement ponds and / or sediment infiltration gallery • Monitoring immediately upstream and 50 metres downstream of the discharge with a clarity tube to estimate any effects on clarity; for pH to detect alkali discharges • Any storm water discharges to watercourses should occur during high flow and / or discharged as close to the outfall as possible to maximise mixing • Water to be reused where possible in the process • Procedures for handling of unhydrated cement material and wet cement to avoid spills
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Safety Issues		
Health and safety risks from such activities as increased traffic, blasting, operation of heavy machinery, etc.	Health and safety risks to villagers and workers shall be minimized	• Provide personal protective equipment and clothing (goggles, gloves, dust masks, hard hats, steel-toed boots, etc.,) for construction workers and enforce their use • Follow national regulation on blasting • Inform villages one week in advance of the blasting event blasting is prohibited during night-time hours • Establish a methodology to be followed in case of fire • Remove workers from tunnels and underground construction in case a hazardous gas is present • Respond to emergencies in a prompt matter
Traffic causing safety risks to road users	Construction traffic will be managed to minimize the impact on existing road users	• Signage to be used to identify current risks to road users • EST and Contractors to discuss • major traffic issues with village representatives • Establish pedestrian routes • Heavy traffic to avoid the hours when school children walk to and from school
Archaeological and cultural site disturbance		
Finding and disturbance of previously unknown sites	No sites shall be disturbed once identified	• Chance find procedure in Chapter 11

Issues	Key Principle / Mitigation Standard	Minimum Mitigation Method
Flora and Fauna		
Wildlife populations may be adversely affected by direct losses of individuals (e.g.: mortality, injury) or modification of habitat. Destruction of native vegetation and land outside proposed working areas.	Sufficient trainings on ecological protection and mitigation measures shall be provided to construction workers and site management staff	• Demarcate natural habitats for sensitive, rare, threatened and/or endangered species before the commencement of construction activities • Ensure that no hunting, fishing, trapping, shooting, poisoning or otherwise disturbance of any fauna takes place • Delineate with temporary construction fencing the vegetation to be preserved • Ensure that the vegetation to be preserved is kept undamaged • Prohibit use of fire wood and the burning of vegetation • Install sediment control measures to prevent siltation of water courses

ESMC = Environmental and Social Management Cell; EST = Environmental Supervision Team; SEO = Safety and Environmental Officer

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Appendix B
Project Environmental and Social Management and Monitoring Plan Framework

Appendix B.1
Owners Environmental and Social Management and Monitoring Plan

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LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

AoI	Area of Influence
BMP	Biodiversity Management Plan
CIA	Cumulative Impact Assessment
CIMP	Cumulative Impacts Management Plan
CITES	Convention on International Trade in Endangered Species
CR	Critically endangered
DRIFT	Downstream Response to Induced Flow Transitions
Eflow	Environment flow
EFMP	Environmental Flow Management Plan
EIA	Environmental Impact Assessment
EN	Endangered
EPC	Engineering, procurement, and construction
ERP	Emergency Response Plan
ESIA	Environmental and Social Impact Assessment
ESMC	Environmental and Social Management Cell
ESMMP	Environmental and Social Management and Monitoring Plan
ESMS	Environmental and Social Management System
EST	Environmental Supervision Team
ha	Hectare
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
km/hr	kilometres per hour
LALRP	Land Acquisition and Livelihood Restoration Plan
LC	Least Concern
LNP	Langtang National Park
MSDS	Material Data Safety Sheet
NT	Near Threatened
NWEDC	Nepal Water and Energy Development Company
O&M	Operations and maintenance

PDA	Project Development Agreement
PH	Power House
PS	Performance Standards
RLNM	Red List of Nepal's Mammals
SEO	Safety and Environmental Officer
VU	Vulnerable

B.1 Owner's Environmental and Social Management and Monitoring Plan

The Project Environmental and Social Management and Monitoring Plan (ESMMP) is the umbrella document that describes how the Owner (i.e., NWEDC, also referred to as the "Employer" in some cases) will manage ESHS risks during Project construction and operations, consistent with the management and mitigation measures identified in the ESIA (2018), as well as all conditions established by the Government Nepal's approval of the Project. The Owner shall retain overall responsibility for the successful implementation of the Project ESMMP. The overall Project ESMMP consists of three parts:

- Owner's ESMMP, for which the Owner has responsibility for finalizing, and has primary responsibility for implementing, although there are elements of some of these management plans that require the involvement of the Construction (EPC) and Operations and Maintenance (O&M) contractors;
- Construction ESMMP (CESMMP), for which the EPC Contractor is responsible for developing, and has primary responsibility for implementing; and
- Operations ESMMP (OESMMP), for which a future O&M Contractor is responsible for developing and has primary responsibility for implementing.

This document presents a framework, including the Lender's minimum requirements, for each of these plans.

1. OWNER'S ESMMP FRAMEWORK

This document presents a framework of, and includes minimum Lender's requirements for, the Owner's Environment and Social Management and Monitoring Plan (hereafter referred to as the Owner's ESMMP) for the construction and operation phases of the Upper Trishuli-1 Hydropower Project (Project). This Owner's ESMMP Framework has been formulated based on the Project understanding and the findings and recommendations of the Project Environmental and Social Impact Assessment (ESIA). The Owner's ESMMP Framework specifies the Management Plans, and the minimum requirements for these plans, to be developed in greater detail by the Owner, and which are required to be implemented and complied with by the Owner, and the Project's EPC and O&M Contractors, during the construction and operations phases of the Project.

1.1. OWNER'S ESMMP PROCEDURES AND RESPONSIBILITIES

This section describes the process for approving and, as needed, modifying the Owner's ESMMP, and each party's responsibilities relating to the Owner's ESMMP.

1.2. OWNER'S ESMMP APPROVAL PROCESS

The development and approval of the Owner's ESMMP will be conducted in a timely manner in accordance with the dates specified in the Environmental and Social Action Plan (ESAP). The general development and approval process is as follows:

- The Owner will develop a detailed Owner's ESMMP, using this Framework to establish the minimum Lender's requirements;
- The Owner will provide the Draft Owner's ESMMP to the Lenders for their review;
- The Owner will address all comments provided by the Lender's and provide a Final Owner's ESMMP to the Lenders for their approval;
- Hard and soft signed copies of the Final Owner's ESMMP will be distributed by the Owner to the EPC Contractor, the Operations & Maintenance (O&M) Contractor, and the Lenders.

1.3. MANAGEMENT OF CHANGE

The need may arise to modify the Owner's ESMMP. The process below establishes Management of Change requirements for any and all changes to the Owner's ESMMP.

The Management of Change process allow for changes when it is reasonably likely that the current Owner's ESMMP is not sufficient to prevent:

- Serious health and safety incidents
- Impacts above those disclosed in the ESIA;
- New impacts not disclosed in the ESIA;
- Violation of Nepal law;
- Non-conformance with Lenders requirements, including the:
    - IFC Performance Standards
    - World Bank Environmental, Health, and Safety (EHS) General Guidelines (2007); and/or
    - Other Lender requirements.

Table B.2-1 below defines three categories of potential changes to the Owner's ESMMP and the review and approval process associated with each.

Table B.1-1: Owner's ESMMP Management of Change Process

Category of Change	Change Description	Action Required
Category 3	Changes that have the potential to, or are reasonably likely to, result in decreased	The Owner will notify the Lenders of the proposed change and provide the rationale

	Owner's ESHS performance, and/or are likely to result in an increase in ESHS impacts above those disclosed in the ESIA, result in new impacts not disclosed in the ESIA, require the acquisition of rights to use additional lands, or require additional permits/approvals from the government.	and justification for the change. This category of change requires Lender approval before implementation.
Category 2	Changes which have the potential to, or are reasonably likely to result in, decreased Owner's ESHS performance, but are unlikely to result in any increase in environmental/social impacts above those described in the ESIA, or result in new impacts not described in the ESIA, or require the acquisition of rights to use additional lands.	The Owner will notify the Lenders of the proposed change and provide the rationale and justification for the change. This category of change only requires Lender notification before implementation, unless the Lenders object within 30 days of receipt of the notice of change.
Category 1	Changes will are expected to result in similar or improved ESHS performance and are unlikely to result in any increase in environmental or social impacts above those described in the ESIA	The Owner will notify the Lenders of the proposed change and provide the rationale and justification for the change as part of its quarterly Environmental and Social Issues Compliance Report. This category of change does not require Lender's approval before implementation.

The Owner is required to maintain a copy of the current version of the Owner's ESMMP at its office at all times, as well as copies at the EPC Contractor's construction office and the O&M Contractor's project office. The Owner understands that the Lender will use the current version of the Owner's ESMMP as the basis for conducting its periodic monitoring inspections.

1.4. OWNER'S ESMMP RESPONSIBILITIES

The list below indicates the Owner's ESMMP-related responsibilities of each entity:

- Owner's Requirements
    - Prepare and maintain an Environmental, Social, Health, and Safety Compliance Registry, which includes all Project commitments in response to Government approvals, Lenders requirements, and discussions with local communities;
    - Develop a Draft Owner's ESMMP, which addresses all applicable Project ESHS commitments based on the ESHS Compliance Registry, and revise it as needed in order to obtain Lender's approval;

- Follow the Management of Change process described above for any changes to the Owner's ESMMP;
- Include language requiring full compliance with the applicable aspects of this Owner's ESMMP in any and all subcontracts the Owner signs for the Project.
- Monitor contractor and subcontractor ESHS performance and conformance with the Owner's ESMMP, and ensure the EPC and O&M contractors monitor their own and their subcontractors' ESHS performance in accordance with the Owner's ESMMP throughout Project construction and operation;
- Hold regular (at least quarterly) ESHS performance meetings with the EPC and O&M contractor to review ESHS performance;
- Notify the EPC or O&M contractors of the need for any corrective actions;
- Issue a stop work order if the EPC or O&M contractors have not taken appropriate action to achieve compliance with ESHS requirements after repeated notices of violation and warnings of noncompliance, and significant ESHS impacts are occurring or imminent, until the contractors ESHS performance is brought up to acceptable standards;
- Provide appropriate training so as to assure that its workforce understands the requirements of Owner's ESMMP;
- Employ qualified ESHS staff to oversee the Project's ESHS performance and ensure that staffing and resources are adequate, commensurate with the magnitude and timing of work and potential ESHS risks;
- Employ an Owner's Engineer to advise on any engineering design questions;
- Ensure the Project is constructed and operated in accordance with the Owner's ESMMP;
- Develop and Implement a Community Grievance Mechanism, including information on how and with whom a community member can log a grievance or make suggestions;
- Notify the Lenders of any significant incidents or accidents in accordance with the requirements and timing of the Environmental and Social Issues Compliance Report;
- Monitor and report on the ESHS performance of the project during construction and operations as described in the Project Monitoring and Reporting section of this Owner's ESMMP;
- Proactively implement corrective actions to address any situations where the Project is not meeting the requirements of the Owner's ESMMP;
- Retain documentation of Project compliance with the Owner's ESMMP to facilitate Lender compliance audits;

  - Cooperate fully with all compliance audits conducted by the Lenders, or the Lenders Independent Engineer (who is also responsible for serving as the Independent Environmental and Social Consultant); and
  - Cooperate fully and implement any Corrective Action Plans required by the Lenders to address any situations where the Owner is not meeting the requirements of the Owner's ESMMP or complying with the laws of Nepal.

- EPC and O&M Contractor Requirements relative to the Owner's ESMMP
  - Comply with the applicable construction and operations phase requirements in the Owner's ESMMP (e.g., biodiversity related commitments);
  - Monitor and report on the ESHS performance of the project during construction as described in the EPC Construction Monitoring and Reporting section of this Owner's ESMMP;
  - Participate in regular (at least quarterly) ESHS performance meetings with the Owner to review ESHS performance;
  - Proactively implement corrective actions to address any situations where the Contractor is not meeting the requirements of the Owner's ESMMP;
  - Retain documentation of Project compliance with the Owner's ESMMP to facilitate Owner and Lender compliance audits;
  - Cooperate fully with all compliance audits conducted by the Owner, the Lenders, or the Lenders Independent Engineer (who is also responsible for serving as the Independent Environmental and Social Consultant); and
  - Cooperate fully and implement any Corrective Action Plans required by the Owner or the Lenders to address any situations where the Contractor is not meeting the requirements of the Owner's ESMMP or complying with the laws of Nepal.

- Lender Requirements
  - Review and provide comments to the Owner on the Draft Owner's ESMMP;
  - Comply with the Management of Change process described above for any changes to the Owner's ESMMP;
  - Conduct periodic monitoring visits; and
  - Provide the Owner with all Monitoring Trip Reports and notify the Owner of the need for any Corrective Action Plans.

This Owner's ESMMP Framework includes minimum Lender requirements for each of the following Management Plans:

- Biodiversity Management Plan
- Stakeholder Engagement Plan

- Land Acquisition and Livelihoods Restoration Plan
- Gender Action Plan
- Indigenous and Vulnerable Peoples Management Plan
- Labour Influx Management Plan
- Local Benefits Sharing Plan
- Employment and Skill Training Plan
- Industrial Benefit Sharing Plan
- Owner's Environmental and Social Monitoring and Reporting Plan

In some cases, the Management Plans presented in this Framework may be essentially complete, but in other cases, some of the Management Plans may need to be updated to reflect to reflect and incorporate all of the commitments identified in the Environmental, Social, Health, and Safety Compliance Registry, which the Owner is required to prepare, as well as applicable items in the Lender's Environmental and Social Action Plan (ESAP).

1.5. BIODIVERSITY MANAGEMENT PLAN

1.5.1. Purpose

Where biodiversity values of importance to conservation are associated with a project site or its AoI, the preparation of a Biodiversity Management Plan (BMP) provides a useful means to facilitate implementation of a project's mitigation and management strategy. The development of a BMP might be required under a company's own biodiversity policy, or International Finance Institutions (IFI or "Lenders") might request a BMP to help document compliance with Lender standards. Other parties, such as government agencies, conservation organizations or Affected Communities, might also be interested in the development of a BMP to address a specific topic of concern.

This BMP has been prepared to support the corporate commitments of the Nepal Water and Energy Development Company (NWEDC) for conserving aquatic and terrestrial biodiversity in the Trishuli River Basin.

1.5.2. IFC Performance Standard 6

IFC applies the Performance Standards (PS) to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing. IFC PS 6, Biodiversity Conservation and Sustainable Management of Living Natural Resources, aims at protecting and conserving biodiversity, the variety of life in all its forms, including genetic, species, and ecosystem diversity and its ability to change and evolve. This PS addresses how projects will avoid or mitigate threats to biodiversity arising from their construction and operations as well as incorporate sustainable management of renewable natural resources.

IFC PS6 categorizes habitats as follows:

- Modified Habitat: are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition.
- Natural Habitat: are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.
- Critical Habitat: are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.

1.5.2.1. Objectives of the BMP and Compliance to IFC PS6.

In accordance to PS 6, Projects affecting areas of Natural Habitat, the client will not significantly convert or degrade Natural Habitats, unless all of the following are demonstrated:

- No other viable alternatives within the region exist for development of the project on Modified Habitat;
- Consultation has established the views of stakeholders, including Affected Communities, with respect to the extent of conversion and degradation; and
- Any conversion or degradation is mitigated according to the mitigation hierarchy

Furthermore in areas of Natural Habitat, mitigation measures will be designed to achieve no net loss of biodiversity where feasible. Appropriate actions include:

- Avoiding impacts on biodiversity through the identification and protection of set-asides
- Implementing measures to minimize habitat fragmentation, such as biological corridors;
- Restoring habitats during operations and/or after operations; and
- Implementing biodiversity offsets

The BMP initially classifies all habitats into modified, natural or critical by assessing the prevailing state of habitat modification by human use and presence of threatened, endemic or migratory species. For Modified Habitat, the BMP discusses minimization of impacts. For Natural Habitat, the BMP assesses whether any project alternatives are possible and whether stakeholders have been adequately consulted. It subsequently discusses how the mitigation hierarchy has been used to minimize impacts or compensate residual impacts through biodiversity offsets. The Project does not directly affect Critical Habitat, but the BMP describes measures to avoid or minimize indirect impacts on Critical Habitat.

1.5.3. Impacts on Terrestrial Habitat and its Mitigation

1.5.3.1. Terrestrial Habitats Classification

The Project will directly impact approximately 108 hectares (ha) of land as summarized in Table B.1-2.

Table B.1-2: Project Effects on Land Cover and IFC Habitat Classifications

Land Cover[a]	Area (ha)[a]	Natural Habitat	Modified Habitat	Critical Habitat
Forest	80.9	2.6	78.3	0
Cultivated Land	20.6	0	20.6	0
Cliff	0.8	0	0.8	0
River Banks (bagar)	5.5	0	5.5	0
Total	107.8	2.6	105.2	0

The Project will directly impact biodiversity by the loss of vegetation and habitat and injuring wildlife; and indirectly by increased human activity (i.e. influx of workers, noise, vehicular traffic, potential for illegal hunting and plant collection) and the loss of habitat connectivity. The transmission line will pose electrocution threats to bird species.

Potential Impacts to Natural Habitat

Project construction and operation will directly impact approximately 2.6 ha of Natural Habitat, as defined in the International Finance Corporation's Performance Standards. This small area is located on the east bank of the Trishuli River near the proposed dam/headworks and is part of Langtang National Park (LNP).

The small impact to Natural Habitat associated with the Project cannot be avoided or further minimized because of engineering constraints. In accordance with IFC PSs and the Forestry Guidelines (2017), NWEDC is required to mitigate this residual impact to achieve no net loss. NWEDC will achieve no net loss by working with the LNP to identify a suitable area of cleared/degraded land and reforest it using a 1:2 ratio. Species used will maintain parity with the impacted area. For additional compliance to these guidelines, NEWDC will also provide 2.61 ha of land to be annexed to the LNP and support its management and monitoring/evaluation. This will be as compensation for the 2.61 ha of natural forest required for the project. This will also align with IFS PS6 as mitigation for achieving no net loss for natural habitat lost.

Additionally, NWEDC will enhance riparian vegetation by developing a Riparian Vegetation Restoration Program which describes existing conditions, restoration design, and monitoring and maintenance activities.

Potential Impacts on Modified Habitat

The Project will impact approximately 105.2 ha of Modified Habitat, as defined by the IFC PSs. Modified terrestrial habitats on the west bank of the Trishuli River, where most of the Project components will be built, consist mostly of forest under management by local communities (78.6 ha) and agricultural or marginal lands. The forests are highly intervened and degraded by human activity (e.g. extraction of forests products, cattle grazing). Much of this land will only

be temporarily disturbed, and NWEDC will stabilize and revegetate approximately 76 ha with only approximately 31 ha permanently converted to Project facilities and the reservoir.

Potential Impacts to Critical Habitat

According to the IFC Performance Standard 6, Critical Habitat is defined as "areas with high biodiversity value, including (1) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes (Table B.1-2). We assess the potential presence of Critical Habitat below.

Species Criteria

There are no IUCN Critically Endangered, Endangered, or endemic flora or fauna species within the Project AoI, so no Critical Habitat is identified based on IUCN listed species. There are, however, some fauna species that are endangered or endemic in Nepal, which are evaluated below.

- Isisbill – is classified as Endangered in Nepal and is thereby assessed under Criteria 1 Tier 2 e. The species is widely distributed in Southern Central Asia and numbers in the Modified Habitat of the project's AoI are not nationally or regionally significant. The Critical Habitat criteria are therefore not triggered.
- Assamese monkey *(Macaca assamese)* - is endemic to Nepal and relegated to a single population there. The Nepal population of the species is threatened due to its restricted distribution of less than 2,200 square kilometres extent of occurrence and 914 square kilometres areas of occupancy and continuing decline in area, extent and quality of habitat, the number of locations and in the number of mature individuals. Given its restricted extent of occurrence, threats on its population and habitat, and small numbers in fragmented patches, the Nepal population of this macaque is categorized as Endangered (Boonratana et al. 2008). The species will be affected by habitat loss within the Modified Habitat. However macaque species are highly adaptable and will either move to areas (if competition from other neighbouring troops is limited) or adapt within the cleared area which will be human dominated in the future. Given the wide range of the species in South and Southeast Asia, and that the numbers in the Modified Habitat in the Project's AoI are not nationally or regionally significant, Criteria 1 Tier 2 e is not triggered.
- Asiatic black bear (*Ursus thibetanus*) - is classified as EN in Nepal and is thereby assessed under Criteria 1 Tier 2 e. The species is widely distributed in South and Southeast Asia and numbers in the Modified Habitat of the project's AoI are not nationally or regionally significant. The Asiatic black bear may be found in modified habitat raiding garbage areas and agricultural lands.

Protected Areas Criteria

LNP is an IUCN Category II protected area (Bhugu et al. 2007) and is recognized as an Important Bird and Biodiversity Area (Birdlife 2013). It is not a World Heritage Site or a Biosphere Reserve. IFC PS6 states that internationally and/or nationally recognized areas of high biodiversity value will likely qualify as Critical Habitat; examples include the following:

- Areas that meet the criteria of the IUCN's Protected Area Management Categories Ia, Ib and II, although areas that meet criteria for Management Categories III-VI may also qualify depending on the biodiversity values inherent to those sites.
- The majority of Key Biodiversity Areas (KBAs), which encompass inter alia Ramsar Sites, Important Bird Areas (IBA), Important Plant Areas (IPA), and Alliance for Zero Extinction Sites (AZE).

Therefore, the LNP is considered Critical Habitat. The LNP, however, is divided into a "core area" and a "buffer zone," which is technically outside the park, but within the park boundary. Much of the buffer zone is developed with roads, villages, and farmland. In fact, more than 80,000 people were estimated to live within the park in 2012 (Langtang National Park and Buffer Zone Management Plan 2012). The buffer zone lands need to be assessed on a case-by-case basis as to whether they would qualify as Critical Habitat.

The Project will disturb approximately 6.77 ha of land within the LNP boundary—2.61 ha for construction of the dam and 4.16 ha for the construction of the new worker camp (2.8 ha owned by the government and 1.36 ha privately owned). The new worker camp needs to be relocated from the previously approved Mailung School site for safety reasons in the aftermath of the 2015 earthquake.

Both sites (i.e. the entire 6.77 ha) are designated buffer-zone land along the edge of, but still within, the LNP boundary (Langtang National Park and Buffer Zone Management Plan 2012). The LNP Management Plan recognizes the potential for development of hydroelectric projects near the LNP, specifically mentioning the Upper Trishuli Project, and encourages use of alternative energy as a buffer zone objective.

The 2.61-ha site required for the dam is forested and identified above as Natural Habitat. This site, however, is designed buffer-zone land, which is isolated from the remainder of the LNP by steep cliffs and by the new Army Road. It does not provide habitat of significant importance to Critically Endangered or Endangered, endemic, restricted range, or restricted-range species; does not support globally significant concentrations of migratory or congregatory species; is not a highly threatened or unique ecosystem; and is not associated with any key evolutionary processes. Therefore, we do not consider this site to be Critical Habitat.

Although within the LNP, the 4.16-ha site required for the worker camp is designated buffer zone land, is disturbed and not forested, and is isolated from the remainder of LNP by the new Army Road. As with the 2.61-ha parcel, this site also does not meet any of the applicable criteria, so is not considered Critical Habitat.

Although these sites are not considered Critical Habitat and the Project will not directly impact any Critical Habitat, there is the potential for the Project to indirectly impact core areas of the LNP, which are considered Critical Habitat. This is less of a risk for the 2.61-ha site because the camp for the dam construction workers is on the west bank, with the Trishuli River and the extremely steep slopes on the east bank serving as a barrier limiting access to the LNP core areas.

The 4.16-ha site near the powerhouse, however, poses a greater risk because it will be used as the worker camp, and is located on the east bank of the river with roads providing easy access to the LNP's core areas. The introduction of this workforce in close proximity of Critical Habitat presents several risks, including illegal hunting/poaching and the collection/trade of natural or wildlife products.

NWEDC has agreed to adopt the following measures to minimise indirect Project impact on LNP, Critical Habitat, as well as impacts to Community Forests:

Table B.1-3: BMP Mitigation Measures

Mitigation Measures	Responsibility
Ensure compliance with all applicable NWEDC commitments and the Biodiversity Management Plans are included in the EPC contracts	NWEDC
The Biodiversity Management Plan should include a Biodiversity Evaluation and Monitoring Plan (BEMP) that is developed before construction commences, since impacts to terrestrial diversity will occur during construction. The BEMP will also include monitoring actions discussed below.	
Demarcate in the field the approved limits of clearing to ensure no additional Natural Habitat or Community Forest is disturbed.	EPC
Install fencing around the dam site to prevent unauthorized worker access to LNP forest.	EPC
Collect and store topsoil for use in restoration.	EPC
Provide alternative fuel for heating and cooking to avoid use of forest related products.	EPC
Adopt a Worker Code of Conduct that prohibits unauthorized entrance to LNP or Community Forests; illegal hunting, fishing, and poaching; and the collection/trade of natural or wildlife products. Clearly indicate that these activities could result in the termination of their employment. In addition, provide hording boards showing illegal acts (poaching, hunting, etc.) in consultation with LNP. The conservation significance of black bear will be also displayed in the hoarding board.	EPC
Provide awareness training to construction workers, operations and maintenance (O&M) staff, and site management personnel regarding the elements of the Worker Code of Conduct.	EPC
Prohibit use of wildlife meat at the worker camps.	EPC
Provide staff to monitor/patrol activities in the LNG buffer zone at the dam site and powerhouse worker camp to ensure no illegal activity by construction workers. The staff should be recruited from the local communities.	EPC
Use signage and speed humps in areas where wildlife crossing is likely.	EPC
Train vehicle drivers regarding the driving risks through biodiversity sensitive areas and along remote roads.	EPC
Stabilize and rehabilitate/reforest temporarily disturbed areas, especially community forest. In accordance with the Nepal Ministry of Forest requirements, NWEDC will compensate for the loss of trees on a 2:1 basis in accordance with its PDA agreement. The requirement of	EPC

Mitigation Measures	Responsibility
compensatory planting shall be included in the design and Project contract. A Master Landscaping Plan and requirements of ecological monitoring or survey during different stages of the Project shall be prepared during the design stage, which shall be implemented during construction and maintained during operation. These planning and monitoring requirements shall be integrated into the overall Reforestation Plan.	
Visually monitor number of trees felled within 1 km of dam, access road and switchyard as well as baseline plots, as part of a Biodiversity Evaluation and Monitoring Program (BEMP) to be developed	NWEDC
In accordance with Nepal Ministry of Forest requirements, as mentioned earlier, NWEDC will acquire, reforest, and donate at least 2.61 ha of similar land to be annexed into the LNP to offset the Project's permanent acquisition of parklands. A Participatory Biodiversity Monitoring Program could provide local employment thereby proving opportunities to fulfil project commitments related to biodiversity monitoring. The monitoring should use the following indicators that measure progress against achieving no net loss 1. Plant species composition and diversity. 2. Bird species composition and diversity. 3. Ensuring that butterfly species composition and diversity. Plant species composition and diversity needs to be compared to that of the impacted 2.61 ha to assess progress for no net loss. Bird and butterfly species composition and diversity needs to be compared to that of a control plot in the same habitat within the LNP. Plants, birds and butterfly are good indicators of habitat quality and are practical to monitor. The BEMP should include monitoring of the land annexed to the LNP with details on monitoring protocols and schedules specified.	NWEDC
Provide funding to local forest user groups for monitoring and surveillance to protect wildlife within community forests.	NWEDC
Protect the LNP from further losses of land due to shifting river course and from easy access to the park though dewatered zones during operation. Replanting of trees and vegetation to stabilize slopes and restore erosion regulation could also provide an opportunity for local employment.	NWEDC/ECP
Limiting disturbance and educating construction workers on steps to prevent damage to the park and/or its wildlife	NWEDC/EPC
Enhance riparian vegetation by developing a Riparian Vegetation Restoration Program which describes existing conditions, restoration design, and monitoring and maintenance activities	NWEDC
Regular ecological monitoring on the fauna, flora and specific habitats within the impact areas to ensure that numbers are stable and project activities are not leading to a population decline. A Participatory Monitoring Program could provide local employment thereby proving opportunities to fulfil project commitments related to biodiversity monitoring. Monitoring of flora and fauna within the impacted area needs to be included within the BMEP with details on monitoring protocols and schedules specified.	NWEDC
Raise the transmission poles with suspended insulators in order to reduce the electrocution of bird species or fixing insulated caps made of plastic.	EPC
Require bird-safe strain poles with insulating chains of at least 60 cm length.	EPC
Check for vacuums or holes in the towers to avoid nesting by any of the birds;	EPC
Monitor bird carcasses electrocuted on a monthly basis and record any threatened or migratory species observed. Any spurt in mortality will need consideration of design modifications to reduce mortality	NWEDC

Considering the relatively minor impacts on terrestrial biodiversity, and implementation of these mitigation measures, NWEDC should achieve no less loss of terrestrial Natural Habitat at the UT-1 Project, and should not result in any significant impacts to terrestrial habitat.

1.5.4. Aquatic Biodiversity

The Project will affect aquatic habitat and fish differently upstream of the dam, in the diversion reach, and downstream of the powerhouse. This section summarizes the types of impacts that will occur in each of these river segments and proposed mitigation and management measures.

1.5.4.1. Upstream of the Dam

The Project should have negligible impacts on aquatic habitat upstream of the reservoir. No in-water construction will occur upstream of the dam that would modify riverine habitat, with the exception of the temporary coffer dam using to divert water around dam construction. The Project reservoir will only be 2.1 ha in surface area, which effectively limits the impacts on upstream aquatic habitat. Common snowtrout, which is by far the most abundant fish found upstream of the dam site (see Section 6.2), is known to inhabit lakes (Petr and Swar 2002; Petr 1999), and would be expected to colonize the small UT-1 reservoir, especially during the winter if the water temperatures of the reservoir are slightly higher than current ambient conditions.

The UT-1 dam has the potential to interfere with the ability of fish to move upstream or downstream past the dam, which could affect the abundance of Common (and possibly Dinnawah) snowtrout and its ability to reach upstream spawning grounds. NWEDC, however, proposes to construct a fish ladder at the UT-1 dam, which would allow Common snowtrout and potentially other species to move upstream past the dam. The magnitude of Project effects on Common snowtrout populations upstream of the dam will be largely dependent on the effectiveness of the proposed fish ladder in facilitating the movement of these fish from their over-wintering areas downstream of the dam to their breeding areas upstream of the dam.

1.5.4.2. At the Dam

The UT-1 dam will interfere with the ability of fish to move upstream or downstream past the dam, which could affect the abundance of Common snowtrout (and possibly Dinnawah snowtrout) and its ability to reach upstream spawning grounds. NWEDC proposes to construct a fish ladder at the UT-1 dam, which would allow Common (and possibly Dinnawah) snowtrout and potentially other species to move upstream past the dam.

Fish surveys conducted in 2011, 2014, and 2016 collectively indicate that Common snowtrout migrate upstream of the UT-1 dam site in the early spring (late February to May) to spawn. Most of these fish remain in the upper portion of the river through the summer, with a large downstream migration of some adults, but predominantly juvenile fish, from May through September. Some Common snowtrout were found to overwinter above the dam site, but this population is relatively small.

These data demonstrate that different portions of the Project Area provide important habitat for various life stages of the Common snowtrout at different times of the year, and therefore the

importance of maintaining connectivity between aquatic habitat upstream and downstream of the dam.

NWEDC has committed to providing fish ladder at the UT-1 dam, and contracted with SWECO, a Norwegian company with extensive fishery experience in Nepal, to develop a conceptual design for fish passage at the UT-1 dam. In this case, the Common snowtrout was selected as the target species because it is the dominant species found in the Project area and its IUCN status as Vulnerable. Based on the Common snowtrout's size and swimming ability, SWECO proposed a fish ladder design with the following features (see Figure B.1-1):

- Fish ladder flow of 1 m^3/s;
- An additional attraction flow of 1 m^3/s from a pipe discharging at the top of the concrete roof that covers the first two chambers of the fish ladder (see Figure 7.2-2);
- The remainder of the Eflow will be routed into the entrance pool at the base of the ladder;
- Entrance pool at the base of the ladder equipped with hiding places for fish and water velocities of less than 0.6 metre per second (m/s);
- Approximately 100 steps with an approximate height of 0.3 metre, based on a dam height of approximately 30 metres;
- Water velocity through the vertical slots connecting the various steps with a maximum velocity of 0.7 m/s (slightly higher velocities are allowed in the lowest nine steps;
- Exit from the fish ladder at the top of the weir will be located as far as possible from the powerhouse intake where water velocities are less than 0.3 m/s to minimize the risk of the upstream migrating fish being entrained into the turbines.

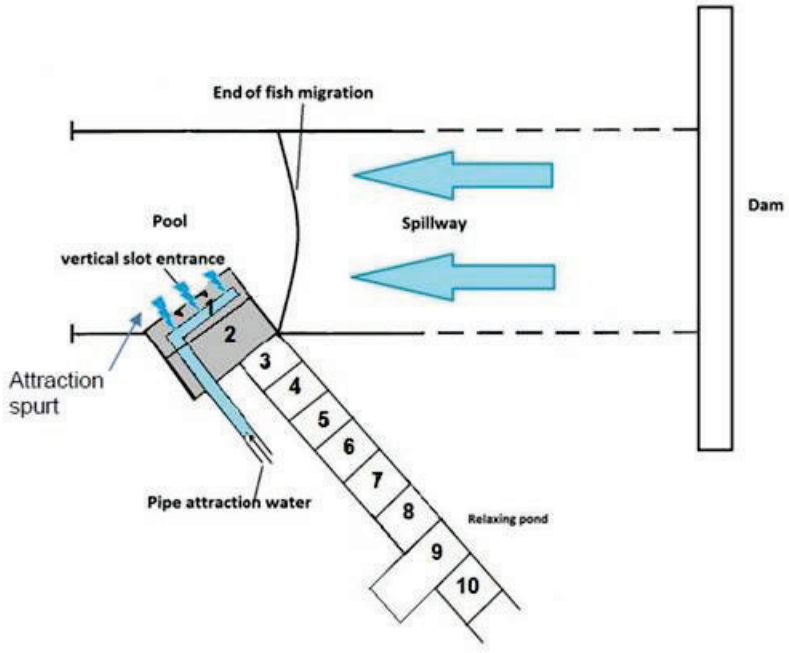


Figure B.1-1: Fish Ladder Design

Following recommendations from SWECO, NWEDC has agreed to:

- Ensure conditions at the powerhouse tailrace are such that the upstream migrating fish are attracted to the flow from the diversion reach and are not diverted to the powerhouse tailwaters;

Ensure the channel in the river section just downstream of the dam leads the fish to the fish ladder entrance.

Monitor flow and temperature (preferably on an hourly basis) to have the data needed to optimize fish ladder functionality; and

- Monitor fish movement to detect the beginning of the upstream migration period and ensure proper functioning of the fish ladder entrance.

Downstream Fish Passage During Operations

Facilitating the safe upstream passage of migrating Common snowtrout above the dam is important, but ensuring the safe downstream passage of migrating fish is equally important. Most adult and juvenile Common (and possibly Dinnawah) snowtrout will migrate downstream in late summer and autumn as river temperatures gradually decline. In order to avoid fish being entrained into the powerhouse turbines, which, given the pressures associated with 327 m of head, would result in high levels of injury or mortality given the pressures associated with 327 m of head, NWEDC proposes to:

Provide a guidance mechanism to help direct adult and juvenile fish away from the powerhouse intake;

- Ensure a smooth spillway and a deep pool at the base of the dam to minimize injury to fish migrating through the flap gates with spillage water; and
- Preferably spill water via the spillway at the left side of the weir.

The fish ladder design has been peer reviewed by fish experts with the IFC (see Appendix G for the IFC fish expert's review). SWECO has provided advice and coordinated with the Project engineers on the fish ladder (SWECO 2018; see Appendix D, Design Advice on Fish Ladder and Associated Spillway Designs at the UT-1 Hydropower Project) to ensure its design is technically feasible and economically viable. This fish ladder design has now been incorporated into the overall dam design drawings.

Monitoring

As indicated by SWECO, additional monitoring is required to ensure the proper operation of the upstream and downstream fishways. NWEDC has committed to contracting an international fish scientist with expertise in Nepal fish to oversee the following actions:

- During Project construction:
  - Develop a fish monitoring plan, as part of an overall Biodiversity Evaluation and Monitoring Program (BEMP), which would begin to be implemented prior to the initiation of construction to provide a solid baseline against which to measure Project effects on fish populations, especially the Common snowtrout, and to help better understand the timing of Common snowtrout upstream and downstream migration, the extent to which Common snowtrout spawns in the Trishuli River mainstem versus tributaries in the Project area, and the relative population of Common snowtrout in the diversion reach;
  - Monitor the effectiveness of the Project's diversion tunnels in allowing upstream and downstream migration of fish;
  - Monitor construction of the fish ladder and dam to ensure it is consistent with the SWECO design; and
  - Develop a more detailed design for the fish guidance mechanism around the powerhouse intake.
- During Project commissioning and reservoir filling
  - Ensure the fish ladder is ready to be operational before reservoir filling begins; and
  - Oversee commissioning of the fish ladder.
- During the initiation of Project operations:
  - Inspect the diversion reach to ensure no barriers or obstacles exist to upstream migration under Eflow only conditions, and if any are identified, recommend and implement measures to mitigate them;

- Ensure the channel in the diversion segment just below the dam leads the fish to the fish ladder entrance;
- Establish a flow and temperature monitoring program to optimize fish ladder performance;
- Develop a Biodiversity Evaluation and Monitoring Program and train NWEDC staff to monitor and report on the effectiveness of the fish ladder for upstream fish passage and the effectiveness of downstream fish passage guidance measures;
- Establish a program and train NWEDC staff to monitor and report on the populations of Common (and possibly Dinnawah) snowtrout upstream of the dam, in the diversion reach, and downstream of the powerhouse relative to baseline conditions using tagging methods; and
- Evaluate the effectiveness of the current Eflow program and determine whether further actions are warranted in accordance with the Eflow Adaptive Management Program, which is described in the Biodiversity Management Plan that is part of the Project Environmental and Social Management and Monitoring Plan (see Appendix B).

This monitoring program will involve national fish experts in order to build capacity and involve participatory monitoring by local community residents. The monitoring results will be reported and disclosed on the Project website.

The BEMP will be designed to demonstrate that viable populations of native fish species are maintained and that no net loss of biodiversity is achieved in the Project area, as indicated by the following key metrics:

- Successful upstream migration of Common (and possibly Dinnawah) snowtrout to, and through, the fish ladder as documented by actual counts in the fish ladder;
- Successful natural reproduction of Common (and possibly Dinnawah) snowtrout upstream of the dam as documented by presence of juveniles;
- Successful downstream migration of Common (and possibly Dinnawah) snowtrout over or around the dam as documented by the presence of juveniles in the diversion reach (note that Common snowtrout is not believed to spawn in the diversion reach so the presence of juveniles in this reach should likely reflect their successful downstream migration); and
- Maintenance of viable populations of catfish and loach species as documented by maintaining catches similar to those found during the baseline fish surveys.

Cumulative Impacts of HPPS on the Trishuli River

There are several other hydropower projects under construction and proposed both upstream and downstream of the Project area. There is the potential that decreases in the numbers of migrating Common snowtrout passing through the UT-1 Project area, and the populations of Common snowtrout found in the Project area could occur, and not be attributable to the UT-1 Project, as has likely recently occurred with the Dinnawah snowtrout population in the Project area as a

result of the UT-3A HEP (see Section 6.2). NWEDC is participating in a Trishuli River Basin Cumulative Impact Assessment funded by IFC, and has committed to participate in a Trishuli Basin Co-Management Platform to facilitate collaborate monitoring and management of cumulative impacts (see Section 7.12 for more details on Cumulative Impacts).

1.5.4.3. Diversion Reach

The Project will divert up to 76 cubic metres per second (m^3/s) of flow from the 10.7-kilometre segment of the Trishuli River between the dam and the powerhouse (i.e. the diversion reach). This flow diversion will reduce the width, depth, velocity, and sediment transport characteristics of water in the diversion reach, thereby potentially impacting aquatic habitat and fish. During nearly six months of the year (November through April), this diversion would represent much of the Trishuli River flow.

In Nepal, hydropower projects are required to release 10 percent of the minimum monthly average flow or an alternative Eflow recommended in the project's EIA, whichever is higher. The biodiversity purpose of the Eflow is two-fold: to preserve the minimum habitat required to support fish and other aquatic life in the diversion reach and to preserve flow continuity for fish movement/migration through the Project Area. As Table B.1-4 shows, 10 percent of the minimum monthly average flow for the UT-1 Project would equate to a required minimum flow of approximately 3.9 m^3/s (i.e. 10 percent of 38.6 m^3/s, which is the average flow during the river's lowest flow months of February and March at the Project site).

NWEDC has proposed an Eflow that is higher than that required by Nepalese regulations during most months of the year, essentially providing 10 percent of the average monthly flow for each month, rather than 10 percent of the minimum monthly average flow. Actual flow in the diversion reach would typically be higher than this Eflow from May to October (e.g. the spring snowmelt and monsoon period) as river flow would exceed the hydraulic capacity of the Project and excess water would be spilled into the diversion reach. Table B.1-4 below shows the existing, required minimum, proposed minimum, and the proposed actual diversion-reach flow regimes by month.

Table B.1-4: Flows into the Diversion Reach Based on Mean Monthly Flows under Regulated and Unregulated Conditions

Flow Management Scenarios	Mean Monthly Flow (m^3/s) at the Intake Site											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Existing average river flow regime	43.7	38.6	38.6	49.5	87.5	230.4	487	557.8	370.8	160.4	79.9	54.6

Flow Management Scenarios	Mean Monthly Flow (m^3/s) at the Intake Site											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Required (Nepal law) minimum diversion reach flow regime	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Proposed minimum diversion reach Eflow regime	4.4	3.9	3.9	5.0	8.8	23.0	48.7	55.8	37.1	16.0	8.0	5.5
Proposed actual average diversion reach flow regime[a]	4.4	3.9	3.9	5.0	11.5	154.4	411.0	481.8	294.8	84.4	8.0	5.5
% of mean monthly flow	10%	10%	10%	10%	13%	67%	84%	86%	80%	53%	10%	10%

Source: Modified from ESSA 2014

[a] Includes flows above the hydraulic capacity of the powerhouse (76 m^3/s) that would be spilled.

NWEDC proposes to release the Eflow as follows (SWECO 2018):

- Fish ladder – 1 m^3/s through the fish ladder
- Fish ladder attraction flow - 1 m^3/s from the top of the concrete roof that is covering the first two chambers of the fish ladder
- Flap gates - remainder of Eflow will be released through the flap gates into the pool at the entrance of the fish ladder

If the fish ladder is not operating (e.g., during periods when the snowtrout is not migrating), all the Eflow can be released from the flap gates.

Project Effects on Aquatic Habitat and Common Snowtrout in the Diversion Reach

The 2016 DRIFT Model evaluated the effects of five alternative flow scenarios for the diversion reach on aquatic habitat and on the Common snowtrout. The results indicate that the Project

would have significant adverse effects on Common snowtrout in the diversion reach for all five flow scenarios. The overall ecosystem integrity scores for this reach would be reduced from a "B" rating (i.e. Slightly Modified condition) to a "D" rating (i.e. Largely Modified condition), which is primarily attributable to impacts of the low water flow on overwintering Common snowtrout populations in the diversion reach. The study concludes that the Common snowtrout may vacate the diversion reach during the winter primarily because of the low flows (assumed to be 3.9 m^3/s) provided by the Project. The preliminary DRIFT model results indicate that the release of more water by the Project during the winter would be needed to sustain a year round Common snowtrout population in the diversion reach (see Appendix E – Final Eflow Report).

While the 2016 DRIFT model understandably predicts negative impacts on the Common snowtrout and its habitat in the diversion reach, evaluation of the baseline fish data provide additional insight into the relative magnitude and likelihood of the impacts. The fish survey data indicate that the population of Common snowtrout overwintering (October through February) in the diversion reach is small, with the total number of Common snowtrout captured at three diversion reach monitoring stations representing only approximately 17 percent of the number of Common snowtrout captured at a single station downstream of powerhouse monitoring station (see Section 6.2). Thus the lower flow during the winter months will impact only a small percentage of the Common snowtrout population in the area. In addition, the lower flow and warmer temperatures of the diversion reach may create better conditions for the snowtrout, including pools and spawning sites, which could lead to an increased population of snowtrout within the diversion reach. The 2018 connectivity assessment will analyse this potential impact further. The project's Biodiversity Evaluation and Monitoring Program (BEMP) will closely monitor the conditions and fish population within the diversion reach and recommend adaptive management as needed to maintain fish habitat and population. Project Effects on Fish Migration through the Diversion Reach

Increasing flow and water temperatures are likely the cues for both snowtrout species to begin migrating upstream to spawn in early spring. The Project will have negligible effect on these cues downstream of the Project because of the true run-of-river operating mode (flow) and small reservoir/short detention time (temperature).

Section 6.2 summarizes the migration pattern of the Common snowtrout, which includes upstream migration of adults primarily in March-May and downstream migration of juvenile fish primarily in August-October. UT-1 will provide a fish ladder for upstream migration, and mechanisms for downstream migration (see below). However, the Eflow must provide appropriate water depths and velocities for the Common snowtrout to be able to reach the fish ladder and the upstream spawning areas. The literature reports a range of minimum depths for the species. The preliminary DRIFT Eflows assessment for the Project reported a preferred depth for adults of 1 to 3 m (S.A.N. Engineering Solutions 2017) based on one study from the 1970s (Shrestha and Khanna 1976), but more recent studies indicate a minimum depth of 0.8 m for spawning adult Common snowtrout (Mathur and Kapoor 2015).

Table B.1-5 compares the estimated flows, based on hydraulic calculations, required to provide average depth of 0.8 m through the diversion reach, assuming a trapezoidal channel and the average Trishuli River gradient through the diversion reach.

Table B.1-5: Comparison of Minimum Flows Required to Achieve Critical Depths for Common Snowtrout (S. richardsonii) in the Diversion Reach

Depth (m)	Manning Coefficient (n)	Gradient (m/m)	Flow (m^3s)
0.8	0.04-0.08	0.03	3.45-6.90

The Project's proposed Eflow for the winter months (3.9 to 11.5 m^3/s, see Table 7.2-1 above) provides sufficient depth in the diversion reach for the minimum 0.8 m critical depth. With adaptive management implemented as needed, the proposed Eflow during March and April should be adequate for the Common snowtrout, and other fish species to pass through the diversion reach. Obviously, the depth requirements will vary for different sizes of fish, with smaller fish likely to pass more easily through the diversion reach. Although the results of the 2018 Connectivity Assessment are not yet available, it should be noted that the spring 2018 field sampling in the Project area found evidence of successful Common snowtrout spawning in several tributaries of the Trishuli River (including the Mailung Khola) where water depths were much less than 0.8 m.

There are some uncertainties in this analysis, including the few studies establishing the 0.8 m critical flow depth required to support the upstream migration of Common snowtrout and estimates of the flow required to achieve this critical flow depth. Discussions with NWEDC indicate constraints on their ability to increase Eflows, especially during the critical early migration months, if monitoring indicates water depths are insufficient to allow the Common snowtrout to reach the fish ladder. These constraints include the terms of their Power Purchase Agreement and the economic impact of increasing Eflows, which means decreasing flows available for power generation during the peak demand months.

Adaptive Management Program

Given these uncertainties, NWEDC has agreed to implement an Adaptive Management Program as part of the Biodiversity Management Plan (BMP) based on intensive monitoring through a Biodiversity Evaluation and Monitoring Program (BEMP) during the 5 years of construction and the Project's first few years of operation to ensure that upstream migrating Common snowtrout are able to reach the UT-1 fish ladder.

The Adaptive Management Program includes the following elements:

- Implement an intensive fish monitoring program during construction and the first few years of operation to ensure most upstream migrating Common snowtrout are able to reach the Project's fish ladder, especially during the early portion of the migration period (i.e. March and April) when the proposed Eflows are relatively low.

- If a meaningful percentage of Common snowtrout are not able to reach the fish ladder (i.e. sufficient to achieve the "no net loss" standard in IFC PS 6), then NWEDC will evaluate alternatives to effectively increase water depths and guide the fish to the fish ladder; including, in the following sequential order of action:
- Constructing channel improvements to direct more flow to a primary channel in order to achieve critical water depths or to remove impediments to movement such as small cascades;
- Increasing the required Eflow during the periods of upstream fish migration to achieve critical water depths. As indicated above, NWEDC is limited in its ability to modify these Eflows given the constraints of its Power Purchase Agreement, but it would be worth investigating the potential to reduce Eflows during the pre-migration winter (i.e., peak demand) months of December to February, and increase them proportionally during March and April so, as to better support fish migration while having no net change in power generation during the peak demand season;

If monitoring indicates that initiating a trap and haul program to capture upstream migrating Common snowtrout, transport by vehicle, and release them upstream of the dam;

- Establishing a hatchery for Common snowtrout, possibly in combination with other hydropower developers in the area, and release sufficient numbers of hatchery-bred fish upstream of the dam to maintain fish populations in the Project area.

Management of sediment represents another potential risk to fish migration through the diversion reach. Although periodic sediment flushing from the desander and reservoir is unlikely to directly affect fish spawning, since nearly all documented spawning in the Trishuli River has been in the tributaries rather than the river itself, the flushing could result in sediment deposition within the diversion reach and affect channel morphology and critical water depths required for successful migration. As indicated in Section 7.2.2 above, the O&M Contractor will be required to develop a Sediment Management Plan that limits the flushing of the desander and the reservoir to periods when flows are sufficient to transport the sediment through the diversion reach.

Section 7.2.5 describes the process for establishing measurable targets and thresholds for implementing the Adaptive Management Program, which are linked to achieving the requirement for No Net Loss of Biodiversity in Natural Habitat. This Adaptive Management Program is incorporated into the Project's Biodiversity Management Plan (see Appendix B.1, Owner's Environmental and Social Management and Monitoring Plans). Implementation of this Adaptive Management Program provides assurance that Project effects on flow will not prevent Common snowtrout from reaching spawning grounds upstream of the UT-1 dam.

NWEDC's 2018 Connectivity Assessment, which will include an enhanced hydraulic analysis and DRIFT modelling of the diversion reach, will help evaluate Common snowtrout's upstream migration flow requirements.

1.5.4.4. Downstream of the Powerhouse

Impacts on aquatic habitat and fish downstream of the powerhouse will be relatively minor for the following reasons:

- Flow—The Project will operate in a true run-of-river regime and should have no effect on flow downstream of the UT-1 powerhouse;
- Sediment—The Project is designed to periodically flush sediments using a desander and the dam gates. The timing of this flushing will be generally consistent with periods of natural high sediment transport (i.e., during the monsoon season and other times of high flows, see Sections 2.3.4, Sediment Management, and 7.2.2, Sediment Transport), although the flushing will be more episodic than under natural conditions;
- Physical Water Quality—The Project has a very small impoundment (2.1 ha) with negligible water retention, so the Project is not predicted to have any effect on physical water quality (e.g. water temperature, dissolved oxygen) that could affect downstream fishery habitat; and
- Chemical Water Quality—The Project will provide wastewater treatment for both its construction and operation workforce and other construction waste streams, ensure proper handling and storage of all hazardous materials, implement an emergency preparedness and response plan in the event of any spills of hazardous materials, manage slope stability and sediment control, and stabilize and landscape disturbed areas (see Appendix B, Environmental and Social Management and Monitoring Plans).

The existing baseline ecological status of the Trishuli River downstream of the powerhouse is considered "Slightly Modified" (S.A.N. Engineering Solutions 2017). The DRIFT Model results confirm that the Project would have little effect on the overall ecological integrity of the Trishuli River downstream of the powerhouse, with the predicted ecological integrity remaining as "Slightly Modified," with only a slight impact on Common snowtrout populations related to the assumed effect the dam will have on upstream spawning and the return downstream of breeding adults and juveniles.

Overall, Project design measures and Management Plans will be adequate to ensure that the Project will not adversely impact fishery habitat downstream of the Project powerhouse.

1.5.4.5. Aquatic Habitat Classification

Based on the physical habitat and water quality conditions documented by Project baseline studies, the aquatic habitat in the Project Area meets the IFC's definition of Natural Habitat (IFC 2012). Although the concentrations of several metals (notably iron, manganese and zinc) as well as oil and grease were elevated during the monsoon period, the physical habitat in the diversion reach currently retains its natural ecological function and supports a viable aquatic community.

The Trishuli River is fragmented by the downstream Devighat and Trishuli hydropower projects, which have affected the ecological continuity of the river, but the prevalence of migratory species such as Common snowtrout in the UT-1 Project area demonstrates that the ecosystem is still functionally intact and capable of supporting migratory species. It should be noted, however,

that the Upper Trishuli 3A and 3B hydropower projects are under construction immediately downstream of the UT-1 site, and the Rasuwagadhi

Hydropower Project is under construction upstream of the UT-1 site. An additional risk to the local fishery is the introduction of the exotic species Rainbow trout from fish farms. The Common snowtrout population in the Project area appears robust at this time and the Rainbow trout population has not substantially altered the aquatic community to date.

The Trishuli River does not meet the definition of Critical Habitat because it does not support any Critically Endangered, Endangered Species, endemic, or restricted range species; or any highly threatened or unique ecosystems; nor is associated with any key evolutionary processes. The Trishuli River does support migratory species (e.g. Common snowtrout and possibly the Dinnawah snowtrout), but does not support globally significant concentrations of these species.

1.5.4.6. Achieving No Net Loss of Natural Habitat

Pursuant to the IFC Performance Standards, the goal for Natural Habitat is No Net Loss of biodiversity. As indicated above, the Project is predicted to impact aquatic habitat upstream of the dam and along the diversion reach, but not downstream of the powerhouse because the Project will operate in a true run-of-river regime. IFC's Performance Standard 6 requires Project's to avoid "significant" conversion of Natural Habitats unless:

- No other viable alternatives within the region exist for development of the project on Modified Habitat;
- Consultation has established the views of stakeholders, including Affected Communities, with respect to the extent of conversion and degradation; and
- Any conversion or degradation is mitigated according to the mitigation hierarchy.

The Project has been designed to take advantage of the generation potential offered by the specific set of hydrologic conditions at the Project site and the entire Trishuli River Basin would be considered Natural Habitat, so there are no other viable alternatives for the Project in Modified Habitat. NWEDC has also engaged with stakeholders and communities within the Project area. The major habitat impacts (e.g. minimal impoundment of riverine habitat, reduced flow, and fragmentation of the river) are inherent in the design of the Project and cannot be avoided without fundamentally altering the design and purpose of the Project.

The next step in the mitigation hierarchy is minimization. The fragmenting effects of the dam and the size of the impoundment (and the consequent loss of riverine habitat) are functions of the size of the dam necessary to generate a sufficient amount of electricity to make the Project economically viable and cannot be minimized without jeopardizing the Project's economic viability. In this case, the Project reservoir is quite small. The loss of aquatic habitat in the diversion reach will be minimized through the Eflow as described above. As described in Section 7.2.3., the Common snowtrout has been selected as the indicator species for Eflow analysis; based on the available information on its habitat requirements, the Eflow is likely to be sufficient to maintain habitat connectivity through the diversion reach.

Mitigation follows minimization in the mitigation hierarchy. Although the Project does not propose any measures to compensate for the loss of riverine habitat that will occur upstream of the dam within the reservoir footprint, Common snowtrout is expected to persist in the reservoir, and may expand given the amount of new habitat that will be available within the reservoir and the incrementally warmer water temperature of the reservoir, so the loss of Natural Habitat upstream of the dam is negligible. As indicated above, the Project will not impact Natural Habitat downstream of the powerhouse.

Project impacts on the diversion reach relate to a net reduction in flow that will decrease available habitat for the Common snowtrout and other species. As discussed above, even under existing conditions, the diversion reach only supports a small population of Common snowtrout. Therefore, the impact of the Project on the value of aquatic habitat in the diversion reach is likely small. The critical issue for the diversion reach is the provision of sufficient flow to enable upstream migrating Common snowtrout to navigate the diversion reach and access the fish ladder.

NWEDC proposes the following measures to mitigate these impacts:

- Diversion Reach Eflow
    - Provide an Eflow sufficient to maintain habitat connectivity and support upstream fish migration through the diversion reach;
    - Implement the Adaptive Management Program described in Section 2.2.7 above to ensure the reduced flows in the diversion reach do not create any barriers or obstacles to upstream fish migration;
    - Adopt a Worker Code of Conduct that prohibits fishing in the Trishuli River. Require the EPC to provide awareness training of this requirement. Clearly indicate that this activity could result in the termination of their employment.
- Upstream Fish Passage
    - Install a fish ladder in accordance with the approved design to enable upstream migration of snowtrout;
    - Ensure conditions at the powerhouse tailrace are such that the upstream migrating fish are attracted to the flow from the diversion reach and are not diverted to the powerhouse tailwaters;
    - Ensure the channel in the river section just downstream of the dam leads the fish to the fish ladder entrance.
- Downstream Fish Passage
    - Ensure the main river current in the reservoir directs fish toward the spillway rather than the powerhouse intake;
    - Provide a guidance mechanism to help direct adult and juvenile fish away from the powerhouse intake;

- Ensure a smooth spillway and a deep pool at the base of the dam to minimize injury to fish migrating through the flap gates with spillage water; and
- Preferably spill water via the spillway at the left side of the weir.

The Project complies with the IFC's No Net Loss standard for Natural Habitat considering the relatively small footprint of the Project, the provision of Eflow and a fish ladder to maintain the ecological integrity and connectivity of the diversion reach, and NWEDC's commitments to:

- Contract with an international fishery biologist to help monitor and protect aquatic ecology during oversee the fish monitoring program (BEMP during Project construction and early operations;
- Develop and conduct a robust Biodiversity Evaluation and Monitoring Program (BEMP) and share any enhanced understanding of Common snowtrout biology with the Government of Nepal and other hydropower developers in the Himalayan region;
- Demonstrate No Net Loss of biodiversity Common snowtrout with monitoring metrics;
- Apply an Adaptive Management Program to ensure Common snowtrout are able to successfully reach their spawning grounds upstream of the dam; and
- Implement the Project's Biodiversity Management Plan.

The combined objective of the Eflow and fish passage will be to support a stable population of Common snowtrout in the Project area by achieving and demonstrating No Net Loss of aquatic biodiversity per IFC's PS6 requirements, so the comparative analysis and trend analysis will be conducted to identify patterns in year-over-year changes in the Common snowtrout population. The details of the metrics and analysis will be developed and guided by the fish expert to be hired by NWEDC. Particular attention will need to be paid to the changes not only in overall population but also in the life stage composition of the population because changes in the relative abundance of life stages within the population may indicate certain deficiencies in the Eflow or fish passage program. For example, a decrease in the number of juveniles occurring in the dataset that cannot be explained by a corresponding decrease in spawning adults the prior year may indicate that juveniles are experiencing high mortality due to passage through the turbines and that the exclusion devices at the dame need to be adjusted or replaced.

With the implementation of these measures, NWEDC should achieve no less loss of aquatic Natural Habitat at the UT-1 Project.

1.6. STAKEHOLDER ENGAGEMENT PLAN/ GRIEVANCE REDRESSAL MECHANISM

A Stakeholder Engagement Plan and Community Grievance Redress Mechanism has been prepared and is included as Appendix G.

1.7. LAND ACQUISITION AND LIVELIHOOD RESTORATION PLAN

Provided as Attachment 1 to this ESMMP.

1.8. GENDER ACTION PLAN

1.8.1. Gender Assessment and Action Plan

This document presents the Gender Action Plan (GAP) for the Upper Trishuli 1 project commissioned by Nepal Water and Energy Development Company (NWEDC) and the International Finance Corporation (IFC). This plan has been prepared as part of the Social Impact Management Framework (SIMF) for the project. This GAP provides an understanding of the role of women in the Area of Influence for the project and puts in place specific measures for women to be put in place as part of the LALRP process. This Gender Action Plan shall be implemented in parallel with the other plans prepared as part of the larger Social Impact Management Framework (SIMF) for the project, including the Livelihood Restoration Plan, Stakeholder Engagement Plan, Indigenous Peoples Plan and Grievance Redressal Mechanism.

1.8.1.1. Context of Gender Action Plan

The Project is being developed as a 216 megawatt green field run-of-the-river project located in the upper part of the Trishuli watershed, approximately 50 kilometres north of Kathmandu. The project area of influence [AoI] is located in the former Haku, Ramche, and Dhunche Village Development Committees (VDCs), Rasuwa District in the Central Development Region of Nepal, (the Project's AoI currently includes four out of the five Gaonpalikas). In March 2012, the International Finance Corporation (IFC) Infra-Ventures signed a Joint Development Agreement with Korea South-East Power Co. Ltd, Daelim Industrial Co., Ltd; Kyeryong Construction Industrial Co. Ltd.; and Jade Power Private Limited to develop the Project. The Project Development Agreement (PDA) with the Government of Nepal was signed on 29th December 2016.

As part of this Project and in keeping with the applicable reference framework, a number of environmental and social assessments were performed and management plans were developed. As part of the Livelihood Restoration Plan (LRP) developed for the project, certain specific provisions were put in place for women amongst the Project Affected Families and in the AoI. This was based on an understanding that due to the socio-economic conditions and gender dynamics in the AoI, there was a risk that women would face differential impacts from the project activities and would not have equivalent access to the benefits accruing from the project.

Furthermore, in 2017, the Lawyer's Association for Human Rights of Nepalese Indigenous Peoples has undertaken a study on the project and provided certain feedback on the project activities and impacts. This study is primarily based on the studies/ reports prepared for the project prior to 2015, and information made available by the local community during consultations undertaken by the organization's representatives. One of the key observations of this report was that the engagement activities undertaken for the project thus far (prior to 2015) did not allow for adequate participation of women or vulnerable Indigenous People PAFs. The report was of the opinion that the participation of women till 2015 was 'inadequate and tokenistic', as most of the women can't speak Nepali and thus could not be properly engaged.

The 2015 Gorkha earthquake also resulted in changes in the Project baseline. These changes included residences, asset ownership, livelihood profile, financial status of the Project, and stakeholder expectations from the Project. Due to these changes, the impact assessments and management plans needed to be updated. In keeping with these aspects, the present Gender Action Plan has been formulated.

1.8.1.2. Aims and Objectives of the Gender Action Plan

The primary objective of the Gender Action Plan is to ensure equivalent participation of women in the project lifecycle and decision making processes, in keeping with the project context stated above. The GAP is thus aimed at putting in place, specific targets and performance indicators to ensure gender inclusion and facilitate women's involvements in the project lifecycle. While the LRP, SEP, GRM and ESIA and benefit sharing plans put in place the project's commitments towards the local community in the AoI and specifically the PAFs, the GAP is aimed at identifying specific measures within these plans which would allow for gender inclusion and parity.

1.8.1.3. Applicability of the Gender Action Plan

The GAP applies to the entire Upper Trishuli-1 Project, including any new acquisitions such as offices, camps, research and development, and associated facilities. This document is applicable to the entire life cycle of the Project with a specific focus on the implementation of the SIMF and other management plans. The GAP is a part of the larger SIMF and is to be considered as a living document, to be updated regularly based on the emerging needs and patterns for engagement with the various stakeholders.

1.8.1.4. Applicable Reference Framework

The GAPs and its provisions are governed by the applicable reference framework for the project, which include the following:

- Applicable national regulations;
- Applicable World Bank Group (WBG) Performance Standards (PSs);
- Asian Development Bank (ADB) Safeguards; and
- Asian Infrastructure Investment Bank's (AIIB) Environmental and Social Standards.

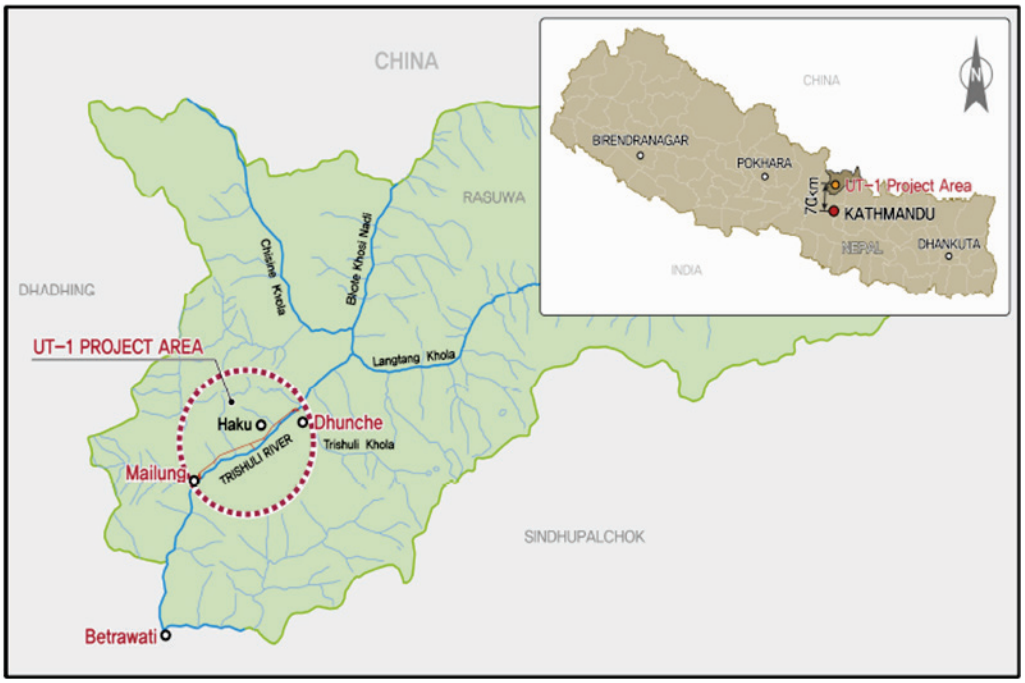
1.8.2. Project Understanding

This section provides a brief description of the Project, Project background, and the AoI. This information is important for setting the context of the GAP.

1.8.2.1. Project Background

The Project is a 216 megawatt green field runoff- river hydropower facility to be located in the upper part of the Trishuli watershed, in the Rasuwa District in central Nepal, 50 kilometres

northeast of Kathmandu, with the geographical coordinates longitude between 85°12′40″E and 85°18′03″E, and latitude between 28°04′27.50″N and 28°07′42″N (see Figure B.1-2).



Source: Upper Trishuli-1 Detailed Project Report

Figure B.1-2: Project Location

1.8.2.2. Area of Influence of the Project

The Project footprint is spread across three former VDCs: Haku, Dhunche, and Ramche. Land acquisition for the Project is from eight villages (Haku Besi, Sanu Haku, Thullu Haku, Gogone, Tiru, Thanku, Mailung, and Phoolbari) from the Haku VDC. A total of 107.79 hectares of land are required for the Project. LRP provides an understanding of the land take process till date for the Project.

The introduction of the new Nepalese Constitution in 2015 was accompanied by a change in the administrative structure of the country (see Figure B.1-3) in keeping with this, the following wards and Gaunpalika/ Gaupalika are now included in the Project footprint (Table B.1-6). The figure shows the Project layout in reference to both the former administrative structure and the new administrative structure.

Table B.1-6: Change in Administrative Structure for the Project's AoI

Impacted Village	Old Administrative Structure	New Administrative Structure
Haku Besi, Sanu Haku and Thullu Haku	Haku Ward number 3	Parvati Kunda Ward number 1 & 2
Gogone and Tiru	Haku Ward Number 8&9	Uttar Gaya Ward number 1

Impacted Village	Old Administrative Structure	New Administrative Structure
Mailung	Dadagaon Ward number 9	Uttar Gaya Ward number 1
Thanku	Haku Ward number 5	Parvati Kunda Ward number 1 & 2
Phoolbari	Haku Ward number 3	Parvati Kunda Ward number 1 & 2
No directly affected villages	Ramche	Kalika Ward Number 1
No directly affected villages	Dhunche	Gosaikunda Ward number 6

Source: NWEDC

Under the previous administrative structure, the Rasuwa district was comprised of 18 VDCs, each with nine wards. However, under the new administrative structure, there are five Gaunpalikas in the Rasuwa district. Thus, while the Project footprint was previously directly affecting 3 of the 18 VDCs, it is now affecting four of the five Gaunpalikas in the Rasuwa district. Furthermore, the reorganisation of the wards within the 18 VDCs has been done in such a manner that even if the wards fall under one VDC, they may not fall under a single Gaunpalika. This results in an increase in the population within the Gaunpalikas within the Project footprint.

The AoI for this GAP is comprised of the directly affected villages and VDCs, and areas of indirect Project impacts on ecosystem services, upon which there is livelihood dependence, and associated facilities that have a land impact. The AoI as determined by the ESIA covers the three former VDCs of Haku, Dhunche, and Ramche. Certain Project benefits will be at the district and Gaunpalika level (such as the Benefit Sharing Plans); however, they are outside the scope of this Plan. Please refer to the ESIA, LRP and the Indigenous Peoples Plan for a detailed description of the Project's AoI.

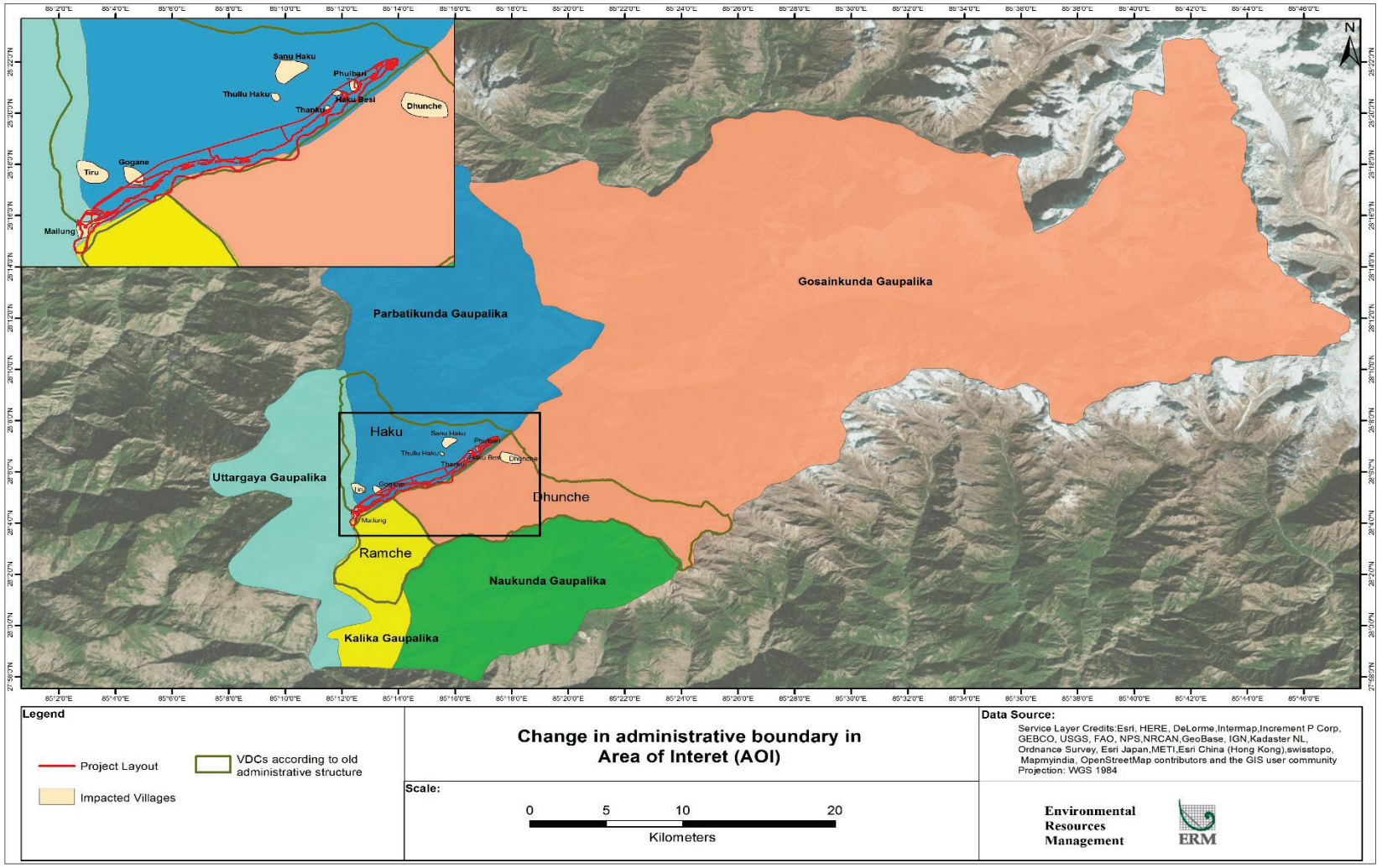


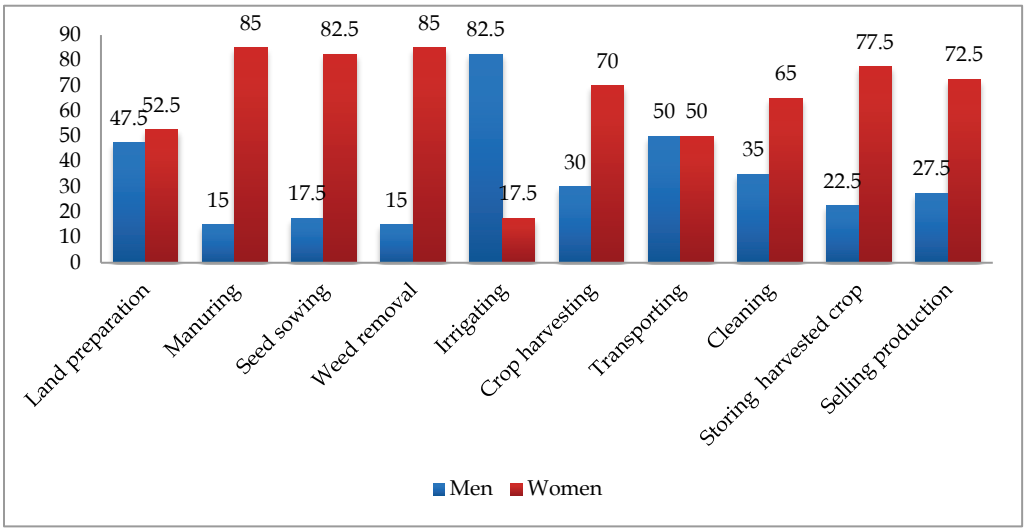
Figure B.1-3: Project Layout Against the Revised Administrative Structure

1.8.3. Understanding of Women's role in Society

As has been discussed in the Section 4 of the LALRP the project AoI are characterised by a negative sex ratio of 989 females per thousand males. The following sub sections provide a detailed understanding of the role of women in certain key sectors in the AoI. The following discussions provides an understanding of the overall role of women in the Project AoI, and is not specific to any particular social group. The following discussion is based primarily on data collected as part of the supplementary social baseline for the project. This baseline was formulated based on structured questionnaires and focus group discussions undertaken with the local community in the AoI.

1.8.3.1. Livelihood and Economic Activities

According to the discussions undertaken during the complementary SIA and the LALRP preparation, it is understood that women play a critical role in the society in terms of their role in the decision making within the household and in economic activities, especially agriculture and small businesses.



Source: UT-1 Supplemental ESIA Appendix A, 2014 based on the responses given

Figure B.1-4: Gender Based Division of Labour (%) in agriculture-related works in Project AOI (VDC level)

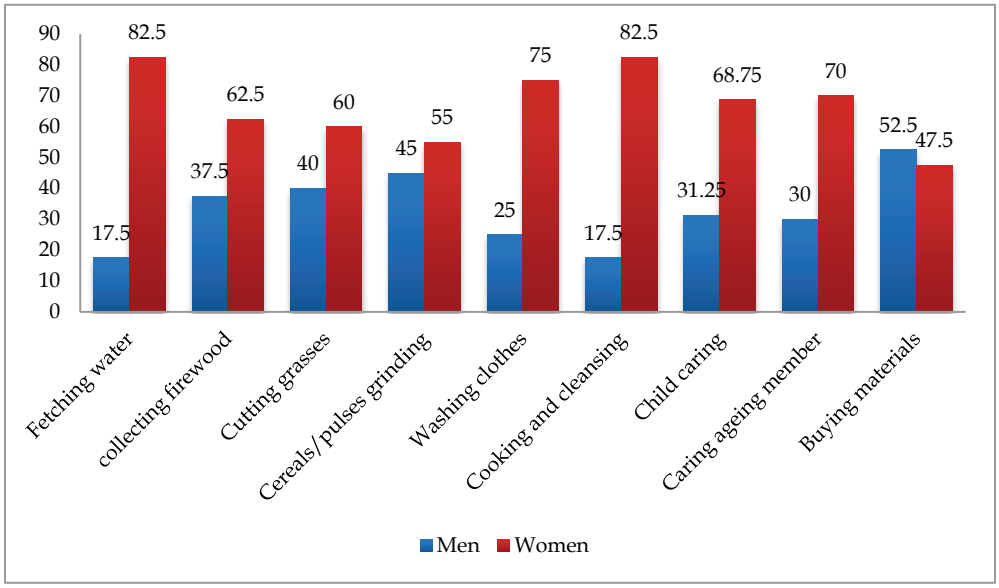
As can be seen from the above figure, the ratio of the involvement of women is higher than men in activities such as manuring, seed sowing, weed removal, crop harvesting, cleaning, storing of the harvested crop and sale of the produce. The involvement of men and women is reported to be equivalent in land preparation and transport of the produce.

However, post-earthquake; as a result of the exposure of the villages to the market economy and opening up of communication/transportation routes, there has been a clearer division of labour along gender lines. The women in the households on the other hand, are reported to be more engaged in wage based labour, especially, stone breaking. The consultations with the women's

groups suggested that pre-earthquake, the women generally did not work outside their houses, agricultural fields or their own shops (close to their houses). However, the scenario started changing after 6-7 months of the earthquake, where livelihood and income constraints, led to the women getting involved in livelihood generating options outside the households, such as work as construction labours, in stone cutting activities, etc. On the other hand, the introduction of wage based labour in the society has led to men preferring to migrate out of the villages for wage labour either to India, Malaysia or Arab countries. However, the household commitments and young children requiring attention do not let the women engage in work for more than 10-12 days in a month.

1.8.3.2. Role in Household Activities

Similarly, the role of women in household activities is higher in proportion to that of the men, except in case of purchasing materials. Women are reported to be prominent in activities such as fetching water, cooking and cleaning, washing clothes, caring for the elderly members of the family, child caring, firewood gathering, grass cutting and cereal/pulses grinding.

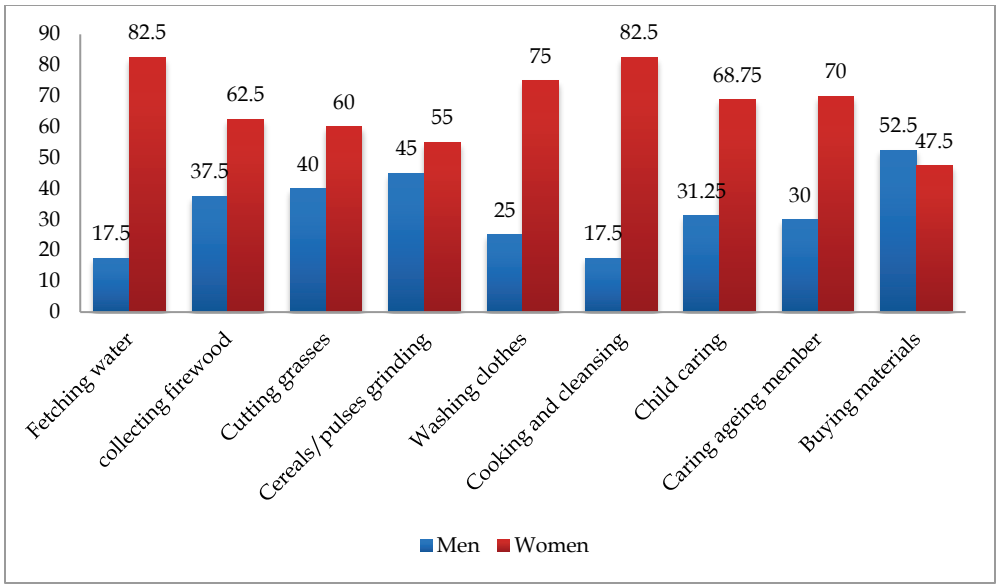


Source: UT-1 Supplemental ESIA Appendix A, 2014 based on the responses given

Figure B.1-5: Gender based Division of Labour (%) in household Activities in Project AoI (VDC level)

1.8.3.3. Decision Making Process

The men are reported to be more visible in the decision making process at the household and community level, although the participation of women is understood to be crucial, especially at the Household level. According to the consultations undertaken, the women are reported to have the least say in the decision making, especially in regards of borrowing money and purchase of land and property. However, in aspects such as agricultural activity and the education of the children, women were reported to take more decisions than men.

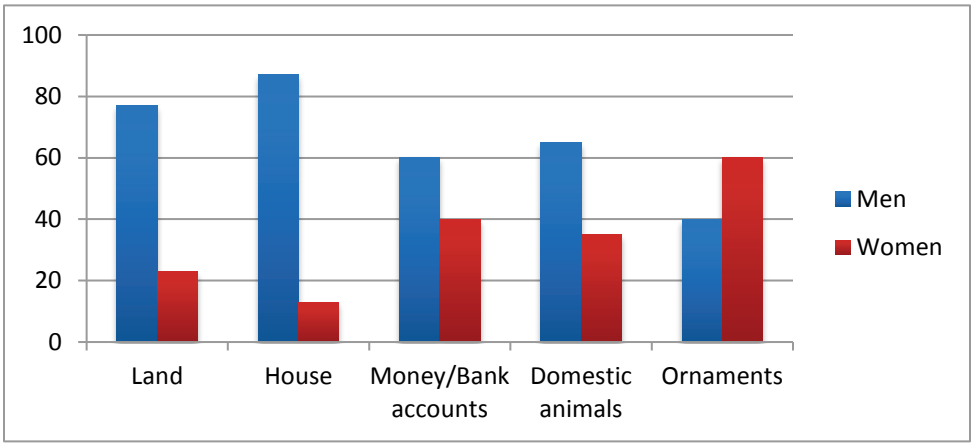


Source: UT-1 Supplemental ESIA Appendix A, 2014 based on the responses given

Figure B.1-6: Gender Participation (%) in Decision Making Process in Project AoI (VDC level)

1.8.3.4. Ownership of Property

In terms of ownership of property, in most cases (65%) it remains in the name of men. However, certain assets are predominantly owned by women, such as ornaments.



Source: UT-1 Supplemental ESIA Appendix A, 2014

Figure B.1-7: Gender based ownership of Property (%) in the Project Area VDCs

1.8.3.5. Share in UT-1 Compensation and its Use by PAFs

Of the total 38 land owners/tenants, 7 are women, while of the 142 PAFs, 7 were reported as women headed households. In terms of receiving the compensation amount, there does not appear to be a significant difference amongst men and women. It is understood that the compensation payment has been completed for the affected households and was paid through

cheques in the name of the land owners, irrespective of the gender. The money was further divided internally among families sharing the household, depending upon how the family was organised and the way the land ownership was understood within the family. Furthermore, according to the consultations undertaken during the LRP survey it is understood that in many instances, the compensation was split amongst the daughters and sons of the land owners albeit with sons getting the larger share. However, assessing the exact number of families in which payment reached the female member of the family is difficult.

A woman PAP who received the compensation amount of 30 lakhs NR divided this sum among each of her three sons, while she kept a sum of only 3 lakhs NR for herself. She continues to stay with the sons and sometimes resides with her daughters too. The same trend is reflected for the male land owners too who have multiple sons and daughters.

In another case, a lady PAP received payment of almost 20 lakhs NR. She is a widower and hence lives with her daughter who is settled in Mailung. Consultations with her suggested that she purchased jewellery for herself and her daughter with the compensation and then spent the rest of the amount for the construction of the house for the daughter. In a third case, the compensation amount of 16 lakhs NR was divided among her two sons, while some amount was kept for herself. She expected the sons to take care of her.

It is important to note that one of the reasons why the compensation amount was also shared with the daughters (though this is not the norm) was that most of the girls are married in the same locality and a sense of strong relationship between the parents and daughters exists even after the marriage. However, the proportion of the compensation shared with the married daughters is much lower than that shared with the sons.

Another important indicator of the gender dynamics in the community is the role women played in deciding the utilization of the compensation received. It is understood that despite the fact that the education levels and exposure to market forces in the older generation of women was limited; it is common practice for men to consult women in deciding the use of the compensation. ERM found that construction or buying of land or house in Dhunche or Kathmandu is the first preference of many of the HHs and the women too have supported such a choice. Alternate land for farming has been bought in very few instances. In cases where the compensation amount was not enough to facilitate house construction in an urban centre, the compensation amount has either not been used or has been used to support the family's daily needs, or has been used for children's education. For children's education no discrimination was reported along gender lines.

1.8.3.6. Role in Community Forest User Groups

The women are important in the membership of Community Forest User Groups (CFUGs) and are quite vocal, once they understand the context and the implications of the project community forest land requirements and the loss of the community forest. However, their understanding of the process related to cutting of the trees in the community forest or the area diverted for the construction of the project access road was limited. While in case of Gogone and Tiru, where the project has impacted on the community forest, the women articulated their concern about the

losses. In Haku Besi, the women, though aware of the project, compensation etc., were unclear about the project's impact on community forests and loss of the trees therein.

1.8.3.7. Consultations with Women's Groups

This sub section provides an understanding of the perception of women towards the project and its activities.

Awareness about Project Activities

The awareness levels of the project and its activities was observed to differ across the groups engaged during the consultation process. This was understood to be resultant from the location of the village of residence and the subsequent proximity to project activities and larger VDCs of Mailung and Dhunche and exposure to market forces. The women's group consulted in Mailung prior to earthquake, were aware of the project activities, the land acquired, the negotiation process and the payments received because they were located closer to the project. However, the women from the villages of Gogone and Tiru were observed to have minimal understanding of the project and its activities and were not aware of the negotiation process, while it was underway. Furthermore, while both the women groups had an understanding of the compensation provided and played some role in how the money was to be spent.

The women are less aware and updated in land related matters. In the present scenario, the women are less informed on the cultivable land available in their original villages. It is the men's group which has largely undertaken visits to the original villages, which can also be attributed to destroyed access to the villages, from the present places of residence and lack of adequate shelter in the villages.

Expectations of women: Post-earthquake

The preference of work amongst women is still reported as those activities which can help them earn while maintaining balance with household responsibilities, e.g., tailoring, poultry, livestock faming, etc.

As per the consultations undertaken, the key expectations of women from the project primarily pertain to the generation of livelihood opportunities and employment in the project for the local community. Apart from this, the project was expected to provide trainings and assistance in establishment of alternative livelihoods, while allowing them to fulfil their familial responsibilities.

1.8.4. Purpose of this Gender Action Plan

In keeping with this understanding of the role and status of women in the community, a specific gender action Plan has been formulated. The management plans prepared as part of the SIMF identify specific action items and steps to be taken by the project, to ensure minimization of negative impacts, maximization of benefits and community participation. The purpose of the GAP is to maximize the involvement of women in the action items thus identified, and to minimize the possibilities of increasing the vulnerability of women after the completion of the

implementation of these plans. While the management plans prepared as part of the SIMF provide the exact details of the action items, the specific measures to be taken to ensure women's participation include the following:

- **Encouragement of women's participation in public meetings:** the SEP, ESIA and LALRP for the project put in place specific requirements for engaging with the local community in the AoI and PAFs and minimizing project related impacts. As part of the implementation of these plans, NWEDC will facilitate the involvement of women in the public meetings held for the project as well as any other public meeting/ discussions held in the villages, especially during the Free Prior Informed Consent (FPIC) process. The objective is not just to increase the attendance of women in these meetings, but also enhancement in their participation in discussions and decision making. For this purpose, NWEDC will identify key women in the community with leadership qualities who can assist in creating awareness amongst women and encouraging them to participate in project led engagement. Also, specific engagement will be undertaken with women for this purpose across the project area, in the manner discussed in the SEP for the project.
- Increasing women's awareness towards project activities and health and safety risks associated with the same: as part of the regular engagement to be undertaken by the project during its lifecycle, specific engagement activities will be undertaken with women. Through these engagement activities, an attempt will be made to increase women's awareness on aspects such as potential in-migration due to the project, code of conduct for the workers, risks such as human trafficking, sexually transmitted diseases, potential of accidents due to vehicular movement, provisions in place for women's safety and security etc.
- Increasing women's participation in LALRP entitlements: Furthermore, as part of the engagement activities an attempt will be to ensure that women avail the LALRP options developed for PAFs. This will be achieved through regular engagement with women by the ESMC, in the form of focus group discussions and individual interactions with key informants as discussed in the SEP. Beneficiary selection will be conducted in a manner so as to ensure that women are equally benefitted. In cases where a PAF is getting multiple entitlements and women and men identify different entitlements, the same shall be enabled to the extent possible by the project. Also, women's feedback should be taken for the designing of the implementation plan for the specific entitlements identified. This may be in terms of the timings of the trainings, location of trainings being near the IDP camps, number of days of the training, crèche facility for young mothers etc. through this an attempt should be made to implement the LRP in a manner so as to allow the women to gain maximum benefit while fulfilling their familial responsibilities;
- LALRP Implementation: The LALRP implementation by the social team of the ESMC will be undertaken keeping the gender aspect in context. It will be ensured that decision making on LALRP implementation issues like the provision of employment opportunities to the locals, training and capacity building, selection of beneficiaries, duration and location of the training, types of training, provision of support and linkage with

government schemes etc., is done with special emphasis on women's participation. Also, the project is in the process of hiring two women Community Liaison Officers, which is aimed at further enabling adequate participation by women in the LALRP process;

- Ensuring Women's Feedback in LALRP implementation and Monitoring Process: As part of the LALRP implementation and monitoring process the social team of the ESMC will try and ensure that the feedback and viewpoint of women is captured separately as well as in a larger group and taken into consideration through targeted engagement activities and identifying specific monitoring indicators for the LALRP. Furthermore, to the extent possible, women will be involved in the internal monitoring process as identified in the LALRP

These proposed measures will be disclosed to the local community as part of the disclosure and FPIC process and specific feedback will be sought from women on the same. Based on the discussions and feedback received, the Gender Action Plan will be updated into a detailed plan.

1.8.5. Implementation Roles and Responsibilities

As stated earlier, the project acknowledges the importance of ensuring adequate engagement and participation of women. For this purpose, the project will give the implementation of the GAP as much importance as the other project activities and ensure the availability of the required resources. Since the GAP is linked to the implementation of the SIMF, the specific plans such as LALRP, SEP and GRM put in place the specific requirements for resources and documentation and monitoring. The following sections provide an understanding of the specific provisions within the larger SIMF for the implementation of the GAP.

1.8.5.1. Manpower

In order to ensure the proper implementation of the GAP, the project will make available human resources as required in the form of internal resources within the project as well as external resources such as NGOs or other third parties.

Internal Resources

As discussed in the LALRP and SEP, the project will form an Environmental and Social Management Cell for the Project. The following figure provides an understanding of the proposed structure of the ESMC.

Figure B.1-8: Organization Structure of the ESMC

The project has already employed 2 site level community liaison officers, one of whom is a Tamang PAF for the project. In addition to this, the project will employ two more women CLOs, at least one of which should be a local and conversant in the Tamang language. In addition to this, the project will also identify any additional personnel which may be required for the effective implementation of the GAP. In case the existent resources at the project appear to be insufficient to meet the needs for the implementation of the GAP as outlined in the previous sections, the employment off personnel specifically for the purpose of enabling participation of women through the life of the project will be undertaken.

Furthermore, due to the fact that a number of contractors and external parties will be involved in the project at various stages of its development, it will be ensured that the contractors/third parties abide by the principles established as part of the SIMF. Wherever possible, relevant conditions will be inserted into the contracts, including right to investigate reported incidents of violence against women and penalties for non-compliance. Also, it will be ensured that regular monitoring is undertaken of the compliance of the contactors and their staff to the Labour Influx Management Plan, which includes a code of conduct for the labourers.

External Resources

In case the internal resources at the project appear to be insufficient, the project will also consider engaging a reputed third party in the form of the organization (NGOs/CSOs) working in the field of women empowerment and gender dynamics, familiar with the region and are

acceptable to the community. The NGO would then not only serve as a link between the company and the community but as a third party in the implementation of the GAP.

1.8.5.2. Training Requirements

The project will, from time to time assess the adequacy and capacity of the ESMC team members in terms of their understanding of the SIMF and specifically the GAP put in place for the project and the principles governing the same. Provisions for refresher trainings will be put in place.

1.8.5.3. Financial Resources

The project will ensure that the budget formulated for the purpose of the SIMF implementation is sufficient to meet the expenses of the same. The recruitment of two female CLOs is included as part of the budget for the LALRP implementation. Any other expenses identified are also to be met through the SIMF.

1.8.5.4. Documentation, Monitoring and Reporting Process

The review and appraisal process in any project is an extremely important component for the smooth functioning and the avoidance of major risks within a project. This importance of the review process lies in the fact that it allows for the corrections of any oversight which may have been made during the initial stages of a project through mid-course corrections. This also serves as an important quality assurance mechanism.

The review process becomes all the more important when it is kept in mind that the GAP is a 'live document' or in other words a document which needs to be revised in a timely manner so as to make it comprehensive for any given period of time. This is so because of the fact that due to the life span of the project, it is difficult to properly identify and understand the gender dynamics and requirements for ensuring gender parity at the beginning of the project lifecycle. The GAP thus requires regular reviews keeping in mind attributes such as the requirements of the SIMF, the gender dynamics in the AoI and the feedback of stakeholders over the course of the project lifecycle.

The specific documentation, monitoring and reporting requirements are as specified in the LALRP and SEP. The reporting and monitoring for the LALRP will be inclusive of these gender based indicators and gender segregated information will be provided.

1.9. INDIGENOUS PEOPLES PLAN

An Indigenous Peoples Plan has been prepared and is included as Appendix H.

1.10. LABOUR INFLUX MANAGEMENT PLAN

This document presents the Labour Influx Management Plan (LIMP) for the Upper- Trishuli 1 (UT 1) Hydropower project in Nepal. This plan has been prepared in the keeping with the requirements of the applicable reference framework for the project. The following sections provide an understanding of the purpose of the LIMP, the institutional framework put in place

for its implementation, the scope of the LIMP, the measures included in the LIMP and the monitoring, reporting and reviewing process for the same.

1.10.1. Purpose

The UT1 project is expected to employ approximately 1090 skilled, semi-skilled and unskilled workers over a 60 month construction period. The skilled workforce will be recruited either directly by NWEDC or by its EPC contractors and the subcontractors hired by EPC Contractors. The semi-skilled and unskilled workforce, will however, be subcontracted, to local Nepali subcontractors or local petty contractors in the Rasuwa district or the nearby districts. Based on the project skill requirement and the present skill level of the local community, it is understood that most of the skilled and semi- skilled workforce will be migrant population from other districts of Nepal and expats.

As part of the ESIA for the project, an assessment was undertaken of the potential environmental and social impacts from labour influx due to the project in the construction phase. In keeping with this impact assessment, certain mitigation measures were identified, and included in the Construction phase ESMMP for the project. However, in keeping with the socio-economic profile of the local community in the Project Area of Influence (AoI), a need was identified for a detailed Labour Influx Management Plan (LIMP).

This LIMP is thus aimed at putting in place measures and processes, to allow for avoiding, minimizing and mitigating the risks identified due to influx of labour from outside the AoI.

The CSE/OE shall in turn report the status of the LIMP implementation and any key areas of concern to the Project Management Office (PMO) and EHS Head. The PMO and E&S Managers shall in turn be responsible for the overall review and assessment of LIMP in terms of the requirements of the applicable reference framework. The final decision making authority in regards to the provisions of the LIMP shall lie with the PMO, who shall be supported in their decision by the E&S Manager.

1.10.2. Institutional Framework

The implementation of the LIMP thus formulated, shall be undertaken by the NWEDC Environmental and Social Management Cell (ESMC), ESST and the EPC Contractors and sub-contractors for the project.

The EPC contractors and sub-contractors shall be responsible for ensuring the everyday implementation of the LIMP and ensuring that their labourers and workers comply with the same. On the other hand, the CSE/OE for the project (assisted by the site level ESMC representatives) shall be responsible for the overall monitoring and review process of the LIMP implementation and ensuring that the plan is implemented in keeping with the requirements of the applicable reference framework and the principles identified.

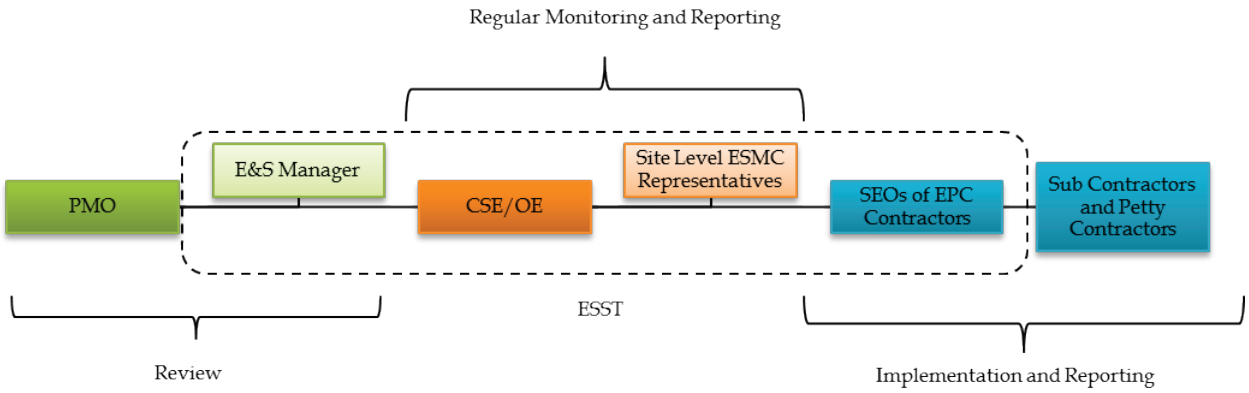


Figure B.1-9: Institutional Framework for the LIMP Implementation

The CSE/OE shall in turn report the status of the LIMP implementation and any key areas of concern to the PMO and EHS Head. The PMO and E&S Managers shall in turn be responsible for the overall review and assessment of LIMP in terms of the requirements of the applicable reference framework. The final decision making authority in regards to the provisions of the LIMP shall lie with the PMO, who shall be supported in their decision by the E&S Manager.

1.10.3. Scope

The LIMP is applicable for the entire UT-1 project and its associated facilities. This plan has been formulated for the mitigation of social impacts from project induced in-migration into the AoI during the construction phase of the project. This plan has to be read in conjunction with the other management plans such as the Stakeholder Engagement Plan (SEP), Grievance Redressal Mechanism (GRM) and the Construction Phase ESMMP.

1.10.4. Potential Environmental and Social Impacts from Labour Influx

The ESIA for the project identifies the following potential environmental and social impacts due to labour influx during construction phase of the project.

Table B.1-7: Potential Impacts from Labour Influx

Social Impacts	Environmental Impacts
• Increased competition for the direct and indirect economic opportunities created due to the project and potential resentment amongst the local community • Increased pressure on and competition for infrastructure and services in the AoI • Increased waste and sewage generation and possible community health and safety risks due to inadequate waste disposal • Risk of social unrest and conflict due to increased presence of migrant population in the AoI • Risk of spread of communicable diseases, especially sexually transmitted diseases in the workers and local population	• Increased pressure on and competition for natural resources in the AoI • Risk of pollution of water resources in the AoI due to lack of appropriate wastewater discharge • Risk of disturbance to wildlife due to presence of labour camp and movement of labour

Social Impacts	Environmental Impacts
• Risk of Change in Community dynamics and potential for community conflict • Additional influx of population seeking economic gains from presence of migrant population (through establishing small businesses and enterprises) • Increased risk of illicit behaviour and crime, especially gender based violence • Increased risk of child labour and school drop outs due to increased opportunities for host community to engage in economic activities • Increased risk of inflation and increase in expenses for the local community due to a general increase in prices in the AoI	

It should be noted that, during the discussions with the local community, the representatives did not report any apprehensions or concerns regarding the presence of migrant workers in the area. The community reported to appreciate the presence of migrant workers in the area as they allowed for economic opportunities to be created. The representatives did not report any instances of conflict or violence due to the presence of the migrant workers involved in the access road construction.

- There are no reported existing issues or tension with the migrant workers in the area
- The community see the labourers as a positive presence and did not report an issue with migrant labourers coming into the area
- However, if the locals don't get employment opportunities from the project or general economic opportunities it may lead to resentment
- Furthermore, cultural conflict can arise if labourers do not respect the local traditions of the community
- Workers on infrastructure projects are predominantly young and male. Those who are incoming are single or are separated from their family or spouse, and are outside their habitual sphere of social control. Further, in rural settings, where the presence of law enforcement is often low, the risk of sexual harassment for local women is likely higher, in particular for younger women and girls, but also boys.

1.10.5. Labour Influx Management Measures

In keeping with the impacts identified, the following mitigation measures have been put in place as part of the LIMP.

Table B.1-8: Labour Influx Management Measures

Potential Impact	Contractor Responsibility	NWEDC responsibility
Overall Impact	• Undertake regular engagement with the workers and sub-contractors through workshops, training sessions and tool box talks to ensure understanding and compliance to the LIMP requirements • Put in place a detailed Code of Conduct, based on the LIMP and ensure its implementation • Undertake regular internal monitoring to ensure compliance to the contract agreement and the overall requirement of the LIMP • Ensure that the workers have all required documentation as follows: employment contract, insurance, routine check-ups, vaccinations, occupational health training, etc.	• Undertake regular and timely engagement with the local community in keeping with the SEP formulated • Undertake timely information disclosure, to ensure the community is aware of the project activities, opportunities in the same and potential adverse impacts from the project • Implement the GRM for the project and ensure the community is aware of the same • Ensure the inclusion of relevant clauses in all sub-contract agreements • Undertake a training of the EPC contractors, sub-contractors and petty contractors to ensure understanding and compliance of the LIMP • Undertake regular monitoring of the compliance of the contractors to the LIMP
Increased competition for the direct and indirect economic opportunities created due to the project and potential resentment amongst the local community	• To the extent possible, recruit local population in keeping with the Employment and Skill Trainings plan for the project; • Undertake timely information disclosure, to ensure the community is aware of the project activities, opportunities in the same and potential adverse impacts from the project.	
Increased pressure on and competition for infrastructure and services in the AoI	• Put in place a detailed Code of Conduct, based on the LIMP and ensure its implementation • Ensure the worker camp has adequate provisions for water, electricity and sanitation facilities • Identify an authorized water supply source for the worker camp and prohibit of use from other community sources;	• Investment in and capacity building of local public service providers • Put in place contingency plans for temporary rise in demand for utilities and public service provision.
Increased waste and sewage generation and possible community health and safety risks due to inadequate waste disposal	• Ensure adequate waste and sanitation facilities in worker camp • Ensure workers' camp and associated facilities are connected to septic tank or other wastewater systems which are appropriate and of sufficient capacity for the number of workers and local conditions.	• Undertake community sensitization campaigns to build awareness about public health impacts from labour influx. • Undertake regular inspections and monitoring of the worker camps and associated facilities in terms of the adequacy of sanitation provisions and their maintenance

Potential Impact	Contractor Responsibility	NWEDC responsibility
Risk of social unrest and conflict due to increased presence of migrant population in the AoI Risk of Change in Community dynamics and potential for community conflict	• Ensure the worker camp has adequate facilities for entertainment and basic provisions to reduce the need for workers to use local community facilities and resources; • Ensure the code of conduct has adequate provisions for the interaction of the labourers with the local community	• Undertake community sensitization campaigns to build awareness about potential impacts from labour influx Undertake regular and timely engagement with the local community in keeping with the SEP formulated • Ensure adequate security provisions across project area, including worker camp and associated facilities
Risk of spread of communicable diseases, especially sexually transmitted diseases in the workers and local population	• Undertake a health and fitness to work assessment of each worker prior to initiation of work; • Ensure all workers have required vaccinations against common and locally prevalent diseases; • Implement HIV/AIDS education program for all workers; • Undertake information campaigns on STDs and transmission of diseases among the workers; • Establish a health centre at the camp and construction sites, which should include – Free testing facilities; – Regular health check-ups; – Database of all the worker health records – Provision of condoms	• Undertake community sensitization campaigns to build awareness about public health impacts from labour influx; • Undertake community sensitization campaigns towards STDs • Ensure access to GRM; • Hold community health camps and check-ups on a regular basis with a focus on the presence and spread of communicable diseases; • Ensure an HIV service provider is available on-site;
Additional influx of population seeking economic gains from presence of migrant population (through establishing small businesses and enterprises)	• Hire workers through recruitment offices and avoid hiring “at the gate” to discourage spontaneous influx of job seekers. • Hire workers in keeping with the employment and skill training plan	• Undertake regular and timely engagement with the local community in keeping with the SEP formulated • Undertake timely information disclosure, to ensure the community is aware of the project activities, opportunities in the same and potential adverse impacts from the project

Potential Impact	Contractor Responsibility	NWEDC responsibility
Increased risk of illicit behaviour and crime, especially gender based violence	• Pay adequate salaries for workers, in keeping with the prevalent wage rates in the country to reduce incentive for theft; • If possible, Pay salaries into workers' bank accounts rather than in cash; however access to banking system need to be looked into. • To the extent possible, recruit local population in keeping with the Employment and Skill Trainings plan for the project • As part of the Code of Conduct, include sanctions (e.g. dismissal) for workers involved in criminal activities; • Introduce substance abuse prevention and management programs and undertake worker sensitization programs on the same • Undertake regular training for workers on required lawful conduct in host community and legal consequences for failure to comply with laws; • Ensure cooperation with law enforcement agencies investigating perpetrators of gender-based violence; • allow for opportunities for workers to regularly return to their families; • Ensure the worker camp has adequate facilities for entertainment and basic provisions to reduce the need for workers to use local community facilities and resources;	• Support and assist local law enforcement agencies investigating perpetrators of gender-based violence; • Monitor the Contractor and worker performance in keeping with the local law requirement in terms of drug abuse and traffic; • Ensure access of local community to the GRM in place
Increased risk of child labour and school drop outs due to increased opportunities for host community to engage in economic activities	• Ensuring that children and minors are not employed directly or indirectly on the project.	• Monitor the contractor performance and ensure compliance to local labour laws, pertaining to child labour
Increased risk of inflation and increase in expenses for the local community due to a general increase in prices in the AoI	• Undertake procurement of law material and goods in keeping with the industrial benefits plan in place	• Ensure compliance to the Industrial benefits plan in place

Potential Impact	Contractor Responsibility	NWEDC responsibility
Increased pressure on and competition for natural resources in the AoI	• Ensure the worker camps and associated facilities have adequate provisions for water conservation and recycling of water, including potential for rainwater harvesting • Ensure workers' camp and associated facilities are connected to septic tank or other wastewater systems to avoid contamination of fresh water sources. • Ensure that only wood from commercial sources is used on the project; • prohibit use of wood for fuel in worker camp; • put in measures to reduce energy demand, noise and light generation in labour camp • Minimise land use change and use of other natural resources to the extent possible due to worker camp and associated facilities • Avoid deforestation and cutting of trees around camp area;	• Ensure inclusion in contract of requirement for rainwater capture, use of non-potable water for construction works, etc. • Cooperation with environmental organizations in the area to seek their advice and allow for early feedback on adverse impacts. • Undertake regular monitoring of impact on natural resources with enforcement of contract or legislative options.
Risk of pollution of water resources in the AoI due to lack of appropriate wastewater discharge	• Ensuring workers' camp and associated facilities are connected to septic tank or other wastewater systems which are appropriate and of sufficient capacity for the number of workers and local conditions.	• Regular inspection to ensure proper functioning of the systems in place
Risk of disturbance to wildlife due to presence of labour camp and movement of labour	• Ensure placement of workers' camp away from environmentally sensitive areas to avoid impacts on the local wildlife; • Ensure routing of new access routes for workers' camp to avoid/minimise environmentally sensitive areas.	• Inclusion in contract of requirements for camp locations.

A major concern during the construction of large hydroelectric projects is the potential negative impacts that might arise from the interaction of outside workers with local communities. For this reason, it is important that the Contractor establish a Code of Conduct that emphasizes the importance of appropriate behaviour, respect for local communities and customs, and compliance with all Nepalese laws and regulations. Each employee/worker shall be informed of the Code of Conduct, once she/he has signed the contract to work for the Project. The Code of Conduct as well as all other ESMMP requirements of the contractor also apply to all subcontractors and should be referenced by the main contractor in all subcontracts. The Code of Conduct should be available to local communities at the Public Information Centres (PIC) established for the Project. The Code of Conduct should address at least the following topics:

- Expectations for workers to carry out their work in a safe manner, and to look after the safety of others.
- Expectations of workers to look after, be aware of, and minimize their impacts on the environment.
- All the workers/labourers shall comply with the laws and regulations of Nepal.
- All illegal substances, abuse of drugs and alcohol, carrying of firearms, as well as pornographic material and gambling shall be prohibited.
- Fighting (physical or verbal), creating nuisances and disturbances in or near communities, disrespecting local customs and traditions shall be prohibited.
- Smoking shall only be allowed in designated areas.
- Workers must follow appropriate standards of dress and personal hygiene while visiting local communities and in the accommodation quarters.
- Workers visiting the local communities must behave in a manner consistent with the Code of Conduct.

The following activities (which must be included in the Code of Conduct) are prohibited on or near the Project site:

- Cutting of trees outside the approved designated areas.
- Hunting, fishing, trapping and trade of wildlife especially endangered species and collection of flora.
- Caging wild animals.
- Purchase of wild animals for food.
- Illegal hunting and poaching of any kind.
- Fishing in any river of water body within the Project area
- Use of unapproved toxic materials such as lead-based paint, asbestos, etc.
- Damage to any property with architectural or historical value.

- Building of unapproved fires.
- Wood collection for cooking or heating and as a fuel for heating during the processing or preparation of any materials forming part of the works.
- Burning waste or vegetation.
- Use of firearms (except authorized personnel).
- Use of alcoholic beverages during working hours.
- Washing machines, vehicles or clothes in rivers, streams or lakes.
- Maintenance of machinery and vehicles outside designated areas.
- Disposal of trash or construction waste outside designated areas.
- Driving vehicles or equipment improperly or under the influence of drugs or alcohol on local roads or in the Project area.
- Working without the proper protective equipment (including helmets and boots).
- Spilling potential contaminants such as petroleum products.
- Defecation or urination outside designated sanitary facilities. The Contractor shall provide portable toilets on all work fronts.
- Any construction worker, office staff, Contractor's personnel, the project's personnel or any other person related to the project found violating the Code of Conduct, the prohibitions established in these specifications, or the rules, regulations, and procedures implemented at the construction camp shall be subject to disciplinary actions that can vary from a simple reprimand to termination of employment, depending on the severity of the offense.

1.10.6. Monitoring

In order to ensure proper implementation of the LIMP, regular monitoring shall be undertaken by the site level ESMC representatives and the CSE/OE. The monitoring shall be undertaken on a weekly, monthly and annual basis. The key aspects to be covered in the monitoring and the means of monitoring are provided in the table below.

Table B.1-9: Monitoring Requirements

Type of Monitoring	Frequency	Aspects to be covered
Internal Monitoring by CSE/OE	• Weekly	• Adequacy of provisions in labour camp
	• Monthly	• Compliance to code of conduct • Review of Records required to be maintained by law and as part of the LIMP

Type of Monitoring	Frequency	Aspects to be covered
	• Annually	• Records of GRM and community engagement activities • Compliance to code of conduct • Review of Records required to be maintained by law and as part of the LIMP • Review of records of previous monitoring undertaken at weekly and monthly basis and the status of the action items identified in the same
Internal Monitoring by ESMC Representatives	• Monthly	• Records of GRM and community engagement activities
External Monitoring by Third Party	• Annually	• Records of GRM and community engagement activities • Compliance to code of conduct • Review of Records required to be maintained by law and as part of the LIMP • Review of records of previous monitoring undertaken at weekly and monthly basis and the status of the action items identified in the same

1.10.7. Reporting, Record Keeping, and Auditing

The EPC contractors, sub-contractors shall maintain detailed documents of the implementation of the LIMP. Some of the records to be maintained (but not limited to) are as follows:

- Detailed code of conduct and any action/ sanction against any worker in keeping with the same;
- Records of trainings, programs, workshops and tool box talks held;
- Compliance to the local laws and regulations;
- Records of the workers, age, their health records, vaccination records etc.;
- Records of the health centre and visitation by workers;
- Records of wage payment ; and
- Records required as part of the employment and skill training plan and industrial benefit sharing plan, GRM and any other management plans in place

In addition to this, the CSE/OE shall maintain detailed records of the monitoring activities undertaken and those required as part of the employment and skill training plan and industrial benefit sharing plan, GRM and any other management plans in place.

1.10.8. Adaptive Management System

It should be noted that the LIMP presented above is based on the present understanding and resource requirement available. This resource requirement or the socio-cultural dynamics in the AoI are susceptible to change during the construction phase. In keeping with this, it is important that the LIMP is a live document and is reviewed and revised in a timely manner. This is important to ensure that the LIMP remains relevant throughout the construction phase of the

project. This will also allow for the inclusion of any additional measures in the LIMP, which may be identified as part of the monitoring exercise.

1.10.9. Funding

NWEDC will ensure that the budget formulated for the purpose of the LIMP implementation is sufficient to meet the expenses of the same.

1.11. PLANS REQUIRED BY THE PDA

1.11.1. Introduction

The Upper Trishuli (UT-1) Hydropower project is a 216-MW green field runoff-river hydropower facility to be located in the upper part of the Trishuli watershed, in the Rasuwa District in central Nepal, 80 km northeast of Kathmandu. Once commissioned, the project will account for sizeable portion of Nepal's current installed capacity and will sell power under a long-term power purchase agreement (PPA) with Nepal Electricity Authority ("NEA"), the national utility company.

As a part of the Project Development Agreement (PDA) signed between - Nepal Water & Energy Development Company (hereinafter referred to as "NWEDC"), as well as Government of Nepal (hereinafter referred to as "GoN"), the parties (NWEDC and GoN) are committed to maximize the positive impacts and manage and mitigate the negative outcomes of the project to the extent possible.

The PDA requires the following in terms of Benefit sharing:

- The Local Benefit Sharing Plan, including
  - Local Share for the people from affected Project Area;
  - Rural Electrification
- The Nepal Employment and Skills Training Plan;
- The Nepal Industrial Benefits Plan;

The common discourse however does not segregate these interventions and are usually clubbed together under the umbrella of 'benefit sharing' to capture the whole gamut of benefits which can potentially be shared with the community. These benefits are based on differentiated entitlements, achieved through consultations with the various stakeholders as well as complying with the regulatory requirement of GoN and especially the PDA for the Project.

The detailed plan preparation will be undertaken in due course of time. As a part of the present scope, an annotated outline is being developed for each of the relevant plans. Each of the plans has been segregated into separate chapters; however in some cases some of the requirements have been consolidated into a single plan. The annotated outline will provide a framework for the benefit sharing plan. This will include brief description of the following:

Section 3.6.1	Introduction:	This section provides an understanding of: • Purpose of the benefit sharing plans; • Context of the plan; • The legal framework governing the plan; • Existing benefit sharing mechanisms in Nepal; • Guiding principles to be followed by NWEDC; and • The implementation mechanism to be followed by NWEDC.
Section 3.6.2	Local Benefit Sharing Plan	This includes guidelines & benefit sharing plan mechanism, including: • Benefit Sharing guideline; • Benefit Sharing Program Identified including Rural Electrification; • Reporting and documentation requirements; • Monitoring and review; and • Schedule and budget for implementation.
Section 3.6.3	Employment and Skill Training plan	This includes the employment and skill training plan for the project, which includes the following: • Skill set requirement for the project; • Recruitment Process; • Trainings to be provided; • Monitoring and review process; • Reporting and documentation; • Schedule and budget for implementation.
Section 3.6.4	Industrial Benefit Plan	This section will provide a detailed industrial benefit sharing plan, in keeping with the requirements and guidance of the PDA, which will include: • Resource requirements of the project • Vendor strategy and principles • Procurement plan • Monitoring and review mechanism • Reporting and documentation • Schedule and budget for implementation

1.11.1.1. Purpose of the Plan

The PDA specifically asks for the local benefit sharing to be undertaken by NWEDC through different means as mentioned in Table B.1-109 below.

Table B.1-10: Benefit Sharing Requirements as per PDA

PDA provisions for Benefit Sharing	Relevant Sections of the PDA
Local Share	Section 10.17 of the PDA
The Local Benefit Sharing Plan	Section 11.3.2 (A) Schedule 11 (Local Benefit Sharing Plan- Guidance Note)
The Nepal Employment and Skills Training Plan	Section 11.3.2 (B) Schedule 12 (Nepal Employment and Skills Training Plan- Guidance Note)

PDA provisions for Benefit Sharing	Relevant Sections of the PDA
The Nepal Industrial Benefits Plan	Section 11.3.2 (C) Schedule 13 (Nepal Industrial Benefits Plan- Guidance Note)
Rural Electrification	Section 11.8

The parties also commit that systems and plans will be put into place to ensure that the skill level and level of employment of the local community is maximized. While the Land acquisition & Livelihood Restoration plan (LALRP) will specifically address the management of socio-economic impacts from the displacement (economic and physical) resulting from the project land requirements, the ESMP will address the management of environmental and social impacts from the construction and operation of the project.

The present document provides an annotated outline of the various plans required to be prepared as part of the benefit sharing which Local Benefit Sharing Plan (hereafter referred to as the "LBSP"). These plans will be supported and will be implemented in coordination with the LALRP and other management plans formulated for the project.

The plan will be implemented for all phases of the Project lifecycle and will be limited to the locals situated within the project impacted VDCs and district, with priority being given to those who have been directly impacted by the project due to land procurement. With the current administrative reorganisation, the Gaunpalikas will be used for deciding the area within which these plans will need to be rolled out.

Note: While some of the benefits like rural electrification will be undertaken based on the PDA requirements and also reflects Supreme Court of Nepal judgement in another HEP Project in Nepal. However, for the sharing of the equity shares, NWEDC will need to coordinate with GoN to agree on the area of influence.

Here clarity is required on the manner in which the scope of the plan will change due to the change in the administrative structure. Based on the discussion with the GoN, the scope of the plan will have to be revised. There may also be instances, where specific components of the plan (such as employment opportunities, rural electrification and skill trainings etc.) have different applicability and scope. For instance, the present employment opportunity may be focused on the PAFs and local community members who received training as part of earthquake relief, but skill trainings may be expanded to the entire population in the VDCs. The detailed plan will identify the specific scope of each mechanism identified in the following sections. This section will provide an overview of the scope in terms of the plan itself.

1.11.1.2. Context Setting

Project Overview

The Upper Trishuli (UT-1) Hydropower project is a 216 MW green field runoff-river hydropower facility to be located in the upper part of the Trishuli watershed, in the Rasuwa District in central Nepal, 80 km northeast of Kathmandu. The geographical coordinates of the project are longitude (between 85°12′40″E and 85°18′03″E) and latitude (between

28°04′27.50″N and 28°07′42″N). The details of the project can be referred to in the Detailed Project Report (DPR) of the project. The location of the project is depicted in Figure B.1-10.

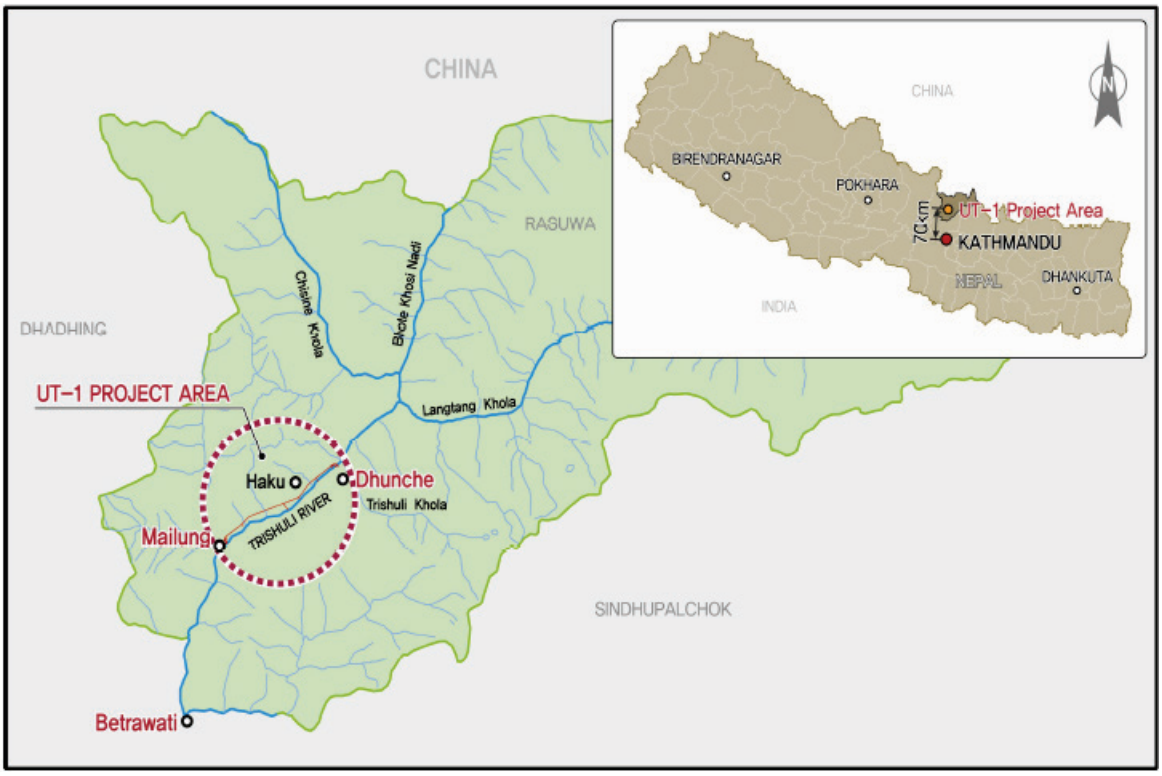


Figure B.1-10: Upper Trishuli 1 Project Location

The intake site is located near the confluence of Bhotekoshi river at Dunche and Haku VDC on the east bank of Trishuli River, about 70 km directly north of Kathmandu. The dam will be located about 275m downstream of the junction with the Bhotekoshi River. The direction of the valley is mostly south-west. The dam site can be viewed on Google Earth at 28-07-36.61N and 85-17-52.42E. Apart from the dam and spillway, all structures are located underground on the east bank of the river. The Pasang-Lhamu highway passes on the left bank of the river, and is the primary access route for the development.

Land Requirement for the Project

A total of 99.79 ha of land was earlier required for the project. Of this amount, 26.15 ha were required on a temporary basis during the construction phase of the project. Post the earthquake, an additional 1.2 ha of land has been identified in Mailung for the new camp site. The following table (Table B.1-11) provides an understanding of the main components of the project and their land requirement.

Table B.1-11: Land Requirement for the Project

Project Component	Land requirement (in ha)	Habitation Impacted
Permanent Land Take	73.64	
Private Land	3.96	• Mailung • Gogone • Tiru
Trust (Guthi) Land	15.53	• Haku Besi • Budget Farm • Thanku • Phoolbari
Community Forest and other Government land like Flood plain	51.54	• Gogone • Tiru • Mailung • Haku Besi • Gosumba • Budget Farm
Langtang National Park[1]	2.61	NA
Temporary Land Take	26.15	
Community Forest and other Government land like Flood plain	25.13	• Gogone • Tiru
Mailung HEP land (5 year lease)	1.02	• Mailung
Total	99.79	

Source: NWEDC 2014

1. An additional 2.8 ha of already disturbed/deforested LNP land will be temporarily used for the workercamps; however, returned once construction is completed.

Note: the Government land includes the forest land apart from the community forest land and the flood plain land

However, in keeping with the design changes caused by the 2015 earthquake, NWEDC is in the process of procuring the additional 1.2 ha of land required, and is presently in negotiations with 7 private land owners for the same.

Impact of the Gorkha Earthquake

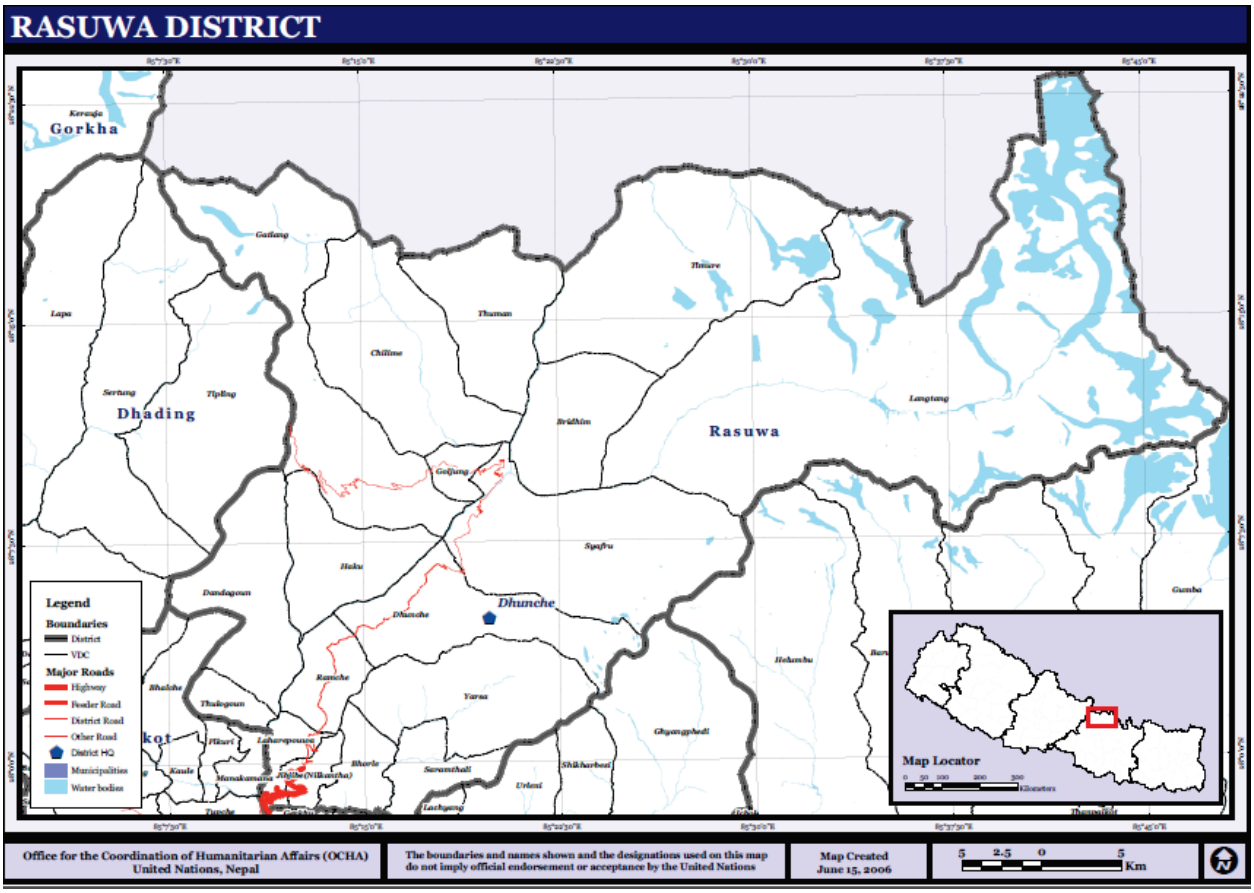
Nepal was struck by 7.8-8.1 magnitude earthquake; the 'Gorkha Earthquake', on 25th April 2015. This earthquake, was the worst natural disaster to strike this country since the 1934 Nepal-Bihar earthquake, and killed nearly 9000 people and injured over 22,000. The epicentre of this earthquake and its aftershocks was located east of the Gorkha District at Barpak, Gorkha; less than 100 kilometres from the UT-1 project site.

The Rasuwa District was one of the worst hit districts from the 2015 Gorkha Earthquake. The earthquake damaged more than 80% of the houses in the project footprint area (3 village development councils- VDCs- accounting for about 500 households) and resulted in more than 200 deaths in the area (43 on the project site) and the access road to the project was totally compromised.

The post-earthquake scenario led to wide spread influx of NGOs in the area and relief support in the form of livelihood and skill related trainings. The present livelihood and skill profile in the area is thus based on the pre-earthquake profile of the community, the impacts of the earthquake led displacement and the relief activities undertaken by NGOs/INGOs in the area.

Rasua District Socioeconomic Profile

The Rasuwa District is located in the north central part of Nepal with a population of 43,300 individuals and 9,778 households and is one of the districts with the lowest population in the country.



Source: United Nations Nepal Information Platform, http://www.un.org.np/attachments/district-map-rasuwa

Figure B.1-11: Rasuwa District Map

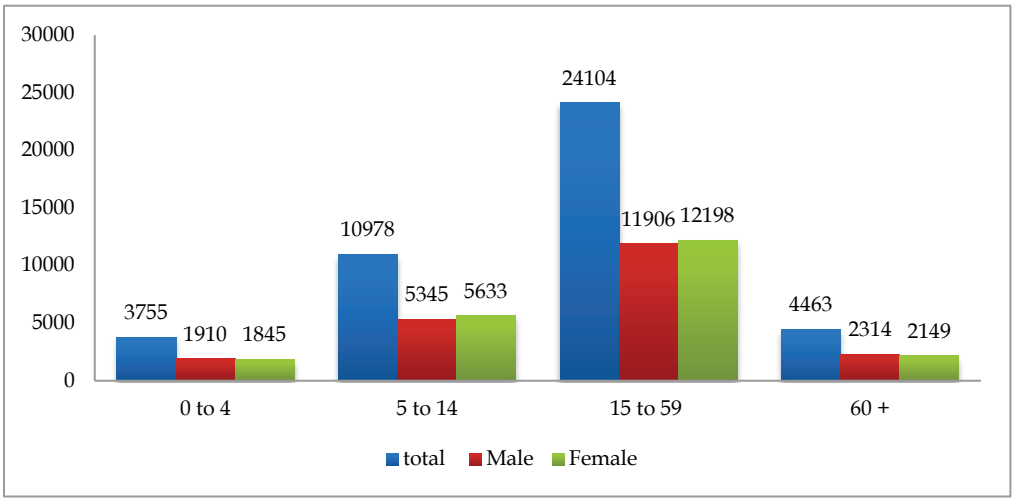
The district has an average household size of 4.43 individuals, and a sex ratio of 1016 females per thousand males, which is higher than but comparable to the national average (1050 females per thousand males). Covering approx. 1,544 sq. km. the district has a population density of 53.6 persons per sq. km as can be seen from the following table.

Table B.1-12: Rasuwa District Demographic Profile

Variables	Value
Total Population	43,300
Total Area (sq. km)	1,544
population density	53.6
Total Households	9,778
Sex Ratio	1016
Average Household Size	4.43

Source: UT-1; Complementary Social Baseline, NESS, July 2014

However, post-earthquake, the district is expected to have undergone a shift in terms of the overall population, average household size and population density. This is primarily understood to be resultant from a portion of the population getting displaced and seeking refuge in VDCs such as Dhunche, Lahare Pahuwa etc. This is expected to have increased in the population and its density in the urban areas and in settlements in the valley. Similarly, the families are also understood to have split up post the earthquake, due to space issues in temporary housing and also to gain maximum benefit from relief support given by NGOs/INGOs.



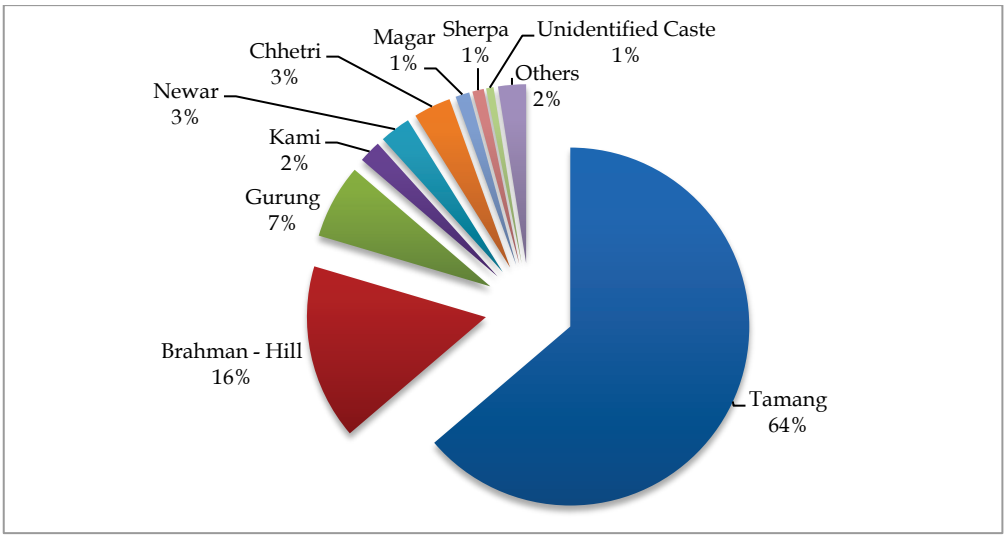
Source: UT-1; Complementary Social Baseline, NESS, July 2014

Figure B.1-12: Classification According to Age Groups

According to the information available, 34% of the district is reported to be in age group of 0-14 years, while the age group between 15 to 59 (the productive age group) represent 56% of the population. The figure above showcases the age classification of the population in the district.

Social Groups

The population in the district is reported to be comprised of 18 ethnic groups, with the Tamang group (an indigenous group) comprising of the majority of the population (63.75%). The other main ethnic groups in the area are Hill Brahman, Gurung, Kami, Newar, Chhetri, Magar and Sherpas amongst others. The following figure provides an understanding of the ethnic composition of the district.



Source: UT-1; Complementary Social Baseline, NESS, July 2014

Figure B.1-13: Ethnic Composition of the District

The main religion in the area is Buddhism (69% of the total population), followed by Hinduism (25.4%) and Christianity (4%). The other religions in the area comprise of Islam, Kirat, Prakriti, and Bon. From the discussions with the local community, it is understood that over the last years, there has been an increase in the number of conversions to Christianity. This is primarily reported to be resultant from the high presence of NGOs/ INGOs in the district and an increase in the number of children studying in Catholic boarding schools.

The district is characterised by 9 languages, the most prominent of which is Tamang (60%), followed by Nepali (31.67%). The other languages spoken in the area are Newari, Magar, Gurung, Sherpa, Maithali, Tharu and Tibetan.

Gender

While the female population constitutes 50.4% of the total population in the district, their access to education, property ownership and participation in social organization and economic activities is lower than in the case of their male counterparts. Compared to the 60.58% male literacy rate, 46.5% of the women are reported to be literate and only 8% of the women have legal ownership of property. However, the life expectancy of women at 54 years is lower but comparable to that of men at 55 years. The following table provides an understanding of the ownership of assets by women.

Table B.1-13: Female Ownership of Assets

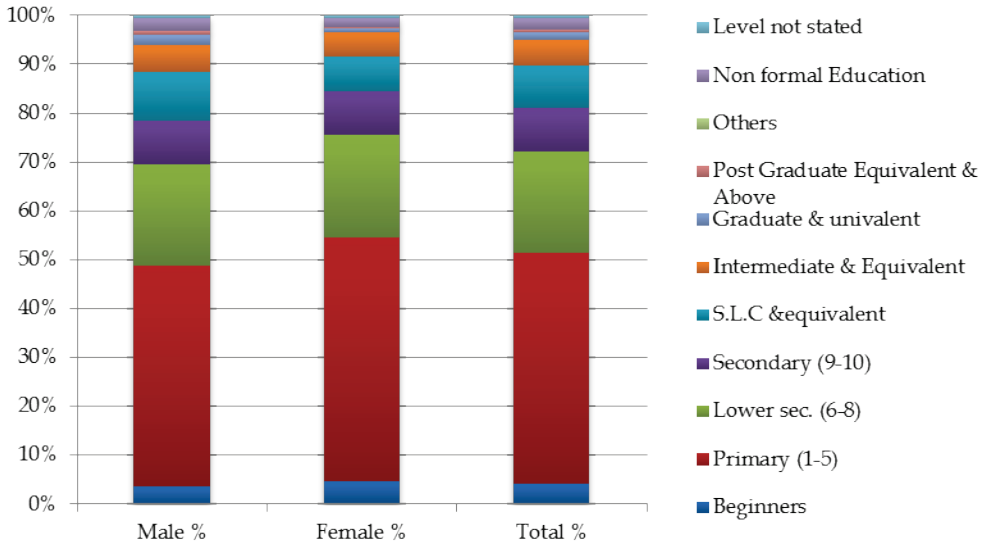
Asset	HHs No.	Percentage
Both House and Land	460	5
Land only	322	3
Neither house nor land	8892	91
Not stated	67	1
Total	9741	100

Source: UT-1; Complementary Social Baseline, NESS, July 2014

While involved in income generating activities such as agriculture and small businesses, women are reported to be mostly involved in household activities including child care, animal husbandry, water fetching, and looking after the welfare of family members.

Education Profile

The district is characterised by a literacy rate of 53.6%, with the male literacy rate being 60.58% and the female literacy rate being 46.5%.



Source: UT-1; Complementary Social Baseline, NESS, July 2014

Figure B.1-14: Educational Profile for the Rasuwa District

Of the literate population, 50% is reported to have education till the primary level while only 16% of the population is reported to have received the School Leaving Certificate and 7.18% has education above the intermediate level.

This literacy profile of the district is undergoing a change in the post-earthquake scenario. This is reported to be resultant from a larger population moving towards urban areas and thus having better access to educational infrastructure.

The district is reported to have 129 educational institutions, of which 123 are managed by the community and 6 are institutional. The primary education institutions comprise of 80% of the total educational institutions.

Health

The district has 18 health care facilities, including 1 hospital at Dhunche. In addition to this, there are 17 health posts and sub-health posts at the VDC level. Apart from this, there are 42 primary health care outreach clinics, 57 Expanded Program on Immunization (EPI) clinics and 24 female and child health volunteers.

The predominant diseases in the district include skin diseases, respiratory problems, diarrhea, parasitic infections, gastric disorders and eye and ear infections.

Water Supply and Sanitation

In the district, 88% of the households are reported to be supplied with tap/piped water, while the remaining are primarily dependent upon nearby springs and rivers. The sources of the water supply in most of the cases are springs.

While 57% of the district is reported to have some type of toilet (predominantly being flush toilets with septic tanks) in their homestead, facilities of storm water drainage and wet sewage drainage do not exist in the district.

As part of the detailed plan, NWEDC will review and update the socio-economic profile put in place. This update shall be based on the understanding of the changed administrative structure and scope of the plan, in discussion with the GoN. Some of the sources of information which may be used include the following:

- Central Bureau of Statistics/UNFPA, Kathmandu, 2002 Population Census 2001, National Report
- CBS/ICIMOD, Kathmandu, 2003 Mapping Nepal Census Indicators 2001 and Trends
- CBS/ Survey Department 2004, The Population and Socio- Economic Atlas of Nepal
- Central Bureau of Statistics 2012, National Population and Housing Census 2011 (National Report)
- Central Bureau of Statistics 2012, National Population and Housing Census 2011 (Tables from form II)
- Department of Education, 2012-2013, "Flash Report 2067"
- Department of Health Services, Kathmandu, Annual Report 2011
- National Planning Commission / UNDP, Nepal Human Development Report 2014
- Central Bureau of Statistics, Kathmandu, 1013 Nepal In Figures 2013
- CBS/ Survey Department 2004, The Population and Socio- Economic Atlas of Nepal

Context for Developing the Local Benefit Sharing Plan

The benefit sharing plan has thus been formulated in keeping with the above mentioned understanding of benefit sharing, project context, the impacted area and the impact of the Gorkha earthquake on the district and the project area of influence. Some of the specific points to be kept in mind for this benefit sharing plan are provided below:

Earthquake-Related Losses and Internal Displacement of People

- The Project area has been impacted by the 2015 Gorkha earthquake.
- The earthquake of April 2015 caused huge losses to the people residing in Rasuwa district at large; especially in Gogone and Tiru. The local community in the project area suffered impacts pertaining to loss of life and property, loss of livelihood, physical injuries, psychological trauma and damage to agricultural land.
- The earthquake and subsequent landslides resulted in the local community (Haku Besi, Phoolbari, Gogone, Tiru etc.) vacating their villages and seeking refuge in Internally Displaced People's (IDP) camps, such as Naubesi, Satbise, Bogetitar etc.
- The land of Gogone, Tiru and Mailung, is heavily impacted by the earthquake. The path from these locations to these villages has been severely damaged and only a few families have gone back to Tiru or Gogone because of the highly prevalent risk of landslides.
- In case of Haku Besi, Thanku, Phool Bari and other nearby villages, though there was destruction of residential structures, the agricultural land is reported to have suffered minor damages, most of which can be or have been repaired. Thus, the people of these villages have started going back to their original villages, either for short duration or some families permanently.
- Most households are moving back and forth between the native villages and the IDP camps. From most households, at least a few household members return to the native village for cultivation three times in a year, for usually 10-15 days at a time. The families return to the IDP camps during monsoons and winters. However, none of the households from Gogone have not returned due to extensive damage and continued risk of landslides.

Permanent Housing and Livelihood Concerns

- Government has identified resettlement site, but this does not include agriculture land.
- Reconstruction or construction of new house in a safe location is another concern of the HHs living in the IDP. In case of Gogone, Tiru identification of an alternate land is also an issue.
- The people living in the IDP camps have been facing various issues in terms of lack of space for livestock and poultry; unsanitary conditions leading to various diseases affecting people frequently, etc.
- Another issue is safety concerns post-earthquake, due to risk of landslides because of which people are still hesitant to move to their native village locations.
- Majority of the IDP camps are constructed on private land for which the people have to pay rents. There are a considerable number of families which are struggling to meet their basic expenses on account of shrinking savings, erratic employment opportunities and increased expenditure.
- Another issue being faced by the community is the instability and uncertainty associated with the present livelihood options available.

- In the pre-earthquake scenario, the local community was primarily dependent upon agriculture and livestock rearing.
- However, in the post-earthquake scenario, the community has reported a shift towards non-farm based livelihoods. This is understood to be primarily resultant from loss of access to agricultural land, loss of livestock in earthquake, issues with climatic conditions in IDP camps which makes it unsuitable for the high mountain breeds earlier kept by the local community.
- A significant portion of the local community has also started undertaking labour as masons or other construction related activities. however, the opportunities with this are also understood to be reducing due to a general reduction in the construction activities in the district

Alternative Land Identification for Resettlement of IDPs

- A government Geological team visited the project villages and assessed the level of earthquake impact in the affected villages. According to the preliminary information available, the areas of Gogone have been identified as High Risk, and resettlement has been suggested for the same; Tiru has not found mention in the draft report. Haku has been considered safe as per the draft geological study.
- For the villages identified as safe, a housing reconstruction grant has been identified. This grant shall be provided to those households, who have lal purza/ tenancy certificates for the land. These households would then be provided with monetary assistance to rebuild houses in keeping with pre-approved designs
- Of the 820 HHs in Haku VDCs, 803 are understood to have been identified as those who were eligible for receiving the grant
- For the villages identified as high risk, resettlement to an alternative land parcel.
- For this purpose, the government has already identified 72/82 ropani of land in Khalte, Lahare Pahuwa for resettlement of the households. This land is understood to have the capacity of accommodating 200 households.
- The ground levelling activities have been initiated by the NGO, Samaritan Purse and entire construction is expected to be completed in 1.5 years.
- Another 65 ropani has been identified in the Uttar Ganga Gaonpalika. However, no activity has been initiated for the same.

Capacity Building Training by NGOs and Government Agencies Post-Earthquake

- Over the last two years, however, the skill set of the community has evolved, due to the numerous trainings given by the NGOs/INGOs active in the area as part of the relief activities post-earthquake, including skill training for plumbers, electricians, masons, poultry farming, WASH etc.
- A lot of the NGOs (including Lumanti, Manekor, LaCCoS, Parivartan Nepal) have been involved in the district as a whole in different training- some are women specific and others

are general. In some cases need assessment was done but not always. Cottage department also did training in Rasuwa.

- Some people have benefited but some took trainings only for livelihood and for some it was too basic for sustaining livelihoods so need refresher courses.
- There is also a lack of understanding amongst the local communities in terms of the purpose of the trainings and the possibility of future livelihood opportunities from the same.
- There are also reported to be certain people who attended training just for the sake of being engaged and to earn money being paid to attend trainings;
- The project can build on this base and with people. This can be done keeping in mind the constraint, such as access to land – which was a major source of sustenance.

Current Livelihood Status

- One of the most important concerns of people has been the continuous pressure to find enough livelihood sources to help them meet the financial needs of their families, in the present temporary shelter. This has also led to a higher level of diversification of the livelihood dependence of the households;
- The most common sources of livelihoods in the local community presently are labour, stone breaking, Masonry, foreign employment, agriculture and remittance;
- While some households are now returning regularly to the original villages. Some households are also undertaking agriculture on share cropping basis in the vicinity of the IDP camps. However, this is limited to households who can afford the rent/ share in crop. There is also a limitation in the total land available for rent/share cropping
- Activities such as livestock are likely to be restricted in the area due to instability associated with residential status and land availability the company will do this.
- Furthermore, it is understood that the breeds to livestock that were maintained by the communities in the native villages are non-compatible with the climatic conditions of the IDP camps, which are hotter as they are mostly in the plain region.
- There is also reported to be a reduction in the availability of labour work opportunities associated with construction such as Masonry, electricians, plumbers etc. due to a reduction in construction activities in the district.
- The livelihood profile and the present trends, is largely dependent upon the present residence of the population and are likely to change once again, if the population goes back to the original village or changes location of residence.

Livelihood Expectations of the Project-Affected Population

- A number of the local community members, especially younger population, are interested in direct employment, petty contracts and daily wage.
- The preference for direct employment pertains to job profiles such as security, housekeeping, general administration, drivers etc.
- There is reported to be a shift, especially amongst the local population, towards foreign employment, as it is perceived as providing better returns and more stable incomes. Thus, there is an interest in the youth to develop skills which would allow them to pursue livelihood opportunities not just in the country but also abroad.
- However, the skill set required by the project, at least in the initial few years, may not be available in the project area. These skill sets however may be available in urban areas such as Battar, Betrawati etc.

Livelihood Options Likely to be Available from UT-1 Project

- As a result of this, it is possible, that in the first few years, the project may have to recruitment workers from outside the project area and the district. However, it is expected that through the training plan, the skill set available in the AoI will increase and after a certain number of years, the project will be able to recruitment a majority of its workers from the project area itself.
- However, one of the challenges in recruiting for the project is the remoteness of the site, due to which finding appropriate skill sets becomes a challenge
- The employment and skills training plan thus formulated will put in place a recruitment plan which will prioritize the recruitment of the locals from the project area, followed by the Gaonpalikas being touched by the project boundaries and then the district, and if not available in the district, then a Nepali citizenship.

1.11.1.3. Legal and Regulatory Framework

The plan implementation will be ensured to be in compliance with applicable requirements/guidelines which as per PDA should comply with Nepal regulations as well as Performance standards (IFC PS and ADB SPS etc. already referred to in the PDA.

Provisions of the Project Development Agreement (2016)

As per the Project Development Agreement:

- In addition to the budget committed in the EIA, the Company shall throughout the Term, support community development of affected communities through benefit sharing activities;
- The Company will set up a grievance mechanism to resolve grievances at the community level as per the EIA;
- As part of the Company's obligations regarding Disclosure of Information and Consultation, the Company will disclose all Plans in Nepali and English;

- The Company shall submit reports, every six months up to Commercial Operation Date and every 12 months thereafter, to GON describing in detail the activities undertaken under the Plan, the amounts spent on such activities and impact evaluation of such activities.
- Local community development activities aim to improve the standard of living of the affected communities through livelihood enhancements and support to construction and maintenance of physical infrastructure such as roads, trails, pedestrian bridges, water supply and sanitation schemes, communication infrastructures, community infrastructure development, such as schools, health posts, community centers, women's centers, small enterprise development funds etc. These initiatives should be developed in coordination with local governments to avoid duplication of interventions/support and ensure sustainability of efforts.
- The Local Benefit Sharing Plan shall also include a component detailing local community development activities (as committed in GON approved Environment Reports), that includes a detailed breakdown of specific activities, timeline, budget and implementation modalities.
- This does not preclude the Company from committing additional resources for the above and other benefit sharing activities.
- The Company and GON shall as per Section 11.3.2 (Plans) jointly prepare the Local Benefit Sharing Plan to be implemented within 12 months from the Agreement Date in accordance with this Schedule.
- The Company shall, and shall ensure that its Contractors and Representative shall, in connection with the conduct of the Project:
  - maximise the use of Nepali resources and give first consideration and full and fair opportunity to technically and commercially qualified Nepalese citizens and firms provided that in each case, the use of such Nepali resources meet the quality, quantity and availability requirements of the Company and provided further that use of such resources does not have a material and adverse impact on the costs and the timelines for the Project;
  - ensure that its Nepal Industrial Benefits Plan provides for an outreach programme under which the Company engages with Nepali suppliers for Project-related opportunities;
  - comply with the Laws of Nepal including the Labour Act, 2048 and Labour Regulation, 2050;
  - ensure that its Nepal Employment and Skills Training Plan provides for appropriate training of suitable citizens of Nepal for Project-related opportunities;
  - conduct employee training programmes from time to time, including training in each of the skills used in the Project, including management training;
  - comply with the Nepal Employment and Skills Training Plan, Nepal Industrial Benefits Plan and Local Benefit Sharing Plan and ensure that appropriate programmes are designed to assist suitable Nepali citizens, entities, and firms to meet the Project's requirements for goods and services;

- shall (to the extent applicable) submit reports every six (6) months to GON for the first three (3) years of the Construction Period and every twelve (12) months thereafter, describing in detail (A) its employee training programmes, (B) the implementation of such training programmes, (C) the progress made towards meeting the objectives set forth in· this Section 11 .9 (Use of Nepali resources; training and development) the Nepal Employment and Skills Training Plan, Nepal Industrial Benefits Plan and Local Benefit Sharing Plan.

Other Applicable Provisions

Constitution of Nepal (2015 AD)

Nepal is governed according to the Constitution of Nepal, which came into effect on Sept 20, 2015, replacing the Interim Constitution of 2007.

- Policies of the State: The state shall pursue a policy of raising the standards of living of the general public through the development of infrastructures such as education, health, housing and employment of people of all regions by equitably distributing investment of economic investment for the balanced development of the country;
- The state shall pursue a policy of making the women participate to the maximum extent in the task of national development by making special provisions for their education, health and employment
- The state shall pursue a policy of making special provisions of social security for the protection and progress of the single women, orphans, children, the helpless, the aged, the disabled, incapacitated persons and tribes on the verge of extinction
- The State shall pursue a policy of making a special provision, based on positive discrimination, for the minorities, landless people, landless squatters, bonded labours, the disabled, backward regions and communities and victims of conflict, the women, Dalit, indigenous people, Madhesi and Muslims, as well.

Nepal Hydropower Development Policy 2056 BS (2001 AD) Requirements

The Hydropower Development Policy was implemented by the Department of Electricity, Nepal to ensure supply of electricity to rural and urban areas, to enhance hydro-power development and to motivate the national and foreign private sector investments for the development of the hydropower sector in the country.[1]

The policy species requirements for various works to be undertaken for the development of hydropower in the country, from which, the following specifications are relevant to the Project:

- Foreign entrepreneurs shall be encouraged to be affiliated with local organizations as the cost of hydropower decreases if the project is developed through the domestic construction entrepreneurs and consultants;

[1] Hydropower Development Policy, 2001, http://www.doed.gov.np/policy/hydropower_development_policy_2001.pdf

- The person licensed to build or operate a hydropower project shall carry out or cause to be carried out works such that technology is transferred to the Nepalese citizens in the course of performing the works in accordance with the license;
- The person licensed to build or operate a hydropower project shall utilize Nepalese labor, skills, means and resources to the maximum extent possible and, shall also give priority to utilize local labor. 6.8.4 Development of industries producing construction materials and equipment to be used in the power sector shall be encouraged.

Land Acquisition, Resettlement and Rehabilitation Policy for Infrastructure Development Projects 2071 BS (2015 AD)

In September 2015, the Government of Nepal formulated the Land Acquisition, Resettlement and Rehabilitation Policy for Infrastructure Development Projects (2071 BS). The main objective of the policy is to make the process of land acquisition for development projects smooth and scientific. Key features of the policy (relevant to benefit sharing) are as follows:

- Social mobilization income restoration and life skill program: Project affected persons should be given necessary training for development of life skills, income generating schemes, savings and credit schemes so that PAFs can take up self-employment projects at the resettlement zone. Preference should be given to women;
- Vulnerable groups such as Janajati/Adivasi, Dalits, landless, women, especially women-headed households, differently-abled, poverty groups and senior citizens are entitled to special benefit and assistance packages in addition to compensation and resettlement;

International Reference Guidelines Requirements

<u>IFC Performance Standards 2012</u>

IFC applies the Performance Standards[2] to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing to its member countries eligible for financing. Together, the eight Performance Standards establish standards that the Client is required to meet throughout the life of an investment by IFC or other relevant financial institutions. The key requirements of these standards in terms of community development and benefit sharing are as follows:

- The project must improve, or at least restore the livelihoods and standards of living of displaced persons
- the project will offer displaced communities and persons compensation for loss of assets at full replacement cost and other assistance to help them improve or restore their standards of living or livelihoods
- economically displaced persons whose livelihoods or income levels are adversely affected will also be provided opportunities to improve, or at least restore, their means of income-earning capacity, production levels, and standards of living

[2] http://ifcext.ifc.org/ifcext/sustainability.nsf/Content/PerformanceStandards

- The project may also provide alternative income earning opportunities may be provided, such as credit facilities, training, cash, or employment opportunities.

ADB Safeguard Policy Statement

In July 2009, ADB's Board of Directors approved the new Safety Policy statement (SPS) governing the environmental and social safeguards of ADB's operations[3]. The SPS builds upon ADB's previous safeguard policies on the Environment, Involuntary Resettlement, and Indigenous Peoples, and brings them into one consolidated policy framework with enhanced consistency and coherence, and more comprehensively addresses environmental and social impacts and risks. The SPS also provides a platform for participation by affected people and other stakeholders in the Project design and implementation.

The key requirements of these standards in terms of community development and benefit sharing are as follows:

- The project shall at least restore, the livelihoods of all displaced persons1 in real terms relative to pre-project levels; and improve the standards of living of the displaced poor and other vulnerable groups.
- The project shall aim to provide displaced persons with opportunities to share project benefits in addition to providing compensation and resettlement assistance.
- Project shall attempt to ascertain specific opportunities for engaging affected persons as project beneficiaries and to discuss how to spread such opportunities as widely as possible among affected persons
- The project shall prioritize land-based resettlement strategies for displaced persons whose livelihoods are land-based.
- If land is not the preferred option of the displaced persons, or sufficient land is not available at a reasonable price, non-land-based options built around opportunities for employment or self-employment should be provided in addition to cash compensation for land and other assets lost.
- The project will also provide assistance to displaced persons in the form of credit facilities, training, and employment opportunities so that they can improve, or at least restore, their income-earning capacity, production levels, and standards of living to pre-displacement levels
- The borrower/client will also provide opportunities to displaced persons to derive appropriate development benefits from the project.

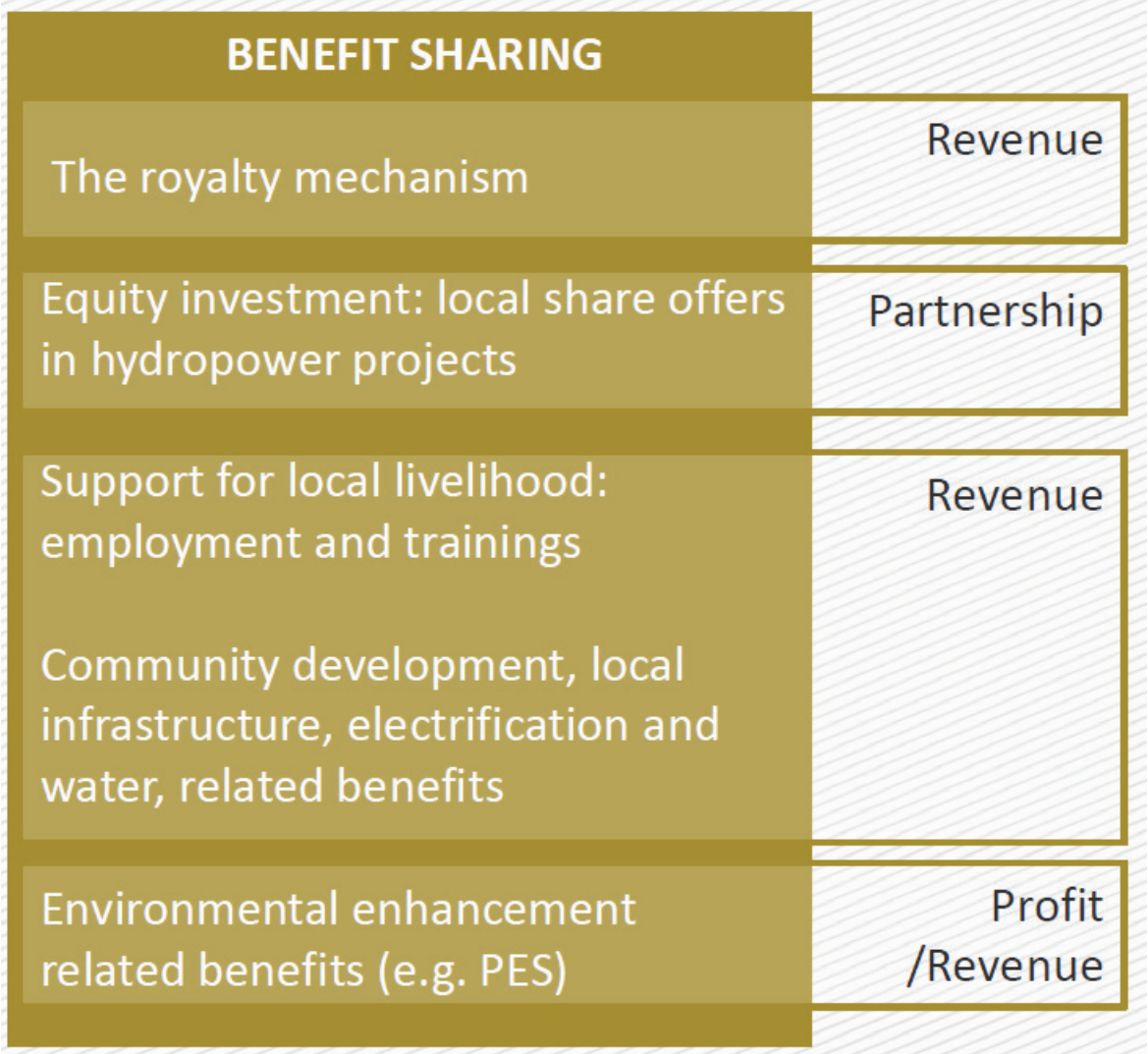
1.11.1.4. Benefit Sharing Mechanism: Practice in other HEP Projects of Nepal

According to the PDA, "Benefit Sharing is the systematic effort of the Company, as well as GON and GON nominated agencies to equitably share benefits of Project with affected communities through benefit sharing mechanisms beyond mandatory mitigation and

[3] http://www.adb.org/sites/default/files/institutional-document/32056/safeguard-policy-statement-june2009.pdf

compensation measures, including but not limited to the enhancement measures detailed in the environmental reports during construction phase, and continued community development activities that benefit the affected communities throughout the concession term".

The benefits typically include monetary and non-monetary initiatives. The following figure provides an understanding of the typical components of a benefit sharing mechanism.



Source: Rai. N & Neupane S. "Sharing benefits" of Hydropower projects: with special reference to the "Shares model". Advancing Sustainable Hydropower Technical Workshop Series. January 23-24 2017

Figure B.1-15: Typical Components of a Benefit Sharing Mechanism

The concept of benefit sharing has been used in many HEP projects in Nepal. While the benefit sharing is used liberally by many, it has also been used liberally in some contexts. The modalities of benefit sharing have definitely evolved over time with communities engaged in continued struggle to get benefits from the Project in their backyard which they consider to be rightfully theirs.

A brief snapshot of how similar HEP Projects in Nepal have implemented benefit sharing in their respective Projects is captured in Table B.1-14.

Table B.1-14: Examples of Benefit Sharing in Nepal

SN	Project name	Royalty	Local project shares	Community development fund	Local livelihoods programme	Electricity support	Water and environment benefits
1	Kulekhani I	Pays	N/A	No	Local jobs, trainings	Infrastructure provided and no load shedding	Drinking, fisheries
2	Kulekhani II	Pays	N/A	No	Local jobs, trainings	Infrastructure provided	Drinking
3	Marsyangdi	Pays	N/A	Yes	Local jobs, trainings	N/A	Drinking, irrigation
4	Aadhi Khola	Pays	N/A	Yes	Local jobs, trainings	BPC grid distribution	Drinking, irrigation
5	Jhimruk	Pays	N/A	Yes	Local jobs, trainings	BPC grid distribution	Drinking, irrigation
6	Khimti	Pays	N/A	Yes	Local jobs, trainings, local union	MHP plant built and local cooperative established	Drinking, irrigation
7	Upper Bhotekoshi	Pays	6% private pending	Yes	Local jobs, trainings	Infrastructure provided	Drinking
8	Kali Gandaki A	Pays	N/A	No	Local jobs, trainings	Connections to some houses	Drinking, irrigation, fisheries
9	Chilime	Pays	10% issued	Yes	Local jobs, trainings	Infrastructure provided	Drinking
10	Middle Marsyangdi	Pays	N/A	No	Local jobs, trainings	Infrastructure provided	Drinking, cultural, environment data
11	Ridi	Pays	10% issued	Yes	Provided	Preferential tariff and no load shedding	Drinking, irrigation
12	Siuri Khola	Pays	10% issued	No	Provided	Infrastructure provided	None
13	Mai	Pays	10% issued	Yes	Provided	Infrastructure provided	Drinking
14	Upper Marsyangdi	N/A	N/A	No	Provided	N/A	Drinking
15	Puwa Khola I	N/A	10% planned	No	Provided	N/A	TBD
16	Kulekhani III	N/A	N/A	No	Provided	N/A	Drinking, attempted environment scheme
17	Rasuwagadhi	N/A	10% planned	No	Provided	Infrastructure provided	Cultural, environment data
18	Upper Tamakoshi	N/A	10% pending	No	Provided	Infrastructure provided	Drinking, environment data

Note: BPC = Butwal Power Company; MHP = micro hydro plant; N/A = not applicable; TBD = to be decided

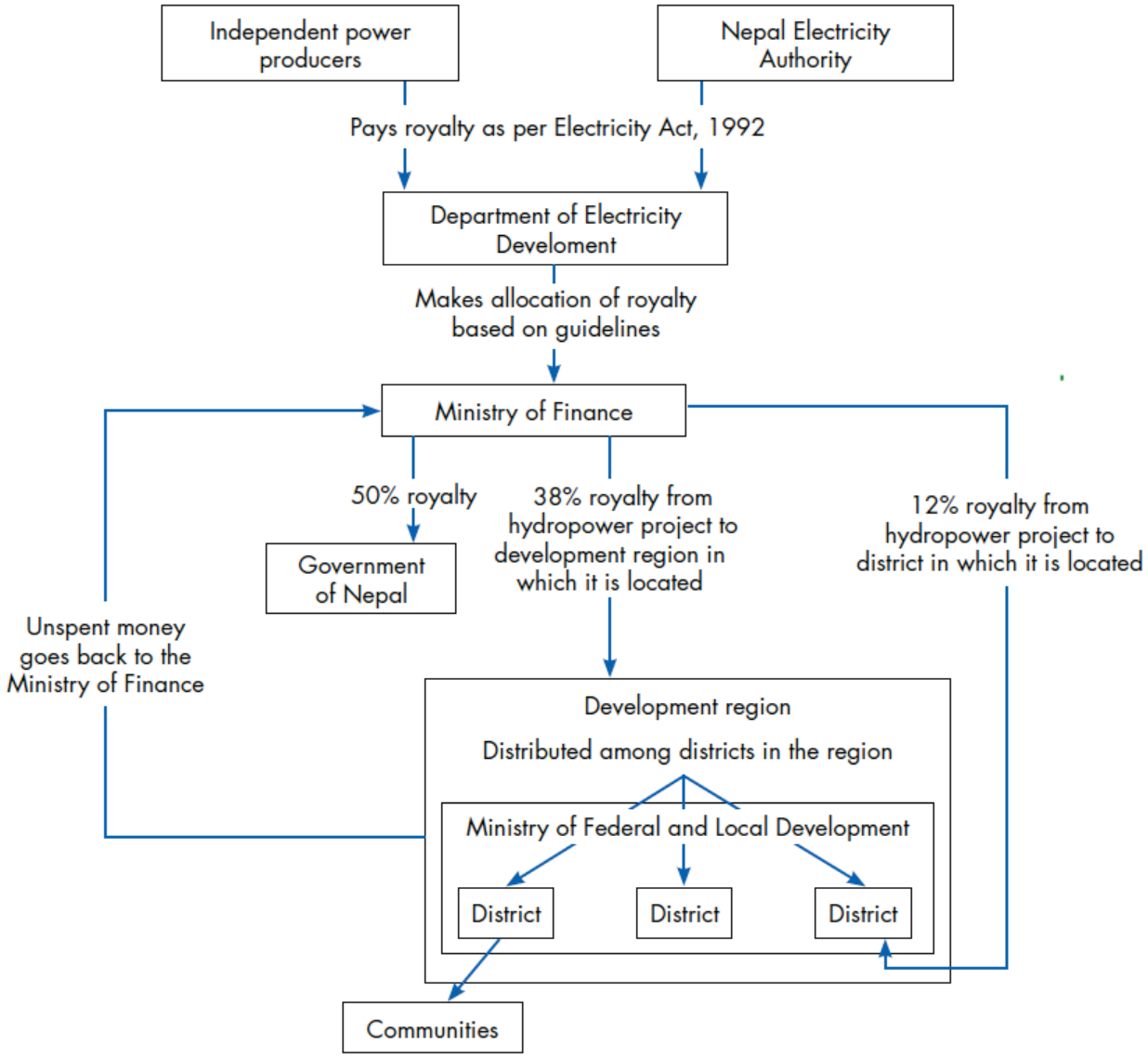
Source: Shrestha, P; Lord, A; Mukherji, A; Shrestha, RK; Yadav, L; Rai, N (2016) Benefit sharing and sustainable hydropower: Lessons from Nepal. ICIMOD Research Report 2016/2. Kathmandu: Nepal

Royalty Sharing

The royalty sharing mechanism is one of the most common types of benefit sharing and usually works on a system of royalty collection by the government from HEP Projects and distribution to local community through local governments.

Typically, the royalty collected is based on the capacity of the hydropower plant and the annual generation of electricity. The annual capacity royalty amount increases ten times after 15 years and the energy royalty increases by five times after 15 years.

The typical process followed for the royalty sharing mechanism is given in the following figure.



Source: Shrestha, P; Lord, A; Mukherji, A; Shrestha, RK; Yadav, L; Rai, N (2016) Benefit sharing and sustainable hydropower: Lessons from Nepal. ICIMOD Research Report 2016/2. Kathmandu: Nepal

Figure B.1-16: Royalty Sharing Process

The table below provides an understanding of some of the projects in which royalties have been collected.

Table B.1-15: Royalties collected by the Government of Nepal from Hydropower Projects in Fiscal Year 2068/69 BS (2012 AD)

SN	Project name	Capacity royalty	Generation royalty	Total
1	Kulekhani I (60 MW)	NPR 60,000,000	NPR 77,136,754	NPR 1,37,136,754
2	Kulekhani II (32 MW)	NPR 32,000,000	NPR 38,531,556	NPR 70,531,556
3	Marsyangdi (69 MW)	NPR 69,000,000	NPR 240,457,529	NPR 309,457,529
4	Aadhi Khola (5.1 MW)	NPR 5,100,000	NPR 14,227,684	NPR 19,327,684
5	Jhimruk (12 MW)	NPR 12,000,000	NPR 34,054,469	NPR 46,054,469
6	Khimti (60 MW)	NPR 6,000,000	NPR 56,293,747	NPR 62,293,747
7	Upper Bhotekoshi (45 MW)	NPR 4,500,000	NPR 35,601,380	NPR 40,101,380
8	Kali Gandaki A (144 MW)	NPR 14,400,000	NPR 92,953,213	NPR 107,353,213
9	Chilime (22.1 MW)	NPR 2,210,000	NPR 17,843,078	NPR 20,053,078
10	Middle Marsyangdi (72 MW)	NPR 7,200,000	NPR 45,906,287	NPR 53,106,287
11	Ridi Khola (2.4 MW)	NPR 240,000	NPR 1,082,686	NPR 1,322,686

Note: Project numbers 1–5 have been in operation for more than 15 years and pay higher royalties as per the Electricity Act, 1992; USD 1 = NPR 107 as in June 2016
Source: Department of Electricity Development, Government of Nepal

Source: Shrestha, P; Lord, A; Mukherji, A; Shrestha, RK; Yadav, L; Rai, N (2016) Benefit sharing and sustainable hydropower: Lessons from Nepal. ICIMOD Research Report 2016/2. Kathmandu: Nepal

The royalty mechanism is intended to promote development on a district and regional scale by distributing benefits to local government institutions rather than individual beneficiaries. According to the Hydropower Royalty Distribution and Utilization Directive, 2063 BS:

- The district with the hydropower project that receives 12% of royalty has to spend half of that money (that is 50% of the 12%) for environmental restoration work in upstream areas (20%);
- For supporting work in surrounding areas impacted by project's infrastructure like the dam, powerhouse, reservoir, transmission lines, tunnel, etc. (15%);
- For work in downstream dry areas below the dam (15%).
- For the remaining 50% of the 12% royalty and the contribution from the 38% royalty distributed within districts of the development region, DDCs have to give higher priority to electrification, alternate energy, and community electrification in affected areas.

But again, as the local development officers have to deal with multiple needs in a district, they often allocate budgets for purposes other than electricity and beyond the affected areas.

Equity Shares

This form of benefit sharing involves the provisioning of a percentage of equity or shares to the local stakeholders through both the public and private markets. This mechanism is aimed at allowing the local shareholders to get a direct financial claim to the project's projects. Although similar to the royalty mechanism in that the value of financial transfers to project beneficiaries is linked to project performance (in the form of dividends, bonus shares, or increased equity value).

As per the amended Securities Registration and Issuance Regulation 2008, only a hydropower company that is registered as a public limited company, not a private company can float a minimum of 30% of its shares to public, out of which 5% must be for company staff, 10% for locals, and the remainder for the general public.

The following table provides an understanding of some of the projects that have undertaken equity sharing as a mechanism.

Table B.1-16: Share offers by Hydropower Projects

Hydropower project, offering status, and offering year	Allocation of 'local shares'	Share offer details
Chilime (completed 2008–2010)	10% to local affected district and 15% to general public	The general initial public offering (IPO) was completed seven years after the completion of the project, post-profitability. The local share offer was conducted in 2010, following the resolution of a court case in which the percentage of shares allocated to the local population was revised from 5% to 10%. Due to this delay in the local offer, shares were offered at par with the IPO price (@ NPR 100) to 'highly-affected' locals in three VDCs and at a backdated share price premium (@ NPR 323) to affected locals. As a result, the company was able to pay dividends to locals immediately following the offer.
Mai (completed 2013–2014)	10% to local affected district and 20% to general public	The general IPO was completed in 2013 and the local share offer was conducted in 2014, both during the construction phase prior to the completion of the project in 2015. The project initially planned to allocate 40% of local shares to affected VDCs, but due to insufficient local demand the project allocated the remaining local shares to other residents of Ilam District. The general IPO was oversubscribed by 29 times.
Ridi (completed 2013–2014)	10% to local affected VDCs and 39% to general public, plus 50% promoter shares to locals	The construction of the project was completed in 2009. The local share offer to affected VDCs was done in October 2013 and the general IPO was done in February 2014. For both the offers, the IPO price was NPR 100 per share. Out of 300 promoters, about 50% are from local affected VDCs.
Siuri Khola (2015–2016)	10% to locals and 20% to general public	The construction was completed in September 2012. Ngadi Power Group completed the local share offer to affected districts in November 2015 and the general IPO in April 2016.
Upper Bhotekoshi (in progress/agreement reached)	6% private-market shares to locals only	Shares were demanded 14 years into commercial operation as a result of local protests following a landslide in August 2014. Following negotiations, project developers committed to provide 6% of 'private-market' shares to locals (distribution still pending).
Upper Tamakoshi (pending 2016–2017; delayed)	10% to local affected district and 15% to general public	The general IPO and local share offer was initiated in early 2015, after roughly 70% of the construction work had been completed. Concerns about eligibility criteria and uneven allocations to different affected areas led to protests and strikes in Dolakha District. Nepali employees of project contractor Sinohydro also organized a labour strike, demanding that workers be allowed to purchase shares in the project. The construction of the project and the share offer have been delayed due to earthquake-related damage.
Rasuwagadhi (planned 2018)	10% to local affected district and 15% to general public	There are plans to offer local shares before completion of construction.
Puwa Khola 1 (planned)	10% to local affected district	There are plans to offer local shares before completion of construction.
Khimti (demanded)	N/A	Local demands for shares emerged 14 years into commercial operation (partially a reaction to Bhotekoshi and Upper Tamakoshi protests/demands), but the project has not agreed to any share offer.
Upper Marsyangdi (demanded)	N/A	Local demands for shares emerged during the construction phase, but no shares have been issued.
Aadhi Khola and Jhimruk projects (demanded)	N/A	Project developer Butwal Power Company (BPC) is a publicly traded company on the Nepal Stock Exchange and, therefore, has not issued shares for its subsidiary projects in the past (although BPC is currently changing its policy by establishing a new project-specific company for its new undertakings). Local people from Aadhi Khola and Jhimruk have demanded shares.

Source: Shrestha, P; Lord, A; Mukherji, A; Shrestha, RK; Yadav, L; Rai, N (2016) Benefit sharing and sustainable hydropower: Lessons from Nepal. ICIMOD Research Report 2016/2. Kathmandu: Nepal

Note: Although the practice is not mandatory for all projects, shares are still widely offered by many power producers as public companies in order to harness domestic or 'local' capital and to obtain the 'social license to operate'.

Community Development

One of the oldest and most common types of benefit sharing is in the form of investment in community development or infrastructure development. This generally includes interventions in key areas such as: Health, Education, Agriculture, Road, Water supply, Religious/ cultural sites. These activities are also undertaken as part of the CSR activities by the project. Some of the community development activities undertaken by hydropower projects are depicted in the table below.

Table B.1-17: Community Development Areas and Activities in Hydropower Projects

Priority areas	Representative activities
Health care	Funding management of health care (e.g., Khimti, Upper Bhotekoshi) Construction of health posts (e.g., Kulekhani III, Middle Marsyangdi, Aandhikhola, Upper Marsyangdi, Upper Tamakoshi) Acquisition of ambulances (e.g., Middle Marsyangdi, Chilime, Rasuwaghadi, Puwa Khola I) Organization of health camps (e.g., Mai, Aandhikhola, Middle Marsyangdi)
Education	In-kind and cash support to schools (e.g., Khimti, Aandhikhola, Kaligandaki,Upper Tamakoshi) Maintenance of school buildings (e.g., Aandhikhola, Upper Marsyangdi, Kaligandaki) Construction of new school buildings (e.g., Middle Marsyangdi, Khimti, Mai, Kulekhani II, Upper Bhotekoshi) Provision of school bus (e.g., Kulekhani II) Support for teachers' salaries (e.g., Upper Bhotekoshi, Khimti, Aandhikhola) Merit-based scholarships and awards (e.g., Upper Bhotekoshi, Khimti) Tuition fee waivers (e.g., Khimti) Literacy programmes (e.g., Khimti, Aandhikhola)
Roads	Opening track of road (e.g., Middle Marsyangdi, Jhimruk, Upper Marsyangdi, Puwa Khola I, Siuri)
Cultural sites	Construction of cremation sites (e.g., Kaligandaki, Upper Marsyangdi, Puwa Khola I) Construction/reconstruction of temples (e.g., Andhikhola, Kaligandaki, Upper Bhotekoshi)
Mother's group	Financial support (e.g., Upper Marsyangdi, Andhikhola, Jhimruk) Literacy classes (Khimti)
Drinking water	One house, one tap programme (e.g., Upper Marsyangdi) Construction of water supply lines (e.g., Middle Marsyangdi, Lower Marsyangdi, Upper Marsyangdi, Jhimruk, Ridi, Kaligandaki)
Irrigation	Expansion and improvement of irrigation systems (e.g., Ridi, Aandhikhola, Jhimruk, Khimti) Irrigation canal maintenance (e.g., Ridi, Aandhikhola, Jhimruk) River works and river bank stabilization (Jhimruk)
Other	Support for fisheries development (Kulekhani I, Kali Gandaki A)

Source: Shrestha, P; Lord, A; Mukherji, A; Shrestha, RK; Yadav, L; Rai, N (2016) Benefit sharing and sustainable hydropower: Lessons from Nepal. ICIMOD Research Report 2016/2. Kathmandu: Nepal

Rural Electrification

Another component of the benefit sharing mechanism is the rural electrification process. This may be undertaken based on the following models:

- Provision of free electricity and distribution infrastructure to the local electricity group, which then manages the distribution;
- Preferential tariff rates for those living in the affected VDCs;

- Provision of distribution infrastructure, but the electricity is purchased by rural electricity groups through NEA; and
- Rural electrification through NEA

The following table provides an understanding of the rural electrification process undertaken by some of the hydropower projects in the country.

Table B.1-18: Support for Rural Electrification Provided by Hydropower Projects

SN	Project name	Rural electrification support
1	Kulekhani I	Infrastructure support for electrification; no load shedding
2	Kulekhani II	No load shedding
3	Marsyangdi	Access through regular NEA connection
4	Aadhi Khola	Electricity connection through BPC distribution at subsidized rate
5	Jhimruk	Electricity connection through BPC distribution at NEA rates
6	Khimti	Free electricity (about 1 MW) to rural electricity cooperative through separate micro hydro plan
7	Upper Bhotekoshi	Some infrastructure support for electrification
8	Kali Gandaki A	Electricity connection to Bote community houses
9	Chilime	Infrastructure support for electrification
10	Middle Marsyangdi	Infrastructure support provided through neighbourhood development programme, complementing electrification policy of Lamjung District
11	Ridi Khola	Distributed electricity to 60 households at subsidized rate; no load shedding
12	Siyuri Khola	Infrastructure support for electrification
13	Mai	Infrastructure support for electrification
14	Upper Marsyangdi	N/A
15	Puwa Khola I	N/A
16	Kulekhani III	N/A
17	Rasuwagadhi	Infrastructure support for electrification (proposed)
18	Upper Tamakoshi	Infrastructure support for electrification (proposed)

Source: Shrestha, P; Lord, A; Mukherji, A; Shrestha, RK; Yadav, L; Rai, N (2016) Benefit sharing and sustainable hydropower: Lessons from Nepal. ICIMOD Research Report 2016/2. Kathmandu: Nepal

NWEDC will try and build case studies on the examples presented, based on the information available as part of the detailed plans. The primary purpose of this section will be to provide learnings for previous experiences, and the key take –away from the same. The key learnings may be in the form of activities/initiatives that were successful and those which were not.

Employment and Training

The support for local livelihoods is another form of benefit sharing and pertains to employment (usually contractual) of the local community within the project, or development of additional skills through trainings. Typically, the majority of local hiring is unskilled and casual labour, hired formally or informally through the project contractor(s), while the project developer hires a smaller group of locals as drivers or entry-level office staff.

The following table provides an example of some of the hydropower projects that have undertaken local employment as a benefit sharing mechanism.

Table B.1-19: Local Employment and Priority Hiring Programmes Provided by Hydropower Projects

SN	Project name	Local jobs	Employment during construction	Employment after construction
1	Kulekhani I	Yes	Not known	35 locals NEA recruiting process
2	Kulekhani II	Yes	Not known	Some locals NEA recruiting process
3	Marsyangdi	Yes	Preference to people who lost more than 70% of land	Some locals in contract later NEA recruiting process
4	Aadhi Khola	Yes	Priority to locals	85 locals
5	Jhimruk	Yes	Priority to locals	Priority given to locals by Jhimruk Industrial Development Company (JIDCO) – previously established by the project, but later turned into a non-government organization (NGO)
6	Khimti	Yes	Priority to locals	Priority to affected district
7	Upper Bhotekoshi	Yes	17 displaced people Priority to affected VDC	26 out of 53 are locals Priority to affected VDC
8	Kali Gandaki A	Yes	Priority to local affected people (especially Bote)	7 locals in contract
9	Chilime	Yes	50/60 people from district	12–15 local staff
10	Middle Marsyangdi	Yes	Priority to locals	NEA recruiting process
11	Ridi Khola	Yes	Priority to affected VDC	8 local staff
12	Siuri Khola	Yes	Local contractor for buildings and 8 local workers	6–7 locals
13	Mai	Yes	15–16 locals after training Selected through concerned committee	10–15 locals Priority to affected VDCs for employment
14	Upper Marsyangdi	Yes	About 800 locals from affected district	TBD
15	Puwa Khola I	Yes	20–25 locals Priority displaced people	TBD
16	Kulekhani III	Yes	Priority to displaced people	TBD
17	Rasuwagadhi	Yes	Priority to people from most-affected VDCs	TBD (verbal commitment)
18	Upper Tamakoshi	Yes	Priority to 'local hiring' of people from Dolakha district, stated preference to hire from most-affected VDCs where possible	TBD (verbal commitment)

Note: TBD = to be decided

Source: Shrestha, P; Lord, A; Mukherji, A; Shrestha, RK; Yadav, L; Rai, N (2016) Benefit sharing and sustainable hydropower: Lessons from Nepal. ICIMOD Research Report 2016/2. Kathmandu: Nepal

However, one of the issues is that when the project construction is complete, the daily operations of the hydropower project require much less labour input. Hence, most of the jobs directly created by hydropower development are not durable in the long term. For this reason, the quality and duration of project employment are key variables affecting the distribution of benefits from employment. However, while jobs in hydropower construction are rarely sustainable in this sense, it does allow the local community to develop specific skills which may allow them to find employment elsewhere.

In addition to employment with the project, provisioning of skill trainings has also evolved as a benefit sharing mechanism. These trainings are usually aimed at allowing for the local

community to build and expand their skills to allow them to undertake new entrepreneurship opportunities or for finding employment in the country or abroad. The following table provides an understanding of the types of trainings provided by the various hydropower projects in Nepal.

Table B.1-20: Trainings Provided by Hydropower Projects

SN	Project name	Sample trainings to project-affected people
1	Kulekhani I	Watershed management and soil erosion prevention training for women
2	Kulekhani II	Skill enhancement training on electro-mechanical and 'doko' knitting (for Chepang community)
3	Marsyangdi	House wiring and plumbing training
4	Aadhi Khola	Vegetable farming training
5	Jhimruk	Construction work (welding, plumbing), mobile repair, fruit support programme training
6	Khimti	Skill development and non-formal education programmes
7	Upper Bhotekoshi	Income generating training programme for disabled and backward communities
8	Kali Gandaki A	Fish farming training
9	Chilime	Women's empowerment, cooking, knitting training
10	Middle Marsyangdi	Agriculture training (e.g., in beekeeping and herb identification)
11	Ridi Khola	Converting semi-skilled workers to skilled workers through construction-related training
12	Siuri Khola	None
13	Mai	Construction training to 60 workers (later jobs), knitting training to women
14	Upper Marsyangdi	70 labours trained in construction works (carpentry and bar bending) at Technical Campus
15	Puwa Khola I	Agriculture training
16	Kulekhani III	Driving, computer, stitching, agriculture training
17	Rasuwagadhi	Culinary training
18	Upper Tamakoshi	Electrical and plumbing training, driving, agriculture training

Source: Shrestha, P; Lord, A; Mukherji, A; Shrestha, RK; Yadav, L; Rai, N (2016) Benefit sharing and sustainable hydropower: Lessons from Nepal. ICIMOD Research Report 2016/2. Kathmandu: Nepal

1.11.1.5. Guiding Principles: Benefit Sharing

On the basis of the review of the PDA requirements, and based on understanding from the practices of other HEP Projects in Nepal, NWEDC will develop its own principles finalise in consultation with the GON at the time of formulating the detailed plan.

The Local Benefit Sharing Plan will be based on the following guidelines and principles:

- The Project will ensure compliance to relevant applicable Government of Nepal regulations, IFC Standards and ADB Safeguards Policy Requirements;
- The Project will clearly define and communicate to concerned parties, the areas and populations that qualify for LBS initiatives, with a list of criteria and mechanism for dispute resolution;
- The Project will ensure that the LBS initiatives will include all influenced VDCs and settlements, based on a fair selection process for prioritisation and stage-wise coverage);

- The Project work with credible local institutions and create an enabling environment to promote greater local ownership of initiatives, with the aim of transferring/handing-over operations (where feasible) to ensure both local ownership and long-term sustainability.[4]
- Ownership and user rights will be clearly defined with local participation and involvement of concerned stakeholders for all assets created/enhanced under LBS initiatives;
- The Project will take into consideration all forms of extant ownership and user rights (individual and community) to ensure that these are not involuntarily compromised by the project's initiatives;
- The Project will take into account all the impacts (beyond the 3 VDCs and ensure avoidance or effective management/mitigation);
- The Project will take into account existing schemes and programmes of the Government of Nepal, other plans formulated for the project and schemes and programmes of other multi and bi-lateral lending agencies with the purpose of ensuring complementarities and avoiding conflict or duplication;
- The Project will ensure transparency in disclosing information related to the LBS initiatives (impacts, benefits, eligibility criteria, people's participation, fund-utilisation/expenditure, time-lines etc.), across the project lifecycle;
- With the overall aim of furthering social inclusion, the Project will aim to ensure local participation, (with special care to include marginalised and/or indigenous groups and persons) from the planning stages to implementation and delivery;
- All stages and components of the initiatives will take into account gendered patterns in livelihoods and aim for greater gender equity to ensure practical benefits for women such as necessary safeguards, ensuring access, increased income opportunities and greater financial security;
- Recognising existing social and economic vulnerabilities in the local populations, the Project will build-in additional safeguards to ensure access and up-take of benefits;
- The project-related information dissemination, engagement and disclosure will be through informed consultation and participation (ICP), aiming for the widest coverage and use of the most effective mediums of communication; and
- The implementation of Local Benefit Sharing Plan will be monitored in terms of its impacts, process and outcomes as per agreed and approved indicators and timelines as defined in the Monitoring Plan.

1.11.2. Local Benefit Sharing Plan

As per PDA, "Local Benefit Sharing Plan" is understood to refer to the plan through which the Company agrees to benefit sharing through local community development activities reflected in the EIA, and that which the Company as a good corporate citizen will continue throughout the

[4] ICIMOD.Benefit Sharing and Sustainable Hydropower: Lessons from Nepal (2016).

concession period by channelling some of the benefits generated by the operation of the Project to the affected communities beyond mitigation and compensation measures.

As part of this section, the detailed plan will provide the benefit sharing programs based on the finding of the primary and secondary data of the demographic, socio-economic, and development indicators, as well as status of essential infrastructure in terms of housing, schools, hospitals and road networks. The plan will be developed on the following guidelines (but not limited to these guidelines)

1.11.2.1. Objective of the LBSP

The Local Benefit Sharing plan has been formulated in keeping with the requirements of the PDA signed on 29th December 2016. The primary purpose of the plan is to sustainably benefit local communities affected by hydropower investments.

While the LALRP formulated for the project, is aimed at mitigating the impacts from land procurement for the project, the Local Benefit Sharing Plan (hereinafter referred to as "LBSP"), as per PDA, will be aimed at fulfilling the following objectives:

- Supporting the local development process through direct investments (including local shares, royalty sharing, supply of local rural electrification) as well as collaboration and support of complementary programmes/projects in the area so that communities and other stakeholders benefit from the Upper Trishuli Hydro Power Project;
- Demonstrating good corporate citizenship practices of the NWEDC.

It should be noted that the LBSP shall serve as an umbrella plan, and shall be supported by specific plans including Industrial Benefit Sharing and Employment and Skill training plan formulated for the project.

The plan will be detailed out further by NWEDC in consultation with Government of Nepal (GoN) & GoN nominated agencies.

The objectives of the Plan will be discussed with GoN and any changes in the objectives will be made accordingly.

1.11.2.2. Generic Options under Local Benefit Sharing (Community Development)

In keeping with the EIA requirements and the understanding of benefit sharing in Nepal, the following options have been identified for the LBSP for UT-1.

Table B.1-21: Benefit Sharing Programs

Monetary Benefits	**Non-Monetary Benefits**
Monetary benefit refers to sharing part of the monetary flows generated by the operation of the hydropower projects with local communities. It includes, but is not limited to, the following mechanisms: • Direct payments/royalty and revenue sharing • Preferential electricity rates • Payments for environmental or ecosystem services • Community development fund • Equity sharing	Non- monetary benefits refers to the approaches adopted by the project entity for ensuring that local communities benefit from construction and operation of a hydropower project in non-monetary terms.: • rural electrification, • improved infrastructure, • support for health and education programs, • improved access to fisheries and forests, and • legal title to land.
Note: Based on the understanding of the above mentioned benefits, profile of the target district, the guidelines & the PDA, following activities can be included in the benefit sharing plan.	
1. Sharing	**1. Watershed management**
• Allowing the local population an equity stake (i.e. shares). As mentioned previously, current thinking requires moving beyond mitigation and compensation to work with communities to maximize development benefits and engender more equitable outcomes. • Providing the local government a share in the royalties for the project.	• This includes development of an integrated management plan for the river watershed,
2. Community Development Fund/ Plan	**2. Associated Infrastructure and Public Service Investment**
• Community development funds financed from electricity sales can be established to foster economic development in the project areas, including the project-affected communities. • The sources of the fund can also be from the royalties and taxes paid to the government. • The objectives, structure, and duration can be the result of negotiations between local authorities and the hydropower project companies. • An important component of community development is rural electrification	• The investment can cover • Social and environmental investment such as for schools, health facilities, local infrastructure or watershed protection. • Local people will benefit from these investments if efforts can be made to ensure they are an integral part of the local development plan

The following subsections provide an understanding of the key components of the LBSP.

Based on the programs identified above, during the preparation of the detailed plan, specifics of such mechanism will be put in place, which shall provide details on how each of the initiatives will be rolled out. While finalizing the modalities of such plans NWEDC will;

- Refer to PDA requirements;
- GoN regulatory requirements (including past precedence of Court Judgements in Nepal); and
- Refer to the lenders requirement (already stipulated under PDA).

These plans will provide an understanding of (but not be limited to):

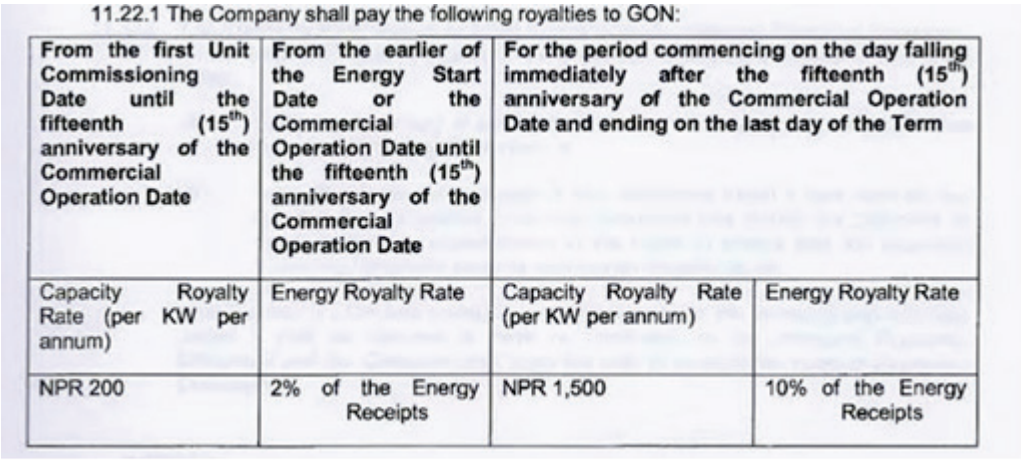
- The specific objectives of each of the mechanisms identified;
- The target groups and population;
- The year wise targets for implementation; and
- The key steps for implementation

A year wise plan of implementation will be put in place for achieving the objectives identified.

These programs will be based on the understanding of the above mentioned benefits, profile of the target district & the guidelines. The section below describe the modalities in brief and suggests the way forward for detailed plans to be prepared to meet PDA requirements.

Royalty to GoN

According to the PDA requirements (Section 11.22.2), the royalty payable shall thus be based on the following figure.



11.22.1 The Company shall pay the following royalties to GON:

From the first Unit Commissioning Date until the fifteenth (15th) anniversary of the Commercial Operation Date	From the earlier of the Energy Start Date or the Commercial Operation Date until the fifteenth (15th) anniversary of the Commercial Operation Date	For the period commencing on the day falling immediately after the fifteenth (15th) anniversary of the Commercial Operation Date and ending on the last day of the Term	
Capacity Royalty Rate (per KW per annum)	Energy Royalty Rate	Capacity Royalty Rate (per KW per annum)	Energy Royalty Rate
NPR 200	2% of the Energy Receipts	NPR 1,500	10% of the Energy Receipts

Source: UT-1 PDA

Figure B.1-17: Royalty Payable to the Government

The capacity royalty chargeable from the project shall be calculated based on the following:

- From and after the first Unit Commissioning Date until the Commercial Operation Date: Capacity Royalty Rate multiplied by the total nameplate capacity (in kW) of the relevant unit(s) of the Power Station that has been commissioned.
- From and after the Commercial Operation Date: Capacity Royalty Rate multiplied by the total nameplate capacity (in kW) of the Power Station.

However, the royalty shall not be payable if:

- If NEA is in default of its payment obligations under the Domestic PPA;

- Any payments received from GON or NEA in the circumstances described in the following PDA sections: Section 6.1 (GON rights and obligations), 12.7 (Staggered Remedies) or 12A.6 (Change in Law) or Local Free Power.

It is further clarified in the PDA that in the event of non-payment of any undisputed amounts due and payable by GON to the Company under this Agreement, the Company shall, at its option, be entitled to set-off such amounts against the Capacity Royalty and/or Energy Royalty payable by the Company hereunder.

Note: In keeping with the requirements of the PDA, the royalty sharing program with the local government shall be identified, in consultation with the GoN.

Equity Shares

In addition to royalty sharing, the project shall make available shares to the local community. These shares shall be available for purchase by any member within the local community at a subsidized rate.

As per PDA,

10.17.1 *"At the option of the Project Affected People, the Company agrees that the Project Affected People:*

(A) Required to be resettled and rehabilitated as a result of the Project; and

(B) Who are natural persons and other natural persons residing permanently in the districts of the Project Area at the date on which the construction activities for the Project commence,

shall, directly or indirectly, be sold or issued up to a maximum of ten per cent (1 0%) of all the Company Shares with the value of each share determined on the basis of the face value of such shares without applying any premium, which shall be exercised and the total value paid in full in the period from the date of Financial Close until the date which is three years after the Financial Close. GON shall work together with the Company to agree on a local share allocation plan and implement such effective mechanisms and processes that is not cumbersome in the ordinary course of business to the Company to give full effect to the transactions envisaged in this Section 10.17.1 (Local share). For the avoidance of doubt, the Company shall not be required to issue any Company Shares to the general public."

Note: In discussion with the GoN, the proportion of equity shares to be made available and the rate shall be identified.

Furthermore, the definition of local community for the purpose of making equity shares available shall be established.

Rural Electrification Plan

Rural electrification is an important component of the benefit sharing mechanism.

As per the PDA,

11 .8.1 *No later than the Financial Close, the Company in consultation with GON shall identify each household (an "Original Household") within the geographical area described in Schedule 12 (Nepal Employment and Skills Training Plan – Guidance Note) (the "**Free Electrification Area**").*

11.8.2 *From and after the Commercial Operation Date, the Company shall supply (at its own cost) twenty (20) kWh of electrical output ("**Local Free Power**") each Month during the Term without charge to each household within the Free Electrification Area as at the Commercial Operation Date to up to 200% of the number of Original Households identified pursuant to Section 11 .8.1 (Rural Electrification) (each an "**Eligible Household**").*

Schedule 11, Rural electrification section additionally mentions that*:*

*From and after the Commercial Operation Date, the Company shall make available for use by **each Eligible Household within a 500 metre radius of the headworks and the Power Station** as at the Commercial Operation Date as identified by the Company and GON (which shall not be more than 200% of the Original Households), twenty (20) kWh of electrical output free of charge each Month during the Term.*

11.8.3 *Prior to Commercial Operation Date, the Company shall build the distribution network to supply such Local Free Power to each Eligible Household within the Free Electrification Area in accordance with Section 11 .8.1 (**Rural Electrification**).*

11.8.4 *GON shall be responsible for the operation and maintenance of such distribution network at its sole cost.*

11.8.5 *GON and the Company shall jointly prepare a plan (the "Rural Electrification Plan"), based on a pre-feasibility study to be carried out by GON and the Company (at the Company's sole cost) to assess the costs and scope of rural electrification in accordance with this Section 11.8 (Rural Electrification). **The Company shall implement the Rural Electrification Plan.***

Note: The final plan to be submitted by NWEDC will need to consider the following:

- In consultations with GoN, identify each household (an "Original Household") within the geographical area described in Schedule 12 (Nepal Employment and Skills Training Plan – Guidance Note); however, Schedule 12 of PDA does not specify such specific Geographical area;

- Schedule 11, somehow defines, each Eligible Household within a 500 metre radius of the headworks and the Power Station;
- NWEDC will also take part in conducting a pre-feasibility study to be carried out by GON and the Company (at the Company's sole cost) to assess the costs and scope of rural electrification.
- Prior to Commercial Operation Date, NWEDC shall build the distribution network.

To sum it up, NWEDC as part of the detailed plan shall provide an understanding of the manner in which the rural electrification requirements of the PDA will be met.

Community Development Plan

The project has undertaken a number of community development and infrastructure development activities in their Area of Influence (AoI) as part of their CSR activities. In addition to this the project was also involved in various relief efforts post-earthquake, an understanding of which is provided in the LALRP. The project is also supporting the rebuilding of two schools in Haku Besi and Dhunche and one health centre.

As per PDA,

Schedule 11

In addition to the budget committed in the EIA,

- *The Company shall throughout the Term, support community development of affected communities through benefit sharing activities.*
- *Local community development activities aim to improve the standard of living of the affected communities through livelihood enhancements and support to construction and maintenance of physical infrastructure such as roads, trails, pedestrian bridges, water supply and sanitation schemes, communication infrastructures, community infrastructure development, such as schools, health posts, community centers, women's centers, small enterprise development funds etc. These initiatives should be developed in coordination with local governments to avoid duplication of interventions/support and ensure sustainability of efforts.*
- *The Local Benefit Sharing Plan shall also include a component detailing local community development activities (as committed in GON approved Environment Reports), that includes a detailed breakdown of specific activities, timeline, budget and implementation modalities.*

EIA Commitment

There are certain community development initiatives which have been included as part of the commitments in the EIA for the project. The same shall be incorporated into the community development plan thus formulated. The EIA commitments of relevance are:

- Local people will be prioritized for employment in project construction works;
- Local people specifically women will be encouraged in agricultural practice through agricultural enhancement programme;

- The project will assist the school of the Haku VDC to provide education to the children of project staff and workers;
- The project will assist the local health institutions;
- The ethnic group 'Tamang' of the project area will be supported to preserve their, tradition, culture, identity as well as their traditional occupation;
- Dalit group will be prioritized in project works as per their skills and capacities with certain percentage reservation for dalit;
- Local people will be provided training on business and trade;
- Local people will be prioritized in training in project related works;
- The project affected VDCs will be supported for rural electrification;
- Local people will be encouraged for tourism enhancement;

Also, the following measures are suggested in the EIA,

- The erosion of river bank will be minimised by implementing river bank protection measures in susceptible site downstream of weir;
- The area equivalent to occupied forest area (27.20 hectares) for project physical infrastructures will be afforested and protected for 5 years and handed over to concerned stakeholders as per the Forest Guideline for the Allocation of the Forest land to other Development Projects. The afforestation area will be as per the area designated by the respective district forest office and LNP;
- The project will carried out compensatory plantation of 4797 felled trees at a ratio of 25 seedlings for each lost tree equivalent to 119925 numbers as per the Forest Guideline, 2006 in an area as directed by the District Forest office of Rasuwa district and LNP authorities;
- The construction workers will be prohibited to collect firewood, timber and other forest products from the local community forest of Haku VDC and such act will be termed illegal;

Note: NWEDC will finalise these and ensure that these are developed in coordination with local governments and GoN to avoid duplication of interventions/support and ensure sustainability of efforts. These commitments will be further streamlined with clarity on numbers, schedule and budget for implementation across years.

1.11.2.3. Implementation of LBSP

During the preparation of the detailed plan, an understanding of the overall implementation mechanism for the LBSP, in keeping with the specific programs identified, will be proposed. NWEDC will formulate this implementation mechanism, based on the specific requirements of the programs, the resources available and the requirements of the GoN.

Organization Structure

The NWEDC and GoN, as per section 11.3.2 (of the project development agreement) jointly prepare the Local Benefit Sharing Plan to be implemented within 12 months from the Agreement Date in accordance with this Schedule.

NWEDC will put in place a team with clear cut roles and responsibilities for the implementation of the detailed plan. NWEDC will provide an understanding the team and the manner in which they will be involved in the implementation. Some key things to be kept in mind and questions which will be answered as part of this section are as follows:

- NWEDC's role;
- GoN's role;
- Stakeholders to be engaged in decision making;
- Decision making in relation to LBSP components;
- Possible implementation partner;
- The role of third parties (if any).

This section will provide a brief description about the effectiveness of the institution/implementation agency for planning, management, monitoring and delivery of the plan. This will also include suggestions for workable linkages with other programs/projects (government-run; multi/bi-lateral agency sponsored).

Implementing Partners

For the purpose of implementing specific components of the plans, NWEDC shall/ may associate with external third party experts, as required, who have experience in the field and the geographical area.

As part of this, NWEDC will,

- Identify NGOs/civil society and government department/ agencies who shall be involved in the implementation of the plan thus formulated.
- Some of the key agencies identified include Manekor, Parivartan Nepal, LaCCoS, Cottage Industries department, veterinary department, horticulture department etc.
- The NRA may serve as a consolidation point for all the existing NGOs and agencies in the area.
- NWEDC will build on such networks and allow for opportunities to be created for knowledge transfer.

Interlinkage with other Plans

The benefit sharing plans thus formulated are part of a larger social impact management framework for the project and shall be implemented in coordination with the other management plans such as the following (but not limited to):

- Stakeholder Engagement Plan;
- Livelihood Restoration Plan;
- Labour influx management plan; and
- Grievance Redressal Mechanism.

Schedule for Implementation

This section provides an understanding of the schedule of implementation of the plan thus formulated

As part of the detailed plan, NWEDC will put in place a schedule for implementation of the LBSP, in discussion with GoN. This schedule will provide an itemized timeline for each step of the implementation process.

1.11.2.4. Engagement Strategy

This section will provide the Engagement strategy for the LBS plan. An essential component of the implementation of the benefit sharing plan is the engagement with the local community and other external stakeholders.

The strategy will specifically explain the key needs and sensitivities viz. communities, government, and other stakeholders who will be associated ort linked to implementation of the LBS plan.

Although this will be in line with the overall stakeholder engagement activities of LALRP /ESIA, it will describe how to position LBS actions and address a larger audience (3 VDCs and beyond).

The engagement strategy as a part of the detailed plan will include the following:

- Aim, objectives of LBS;
- Coverage, potential beneficiaries, thematic areas of intervention, entitlements;
- Engagement mechanism,
- Phased approach, timelines and outcomes;
- Disclosure mechanism;
- Grievance management (as per EIA/ESIA/LALRP); &
- Feedback, documentation, communication, multi-media.

1.11.2.5. Monitoring and Review Mechanism

The LBSP will serve as a macro plan that will be constantly reviewed and updated on annual basis, throughout the project lifecycle. Micro plans will be developed, that will comply with the major principles identified, and are ready for implementation during the project activities.

As part of the detailed plan, a monitoring and review mechanism will be put in place, which will include the following:

- Provision for internal and external monitoring
- Frequency of monitoring and review
- The KPIs for internal and external monitoring
- Process of reviewing and updating the LBSP based on the findings of the monitoring reports
- Responsibilities of NWEDC, GoN, implementation partners and any third party involvement for monitoring purposes
- Overlaps and integration with project and other reporting timelines (LALRP etc.); and
- Systems and institutional linkages for feedback and mid-course correction

1.11.2.6. Budget

NWEDC will ensure that adequate budget is allotted for the implementation of the LBSP.

As part of the detailed plan, this section will provide an itemized budget for each step in the implementation of the LBSP

1.11.2.7. Reporting and Documentation Requirements

As per the agreement, NWEDC shall submit reports, every six months up to Commercial Operation Date and every 12 months thereafter, to GON describing in detail the activities undertaken under the Plan, the amounts spent on such activities and impact evaluation of such activities.

The activities undertaken, observations made and mitigation measures implemented, if any, will be reported to the Government of Nepal on an annual basis by the Project team.

As part of the detailed plan, a reporting mechanism will be put in place, in consultation with the GoN, which will provide an understanding of the following:

1. Requirement for internal and external reporting
2. The frequency of reporting
3. Chain of reporting
4. The format- report, presentation, verbal discussion etc.

1.11.3. Employment and Skill Training Plan (ESTP)

This section puts in place the employment and skill training plan (ESTP) for the project. The ESTP shall comprise of following key components, namely:

- Employment opportunities in the project, directly by NWEDC as well as through the contractors and sub-contractors;
- Trainings for skill development of the local labourers, who are employed in the project; and
- Trainings for livelihood development for those who presently do not have the skills required for employment in the project or other hydropower projects in the area.

As per PDA, (Section 11.9) - Use of Nepali resources; training and development:

The Company shall, and shall procure that its Contractors and Representative shall, in connection with the conduct of the Project:

11.9.1 *maximize the use of Nepali resources and give first consideration and full and fair opportunity to technically and commercially qualified Nepalese citizens and firms provided that in each case, the use of such Nepali resources meet the quality, quantity and availability requirements of the Company and provided further that use of such resources does not have a material and adverse impact on the costs and the timelines for the Project;*

11.9.3 *comply with the Laws of Nepal including the Labour Act, 2048 and Labour Regulation, 2050;*

11.9.4 *ensure that its Nepal Employment and Skills Training Plan provides for appropriate training of suitable citizens of Nepal for Project-related opportunities;*

11.9.5 *conduct employee training programmes from time to time, including training in each of the skills used in the Project, including management training;*

11.9.6 *comply with the Nepal Employment and Skills Training Plan, Nepal Industrial Benefits Plan and Local Benefit Sharing Plan and ensure that appropriate programmes are designed to assist suitable Nepali citizens, entities, and firms to meet the Project's requirements for goods and services;*

11.9. 7 *shall (to the extent applicable) submit reports*

- *every six (6) months to GON for the first three (3) years of the Construction Period and*
- *every twelve (12) months thereafter, describing in detail*
  (A) its employee training programmes,
  (B) the implementation of such training programmes,
  (C) the progress made towards meeting the objectives set forth in· this Section 11 .9 (Use of Nepali resources; training and development) the Nepal Employment and Skills Training Plan, Nepal Industrial Benefits Plan and Local Benefit Sharing Plan.

Schedule 12 of the PDA, also mentions the following:

Schedule 12

- *Identify expected labour force (Nepali and Non-Nepali) requirements over the Project life cycle by Year and by skill, both directly by the Company and by each of its expected major Contractors.*
- *identify the expected opportunities for employment and skill development at local levels;*
- *set out the Company's and the major Contractors' planned measures to recruit and train workers over time;*
- *contribute to the development of employable skills and human resources*

The employment and skills training plan will not restrict itself only to the hydro power related training, but will also comprehensively look into vocational training opportunities to provide impetus to the improvement of living standards of locals e.g.

- *The area- specific farm (agriculture, animal husbandry;*
- *small orchards and other farm based allied activities) and non-farm linked training;*
- *productivity improvement (knowledge transfer) and*
- *Self-employment program.*

As far as practicable, the Company shall attempt to transfer the skills of skilled and semi-skilled foreign personnel to Nepalese counterparts during the course of Project implementation.

1.11.3.1. Objective of the Plan

The ESTP has been formulated in keeping with the requirements of the PDA signed on 29th December 2016. The plan has been developed by NWEDC and Government of Nepal (GoN) & GoN nominated agencies. The main objective of the plan is:

- To create opportunities for employment, training and skills enhancement in project related activities, or vocational trainings and other trainings.
- Encourage training and employment of local people in Project related activities, which employment will be commensurate with educational qualifications, relevant skills and experience;
- Hydro development will act as a stimulus to bring long term sustainable benefits to Nepal and its people, and that one of the key benefits is improved skill development and employment of the Hydro Property affected people;

- It is expected that the majority of job requirements can be met by Nepalese, and that the project cycle for hydro projects will enable training to be proceeded sufficiently in advance to enhance employment opportunities for the locals; and
- Comply with the Laws of Nepal including the Labour Act, 2048 and Labour Regulation, 2050.

The objectives of the Plan will be discussed with GoN and any changes in the objectives will be made accordingly.

The detailed plan will be developed, in consultation with the GoN, keeping in context the following:

- Literacy and skill profile of the area;
- The skill training programs being implemented in the area by the NGO/INGO and other agencies;
- Skill requirement for the Project during construction and operations stage;
- Potential employment opportunities- existing and during project construction;
- The One Belt One Road (OBOR)/ Belt and Road Initiative (BRI) and other future developments in the area.

1.11.3.2. Context of Livelihood and Associated Skill Set in Project Area

Preparation of the ESTP will need to be situated in the context of the existing socio economic condition, earthquake induced impacts and the current livelihood practices in the Project area. A summary of the existing livelihood and associated skill profile of the PAFs which could to a great extent reflect the profile of the district (especially the ones affected by the earthquake).

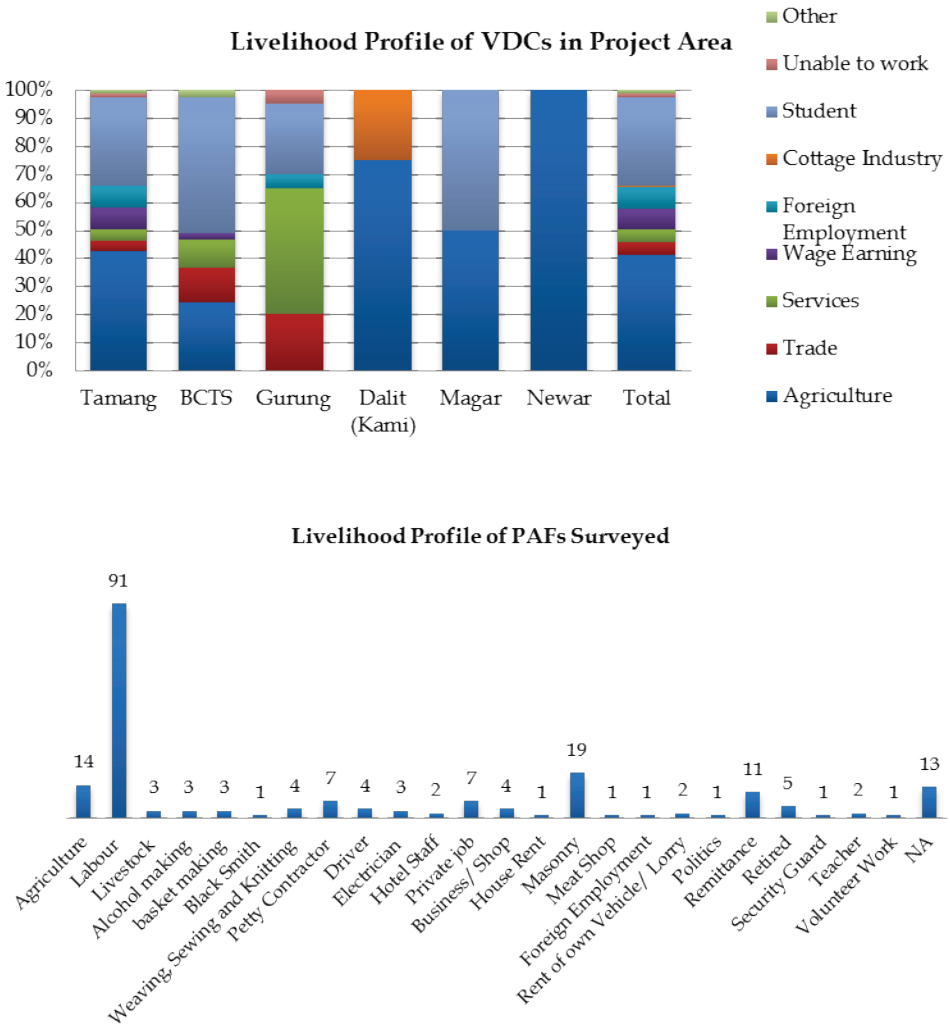
Existing Livelihood Profile and Associates Skill Set of PAFs

Subsistence agriculture has been the mainstay of the economy in the Project area. As can be seen from Figure B.1-18, a significant portion of the population (41.3%) within the economically active age group in the project area reported agriculture as the key source of livelihood. Apart from agriculture, the other sources of income identified are as follows:

- Wage labour (7.3%);
- Foreign employment (7.5%);
- Business (4.9%); and
- Service (4.76%).

As can be seen from the Figure B.1-18, within the project area, the social groups such as Kami, Magar and Newar are reported to have the highest dependence on agriculture. On the other hand, wage earnings and foreign employment is primarily undertaken by the Indigenous groups of Tamang and Gurung. From the discussions with the local community, it is understood that post-earthquake, the dependence on agriculture has reduced, due to loss of access to and damage to

agricultural land; this will however slowly build up once people start going back to their villages and repair their land parcels, some of which are affected beyond any repair, while in other cases they can be worked upon. However, post-earthquake, there has been an increase in the dependence upon wage labour in construction sites and stone breaking.



Source: UT-1 Supplemental ESIA Appendix A, 2014 and LALRP HH Survey 2017 based on the responses given

Figure B.1-18: Livelihood Profile of the Project Area and PAFs

Amongst the PAFs surveyed for the LALRP, the primary source of livelihood is reported to be labour (45% of PAFs) and Masonry (9% of PAFs). This is followed by Agriculture (7% of PAFs) and remittance (5% of PAFs). The remaining sources of income represent less than 5% of the total PAFs. This is a significant shift in the livelihood profile, in comparison to the pre-earthquake scenario, where approximately 50% of the population reported a dependence upon agriculture as a source of income. The decrease can also be seen in terms of complete dependency on agriculture; in most cases, people have been forced to look out for other options.

Post-earthquake, the situation is still uncertain; while the first year after 2015 earthquake, NGOs came out with some sort of support mechanism, this has gradually reduced with help directed on housing, skill building, education, water supply and sanitation. According to the discussions with the PAFs during the LALRP formulation, in the post-earthquake scenario, the livelihood profile of the community is characterised by a larger variation and uncertainty associated with income sources. The survey conducted in April 2017 provides evidence of the livelihood shift in the community. Of the 129 PAFs, 74 reported to having difficulty in finding sources of livelihood. The people were forced to look for livelihood options after the NGO support started diminishing around a year.

The trainings conducted by NGOs provided some skills and cash based support, but the utilisation of trainings after withdrawal of NGO intervention did not take place. Only some people could translate the trainings provided in having gainful employment/ engagement, which is largely in case of occupations like Masonry. Since the period between January 2016 and April 2017 witnessed a lot of activity on reconstruction and rehabilitation front, thus there was a huge requirement of masons, which was fulfilled by these trained people. However, most of the PAFs involved in labour work, reported to be gainfully engaged for approx. 8-15 days in a month. This has also resulted in the PAFs diversifying their livelihood sources, with income from labour work, being supplemented by livestock/ poultry farming, agriculture, weaving, basket making and sale of homemade alcohol.

Furthermore, 28% of the PAFs surveyed during the LALRP, expressed the desire to return to the original settlements. Also, most of the remaining 72% PAFs, reside in IDP camps, on rented private land or government land. Thus, this livelihood profile and the present trends, is largely dependent upon the present residence of the population and are likely to change once again, if the population goes back to the original village or changes location of residence.

Also, while in the pre-earthquake scenario, most women were engaged in agricultural or livestock farming activities, presently a larger number of women are reported to be engaged in income generating activities, primarily stone breaking. This is understood to be resultant from the fact the loss of agricultural land and livestock holding. Women trained on tailoring, weaving and mat making could not continue with the same after withdrawal of NGO support. The people were trained with basic skills of tailoring and handicrafts, which equipped them enough to manage household needs. However, these trainings could not result in income generating activities because of the following reasons:

- Lack of advanced or specialist skills and the general interest in taking things forward without support;
- There was lack of finishing in the goods produced which restricted them being able to adequately sell in the market; and
- Lack of market linkage provided as part of the training.

Another shift in the post-earthquake scenario has been the increased burden on the younger population. This has resulted from the older generations (50 years and above) losing access to agricultural land and livestock holding and to not having any other skill training or physical

fitness to undertake wage labour. While in the pre-earthquake scenario, the elderly population could sustain themselves, by sustenance agriculture or taking care of the family's livestock holding, they are now forced to depend upon the younger generation for support. There are thus situations where the elders of the family are living in a separate household, in the IDP camp or original village, but are dependent completely upon their sons for maintenance and support in terms of provisions, food and medical care.

The following sub sections provide an understanding of the key sources of livelihood amongst the PAFs, namely wage labour, agricultural production, livestock holdings and foreign employment.

Wage-Based Labour

As discussed previously, 7.3% of the population in the project area reported dependence on wage labour as a source of livelihood in the pre-earthquake scenario. However, there is a profound shift in the livelihood profile of the PAFs, from agriculture to wage based livelihoods. 54% of the PAFs reported undertaking wage labour and masonry as the source of livelihood during the LALRP updation survey. This wage labour is primarily daily wage labour and is comprised of both semi-skilled (masonry, plumbing, bag weaving etc.) and unskilled work (stone breaking, labour in shops). The people were trained on construction of houses (both mud and stone) by the NGOs under the "Food for Work" programme.

Stone Breaking

A large number of members from the PAFs have reported to be engaged in stone breaking activities, as a primary or secondary source of income. A large number of unskilled women and aged people (above 50 years) are involved in stone breaking activities, earning an amount ranging from 250-500 NPR per day, being paid on a piece per rate basis. This activity is one of the most prominent sources of income because of its proximity to the IDP camps, especially near Farm Camp and Pradhikaran camp in Dhunche.

Agriculture

In the pre-earthquake scenario, agriculture was reported to be one of the most important sources of livelihood in the community. The main crops grown in the area include paddy, buck wheat, pulses, oil seeds, maize, potato, corn, millets and vegetables. While crops such as paddy and maize are grown primarily for household consumption, crops such as potato and vegetables are grown both for household consumption and for sale in the market. The households owning irrigated land parcels (Khet) are understood to grow multiple crops (two or more) on their land. On the other hand, those households who own unirrigated land (Bari) primarily understood to grow a single crop, with certain households growing vegetables, pulses and potatoes on small scales. Most of the land parcels are reported to be unirrigated, and depending upon monsoons and rainfall for irrigation.

However, post the earthquake, and the damage to agricultural land, there is a marked shift from agriculture to other sources of livelihood. Another reason, for the shift away from agriculture, is the increased proximity of the PAPs to urban areas and consequently non-farm based livelihoods.

As discussed earlier, only 7% of the 129 PAFs surveyed during the LALRP reported a complete dependence on agriculture as a source of livelihood over the last 2 years. Also, these PAFs are reported to be undertaking agriculture solely for the purpose of self-consumption. The present agricultural practices are comprised of agriculture on rented land in the vicinity of the IDP camps and agriculture in Native villages.

Livestock Rearing

The PAFs were understood to have considerable livestock holdings prior to the earthquake, which serves their needs of dairy products, eggs, meat, etc. Of these, the most common livestock holdings were poultry, followed by goats and cattle.

However, the earthquake resulted in deaths/ loss of livestock of the PAFs, leaving the families with no or lesser number of livestock. Furthermore, while most have tried to rebuild their livestock rearing, 75 PAFs (58% of total) report a reduction in the total number of livestock heads owned, while 4 PAFs (3% of total) reported to have same or increased livestock holdings. This is despite training and support being provided to PAFs by NGOs/ INGOs in poultry farming and boar farming as part of relief work post-earthquake.

Some of the reasons for the PAFs not restoring (OR not able to restore) their livestock holdings are as follows:

- Lack of monetary resources for purchasing and maintaining the livestock;
- Lack of space in IDP camps for keeping the livestock heads especially cattle;
- Lack of grazing land, for goats and cattle/bovine especially in Nuabesi, Bogetitar, Satbesi and Battar; and
- Reluctance by PAFs and community to keep larger number of livestock in IDP camps, due to issues such as bad odour and sanitation.

In the present scenario, the livestock holdings comprise of poultry, goats, cattle/bovine, and boars/ pigs. Of the PAFs surveyed, only 2 PAFs reported owning boars. While one household reported owning one boar, the other household reported to owning a pair.

Small Enterprises

It has been understood from the consultations with PAFs from Haku Besi and PhoolBari that a lot have families were having small grocery shops, restaurants, tea shops, etc. in their original villages prior to earthquake.

Some people had also bought land in and around Dhunche and had set up small shops in the newly purchased land or land rented land being used for residence. These shops are reported to have comprised of meat shops, tea shops, grocery shops, etc. In this case, the prior experience of managing an enterprise and savings helped restart business enterprises in the new setting. It has also been observed and understood through consultations that new enterprises are also being set up in Nuabesi and Khalde camp areas, but the people venturing in this area for the first time

require some handholding support in terms of technical knowledge of managing an enterprise in order to run their venture profitably.

Migration to other Countries

It was understood during the survey and the consultations undertaken in May, 2017, that a lot of young population of the community is increasingly getting interested in foreign employment. Consultations suggested that migration to other countries was existent earlier as well, but the number of people opting for and investing in this option is definitely on the rise with more people thinking around these options. Apart from this, many households also reported having family members, who had gone for wage labour to foreign countries for a few years, and had saved money and subsequently returned back to Nepal. The most common country for migration presently is China (kerung and China-Nepal border) for short term, whereas Malaysia and middle-east countries are considered for long term opportunity (3 years). The most common nature of activity for migrant workers is as masons or labourers.

The primary objective of foreign employment is reported to be the savings from the salaries that can be brought to Nepal and put to productive uses like buying land, construction of house, buying assets like trucks, etc.

Trainings Provided by NGOs/Government in Project Area/Rasuwa District

The influx of NGOs began right after the earthquake and the number was at its peak during that period. There have been developmental efforts in areas of provision of supplies, reconstruction, trainings, etc. during the period between May 2015 and May 2016 in the IDP camps; involving the local community in the project area.

The number of NGOs active in Rasuwa district during the first year was reportedly 200 (some of them directly on the ground while others through the local NGO partners) and it reduced to nearly 20-25 in the first quarter of the second year (2017), which also kept decreasing gradually.

The current activities in Rasuwa District are reported to the National Reconstruction Authority (NRA) in quarterly coordination meetings. During the consultations with NRA Project implementation Officer (PIO) in March, 2017, it was mentioned that currently, nearly 18 NGOs and INGOs involved in various interventions which revolve around livelihood, capacity building, house reconstruction, WASH, child care, education etc.

Some of the key NGOs and their area of interest are discussed subsequently. Most of the INGOs and national level prominent NGOs (like Parivartan Nepal), Bilateral and Multilateral agencies are operating in the Rasuwa district through selected local NGO partners who had a long standing presence and resources in the area.

Table B.1-22: Key NGOs in Rasuwa According to Area of Interest

NGO/INGO	Area of Interest
Build Change;	Housing Reconstruction
Lumanti; (with Parivartan Nepal)	Housing Reconstruction and livelihood restoration
Nepal Red Cross;	Housing Reconstruction
Batas Foundation;	Housing Reconstruction
Manekor.	Housing Reconstruction and livelihood restoration
Laccos	Livelihood Restoration

The key NGOs presently active in the IDP camps of Nuabesi and Batar include Manekor, LACCOS and Lumanti. Lumanti has also been undertaking livelihood restoration trainings in the IDP camps, in collaboration with Parivartan Nepal. Consultations with the NGOs suggested that most of these interventions related to livelihood support and training will be over in the period from June to October, 2017 and there is lack of clarity on further fund availability for these kinds of interventions.

In Dhunche area, where the PAFs of Haku Besi and Phool Bari are residing, not much intervention has been undertaken by above mentioned NGOs. The limited number of trainings provided to PAFs has been through Cottage and Small Industries Board.

Mode of Operation of NGOs and Training Provided in IDP Camps

Based on the consultations undertaken with the NGOs such as Manekor, Lumanti and LaCCos, it is understood that the NGOs have identified target areas as women's group, men's group and youth group. The specific skill training for each of the groups was identified keeping in mind the expectations, capacity and practical feasibility of each activity identified for each group.

Consultations undertaken with NGOs and later corroborated with people in the IDP camps suggested that following types of training were provided as enlisted in Table B.1-23.

Table B.1-23: Livelihood Support by Main NGOs in Rasuwa District

Target Group	Manekor	LaCCos	Parivartan Nepal
Men Focused	• Tourism Capacity Building • Sherpa Training • Plumbing training • Electrician Training • First aid Veterinary training	• Training for Tomato farming • Driver training • Electrician training • Mobile repair training • Mechanic training	• Plumbing training • Electrician Training
Women Focused	• Machines for Spice grinders • Tailoring training • Sewing Machines		• Daka making training

Target Group	Manekor	LaCCos	Parivartan Nepal
Men and Women Focused	• Bakery and Cooking Training • Infrastructure support • Water Sanitation and Hygiene training • Seed capital for enterprises • Farming equipment • Ground apple cultivation • Coffee machines for tourist lodges • Boar Farming	• Livelihood Promotion Programme • Local Governance Community Development Programme • Sustainable Action for Food Security and Resilience Programme	• Poultry farming training • Vegetable farming training • Boar farming training • Seed capital for poultry and boar farming • Soap making training
Other support	• Provision of Accommodation and travel for those attending training • Drinking Water provision for impacted villages • Establishment of user committees • Market linkages	• Financial Assistance immediately post-earthquake • Irrigation and water systems • Construction of training centre • Market place for vegetables and other produce • Water Supply to local schools	• Reconstruction Assistance to NRA
Funding Support	• UNDP • DfID • LWF • Save the Children	• USAID	NA

Source: Limited consultations with NGO

The NGOs have undertaken the livelihood trainings in order to train the people in their areas of operation in Rasuwa district on certain skills on basic level, such that it could prove as an entry point of livelihood activities for people, who needed initial thrust to move out of the stalemate developed due to earthquake. The Table B.1-24 provides an understanding of the manner in which Parivartan Nepal provided various trainings for people residing in Nuabesi camp.

Table B.1-24: Details of Training (Earthquake-Affected Families Residing in Naubise Camp)

Training	Number of People per Batch	Duration per batch	Support Provided to beneficiaries through Parivartan Nepal
Poultry Farming	No batch size limitation	7 days	• Accommodation • Meals • Travel Allowance based on the following: – 1 hour of walking: NPR 100 – Bus travel: ticket refund
Vegetable Farming	No batch size limitation	7 days	
Driving	~20	21 days	
Plumbing	~20-25	390 hours/ 65 days	
Masonry	~25	7 days	
Electrician	~20	390 hours/ 65 days	
Daka Making	~20-25	390 hours/ 65 days	

Note: Consultations with PAFs in Nuabesi IDP camp

The NGOs have been very active in areas near Nuabesi, Bogetitar, Satbise and Battar, where one or more people from each PAF have been reported to have attended one or more skill trainings. However, the scenario in Dhunche is remarkably different where skill trainings have not been received by a considerable number of PAFs.

Effectiveness of Training Programmes

The discussions with the local community on the trainings have helped in understanding their takeaways from the training and the challenges in fully utilising the learning which are enlisted below:

- A lot of households in the IDP camps (except Battar and Satbise) have received one or more livelihood trainings;
- The number and range of trainings by NGOs was larger in Nuabesi and Bogetitar areas, as compared to Dhunche;
- Most of the training is on basic skills, which were scaled up and utilised for their benefits by certain people and could not prove helpful for many others; In certain cases the training was useful for the people who had existing skills in that particular area such as masonry;
- Some of the people trained on masonry skills have reported to be trained on construction earthquake resistant houses, which they think is an essential skill in Nepal;
- The people who got trained as carpenters reported that the training has been essential for building a new skill, but the demand of this skill is not in profusion and hence earnings are irregular.
- People having received masonry, plumbing, and electrician trainings have been able to gain some employment in the nearby areas and to a very limited extent in urban centres; however there is not much opportunity in the District itself. Masonry demand was there as a lot of reconstruction work was being undertaken; and
- Women of some families have engaged in small collective vegetable gardens to meet their daily family requirements. The seeds are provided the NGOs and the entire operation is also presently regulated by NGO representatives. However, the independent functionality and success of these groups will be understood, after the NGO support will be withdrawn.

Key Learnings from Training Outcomes Provided by NGOs Post-Earthquake (2015)

It has been understood from the consultations and focus group discussions that not everyone has been able to utilise their trainings in livelihood / income generating opportunities. The reasons for this varied across the trainings, depending upon the skill set in question.

It has been understood from the consultations and focus group discussions that not everyone has been able to utilise their trainings in livelihood / income generating opportunities. The reasons for this varied across the trainings, depending upon the skill set in question. The understanding of some of the general reasons identified for the trainings being unsuccessful is as follows:

- Apparent lack of willingness of individuals to pursue regular employment;

- There are certain people who attended training just for the sake of being engaged and to earn money being paid to attend trainings;
- A large part of the community people don't want females to go out and work in case of less wages;
- People have limited understanding and awareness on scope and possibilities of employment and need elongated period of hand holding;
- People tried initially, though stopped once they did not get desired outcome in terms of financial gains.
- In some PAFs, the people are engaged in foreign employment, which fetches comfortable money which is required for sustenance. The family members of such families are less interested in making an effort even after receiving trainings.

The following table provides an understanding of some of the reasons identified for the specific trainings being unsuccessful or not yielding intended results.

Table B.1-25: Reasons for Skill Training not being Successful

S. No	Type of Training	Reasons for not being successful
1.	Poultry	While some of the PAFs could gainfully utilise their poultry training after withdrawal of NGO support, a large number of people trained on skills to manage poultry could not take it forward successfully because of the following: • Limited space for poultry farm near camps; • Lack of proper understanding of potential diseases and requirement for vaccinations • Availability of resources such as electricity and water supply, which are critical for the proper growth of the chicks;
2.	Tailoring and Handicrafts	The people were trained with basic skills of tailoring and handicrafts, which equipped them enough to manage household needs. However, the reasons it did not result in income generating activities are: • Lack of advanced or specialist skills and the general interest in taking things forward without support; • There was lack of finishing in the goods produced which restricted them being able to adequately sell in the market. • Lack of market linkage provided as part of the training;
3.	Masonry	There is saturation of skills in market. With majority people trained on masonry skills the supply has outgrown demand in the area;
4.	General Issues	• Apparent lack of willingness of individuals to pursue regular employment; • There are certain people who attended training just for the sake of being engaged and to earn money being paid to attend trainings; • A large part of the community people don't want females to go out and work in case of less wages; • People have limited understanding and awareness on scope and possibilities of employment and need elongated period of hand holding; • In some PAFs, the people are engaged in foreign employment, which fetches comfortable money which is required for sustenance.

Key Learnings from NBGOs Working with Groups

The initial assessments undertaken by the NGOs on each target group helped them in identification of behavioural patterns and expectations of each group (enlisted in Table B.1-26).

Table B.1-26: Characteristics and Expectation of Target Groups

Target Groups	Characteristics
Women's Groups	• The members of which engage in different activities like handicraft, hotels, business enterprise, poultry, etc.; hence there is not much competition; • Expects clear communication and transparency in terms of support provided, timelines of various activities; • Want clarity in the group selection criteria; • Good field agent is critical for successful intervention with this group.
Men's Group (25-40 years)	• They are the main breadwinners of the family and hence tend to turn self-centred when opportunity comes, especially in the given scenario, where the source of income are less; • A considerable proportion of this group is illiterate and hence less aware; • The educated and financially comfortable individuals take responsibility for the group at large and emerge as opinion leaders and decision makers for the group; • This group has an inclination towards working as construction labourers /masons as it is considered as a masculine activity; • The illiterate members of this group are apprehensive of working/ attending trainings in groups, especially with literate folks.
Youth Group (17-25 years)	• Energetic and quick learners; • Clear decision making and thought process; • Involvement in the development and welfare of the community; • Open to working in groups • Interested in conducting adult literacy classes for the community

Note: NWEDC will use this information for preparation of the EST to meet the requirements under PDA.

1.11.3.3. Planning for Employment and Skill Training

Expected Labour Force Requirements over the Project Live Cycle

The following table presents a mapping of the labour/workforce requirement for the project. This shall include Nepali and Non- Nepali workforce requirements for NWEDC as well as its Major Contractors.

Table B.1-27: Labour Requirements

Sr. No.	Category of Manpower	Minimum Educational Qualifications	Technical Skills / Competence Certificate Desired (if any, please specify)	No. of Years of Experience Desired (if any, please specify)	Nos. Required in 2017				Nos. Required in 2018				Nos. Required in 2019				Nos. Required in 2020				Nos. Required in 2021				Nos. Required in 2022			
					1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q
Skilled																												
1.	Driller																											
2.	Blaster																											
3.	Welder																											
4.	Heavy Eq. Operator																											
5.	Plant Operator																											
6.	Foreman																											
7.	Fitter																											
8.	Plumber																											
9.	Carpenter																											
10.	Electrician																											
11.	Technician																											
12.	Supervisor																											
13.	Mason																											
14.	Security Head																											
15.	Others (Please Specify in separate rows)																											
Semi-Skilled																												
16.	Account Helper																											
17.	Stores Helper																											
18.	HR & Admin Helper																											
19.	Cook																											
20.	Asst. Welder																											
21.	Asst. Foreman																											
22.	Wiremen																											
23.	Others (Please Specify in separate rows)																											
Unskilled																												
24.	Office Attendant																											
25.	Survey Helper																											
26.	Quality Helper																											
27.	HSE Helper																											
28.	E&M Helper																											
29.	Geologist Helper																											
30.	Cook Helper																											
31.	Service Boy																											

Sr. No.	Category of Manpower	Minimum Educational Qualifications	Technical Skills / Competence Certificate Desired (if any, please specify)	No. of Years of Experience Desired (if any, please specify)	Nos. Required in 2017				Nos. Required in 2018				Nos. Required in 2019				Nos. Required in 2020				Nos. Required in 2021				Nos. Required in 2022			
					1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q
32.	Cleaning Boy																											
33.	Pantry Helper																											
34.	Helper/Labour																											
35.	Security Guard																											
36.	Others (Please Specify in separate rows)																											

Note:

- Such a mapping exercise shall be undertaken based on discussions with its project team, contractors and sub-contractors to obtain an overview of the required laborers in terms of skill level.
- This will be done for each phase of the Project, and opportunities to include local labor will be identified.

Expected Opportunities for Employment and Skill Development

On the basis of the workforce requirement, NWEDC will identify the expected opportunities for employment and skill development at local levels.

Existing Expectations

One of the main expectations of the local community is that they receive opportunities for livelihoods and income generation from the project;

- This may be in the form of direct or contractual employment.
- Most of the community reported to looking for employment as security guards and housekeeping staff in the project.
- One of the key expectations is do with the driving training which is locally considered to be a better opportunity for employment in the long run; this can be supported with mechanic training as one of the other options.
- In terms of skill development the community's expectations primarily pertain to enhancement of the existing skill level, and allowing a larger proportion of the community to develop skills that are useful for income generation.

NWEDC shall further strengthen the understanding of local community's expectations during the skill mapping exercise.

Existing Skill Mapping

Thus as can be seen from the above discussion, there is an existing skill set in the local community which may be of use for the project. In summary, the following aspects should be kept in mind of the existing skill set in the community:

Table B.1-28: Skill set Overview Pre & Post Earthquake (April 2015)

Timeline	Skillset
Skill set in pre-earthquake scenario:	• In the pre-earthquake scenario, the local community was primarily dependent upon agriculture and livestock farming for livelihood purposes; • The education and literacy levels in the local community were generally low due to a lack of access to infrastructure; • There were a few of the youth in the local community who were engaged in foreign employment, but these were limited to only a few households; • Business, small enterprise, wage labour was limited to a selected segment in the affected villages.

Timeline	Skillset
Skill set in post-earthquake scenario	• A number of NGOs/INGOs entered in the area in the post-earthquake for providing relief support to the local community • As a result of the trainings provided, the overall skill level in the community improved • However, most of the skill level in the community is still basic and preliminary. This is primarily because the trainings provided by NGOs were basic for a short duration and primarily aimed at allowing the community to stabilize their living conditions post-earthquake and cater to the needs in the local area • The overall literacy level is also understood to be improving as the community has increased access to schools and improved infrastructure • The number of young members of the community seeking foreign employment has also increased

Consultations indicate that in general, the young population usually don't continue education after SSC level; no one reported university level in the recent survey for LALRP. The priority for the people is to get such skillet which will allow them to find jobs in Nepal and other countries. Certain skills are more in demand in these countries; for Women- housekeeping, packing etc. while for men it is driving, mechanic, electrical etc.

Note: While doing so NWEDC will look at the existing expectations as well as the existing skill levels in the community. This information can be used to assess the workforce requirements that can be met from the local community and district:

- Without any additional training;
- With some additional training.

This will also take into consideration additional employment generation or business opportunity that will be required to support the Project.

Once the skill training requirement for employing the locals is identified, NWEDC will need to identify the agencies (NGOs/ Government agencies/ Technical agencies/ Universities/ Training institutes etc.) which can help in providing training to the locals.

This will be done based on the following (but should not be limited to):

- Review of the information available with the government, in terms of the following:
  - Number of registered agencies, per resource requirement
  - Details of training and certification programmes available with the government
  - Details of training programs by NGOs/INGOs/Universities and other agencies (if available)
- Consultations with stakeholders, including:
  - Government departments
  - NGOs/Agencies working in the field of entrepreneurship development
  - Representative of contractors/ suppliers and vendors, large; medium and small scale

As part of this process, a mapping will also be done of the existing initiatives for skill enhancement by other stakeholders, such as government agencies and other projects in the district. The Company will then be in a position to assess the skills background of the locals and finalise the trainings required, number of labours to be employed and budget needed.

Other Expected Opportunities in the Area for Employment and Skill Development

The Rasuwa district is expected to have a lot of opportunities for employment and entrepreneurship ventures in the coming years. This is primarily attributed to the development of other hydropower projects being developed in the district as well as the One Border One Road initiative.

Note: As part of this Section, NWEDC will undertake a broad level mapping of the potential employment and skill development opportunities outside the project in the area.

- This may be done through consultations with the government departments and other projects being set up.
- This mapping will in turn allow for the project to identify other opportunities for employment of local community.
- This will also allow for specific skill sets to be identified which may be in demand in the near future for training purposes.

NGOs with previous experience of working with communities on livelihood restoration in the district and elsewhere in Nepal will serve a good resource to identify opportunities outside Project area.

NWEDC and Major Contractors: Measures to Recruit and Train Workers

In keeping with the requirement of manpower thus identified, a detailed plan shall be formulated for each year/phase of the project, to allow maximum locals to be engaged.

The company will develop a plan to be followed for recruitment of the locals during the development of the project. The plan will be at two levels, the macro level (for the entire project lifecycle) and the micro level (an annual plan). The various recruitment methods which will be considered include:

- Direct recruitment of locals;
- Recruitment through local agencies;
- Recruitment with NGOs and other welfare groups.

The process will include the following steps:

- Development of a selection criteria;
- Short-listing of agency/NGO for recruitment;
- Method of approaching the local community;
- Contract terms and conditions, if any;

As far as practicable, the Company shall attempt to transfer the skills of skilled and semi-skilled foreign personnel to Nepalese counterparts during the course of Project implementation. However, the transfer of skill set would depend on the existing skill levels.

Development of Employable Skills and Human Resources

Vocational and Livelihood Training to Locals

The Company will also look into the feasibility of providing livelihood training to the locals to improve the economic conditions of the area. These may include the following types of training or support:

- Vocational training to the locals;
- Assistance to farmers;
- Forest conservation activities;
- Training to women in the area;
- Provision of apprenticeship programs; and
- Improvement of education facilities in the area.

Each of these trainings will be accompanied with a market linkage training, to allow for maximum benefit to be accrued from the training.

The provision of such livelihood trainings will focus on possible training opportunity in:

- The area- specific farm (agriculture, animal husbandry);
- Small orchards and other farm based allied activities) and non-farm linked training;
- Productivity improvement (knowledge transfer); and
- self-employment program

Women consultations suggest that women are interested in such activities and have experience. Consultations with local NGOs like Manekar suggest that in past similar experiments have not succeeded such as agarbatti (incense sticks) making as cost of production was too high and not competitive. Some areas are quite remote and market access is a problem. In another case of improved potato farming intervention, over production and lack of access to market and storage facilities resulted in farmers not making enough profit which further dampened the spirit of the farmers. The Project access road may change this- and provide market connectivity. Too much training for stuff like Shama weaving may overcrowd the market for women who have already been trained. Therefore, new trainings need to be identified based on these learnings.

Any such interventions will need to identify proper market linkage, and will require specific NGOs/ Institutions with past experience. Self-development activities could be piggery, poultry etc. however learning from the intervention made by NGOs post-earthquake will be important to understand the reason for success/ failure of such interventions. Risk appetite of the people especially after the earthquake should be an important consideration.

The One Border One Road initiative market linkage is likely to expose them to other market opportunities which may exist.

Note: Some of the key aspects which will be kept in mind while preparing the plan are as follows:

- For business and entrepreneurship training, preferably individuals or households with a high risk appetite will be identified;
- While formulating a plan for each training, care will be taken to not saturate the market with a particular skill such as Shama making. For this purpose, multiple trainings should be identified, with the total number of individuals trained in each limited to a number which is agreed with the GoN.
- Some training which will be considered include those pertaining to the tourism sector, such as housekeeping and running restaurants, running inns and home stays, Tamang trails etc.
- While identifying any training, focus/ priority will be given to those trainings which will allow for jobs to be found within the country and then in foreign countries.

Training in Course of Employment

Depending on the project phase and activities, the Company will provide the following types of trainings to the local labourers:

- Induction training;
- General H&S training;
- Vocational training to workers and locals;
- Specific on-the-job training;
- Firefighting and mock drill training; and
- Operation and maintenance training.

The company will appoint staff responsible for the implementation of the trainings to the identified locals. Additionally, training materials, schedule and budget will also be developed for each of the training sessions.

The company and GoN will jointly decide the frequency of the trainings and any other additional requirements.

Training Schedule

Training schedule will be developed by NWEDC which will include details regarding the type of training, batch per training, frequency, and staff to be trained.

1.11.3.4. Implementation

This section will provide an understanding of the overall implementation mechanism for the ESTP thus formulated, in keeping with the specific plans put in place.

Note: NWEDC shall formulate this implementation mechanism based on the specific requirements of the plan, the resources available and the requirements of the GoN.

Organisational Structure

The NWEDC and GON, as per section 11.3.2 (of the project development agreement) jointly prepare the ESTP to be implemented within 12 months from the Agreement Date in accordance with Schedule 12 of the PDA.

The implementation of the ESTP thus formulated shall be undertaken by the ESMC of the project.

NWEDC will put in place a team with clear cut roles and responsibilities for the implementation of the detailed plan. This section (and sub sections) will provide an understanding the team and the manner in which they will be involved in the implementation. Some key things to be kept in mind and questions which will be answered as part of this section are as follows:

- NWEDC's role and
- Role of HR Personnel
- Role of CSR Personnel
- Possible implementation partner
- GoN's role
- The role of third parties (if any)
- Roles and responsibilities for each stakeholder

Implementing Partners

For the purpose of implementing specific trainings identified, NWEDC shall associate with external third party experts, who have experience in the field and the geographical area. Cottage & Small Industries Training department is one of the key departments which has customised training calendar for different skills. It not only conducts training on its own, but also helps NGOs to conduct training, identify resource person, has dedicated infrastructure for conducting training. There are some specific vocational training institutes in Kathmandu which provide vocational training. NWEDC is already in talks with some of them.

For this purpose, NWEDC will also undertake consultations with the CDO and NRA, for an understanding of the organizations active in the area.

As part of this section, NWEDC will identify NGOs/INGOs and government department/ agencies who shall be involved in the implementation of the plan thus formulated. Some of the key agencies identified include Manekor, Parivartan Nepal, Cottage Industries department, veterinary department, horticulture department etc. Company will build on such networks and allow for opportunities to be created for knowledge transfer.

Interlinkage with other Plans

The ESTP thus formulated are part of a larger social impact management framework for the project and shall be implemented in coordination with the other management plans such as the following (but not limited to):

- LBSP
- Stakeholder Engagement Plan
- Livelihood Restoration Plan
- Grievance Redressal Mechanism
- Labour influx management plan

Note: This section will provide a brief description about the effectiveness of the institution/implementation agency for planning, management, monitoring and delivery of the plan.

This will also include suggestions for workable linkages with other programs/projects (government-run; multi/bi-lateral agency sponsored).

Schedule for Implementation

This section provides an understanding of the schedule of implementation of the plan thus formulated.

NWEDC will put in place a schedule for implementation of the ESTP, in discussion with GoN. This schedule will provide an itemized timeline for each step of the implementation process

1.11.3.5. Engagement Strategy

An essential component of the implementation of the ESTP is the engagement with the local community and other external stakeholders.

This section will provide the Engagement strategy for the ESTP. The strategy will be specifically to explain the key needs and sensitivities viz communities, government stakeholders and the EST plan.

Although this will be in line with the overall stakeholder engagement activities of LALRP /ESIA and other plans formulated, it will describe how to position EST actions and address a larger audience (3 VDCs and beyond). The engagement strategy will include the following:

- Aim, objectives of ESTP;
- Coverage, potential beneficiaries and thematic areas;

- Phased approach, timelines and outcomes;
- Grievance management (as per EIA/ESIA/LALRP); &
- Feedback, documentation, communication, multi-media.

1.11.3.6. Monitoring and Review Mechanism

The Employment and Skills Training Plan will serve as a macro plan that will be constantly reviewed and updated on annual basis, throughout the project lifecycle. Micro plans will be developed, that will comply with the major principles identified, and are ready for implementation during the project activities.

- Schedule with milestones and tracking of delays;
- Responsibilities of NWEDC, GoN, implementation partners and any third party involvement for monitoring purposes;
- Provision for internal and external monitoring;
- Frequency of monitoring and review;
- The KPIs for internal and external monitoring;
- Process of reviewing and updating the ESTP based on the findings of the monitoring reports;
- Overlaps and integration with project and other reporting timelines (LALRP etc.); &
- Systems and institutional linkages for feedback and mid-course correction.

1.11.3.7. Budget

NWEDC will ensure that adequate budget is allotted for the implementation of the ESTP.

This section will provide an itemized budget for each step in the implementation of the ESTP.

1.11.3.8. Reporting and Documentation

As per the agreement, NWEDC shall submit annual reports, GON describing in detail the activities undertaken under the Plan, the amounts spent on such activities and impact evaluation of such activities.

Other documents which will be maintained during the plan implemented will include, but not be limited to, the following:

- Meeting minutes during the supply and demand mapping consultations;
- Training records;
- Records of human resources involved in the project and the number of locals employed;
- The number of locals supported with other employment opportunities and trainings; and
- Any complaints or grievances obtained.

Person in charge for maintaining documents will be appointed by the Project team.

As part of the detailed plan, a reporting mechanism will be put in place, in consultation with the GoN, which will provide an understanding of the following:

- Requirement for internal and external reporting;
- Frequency of reporting;
- Format- report, presentation, verbal discussion etc.

Person in charge for maintaining documents will be appointed by the Project team.

1.11.4. Industrial Benefit Sharing Plan

This section will present the Industrial Benefit Sharing Plan (IBSP) developed for the project. This plan will be focused only on the procurement of materials and goods from the locals and shall not specify requirements for any skills and employment training to be imparted. Requirements of the same are detailed in the Skills and Employment Development Plan.

As per PDA, (Section 11.9) - Use of Nepali resources; training and development:

The Company shall, and shall procure that its Contractors and Representative shall, in connection with the conduct of the Project:

11.9.1	*maximise the use of Nepali resources and give first consideration and full and fair opportunity to technically and commercially qualified Nepalese citizens and firms provided that in each case, the use of such Nepali resources meet the quality, quantity and availability requirements of the Company and provided further that use of such resources does not have a material and adverse impact on the costs and the timelines for the Project;*
11.9.2	*ensure that its Nepal Industrial Benefits Plan provides for an outreach programme under which the Company engages with Nepali suppliers for Project-related opportunities;*
11.9.3	*comply with the Laws of Nepal including the Labour Act, 2048 and Labour Regulation, 2050;*
11.9.5	*conduct employee training programmes from time to time, including training in each of the skills used in the Project, including management training;*
11.9.6	*comply with the Nepal Employment and Skills Training Plan, Nepal Industrial Benefits Plan and Local Benefit Sharing Plan and ensure that appropriate programmes are designed to assist suitable Nepali citizens, entities, and firms to meet the Project's requirements for goods and services;*
11.9. 7	*shall (to the extent applicable) submit reports every six (6) months to GON for the first three (3) years of the Construction Period and every twelve (12) months thereafter, describing in detail (A) its employee training programmes, (B) the implementation of such training programmes, (C) the progress made towards meeting the objectives set forth in· this Section 11.9 (Use of Nepali resources; training and development) the Nepal Employment and Skills Training Plan, Nepal Industrial Benefits Plan and Local Benefit Sharing Plan.*

1.11.4.1. Objective of the IBSP

The IBSP has been formulated in keeping with the requirements of the PDA signed on 29th December 2016. The plan has been developed by NWEDC and GoN & GoN nominated agencies. The plan, to be implemented jointly by GoN and the Company has the following objectives:

- Ensure full and fair opportunity of access for Nepal-based suppliers of goods and services to participate in the development of the Project;
- Help in promoting a vibrant, growing, competitive supplier base within Nepal that over the time shall meet higher value-added requirements for goods and services for the Project;
- Encourage initiatives for joint venture and quality improvement measures that shall enhance the ability of Nepal-based suppliers to compete domestically and internationally; and
- Promote safe and healthy working conditions among suppliers of goods and services to the Company and the Project.

The objectives of the Plan will be discussed with GoN and any changes in the objectives will be made accordingly.

1.11.4.2. Resource Requirements for the Project

Since there are immediate service requirements and early construction, preliminary Nepal Industrial Benefits Plans shall consider the availability of engineering, legal, planning, consulting and construction services, while the detailed design phase shall enable more precision on the specific requirements for goods and services and their timing that would enable Nepal-based suppliers to be accommodated.

NWEDC will undertake a mapping of the requirement of resource through the project lifecycle, in terms of the specific resource required and any quality and size specifications (Itemisation and quantification of goods and services required over the Hydro Property life cycle).

The following table provides an example of the output which will be presented. This will be done for each phase of the Project, and opportunities to include local population will be identified.

This information should be broadly shared with potential suppliers well in advance to enable them to compete on a full and fair basis. This information could be just shared capturing the basic/ broad requirement. Detailed information will be shared at later stages when specifics are available.

Table B.1-29: Resource Requirements

Sr. No.	Category of Resource	Quality Specifications	Nos. Required in 2017				Nos. Required in 2018				Nos. Required in 2019				Nos. Required in 2020				Nos. Required in 2021				Nos. Required in 2022			
			1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q
1.	Water																									
2.	Fossil Fuel																									
3.	Cement																									
4.	Gravel																									
5.	Office Stationery																									
6.	Housekeeping supplies																									
7.	Furniture																									
8.	Computers																									
9.	Printers																									
10.	Four Wheelers																									
11.	Bulbs																									
12.	Tube lights																									
13.	Construction equipment																									
14.	Labour and Manpower																									
15.	Others….																									
16.	Others….																									
17.	Others….																									
18.	Others….																									
19.	Others….																									
20.	Others….																									
21.	Others….																									
22.	Others….																									
23.	Others….																									
24.	Others….																									

Note: The above table provides certain examples of the resources which will be considered and mapped. NWEDC will undertake a detailed mapping exercise, based on discussions with various departments involved in the construction and post-construction activities. This mapping will be undertaken for various stages of the project including:

- Pre-construction and design;
- Early construction;
- Construction;
- Commissioning, (if any specific resource is required);
- Operations; and
- Decommissioning.

1.11.4.3. Vendor Strategy and Procurement Principles

This section will put in place the key principles and policy points which shall guide the process of industrial benefit sharing for the entire life cycle of the project.

Some of the key principles include the following (but shall not be limited to):

- The procurement process shall ensure full and fair opportunity of access for Nepal-based suppliers of goods and services to participate in the development of the Project;
- The procurement process shall be undertaken in a manner so as to encourage initiatives for joint venture and quality improvement measures that shall enhance the ability of Nepal-based suppliers to compete domestically and internationally; and
- While procuring locally, promote safe and healthy working conditions among suppliers of goods and services to the Company and the Project.

Note: NWEDC shall identify all the principles which shall govern the IBP.

1.11.4.4. Procurement Plan

Based on the principles identified, NWEDC will put in place a procurement plan for the project. The procurement plan will be aimed at allowing for the utilization of the existing resources while also enabling the development of new skills and capacities. The key steps in the procurement plan are discussed below.

Mapping of Nepal-Based Suppliers

While there should be some existing information on the suppliers through some government directory or exchange. This mapping shall include the movable and immovable goods resource requirements. The workforce required for the project shall be covered in the ESTP formulated for the project.

This mapping shall provide an understanding of the following:

- The present organizations which have the existing capacity of serving as contractors and suppliers for the project, in terms of manpower, quality control, availability of raw material, resources to meet the timelines, legal compliances etc.;
- The present organizations which may not have the existing capacity, but can be given trainings and hand holding support to allow them to serve as contractors and suppliers for the project;
- The smaller organizations who can serve as subcontractors to the main contractors for the project.

Registration Process

As part of the procurement plan, NWEDC will formulate a registration process for the project. This registration process may be in the form of hard copy forms to be filled out or an online registration process.

The basic information which would be required for registration purposes, such as (but not limited to):

- Registered Name
- Know Your Customers (KYC) Documents
- Resource/ Material(s) to be supplied
- Certifications and registrations required for the material identified;
- Past experiences;
- Contact Information
- Present capacity;

A vendor or supplier may register for multiple products as well.

Note: In case an online registration process is identified, handholding support may be considered for those who are not adequately trained in computers. Alternatively, the project may consider simultaneously providing an offline registration option for such vendors. The information should be provided through mass mediums like local TV channels, local popular newspapers etc.

Timely Disclosure of Information

Early interaction with Nepal-based suppliers, both existing and potential, is strongly encouraged by GON. All Project phases shall be addressed in procurement plans to afford opportunities for Nepal-based suppliers for goods and services.

NWEDC understands that timely information sharing, enough time to respond and ease of access to communication will be some of the key measures that NWEDC to help enhance local supplier prospects of business success.

NWEDC may consider having an online portal system for early notification for vendor opportunities (it should be matched with newspaper notifications too).

- A critical component of the procurement plan will be the timely disclosure of information pertaining to available opportunities.
- As part of this disclosure, the project will provide information pertaining to the timing, quantity and quality of resource requirements for the project. This would then allow for the vendors to bid for the project.
- The disclosure process to be followed is to be in keeping with the principles identified in the Stakeholder Engagement Plan for the project.

Note: This could be supplemented by NWEDC interaction (in the form of workshop) with key domestic suppliers to help them understand the timing, quantity and quality requirements for goods and services.

Vendor Selection Process

Once the registration process is complete, a short list of qualified vendors will be formulated and maintained in a project database. These vendors and suppliers will then be provided with opportunities for providing services for the project.

Note: As part of this section, NWEDC will identify certain basic parameters for the selection of vendors.

Opportunity will also be provided after giving the disqualified vendors an opportunity to improve with clear feedback on opportunity for improvement.

Vendor Proposal Selection

Based on the information disclosure, the short listed vendors will be identified to submit proposals for each resource requirement. These proposals will then be accessed in terms of the project's quality, cost and EHS requirements.

NWEDC will also take extra efforts for proper structuring of procurement packages at a scale to encourage domestic supplier participation, where possible; this is to ensure that local vendors do not lose out on the opportunity because of the sheer scale of the contract package.

For this purpose, the project may consider develop a marking system with each criterion carrying certain weightage.

- If such a system is developed, the local firms will be given an additional bonus score, to promote local industrial skill development.
- The vendor with the highest score overall will be invited for final negotiations or for providing services.
- The procurement packages formulated will also allow for the local vendors to participate.
- The disqualified vendors at this stage will also be given clear feedback on the gaps or the reason for non-selection to ensure better performance during next bidding process. This

mechanism will be aimed at providing constructive feedback to the vendors and assist in improving their performance.

Capacity Building and Support Activities

It is understood, that initially it is possible that few local vendors and suppliers may qualify, due to lack of present capacity. Efforts will be made to support GON initiatives for domestic supplier development activities to enhance upgrading of capabilities and product and services quality and competitiveness.

- In keeping with this, NWEDC will undertake capacity building activities with local vendors. The primary purpose of this capacity building will be to allow for the improvement of local supplier's prospects of business success.
- Efforts will be made at every stage to ensure that local vendors and supplier's capacity are built up.
- NWEDC will also put in efforts at encouraging joint ventures between local and foreign suppliers to enhance knowhow transfer;

The target group for these capacity building activities shall be:

- Small and medium size vendors, who wish to increase their productivity;
- Vendors who at the outset do not qualify, but wish to improve their performance and capacity;

Some of the key areas of focus for capacity building have been identified below. NWEDC will, in consultation with GoN, finalize and put in place a plan for the same.

- Workshop/ Induction Training;
- Job-specific On-site training;
- Cluster Development;
- HSE Training;
- Joint Ventures;
- Bank Linkages;

1.11.4.5. Implementation

Organisation Structure

The NWEDC and GON, as per section 11.3.2 (of the project development agreement) jointly prepare the IBP to be implemented within 12 months from the Agreement Date in accordance with this Schedule

NWEDC will put in place a team with clear cut roles and responsibilities for the implementation of the detailed plan. This section (and sub sections) will provide an understanding the team and

the manner in which they will be involved in the implementation. Some key things to be kept in mind and questions which will be answered as part of this section are as follows:

1. NWEDC's role
2. GoN's role
3. Industrial Benefits Officer
4. Local communication officer

The roles and responsibilities for each stakeholder will be clearly specified.

Industrial Benefits Officer

As a part of the PDA requirements, NWEDC will appoint an Industrial benefits officer, who shall work with domestic suppliers on opportunities to meet mutual needs.

Interlinkage with other Plans

The benefit sharing plans thus formulated are part of a larger social impact management framework for the project and shall be implemented in coordination with the other management plans such as the following (but not limited to):

- LBSP
- ESTP
- Stakeholder Engagement Plan
- Livelihood Restoration Plan
- Grievance Redressal Mechanism
- Labour influx management plan

Note: This section will provide a brief description about the effectiveness of the institution/implementation agency for planning, management, monitoring and delivery of the plan.

This will also include suggestions for workable linkages with other programs/projects (government-run; multi/bi-lateral agency sponsored).

Schedule for Implementation

This section provides an understanding of the schedule of implementation of the plan thus formulated.

NWEDC will put in place a schedule for implementation of the IBP, in discussion with GoN. This schedule will provide an itemized timeline for each step of the implementation process.

1.11.4.6. Engagement Strategy

An essential component of the implementation of the benefit sharing plan is the engagement with the local community and other external stakeholders.

This section will provide the Engagement strategy for the IBP. The strategy will be specifically to explain the key needs and sensitivities viz local vendors, government, stakeholders, and the IBP.

Although this will be in line with the overall stakeholder engagement activities of LALRP /ESIA and other plans formulated, it will describe how to position IBP actions and address a larger audience (district and beyond). The engagement strategy will include the following:

- Aim, objectives of IBP;
- Coverage, potential beneficiaries and thematic areas;
- Phased approach, timelines and outcomes;
- Grievance management (as per EIA/ESIA/LALRP); &
- Feedback, documentation, communication, multi-media.

1.11.4.7. Monitoring and Review Mechanism

The IBP will serve as a macro plan that will be constantly reviewed and updated on annual basis, throughout the project lifecycle. Micro plans will be developed, that will comply with the major principles identified, and are ready for implementation during the project activities

NWEDC will identify a monitoring mechanism in terms of the following:

- Schedule with milestones and tracking of delays;
- Provision for internal and external monitoring;
- Frequency of monitoring and review;
- The KPIs for internal and external monitoring;
- Process of reviewing and updating the IBSP based on the findings of the monitoring reports;
- Responsibilities of NWEDC, GoN, and any third party involvement for monitoring purposes
- Systems and institutional linkages for feedback and mid-course correction

1.11.4.8. Budget

NWEDC will ensure that adequate budget is allotted for the implementation of the IBP.

This section will provide an itemized budget for each step in the implementation of the IBP.

1.11.4.9. Reporting and Documentation

As per the PDA, NWEDC shall submit annual reports to GON describing in detail the activities undertaken under the Plan, the amounts spent on such activities and impact evaluation of such activities. Some of the key aspects which may be included in the reports shall include (but not be limited to):

- The measures put in place to promote local enterprises;
- The number of local vendors registered with the project;

- The resources procured locally;
- The training and capacity building activities undertaken; and ·
- The way forward

As part of the detailed plan, a reporting mechanism will be put in place, in consultation with the GoN, which will provide an understanding of the following:

1. Requirement for internal and external reporting,
2. the frequency of reporting,
3. chain of reporting, and
4. the format- report, presentation, verbal discussion etc.

Other documents which will be maintained during the plan implemented will include, (but not be limited to), the following:

- Meeting minutes during the supply and demand mapping consultations;
- Training records;
- Records of human resources involved in the project and the number of locals vendors engaged in the project;
- Purchase register used;
- The number of locals supported with other capacity building and trainings; and
- Any complaints or grievances obtained.

Person in charge for maintaining documents will be appointed by the Project team.

1.12. PROJECT ENVIRONMENTAL AND SOCIAL MONITORING AND REPORTING PLAN

The following table describes the monitoring and reporting requirements for the Project as discussed through the ESIA and the ESMMP.

Table B.1-30: Monitoring and Reporting Requirements

Resource/Area	Monitoring Requirement/ Indicator	Frequency	Reporting Requirement	Entity Responsible
Construction Phase				
Air	Dust accumulation: Inspect for and record dust accumulation on roof and vegetation in the surrounding area	Monthly	Monitor, record, and report exceedances	EPC Contractor
Air	Air quality inside the tunnel: PM_{10}, CO, SO_x, and NO_x	Monthly	Report concentrations in excess of parameters in ESIA	EPC Contractor

Resource/Area	Monitoring Requirement/ Indicator	Frequency	Reporting Requirement	Entity Responsible
Air	Install an online real-time gas monitoring system, including analysis equipment, to detect elevated concentrations of hazardous gases (coal gas)	Continuous	Monitor, record, and report the situation of hazardous gas to make sure that the emission has not exceeded the established standards	EPC Contractor
Air	Monitor air quality (TSP/PM_{10}) at Hakubesi-Fulbari, Gogane, and Mailun Villages.	3 times a year	Record and compare with ambient standards in the ESIA.	EPC Contractor
Noise	Noise Level Meter installed at Hakubesi-Fulbari, Gogane, and Mailun Villages.	3 times a year	Record and monitor noise levels.	EPC Contractor
Noise	Maintain noise levels associated with all machinery and equipment at or below 90 decibels.	3 times a year	Record and monitor noise levels.	EPC Contractor
Noise	Construction site noise shall be monitored with portable detecting devices	Continuous	Monitor the noise level at the sensitive receptors	EPC Contractor
Water	Sample three locations for DO, pH, BOD, turbidity, total suspended solids, and hardness: upstream of weir, between weir and power house, and downstream of power house	3 times a year	Record and compare with Standards for Effluents Discharged in the ESIA.	EPC Contractor
Water	DO, pH, BOD, turbidity, total suspended solids, and hardness. Sample immediate points after treatment units of tunnel discharge, discharge from aggregate, crushing plant and batching plant, settling ponds, and sanitary discharge.	Monthly	Report concentrations in excess of parameters listed in the ESIA: Standards for Effluents Discharged into Inland Water from Construction Sites and Camps	EPC Contractor

Resource/Area	Monitoring Requirement/ Indicator	Frequency	Reporting Requirement	Entity Responsible
Water	Water quality from runoff from any fresh bitumen surfaces	As needed	monitored and remedial actions taken where required	EPC Contractor
Water	Water quantity in Community Springs/Water Sources	Before, during and after construction	Monitor water yield to detect impacts and provide alternate water supplies to villages/communities if water supply is affected	EPC Contractor
Water/Soil	Pollution Prevention: open defecation and garbage/solid waste disposal	Daily	Visual monitoring of nearby villages and headwork and powerhouse areas.	EPC Contractor
Water/Soil	Hazardous materials/Waste use as well as the storage, handling, and disposal procedures	Continuously	Records must be kept on site.	EPC Contractor
Water/Soil	Tunnel excavation material disposal (source and final disposal location) shall be monitored and documented	Continuously	Records must be kept on site.	EPC Contractor
Soil	Landslide and slope stability – access roads and tunnel	6 times a year	Record and monitor number of incidence of landslides, slope failure and debris flow.	EPC Contractor
Soil	Erosion of soils and deposition in downslopes of the access roads, tunnels, spoil disposal areas, and quarries	6 times a year	Monitor via frequent mapping and site observations	EPC Contractor
Flora	Forest cover – visually monitor number of trees felled within 1 km of dam, access road and switchyard as well as baseline plots	Bi-annually	Record visual observations	Owner's Environmental and Social Management Cell
Fauna	Monitor and record information on raiding season (flora raiding by wild herbivores), frequency and sites	Bi-annually	Conduct community consultations and maintain records	Owner's Environmental and Social Management Cell

Resource/Area	Monitoring Requirement/ Indicator	Frequency	Reporting Requirement	Entity Responsible
Fauna	Aquatic Ecology - monitored as part of a Biodiversity Evaluation and Monitoring Program (BEMP) to be developed by a fish expert with metrics to demonstrate No Net Loss of aquatic biodiversity as required by IFC's PS6.	Bi-annually	Conduct Fish sampling and interview local fishermen, maintain records.	Owner's Environmental and Social Management Cell
Health and Safety	Sample water supply reservoir and end tap of the Camps.	Monthly	Report concentrations in excess of parameters listed in the ESIA: Drinking Water Quality Standards for Construction Camps and Construction Sites	EPC Contractor
Health and Safety	Monitor structural stability of tunnels	During the construction phase	Record visual observations	EPC Contractor
Health and Safety	Maintain records and reports concerning health, safety and welfare of persons, and damage to property, as the Environmental Supervision Team may reasonably require	Monthly	Records must be kept on site.	EPC Contractor
Health and Safety	Training program numbers	During the construction phase	Keep records of attention and issues covered and provide such records when required by the Environmental and Social Management Cell or the Safety and Environmental Officer	EPC Contractor
Health and Safety	Visually monitor number of houses, construction material, development of cracks and house owner	In response to complaints	Document structured through write ups, maps, and photographs.	EPC Contractor

Resource/Area	Monitoring Requirement/ Indicator	Frequency	Reporting Requirement	Entity Responsible
	information in Hakubesi-Fulbari			
Health and Safety	Visually inspect workers camps for adequate water, wastewater, and solid waste facilities	Weekly	Record visual observations	EPC Contractor
Health and Safety	Compliance to code of conduct and Review of Records required to be maintained by law	Monthly	Maintain records	Environmental and Social Management Cell Representatives
Social	Review records of Grievance Redressal Mechanism and community engagement activities, Compliance to code of conduct, and records of weekly and monthly monitoring	Annually	Document any deviations from requirements in the Labour Influx Management Plan, submit annual reports to the GON	External Monitoring by Third Party
Social	Perception of environmental enhancement programs in Hakubesi-Fulbari, Gogane, and Mailun and VDC Offices in Dhunche and Ramche	Bi-annually	Interviews, observation and structured questionnaire survey of selected groups.	Environmental and Social Management Cell
Social	Monitoring compliance with the Employment and Skills Training Plan, the Industrial Benefit Sharing Plan	Annually	Submit annual reports to the GON	Owner
Socio-economics	Economic and social status of affected communities (Hakubesi-Fulbari, Gogane, and Mailun)	Once a year	Interviews, observation and structured questionnaire survey of selected groups.	
Socio-economics	Inflation of prices - commodities in Hakubesi-Fulbari, Gogane, and Mailun (cereals, cash crops, kerosene, meat, sugar, salt, spices, soap. Milk, ghee, etc.)	Monthly	Record keeping of prices.	Environmental and Social Management Cell
Socio-economics	Trade and business development – number	Three times a year	Direct enumeration and record keeping.	Environmental and Social

Resource/Area	Monitoring Requirement/ Indicator	Frequency	Reporting Requirement	Entity Responsible
	of hotels, tea stalls, and restaurants.			Management Cell
Operation Phase				
Soil	Landslide and slope stability – access roads and tunnel	Bi-annually for the first 5 years or operation	Record and monitor number of incidence of landslides, slope failure and debris flow.	Owner
Soil	Erosion of soils and deposition in downslopes of the access roads, tunnels, spoil disposal areas, and quarries	Bi-annually for the first 5 years or operation	Monitor via frequent mapping and site observations	Owner
Water	Sample three locations for DO, pH, BOD, turbidity, total suspended solids, and hardness: upstream of weir, between weir and power house, and downstream of power house	Yearly for 30 years	Record and compare with Standards for Effluents Discharged in the ESIA.	O&M Contractor
Water	Aquatic habitat loss/degradation (creation of flow reduced segments)	Monitor monthly for 5 years	Engage in coordinated monitoring efforts and explore joint mitigation options with other hydropower sponsors	Owner
Water	Monitor water quality of drainage from spoil disposal areas and quarry sites	Quarterly for 5 years	Record and compare with Standards for Effluents Discharged in the ESIA.	Owner
Water	EFlows releases and river condition: gauging station located at Eflows Site 1 and another at Eflows Site 2	Continuous	Communicate the results of the independent monitoring of EFlows releases and river condition to stakeholders	O&M Contractor and Owner
Drinking Water	Sample water supply reservoir and end tap of the Camps.	Yearly	Report concentrations in excess of parameters listed in the ESIA: Drinking Water Quality Standards	O&M Contractor

Resource/Area	Monitoring Requirement/ Indicator	Frequency	Reporting Requirement	Entity Responsible
Noise	Noise level in the powerhouse area	Once after operation	Measure noise level using noise level meter	O&M Contractor
Flora	Forest cover – visually monitor number of trees felled within 1 km of dam, access road and switchyard as well as baseline plots. Survival of planted tree species and maintenance of floral diversity within offset site	Bi-annually for the first 5 years of operation	Record visual observations	Owner
Fauna	Monitor and record information on raiding season (flora raiding by wild herbivores), frequency and sites	Bi-annually for the first 5 years of operation	Conduct community consultations and maintain records	Owner
Fauna	Aquatic Ecology - monitored as part of a Biodiversity Evaluation and Monitoring Program (BEMP) to be developed by a fish expert with metrics to demonstrate No Net Loss of aquatic biodiversity as required by IFC's PS6.	in January, March, June, and September at the three EFlow monitoring sites	Conduct Fish sampling and interview fishermen, maintain records.	Owner
Fauna	Aquatic Ecology – monitor to ensure fish are able to successfully migrate upstream and downstream through the diversion tunnels	During upstream and downstream migration periods	Visual monitoring of successful passage through tunnel and presence of fish congregating at entrance to tunnel	Owner and EPC Contractor
Fauna	Terrestrial biodiversity will be monitored at the project site and in LNP as part of a Biodiversity Evaluation and Monitoring Program (BEMP) to be developed to demonstrate NNL per IFC's PS6.	Bi-annually for the first 5 years of operation		To be implemented by LNP or NGOs with support of Owner.

Resource/Area	Monitoring Requirement/ Indicator	Frequency	Reporting Requirement	Entity Responsible
Fauna	Monitor bird carcasses electrocuted and record any threatened or migratory species observed as described in the BEMP	Monthly	Record and monitor number	O&M Contractor
Health and Safety	Dam safety reviews should be carried out by an internationally recognised, independent dam safety engineer who was not involved in the design of the Project.	Periodic (approximately every 5 years)	Reporting of results upon reviewing previous inspections, instrumentation reports, and annual inspection reports, along with a comprehensive site inspection.	Owner through independent dam safety engineer
Socio-economics	Economic and social status of affected communities (Hakubesi-Fulbari, Gogane, and Mailun)	Once after 2 years of operation	Interviews, observation and structured questionnaire survey of selected groups.	Owner
Socio-economics	Inflation of prices - commodities in Hakubesi-Fulbari, Gogane, and Mailun (cereals, cash crops, kerosene, meat, sugar, salt, spices, soap. Milk, ghee, etc.)	Three times a year for the first 2 years of operation	Record keeping of prices.	Owner
Socio-economics	Trade and business development – number of hotels, tea stalls, and restaurants.	Three times a year	Direct enumeration and record keeping.	Owner
Social	Perception of environmental enhancement programs in Hakubesi-Fulbari, Gogane, and Mailun and VDC Offices in Dhunche and Ramche	Bi-annually	Interviews, observation and structured questionnaire survey of selected groups.	Owner

ATTACHMENT 1

LAND ACQUISITION AND LIVELIHOOD RESTORATION PLAN

Appendix B.2
Construction Environmental and Social Management and Monitoring Plan Framework

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ACRONYMS AND ABBREVIATIONS

AoI	Area of Influence
BMP	Biodiversity Management Plan
CIA	Cumulative Impact Assessment
CIMP	Cumulative Impacts Management Plan
CITES	Convention on International Trade in Endangered Species
CR	Critically endangered
DRIFT	Downstream Response to Induced Flow Transitions
Eflow	Environment flow
EFMP	Environmental Flow Management Plan
EIA	Environmental Impact Assessment
EN	Endangered
EPC	Engineering, procurement, and construction
ERP	Emergency Response Plan
ESIA	Environmental and Social Impact Assessment
ESMC	Environmental and Social Management Cell
ESMMP	Environmental and Social Management and Monitoring Plan
ESMS	Environmental and Social Management System
EST	Environmental Supervision Team
ha	Hectare
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
km/hr	kilometres per hour
LALRP	Land Acquisition and Livelihood Restoration Plan
LC	Least Concern
LNP	Langtang National Park
MSDS	Material Data Safety Sheet
NT	Near Threatened
NWEDC	Nepal Water and Energy Development Company
O&M	Operations and maintenance
PDA	Project Development Agreement
PH	Power House
PS	Performance Standards
RLNM	Red List of Nepal's Mammals
SEO	Safety and Environmental Officer
VU	Vulnerable

B.2 CONSTRUCTION ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN FRAMEWORK

1.1. PURPOSE

This document presents a framework (hereafter referred to as the "Framework") of, and represents the minimum Lender's requirements for, the Construction Environment and Social Management and Monitoring Plan (hereafter referred to as the CESMMP) for the construction phase of the Upper Trishuli-1 Hydropower Project (Project). This CESMMP Framework has been formulated based on the Project understanding and the findings and recommendations of the Project Environmental and Social Impact Assessment (ESIA). The CESMMP Framework specifies the Management Plans, and the minimum requirements for these plans, to be developed in greater detail by the Engineering, Procurement, and Construction (EPC) Contractor (herein referred to as the Contractor), and which are required, as part of the contract between the Employer and the Contractor, to be implemented and complied with by the Contractor during the construction phase of the Project.

1.2. CESMMP PROCEDURES AND RESPONSIBILITIES CESMMP PROCEDURES

This section describes the process for approving and, as needed, modifying the CESMMP, and each party's responsibilities relating to the CESMMP.

1.2.1. CESMMP Approval Process

The development and approval of the CESMMP will be conducted in a timely manner in accordance with the dates specified in the Environmental and Social Action Plan (ESAP). The general development and approval process is as follows:

- The Contractor will develop a detailed Draft CESMMP, using this Framework to establish the minimum Lender's requirements;
- The Contractor will provide the Draft CESMMP to the Employer for its review;
- The Employer will provide the Draft CESMMP to the Lenders for its review;
- The Employer will incorporate any Lenders' comments along with its own comments and provide an integrated set of comments to the Contractor;
- The Contractor will address all comments provided by the Employer and provide a Final CESMMP to the Employer for its review;
- The Employer will review and, if acceptable, approve the Final CESMMP.
- Hard and soft signed copies of the Final CESMMP will be distributed by the Employer to the Contractor and the Lenders.

1.2.2. Management of Change

The need may arise to modify the CESMMP. The process below establishes Management of Change requirements for any and all changes to the CESMMP.

It anticipated that most proposed changes to the CESMMP will be initiated by the Contractor, or its Subcontractors. The Management of Change process, however, does allow for the Employer or the Lenders to propose changes when it is reasonably likely that the current CESMMP is not sufficient to prevent:

- Serious health and safety incidents
- Impacts above those disclosed in the ESIA;
- New impacts not disclosed in the ESIA;
- Violation of Nepal law;
- Non-conformance with Lenders requirements, including the:
    - IFC Performance Standards
    - World Bank Environmental, Health, and Safety (EHS) General Guidelines (2007); and/or
    - Other Lender requirements.

Table B.2-1 below defines three categories of potential changes to the CESMMP and the review and approval process associated with each.

Table B.2-1: Project CESMMP Management of Change Process

Category of Change	Change Description	Action Required
Category 3	Changes that have the potential to, or are reasonably likely to, result in decreased Contractor ESHS performance, and/or are likely to result in an increase in ESHS impacts above those disclosed in the ESIA, result in new impacts not disclosed in the ESIA, require the acquisition of rights to use additional lands, or require additional permits/approvals from the government.	The Contractor will notify the Employer of the proposed change and provide the rationale and justification for the change. The Employer will notify the Lenders within one week of the receipt of the request for a CESMMP change. This category of change requires Employer and Lender approval before implementation.
Category 2	Changes which have the potential to, or are reasonably likely to result in, decreased Contractor ESHS performance, but are unlikely to result in any increase in environmental/social impacts above those described in the ESIA, or result in new impacts not described in the ESIA, or	The Contractor will notify the Employer of the proposed change and provide the rationale and justification for the change. The Employer will notify the Lenders within one week of receipt of request for a CESMMP change. This category of change only requires approved by the Employer before implementation, unless

Category of Change	Change Description	Action Required
	require the acquisition of rights to use additional lands.	the Lenders object within 30 days of receipt of the notice of change.
Category 1	Changes will are expected to result in similar or improved ESHS performance and are unlikely to result in any increase in environmental or social impacts above those described in the ESIA	The Contractor will notify the Employer of the proposed change and provide the rationale and justification for the change. The Employer will notify the Lenders as part of its quarterly Environmental and Social Issues Compliance Report. This category of change only requires Employer approval before implementation.

The Contractor is required to maintain a copy of the current version of the CESMMP at its construction site management office at all times. The Contractor understands that the Employer and/or Lender will use the current version of the CESMMP as the basis for conducting its periodic monitoring inspections.

1.2.3. CESMMP Responsibilities

The list below indicates the CESMMP-related responsibilities of each entity:

- Contractor (EPC) Requirements
    - Develop a Draft CESMMP, which addresses all applicable construction phase ESHS commitments based on the ESHS Compliance Registry to be completed by the Employer (see below under Employer's Requirements), and revise it as needed in order to obtain Employer approval;
    - Maintain a copy of the current approved CESMMP at the construction site management office at all times;
    - Follow the Management of Change process described above for any changes to the CESMMP;
    - Include language requiring full compliance with this CESMMP in any and all subcontracts the Contractor signs for the Project. If a Subcontractor proposes any changes to the current approved CESMMP, those changes must go through the approved Management of Change Process;
    - Provide appropriate training so as to assure that its workforce understands the requirements of CESMMP;
    - Ensure all new project personnel as part of their induction process receive environmental and cultural sensitivity training as described in the Construction

Worker Induction Training and Code of Conduct Management Plan and are provided a copy of the Worker Code of Conduct. All new personnel are required to provide written verification (induction sign-off) that they have completed the Project induction, understand their environmental and social obligations and the Code of Conduct, commit to comply with the Code, and understand the penalties for failure to comply with the Code;

- Employ qualified ESHS staff to oversee the Project's ESHS performance and ensure that staffing and resources are adequate, commensurate with the magnitude and timing of work and potential ESHS risks;
- Construct the Project in accordance with the CESMMP;
- Comply with the Owner's Community Grievance Mechanism by either referring person's with grievances to the Owner's designated representative (e.g., Community Liaison Officer) or logging and promptly submitting the grievance to the Owner's designated representative;
- Erect notification boards at all construction sites providing information for the local communities about the Project, as well as instructions on how to log any grievances or make suggestions along with contact information for the site managers, and environmental and social staff;
- Establish a Worker's Grievance Mechanism to provide a way for worker's to file grievances or make suggestions;
- Notify the Employer of any significant incidents or accidents in accordance with the requirements and timing of the Environmental and Social Issues Compliance Report;
- Comply with the applicable construction-phase requirements in the Owner's Environmental and Social Management Plan;
- Monitor and report on the ESHS performance of the project during construction as described in the EPC Construction Monitoring and Reporting section of this CESMMP;
- Participate in regular (at least quarterly) ESHS performance meetings with the Employer to review ESHS performance;
- Proactively implement corrective actions to address any situations where the Contractor is not meeting the requirements of the CESMMP;
- Retain documentation of Project compliance with the CESMMP to facilitate Employer and Lender compliance audits;
- Cooperate fully with all compliance audits conducted by the Employer, the Lenders, or the Lenders Independent Engineer (who is also responsible for serving as the Independent Environmental and Social Consultant); and

  - Cooperate fully and implement any Corrective Action Plans required by the Employer or the Lenders to address any situations where the Contractor is not meeting the requirements of the CESMMP or complying with the laws of Nepal.

- Employer (Owner) Requirements
  - Include language requiring the Contractor to comply with the approved CESMMP in the EPC Contract;
  - Prepare and maintain an Environmental, Social, Health, and Safety Compliance Registry, which includes all Project commitments in response to Government approvals, Lenders requirements, and discussions with local communities;
  - Review and approve the Contractor's CESMMP;
  - Comply with the Management of Change process described above for any proposed changes to the CESMMP;
  - Monitor contractor and subcontractor E&S performance and ensure the contractor monitors its own and all subcontractors' E&S performance throughout construction, including mobilization;
  - Monitor contractor and subcontractor ESHS performance and conformance with the CESMMP, and ensure the Contractor monitors its own and its subcontractors' ESHS performance throughout construction, including mobilization, construction, and demobilization;
  - Hold regular (at least quarterly) ESHS performance meetings with the Contractor to review ESHS performance;
  - Notify the Contractor of the need for any corrective actions;
  - Issue a stop work order if the Contractor has not taken appropriate action to achieve compliance with ESHS requirements after repeated notices of violation and warnings of noncompliance, and significant ESHS impacts are occurring or imminent, until the Contractors ESHS performance is brought up to acceptable standards;
  - Provide the Lenders with copies of the Contractor's monitoring reports;
  - Cooperate fully with all compliance audits conducted by the Lenders or the Lenders Independent Engineer (who is also responsible for serving as the Independent Environmental and Social Consultant); and
  - Fully cooperate with any Lenders' Corrective Action Plans.
- Lender Requirements
  - Review and provide comments to the Employer on the Draft CESMMP;
  - Comply with the Management of Change process described above for any changes to the CESMMP;

- Conduct periodic monitoring visits; and
- Provide the Employer with all Construction Monitoring Trip Reports and notify the Employer of the need for any Corrective Action Plans.

1.3. CONSTRUCTION MANAGEMENT PLANS REQUIREMENTS

This section identifies the Lender's required minimum requirements for each construction phase environmental and social management plan for the Project. The contractor will prepare detailed management plans based on these minimum requirements.

1.4. AIR QUALITY MANAGEMENT PLAN

The Contractor shall propose and develop methods and actions to control dust resulting from construction-related activities, such as excavation, drilling, blasting, use of heavy equipment, quarry sites, crushing and concrete batching plants, earthworks including road construction, embankment and channel construction, haulage of materials, and construction of worker camps prior to the start of Project construction activities. The Contractor shall ensure the following minimum requirements are met:

- Dust and particulate material emissions shall be minimised at all times to avoid impacts on surrounding communities, and especially to vulnerable people (e.g. children, elderly).
- Phased removal of vegetation shall be practiced to prevent large areas from becoming exposed to wind.
- Surface clearing activities shall be restricted to Project foot print.
- Batching plant, crushers, and other construction facilities shall be located away from the residential and ecological sensitive receptors.
- Crushers shall use a high-efficiency dust suppression system.
- Vehicle speed shall be restricted to 15 kilometres per hour (km/hr) at site, including the Project Access Road, to minimise potential for dust generation in the surroundings.
- Paved roads shall be cleaned and unpaved roads shall be stabilized to reduce offsite tracking of soils and avoid dust generation.
- Diesel generators for power supply shall be optimally operated and regularly maintained to ensure emissions from fuel combustion remain at design levels.
- Provide alternative fuel for heating and cooking to avoid use of forest related products.
- Machinery shall be turned off when not in use.
- Dust screens shall be placed around construction areas, paying particular attention to areas close to local communities.
- Spraying of water shall be carried out as needed on dirt roads, cut areas and soil stockpiles or fill material. The water spray operation shall be carried out in dry and windy days, at least

twice a day (morning and afternoon). The frequency of water spray near local communities shall be increased as needed.

- Access roads shall be paved with gravel in the sections which are located in close proximity to the communities and other sensitive receptors, to reduce generation of air-borne dust.
- Construction equipment/vehicles that generate significant air pollution (above the applicable limit), and those which are poorly maintained shall not be allowed on-site.
- Concrete batching plants and crushing plants shall be operated with approved fitted dust control devices only.
- The truck transporting powder materials, such as cement, sand, and lime, shall be covered entirely with clean impervious sheeting to ensure that the dusty materials are not released from the vehicle. Overflow of material shall be avoided. All the stockpiled materials and sloped surface shall be covered with impervious sheeting to reduce dust emissions.
- Linking roads shall be maintained in good condition to reduce dust and noise emitted while using these roads for transportation.
- Construction machinery and vehicles shall be inspected and adjusted as required to minimise pollution levels. Exhaust fumes shall comply with relevant Nepalese standards on fumes. Construction equipment with idling control technologies shall be used.
- Use low sulphur diesel fuel for diesel-powered equipment and vehicles to the extent available.
- Regular (monthly) maintenance of all vehicles in accordance with manufacturer specifications shall be undertaken mandatorily.
- All stockpiles shall be covered and uncovered stockpiles and transfer points shall be periodically water sprinkled to minimise fugitive dust generation.

1.5. BLASTING AND EXPLOSIVES MANAGEMENT PLAN

The Contractor shall ensure the following minimum requirements are met for any blasting activity pertaining to access road, adit, or any other construction activity:

- The transportation, storage, processing, packaging on site, blasting and the disposal of the blasting material shall comply with the Nepalese regulations on the use of explosives.
- Before blasting is carried out, a detailed survey shall be conducted in the nearby communities to evaluate the degree of impacts that may be caused due to the blasting activity (e.g. possible damage to structures or infrastructure due to vibration, effects on animals, local residents). The survey, which shall be conducted prior to the use of any explosives, shall include all structures located within 250 metres on either side of Adit 1 access road at Hakubesi to verify condition of these structures. Compensation shall be provided by the Contractor for any structures reported to be damaged from blasting activities, to the extent that the structure survey did not find pre-existing damage.

- The Contractor shall ensure that the site of overburden depth and with proper alignment (with respect to rock type and geological structures) is selected for tunnel excavation to reduce instabilities within the tunnel.
- No blasting shall be allowed by the Contractor during night time unless prior approval is obtained from the government authority and the Environmental Supervision Team (EST) and local residents are notified in advance. The only exception to this will be for underground blasting for tunnel construction, which will be allowed as long as it can be demonstrated that it will not disturb local residents.
- The Contractor shall take necessary precautions to prevent damage to special features in the surroundings (e.g. ecological, historical, or culturally important areas) and the general environment.
- Only qualified and authorized personnel shall handle explosives and manage the blasting process.
- The Contractor shall adopt optimised blasting techniques using delay detonators for blasting in confined areas (inside the tunnels).
- Prior to a surface blasting event (i.e., excluding underground blasting), water shall be sprayed on the surface of the blast area to increase its moisture content, and wire mesh, gunny sacks, and sandbags shall be used on top of the blast area at each shot to prevent flying rocks and dust. Blasting shall not be carried out in adverse weather conditions. Spraying shall be conducted after the blast to control fugitive dust.
- The Contractor shall provide notification to any occupants of surrounding land at least one day prior to any surface blasting activity and shall address any concerns that they may have. The Contractor shall also issue a warning siren 20 minutes before the blast, again about 1 minute before the blast, and an “all clear” siren shortly after the blast, which can be heard up to approximately 1 kilometre from the surface blast site.
- The Contractor shall ensure that any unauthorized persons shall be located a safe distance (e.g. at least 200 metres) away from the blasting point. Before the detonation takes place, the Contractor shall check that there are no people inside the controlled area.
- The use of electric detonators shall be prohibited during thunderstorms.
- If there has been a failure in the blasting operation, only competent personnel may be allowed on site to do the work necessary to detonate the explosive, or completely redo the blasting.
- The quantity of blasting materials shall be carefully controlled according to the real situation requirements to avoid unnecessary breakage of rock mass.
- State of the art drilling machines provided with dust extraction system shall be used. In the event that a dust extraction system is not available, water spraying will be used to prevent airborne dust.

- Explosives and detonators shall be of good quality and suitable for the blasting operation. Explosives with past expiration dates shall not be used.
- Explosives and detonators must be packed in closed boxes. The explosives damaged by handling or transportation shall not be used and shall be disposed of in accordance with established procedures and any national regulations.
- The boxes of explosives and blasting caps must be visibly labelled with signs indicating their contents and instructions on how to dispose and handle them.
- The Contractor shall ensure proper stemming after charging of explosives. Proper stemming material (stone chips and drill cutting) will help in minimizing dust throw hence lower spread of dust particles in ambient air or within tunnel or adits.
- Notify local communities before blasting
- The explosives storage building shall be a dry, well-ventilated facility located away from other villages, buildings, roads, and high activity areas. The building shall be constructed using materials resistant to firearms, fire, and atmospheric phenomena. It shall also have a metal door with a safety lock, lightning protection, warning signs and strict surveillance.
- The Contractor shall provide strict security and restricted entries in magazine area. It is currently understood that the Nepal army is required to provide security for any explosives storage in Nepal.
- The Contractor shall provide good firefighting system at the explosive storage area if kept in a storage bunker on-site.
- Specific training on explosive handling and safety management shall be provided to the personnel appointed in magazine area.

1.6. CULTURAL HERITAGE MANAGEMENT PLAN

No historical sites, archaeological sites, or temples have been identified in the Project area of disturbance. Only a museum and two Ghumpas are reported in the Project's area of influence. However, the Contractor shall put in place the following measures in case sites or artefacts with archaeological or historical value are discovered during the Project construction activities:

- Contractor staff, including subcontractors, involved with land clearing, grading, and blasting shall receive training regarding the identification of artefacts and other chance find items to help them detect such finds and with the Chance Find process.
- If buried artefacts are encountered during the land clearing, grading, or blasting activities, all activities in the vicinity of the work shall be stopped.
- Workers shall report the findings to the Contractor immediately. The Contractor shall notify the Employer, who in turn will notify local or national relevant authorities within 24 hours of the discovery.

- The find location and all remains shall be left in place. The Contractor is responsible for securing the area (i.e., preventing anyone from removing or damaging any find) until appropriate local or national authorities indicate in writing that work can begin to prevent any damage or loss of removable objects. A night guard shall be arranged until the responsible local authorities take charge of the situation.
- The Contractor will cooperate with the relevant local or national authorities. The job of these authorities is to:
  - Describe the artefact or historical remain;
  - Define the scale of the site/object;
  - Perform a preliminary evaluation;
  - Set up a plan to protect and handle the discovery; and
  - Determine the significance of the discovery;
  - Decide on the procedures to handle the finding, which could include conservation, preservation, restoration and salvage.
- If the cultural sites and/or relics are of high value and site preservation is recommended by the professionals and required by the relevant local or national authority, the Employer and the Contractor shall make necessary design changes to accommodate the request and preserve the site.
- Decisions concerning the management of the finding shall be communicated in writing by relevant authorities to the Employer, who in turn will notify the Contractor.

1.7. CONSTRUCTION WORKS SHOULD RESUME ONLY AFTER PERMISSION IS GRANTED FROM THE RESPONSIBLE LOCAL AUTHORITIES CONCERNING SAFEGUARD OF THE CULTURAL RESOURCE.CONSTRUCTION WORKER INDUCTION TRAINING AND CODE OF CONDUCT MANAGEMENT PLAN

The Contractor is responsible for providing appropriate health and safety (H&S) and environmental and cultural sensitivity training to its workers, as described below:

- All new Project personnel shall receive appropriate H&S training during their induction (i.e., within their first week of work). The training shall be conducted by an experienced and qualified H&S professional. The H&S training shall involve a detailed review of the Contractor's Occupational Health and Safety Management Plan (see Section 1.3.10), a detailed description of the H&S risks each employee will be exposed to given their work assignment, identification of the appropriate Personal Protective Equipment (PPE), and the proper use of the PPE. The Occupational Health and Safety Management Plan provides additional requirements relative to ongoing and refresher H&S training.
- All new Project personnel shall receive appropriate environmental and cultural sensitivity training during their induction (i.e., within their first week of work). The training shall be conducted by an experienced and qualified environmental science professional and a social

science professional. This training shall involve a description of the sensitive environmental setting of the Project (i.e., adjacent to the Langtang National Park) and the potential presence threatened and endangered species. The new personnel shall be informed about these species and what actions they should take if they were to encounter any of these species, or wildlife in general. The new personnel will also receive training regarding the customs and practices of the Tamang people and the Contractor's requirements regarding any interactions with the Tamang of other local residents. The new personnel will also receive training on the Project's Chance Find Procedures as described in the Cultural Heritage Management Plan.

- The Contractor shall develop a Worker Code of Conduct, which emphasizes the importance of appropriate behaviour, respect for local communities and customs, protection of the environment, including fish, wildlife, and trees, and compliance with all Nepalese laws and regulations. This Code of Conduct shall be reviewed and approved by the Employer and the Lenders prior to the initiation of construction. The Code of Conduct should be available to local communities at the Public Information Centres (PIC) established for the Project. All new Project personnel shall receive appropriate training in the Worker Code of Conduct during their induction (i.e., within their first week of work). The Code of Conduct should address at least the following topics:
    - Expectations for workers to carry out their work in a safe manner, and to look after the safety of others.
    - Expectations of workers to look after, be aware of, and minimize their impacts on the environment. This includes a prohibition on unauthorized entrance to Langtang National Park or Community Forest lands, hunting, fishing, poaching, logging, collection of firewood, clearing of vegetation, collection of/trade in plants, animals, and non-timber forest products.
    - Urination and defecation in open areas and water bodies and haphazard disposal of solid waste shall be prohibited. The EPC Contractor shall provide the appropriate toilet and waste disposal facilities at each construction site for workers to use.
    - All the workers/labourers shall comply with the laws and regulations of Nepal.
    - Possession of illegal substances, abuse of drugs and alcohol, gambling, carrying of firearms, and involvement with prostitutes shall be prohibited.
    - Workers shall respect local customs and traditions. Workers visiting the local communities or interacting with local residents shall follow appropriate standards of dress and personal hygiene, must behave in a manner consistent with the Code of Conduct. Fighting (physical or verbal), creating nuisances and disturbances in or near communities, and disrespecting local customs and traditions shall be prohibited.
    - As part of the Code of Conduct, the Contractor must include sanctions (e.g. penalties up to dismissal) for workers violating this Code of Conduct.

- The Contractor shall retain documentation demonstrating that every Project employee, including subcontractor personnel, has received the required H&S training, environmental and cultural sensitivity training, and has signed the Code of Conduct.
- The Contractor shall also establish a worker grievance redressal mechanism to enable workers to file complaints. The Contractor shall inform the workers of the grievance mechanism at the time of recruitment and make it easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned, without any retribution. The mechanism should also allow for anonymous complaints to be raised and addressed. The mechanism should not impede access to other judicial or administrative remedies that might be available under the law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.
- The Contractor shall provide a grievance mechanism for workers (and their organizations, where they exist) to raise workplace concerns. The Contractor shall inform the workers of the grievance mechanism at the time of recruitment and make it easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned, without any retribution. The mechanism should also allow for anonymous complaints to be raised and addressed. The mechanism should not impede access to other judicial or administrative remedies that might be available under the law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.

1.8. EMERGENCY PREPAREDNESS AND RESPONSE MANAGEMENT PLAN

This Management Plan shall address all reasonably foreseeable emergencies that may occur at the Project, including dam break, Glacial Lake Outburst Flood, natural flood, sudden unexpected release of water from the dam or powerhouse, earthquake, fire, landslides, tunnel collapse, hazardous material spills, hazardous gas concentrations in the tunnels, drowning, traffic accidents, and similar events.

For each of these emergency situations, the Management Plan shall describe the:

- Contractor's Command Structure for responding to the emergency;
- Measures the Contractor will take to prevent the emergency from occurring, if possible;
- Monitoring the Contractor will conduct in order to detect developing emergency conditions (e.g., monitor flow in the river, real-time gas monitoring system in the tunnel);
- Equipment the Contractor will ensure is available and well-maintained at the construction site;
- Alarms, including both visual and auditory alerts, to notify personnel and the public of emergency conditions;

- Communication procedures and equipment that the Contractor shall use for notifying its personnel, nearby and downstream residents, and local and national government of impending or actual emergency conditions;
- Training exercises and drills the Contractor will conduct to ensure workers are aware of and prepared in the event of each type of emergency;
- Awareness and other training for local residents so they know how to protect themselves in the event of an emergency;
- Evacuation plans for its personnel as well as nearby or downstream residents;
- Rescue procedures;
- Records the Contractor will maintain onsite documenting the training exercises and drills it has conducted;
- Detailed procedures the Contractor will follow in the event of each type of emergency;
- Conditions under which the Project can return to normal operations and the procedures to document those conditions;
- Measures the Contractor will take to document lessons learned from training exercises, drills and actual emergencies.

The Contractor shall prepare this Emergency Preparedness and Response Management Plan in consultation with appropriate National and Local government agencies.

1.9. CLEARING, GRADING, UNDERGROUND EXCAVATION, AND SEDIMENT AND EROSION CONTROL MANAGEMENT PLAN

1.9.1. Clearing

- The Contractor shall not clear or disturb any land beyond that required for construction and/or identified for clearing in the approved Grading Plan.
- The Contractor shall establish clearing limits in the field so personnel know where to stop clearing vegetation.
- The Contractor is responsible for all penalties, fines, and tree replanting requirements for clearing or disturbing any unapproved land.

1.9.2. Earthworks and Grading

Earthworks, grading (e.g., cut and fill), and spoil sites shall be carefully managed to minimise negative impacts on the environment through the following measures:

- The Contractor shall maintain stable cut and fill slopes at all times and cause the least possible disturbance to areas outside the prescribed limits of the construction works.
- All earthworks shall be properly controlled, especially during the rainy season.

- The Contractor shall complete cut and fill operations to final cross-sections at any one location as soon as possible and preferably in one continuous operation to avoid partially completed earthworks, especially during the rainy season.
- To protect any cut or fill slopes from erosion, in accordance with engineering drawings, cut-off drains and toe-drains shall be provided at the top and bottom of slopes and be planted with grass or other cover. Cut-off drains shall be provided above high cuts to minimise water runoff and slope erosion.
- Slope works and earth moving/excavation shall be conducted in order to minimise exposure of soil surface both in terms of area and duration.
- Temporary soil erosion control and slope protection works shall be carried out in sequence to the construction.
- During the cutting, backfilling, and levelling activities, the cut material with the best mechanical properties shall be used for backfilling. In the sections where the suitable excess material from excavation might be insufficient, the required volumes shall be extracted from quarries previously authorized by EST.
- Any excavated cut or unsuitable material shall be disposed of in designated disposal areas as agreed to by EST.

1.9.3. Underground Excavations

The Contractor shall ensure the following safeguards are in place during underground excavation. These specifications are applicable to all underground excavations (e.g., desander, settling basin at the intake structure, tunnels, the surge tank, and the powerhouse).

- Excavated soil shall be used in for construction purpose to the extent possible, or disposed at the approved spoil disposal sites. See the Spoil Handling and Disposal Management Plan and the Rock Cuttings Management Plan for additional requirements.
- Water draining from the underground excavation activities shall be considered Process Wastewater and shall be collected in settling ponds or tanks for solids removal. Solids shall be removed from site and the supernatant will be reused or discharged depending on the final quality. Wastewater shall not be discharged into water bodies without prior treatment. See the Wastewater Management Plan for additional requirements.
- The Contractor shall protect against high water and mud inflow by the following:
  - Grout old drill holes;
  - Pre-grout before excavation starts;
  - Probing, drilling and draining;
  - Including provision for dewatering and pumping; and
  - Providing sump and excellent drainage systems.

1.9.4. Erosion and Sedimentation

Site activities shall be carefully managed in order to avoid soil erosion and sedimentation of downstream waterways that can impact aquatic ecosystems. Erosion and sedimentation shall be controlled during the construction of the Project by implementing the following mitigation measures:

- Silt fencing shall be provided around stockpiles at the construction sites close to river/tributaries/ and springs. The fencing needs to be provided prior to commencement of earthworks.
- The Contractor shall ensure the establishment of an appropriate drainage system in and around the spoil and muck disposal areas on-site.
- Muck disposal sites shall be provided with retaining walls and other engineering and biological control measures to mitigate erosion.
- The capacity/volume of the muck dumping sites shall be more than the volume of the muck to be disposed taking into consideration the swelling factor.
- Areas of the site that are not approved for construction activities shall be maintained in their existing conditions and shall remain untouched.
- The Contractor shall ensure that minimal ground area is disturbed during the construction phase. The Contractor shall ensure that the disturbed area is stabilised as quickly as possible, drainage is controlled, and the sediments are trapped onsite to prevent runoff.
- The Contractor shall erect erosion control barriers around the perimeter of cuts, disposal pits, and roadways.
- All areas susceptible to erosion shall be protected by installing necessary temporary and permanent drainage works as soon as possible and by taking any measures necessary to prevent storm water from concentrating in streams and scouring slopes, banks, etc.
- Terraces and other erosion control measures shall be implemented, where necessary to prevent soil erosion.
- As a general rule, slopes exceeding 35 percent shall not be machine cleared (bulldozer).
- The Contractor shall preserve as much vegetation as possible as it is beneficial in the following areas:
  - Floodplains;
  - Buffers;
  - Wetlands;
  - Stream banks;
  - Steep slopes; and

  - Other sensitive resource areas where it might be difficult to establish, install, or maintain erosion control devices.

- The topsoil with its leaf litter and organic matter shall be conserved, and reapplied to local disturbed areas to promote the re-establishment of local native vegetation.
- The Contractor shall add local, native grass seed and mulch to barren erosive soil areas or closed construction surfaces.
- The Contractor shall ensure that erosion control measures are implemented before the rainy season begins, preferably immediately before construction starts. Erosion control measures shall be installed at each construction site.
- Slope breakers such as silt fences, staked hay or straw bales, or sand bags shall be installed to reduce runoff velocity and divert water off the construction site.
- Slope breakers shall be installed on slopes greater than 5 percent, where the base of the slope is less than 15 metres from water bodies, wetlands, and road crossings.
- The Contractor shall reduce water speed and volume by increasing the number of drainage culverts and selecting proper places for duct placement to avoid erosion effects.
- Retaining and gabion walls shall be built to prevent scouring of river banks at strategic locations, especially upstream of the river above the dam.
- The bank of the river especially around the tailrace outlet shall be protected using inlet control structures and proper protection works.
- Sediment control structures shall be installed where necessary to slow or redirect runoff and trap sediment until vegetation is established. These control structures include windrows of logging slash, rock berms, sediment catchment basins, straw bales, brush fences, silt fences, silt curtains, fibre rolls, etc.
- Water flow through construction sites or disturbed areas shall be controlled with ditches, berms, check structures, live grass barriers, and rock liner.
- Ground surface at the site offices shall be paved in concrete, in order to minimise soil erosion.
- Until vegetation is successfully established, erosion control measures shall be maintained.
- Water shall be sprayed as needed on dirt roads, cuts, fill material and stockpiled soil to reduce wind-induced erosion.
- Larger changes in the landscape from quarries, tunnel spoil tips, etc., shall be landscaped and replanted, both to reduce erosion problems and to reduce the visual impact of the construction.
- Exposed soil and material stockpiles shall be protected against wind erosion and the location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors.

- All structures to control erosion and sedimentation shall be inspected routinely (monthly) to ensure that they are working properly.
- Traffic and movement over stabilized areas shall be restricted and controlled, and damage to stabilized areas shall be repaired and maintained to the satisfaction of EST.
- Potential impacts/activation of landslides shall be monitored regularly.

1.10. LANDSLIDE AND SLOPE STABILIZATION MANAGEMENT PLAN

The Landslide and Slope Stabilization Management Plan shall be prepared and implemented for the construction of the Project Access Road at landslide susceptible areas and any other construction disturbance to slopes greater than 35 degrees. At a minimum, the Plan shall include:

- Pegging and flagging of landslide area boundary;
- Redirect or manage drainage both vertically and horizontally to avoid the release of concentrated flow to slopes greater than 35 degrees;
- Maintain slopes at less than the angle of repose to the extent possible;
- Monitor slope stability in the vicinity of blasting, within increased monitoring during the monsoon season, and stop blasting if slopes are becoming unstable until a mitigation plan is approved;
- Protect steep slopes greater than 35 degree through necessary civil structures such as breast wall, gabion structure or concreting as per the requirement of the site;
- Use bio-engineering techniques for long-term slope stabilization wherever possible; and
- All disturbed surfaces should be stabilized and none should be left exposed.

1.11. NOISE AND VIBRATION MANAGEMENT PLAN

To minimise noise within the construction site, the Contractor shall:

- Vehicle speed shall be restricted to 15 kilometres per hour (km/hr) at site, including the Project Access Road.
- To the extent possible, maintain noise levels associated with all machinery and equipment at or below 90 decibels, especially for crushers (at night) unless it is demonstrated that noise levels are not affected in the surrounding villages.
- In noise-sensitive areas (including residential neighbourhoods), stricter measures shall be implemented to prevent undesirable noise levels, as per the regulatory requirements in Nepal.
- Proper measures to minimise disruptions from vibration or noise coming from construction activities shall be applied.

- A transportation schedule shall be developed for the construction materials to minimise the adverse impact on residents as well as the traffic on the existing roads.
- The transportation vehicles shall be required to slow down and be banned from horning when passing through sensitive areas.
- Maintain the construction equipment in its best operating conditions and lowest noise levels possible.
- Temporary noise barriers shall be used to minimise the noise caused by the construction equipment.
- Workers shall be provided with ear plugs around highly noisy machines such as piling, explosion, mixing, etc., for noise control and workers protection.
- The construction team shall be equipped with portable detecting devices to monitor the noise level at the sensitive receptors.
- Properly designed silencers, mufflers, acoustically dampened panels and acoustic sheds or shields, etc. shall be used. Mufflers and other noise control devices shall be repaired or replaced if defective. Electric-powered equipment shall be used when applicable instead of diesel-powered or pneumatic-powered equipment.
- Equipment known to emit a strong noise in one direction, shall when possible, be oriented to direct noise away from noise sensitive receivers.
- Machines and equipment that may be in intermittent use shall be shut down between work periods or throttled down to a minimum.
- Equipment such as cranes, earth moving equipment, and heavy vehicles shall be routed in such a way that there is minimum disturbance to receptors along the route.
- Inherently quiet equipment shall be used (as far as reasonably practicable); the equipment shall be regularly maintained to ensure noise levels are maintained at design level.
- Loud, sudden noises shall be avoided wherever possible.
- Integral noise shielding (including provision of tin sheets as noise barrier) shall be used where practicable and fixed noise sources shall be acoustically treated, for example, with silencers, acoustic louvers and enclosures. All diesel generators shall be installed in conformance with the statutory requirement of acoustic enclosure to achieve the required norm of 75 A-weighted decibels.
- Noise isolators at equipment/machinery shall be used for construction.

1.11.1. Night-time Construction Noise Management

Although in general, night-time construction shall be banned near sensitive receptors, some construction may still occur for technical and other reasons. If occurred near local communities, night-time construction noise would result in particularly significant impacts to residents and other sensitive receptors. Hence, besides the above mitigation measures, the following special

measures shall be taken during the construction phase to ensure minimum emission of night-time noise:

- People living within potentially impacted areas shall be notified ahead of time of the length and noise intensity of the proposed night-time construction. There will be no night time operation of the crushing plant or batching plant.
- Residents shall be informed on:
  - Why the night construction is necessary; and
  - Mitigation measures that are going to be implemented to obtain their understanding.
- These residents shall be allowed to express their concerns, difficulties, and suggestions for noise control prior to the commencement of night-time construction. These concerns shall be addressed and suggestions adopted where appropriate.
- Concrete batching plants, power generators, and other stationary equipment shall be carefully placed as far away from local communities to reduce noise impacts from these machines. Wherever possible, municipal power supply shall be utilized in construction, including night-time construction, as diesel generators are extremely noisy and avoiding their use is the best mitigation possible.
- Equipment with lower noise levels shall be used for concrete pouring operations, which may require 24 hours non-stop operation.
- Temporary noise barriers at the appropriate places shall be erected to reduce the noise impacts at night.
- If necessary, the Contractor shall arrange temporary accommodations away from the impacted area for the extremely vulnerable people such as persons with illness and the elderly.
- Supervision personnel shall be assigned to the construction sites during the period of night-time construction to ensure that the above measures are taken and to respond to any un-anticipated impacts by implementing any necessary mitigation measures.

1.12. OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT PLAN

The Contractor shall prepare and enforce an Occupational Health and Safety (OHS) Management Plan to address matters regarding the health and wellbeing of workers, Project staff and nearby communities during the construction phase. The OHS Management Plan shall:

- Describe potential health and safety hazards based upon the specific project works/activities;
- Describe the procedures and equipment which are technically appropriate to deal with such works/activities;
- Describe all major responsibilities and authorities relating to the implementation of the OHS Management Plan;

- Describe the specific project supervision methods (including audits, documentation and record-keeping, on-site monitoring and medical surveillance) to be implemented to ensure that the plan is completely and properly implemented;
- Describe the specific health and safety training that will be provided to any persons involved with the Works and the minimum levels of training required;
- Describe the emergency response procedures that will be implemented; and
- Describe the estimated cost, time schedule and assigned responsibility for implementing each component of the plan.

The Contractor shall:

- Provide all personnel with the proper Personal Protective Equipment (e.g. safety boots, safety glasses, helmets, hearing protection, gloves, respirators), or PPE.
- Carry out health screening and fitness test of all workers at the time of recruitment. This health screening shall be undertaken in keeping with the work profiles of the workers. The fitness test shall screen for communicable diseases and any health risks which may create issues in undertaking the task assigned. In addition to this, regular annual health check-ups shall be undertaken of all workers.
- Provide appropriate information and education to the workforce on basic personal hygiene, prevention of diseases, including respiratory diseases, water and food borne diseases such as diarrhoea, tuberculosis, etc.
- Implement a program for workers and local communities for the prevention, detection, screening, and diagnosis of sexually transmitted diseases, especially with regard to HIV/AIDS. The program shall also include information on alcohol abuse and human trafficking.
- The HIV/AIDS program shall include awareness campaigns at the construction sites and in the communities, developing peer educators and community, monitoring combined with the prevention of human trafficking, awareness on safe migration, and community monitoring.
- Distribute educational materials to all workers including brochures, and leaflets which provide information of tuberculosis, HIV/AIDs symptoms and counselling and treatment services.
- Establish a health post or a hospital or promotion of medical clinics and dispensaries in Haku area, in particular where population densities are likely to increase.
- Provide basic first-aid services to the workers as well as emergency facilities for emergencies for work-related accidents, including medical equipment suitable for the personnel, type of operation, an ambulance or motorized vehicle, and the degree of treatment likely to be required prior to transportation to a hospital or health care centre.
- Ensure that medical staff, first-aid facilities, sick bay, and ambulance service are available at all times and that suitable arrangements are made at the labour camp and work sites, for all necessary welfare and hygiene requirements and for the prevention of epidemics.

- Send details of any accident to the EST as soon as practicable after its occurrence.
- Maintain records and reports concerning health, safety and welfare of persons, and damage to property, as the EST may reasonably require.
- The Contractor will notify and provide training to all appropriate personnel of any changes to the Occupational Health and Safety Management Plan per the Management of Change process.
- The safety training shall be accompanied by regular refresher trainings and daily tool box talks on safety issues.
- The Contractor shall provide construction workers with sufficient personal protective equipment and clothing such as goggles, gloves, respirators, dust masks, hard hats, earmuffs, steel toed boots, etc., and enforce their use.
- During heavy rains, accidents, or emergencies of any kind, all work aboveground shall be suspended.
- Electrical and mechanical equipment shall be braced to withstand seismic events during the construction.
- Sawing, cutting, grinding, sanding, chipping, or chiselling shall be conducted with proper guards and anchoring as applicable.
- The Contractor shall establish safe sight distance in both construction areas and construction camp sites.
- The speed of vehicles moving within the construction site shall be limited to 15-20 km/hr;
- Signs shall be erected around the construction areas to facilitate traffic movement, provide directions to various components of the works, and provide safety advice and warning.
- MSDSs for each chemical present on the worksite shall be maintained.
- The Contractor shall ensure that all workers read all MSDSs explaining the risks to them and their partners, especially when pregnant or planning to start a family. The Contractor shall encourage workers to share the information with their physicians, when relevant.
- The Contractor shall ensure that the removal of asbestos-containing materials or other toxic substances shall be performed and disposed-off by trained workers.
- Seminars on safety issues for local inhabitants, particularly school students shall be organised, to include prevention of road accidents, drowning, and electric shock.
- Warning signs and fence high-risk areas signs such as deep excavations, or blasting areas shall be erected to control public access.
- Include a Pest Management Program for the construction areas, including construction work camp areas, in the OHS Management Plan. The use of pesticides shall follow procedures acceptable to the government of Nepal.

- The Contractor shall present to ESMC and SEO for approval the proposed methods for conducting the training program, which shall include formal training sessions, posters, data in newsletters, signs in construction and camp areas, and 'tool box' meetings.
- The Contractor shall provide periodical training as deemed necessary.
- The Contractor shall keep records of attention and issues covered and provide such records when required by ESMC or SEO.

1.12.1. Underground Excavation H&S Requirements

- Staff shall also be trained in fire control, emergency call, and in the rescue and transportation of injured workers to health centres or the medical facilities, if available, established for the Project.
- Training on safety and personal security shall also be provided to the tunnel workers and administration staff. This training shall be incorporated into the training plan provided by Contractors to their workers.
- Temporary traffic regulations shall be implemented and signs shall be posted inside the tunnels. The movement of equipment, machinery and workers within the tunnels shall be directed by trained personnel.
- The Contractor shall install a temporary maintenance station that shall be in charge of daily maintenance and repairs to ensure the proper functioning of the equipment and machinery, and the lighting and ventilation systems inside the tunnels and underground excavations.
- The Contractor shall protect against rock-fall by the following:
  - Regular inspection of tunnel and scaling where needed;
  - Mechanically scaling and bolting;
  - Provision of ground support;
- The Contractor shall provide adequate ventilation and air cooling systems and other measures to control the concentration of air pollutants and temperatures within tunnels and underground excavations. Concentration of gases shall be monitored, recorded, and reported in confined spaces.

1.12.2. Working in Watercourses

- When crossing or working near watercourses the following measures shall be taken into consideration:
- As far as reasonably possible, the Contractor shall work in watercourses shall take place outside of the expected rainy season. Sufficient time shall be allowed for construction processes to be effected before the rains start.
- Steep slopes (>25 percent) leading to watercourses shall be hand-cleared.
- Temporary embankments shall be built to protect riverbanks and ponds from erosion.

- Fallen trees, debris, or soil inadvertently deposited within the high water mark of any watercourse shall be removed to reduce damage to any aquatic habitat.
- Drip trays shall be used for all pumps, generators, etc. to prevent water contamination as a result of fuel spills or leaks.
- In the event of a spill, the Contractor shall take prompt action to clear polluted areas and prevent spreading of the pollutants.
- The Contractor shall be liable to arrange for professional service providers to clear affected areas, if required.
- Any work requiring the fording of watercourses by machinery and vehicles shall be undertaken at slow speed and with clean vehicles (no leaks, etc.) and along a single track.
- The Contractor shall select appropriate equipment and vehicle crossing methods. Such methods shall be approved by EST.
- The Contractor shall use existing stream and river crossings as much as possible if the crossings can stand the weight of machinery and equipment.
- The Contractor shall build temporary stream crossings such as fords, culverts, polyvinyl chloride and high-density polyethylene pipe bundles, and portable or on-site constructed bridges when existing crossings cannot be used.
- Temporary crossings shall be required to provide safe, erosion-free access across a stream for construction equipment. Properly designed, installed, and maintained temporary stream crossings can greatly reduce costs and help meet concerns of regulating agencies.
- When vehicle crossing is no longer required, the Contractor shall remove stream crossing structures, restore and stabilize stream beads, banks and other disturbed areas, if required.

1.13. SITE SECURITY MANAGEMENT PLAN

The Contractor's responsibilities include the maintaining the safety and security of all Contractor personnel and visitors to the construction site. The Contractor shall be responsible for the following:

- Prepare a Security Risk Assessment identifying the key security risks to the Project.
- Ensure the project is compliant with IFC Performance Standard 4 and the UN Voluntary Principles on Security and Human Rights (http://www.voluntaryprinciples.org/)
- Keep unauthorized persons off the construction site. Authorized persons shall be limited to the Contractor's and the Employer's personnel, and any other personnel notified to the Contractor by (or on behalf of) the Employer.
- Provide adequate night-time lighting.
- Install a perimeter security fence around the Worker Camps with guards to restrict access to public.

- Obtain written permission for visitors and relatives of the camp residents to enter the camp. This permit shall be approved by the construction camp manager.
- Arrange guided tours whenever required to inform people about construction activities of the Project to avoid local people from gathering and crowding near the construction sites.
- Ensure that security personnel on-site are not armed, and receive detailed training on community engagement and the community grievance mechanism.

1.14. RESTORATION AND REVEGETATION MANAGEMENT PLAN

1.14.1. Site Restoration

Remedial actions which cannot be effectively carried out during construction shall be carried out on completion of the works (and before issuance of the acceptance of completion of works). Various activities to be carried out for site restoration are:

- Following the completion of the Project, access roads may be turned back to the local government and if desired, used as rural roads or wood land roads. If local governments elect not to use these access roads, the land can be used for farming or plantation purposes.
- At the completion of the construction work, all construction camp facilities shall be dismantled and removed from the site and the whole site shall be restored to a similar condition to that prior to the commencement of the works, or to a condition agreed to with the land owner.
- Water courses shall be cleared of debris and drains and culverts checked for clear flow paths.
- All sites shall be cleaned of debris and all excess materials properly disposed as approved by EST.
- No foreign material generated/ deposited during construction shall remain on site.
- Oil and fuel contaminated soil shall be removed and transported and buried in government approved waste disposal areas.
- Soak pits and septic tanks shall be covered and effectively sealed off.
- Revegetation shall start at the earliest opportunity and appropriate local species of vegetation shall be used.
- Construction campsite shall be vegetated and trees cut replaced with saplings of similar tree species.
- All affected areas shall be landscaped and any necessary remedial works shall be undertaken without delay, including vegetation and reforestation.
- To make the land fertile, compaction, grading, construction of drainage channels and spreading topsoil over terrains shall be carried out upon completion of the Project.
- Restoration of cleared areas, such as borrow pits no longer in use, disposal areas, construction roads, construction camp areas, stockpiles areas, working platforms and any

areas temporarily occupied during construction of the Project works shall be restored using landscaping, adequate drainage and vegetation. Restored dumping sites can then further be used for farming.

- Land used for agricultural activities (especially the additional land being taken on lease), prior to use for construction activities, shall be, as much as possible, restored to a state to allow the same agricultural activity to continue.
- Watercourses, which have been temporarily diverted by the construction activities, shall be restored to their former flow paths after commencement of construction.
- Any damaged to occupied drainage, irrigation and other agricultural infrastructure shall be restored to its previous condition as much as possible.
- Topsoil stripped from the work areas shall be used for landscaping works. Given the relatively little depth of topsoil in much of the Project area, trees and shrubs that need to be cleared for construction should be chipped and mulched to create a biomass mulch to promote revegetation during site restoration.
- Appropriate grass or other erosion control material (such as jute) shall be planted on high embankment slopes to recover vegetable cover and protect from erosion.
- The Contractor shall use mulch, blankets, and mats, along with native grass seeds, in situations when disturbed soil is difficult to stabilise, such as bare or exposed soil, steep slopes, (generally steeper than 1:3), slopes where the erosion potential is high, disturbed areas where plants are slow to develop, channels with flows exceeding 1 metre per second, stockpiles, and slopes adjacent to water bodies and other sensitive resources.
- Spoil heaps and excavated slopes shall be re-profiled to stable batters, and shall be vegetated to prevent erosion.

1.14.2. Access Roads

To reduce the environmental impact caused by the construction of new access roads, the Contractor shall put into place the following measures:

- All new access roads shall be approved by ESMC and EST. A road engineer shall corroborate that the proposed access road is properly designed.
- The Contractor shall present a 1:5000 scale map of the road.
- The design of the new access roads shall follow the landform and avoid alignments that require large volumes of excavation and clearance of vegetation.
- The new access road shall include a drainage ditch, and all unstable slopes shall include retaining walls or other appropriate structures to control erosion and landslides.
- Where the soil texture on the slopes to be filled is too loose to resist erosive forces of storm water, storm water will be diverted via drainage ditches and treated (via a sedimentation basin) prior to discharge. Temporary drainage ditches shall be constructed along the roadbed at an interval of 50 metre to divert the excessive storm water.

- If possible, a sedimentation basin shall be provided where necessary downstream of the drainage ditch in order to remove solids in the run-off before it reaches any watercourse.
- The Contractor shall carry out stabilization and appropriate bio-engineering activities such as grass and tree plantation along the entire route.
- New access roads shall avoid areas of high scenic value and protected and sensitive areas.
- Access roads shall avoid agricultural areas wherever reasonable and practical.
- The Contractor shall avoid road construction on unstable slopes and shall improve existing low-standard roads, which shall be used for the movement of construction equipment and vehicles. Community roads also used for this purpose shall be properly maintained, restored, rehabilitated or upgraded, including strengthening of the road surface and drainage system.
- Night construction activities near sensitive receptors such as residential areas, hospitals, rest homes, etc. shall be prohibited.
- The Contractor shall set all necessary warning signs, and speed bumps near sensitive receptors to reduce speed and increase traffic safety.
- For unpaved access roads, the Contractor shall spray water as needed during the dry season to reduce fugitive dust.
- If temporary bridges are needed, their design shall be reviewed by a licensed engineer and approved by ESMC and EST. These bridges can be constructed from locally available materials or the Contractor can use pre-fabricated bridges if available. All temporary bridges shall be removed after the completion of construction;
- Roads should be designed with the necessary width and slope to allow the transit of equipment and machinery in both directions without causing any delay.
- In access roads adjacent to communities, the Contractor shall inform local communities of traffic patterns and usage and provide awareness materials to schools to inform children about traffic safety.
- Once the construction of the Project is finished, all access roads shall be:
  - Given to local governments/communities;
  - Decommissioned and the area restored for use in agriculture or grassing, or re-stored to its pre-construction condition; or
  - Used for maintenance of the components of the Project.
- Areas proposed for clearing shall be approved by ESMC and EST. Only those areas shall be cleared that are in accordance with the Plan.
- The Contractor shall identify vegetation to be preserved during the planning process and shall delineate with temporary fencing. Preserving vegetation helps to stabilize the soil, prevent erosion, protect water quality and has visual and aesthetic benefits.

- Initially, the Contractor shall perform the removal of existing vegetation to allow access for construction machinery and establish a safe workplace for personnel.
- Large or significant trees and plants with ecological value (for example, those that serve as nesting or rest areas for birds) or that have commercial value, should be preserved wherever possible.
- Transplantation of existing trees affected by the Project works shall be carried out prior to the commencement of construction.
- The Contractor shall take into account soil stability, protection of wildlife, and natural vegetation and the prevention of sedimentation of watercourses when determining the method and time to carry out the clearing.
- The removal of vegetation shall be avoided, as far as possible, in steep terrains, erosion, and landslide prone areas and ecologically sensitive sites.
- When clearing within 30 metres of permanent streams and 15 metres of intermittent streams, the Contractor shall use hand cutting or winching to remove timber.
- The Contractor shall use "brush rakes" on bulldozers to minimise disturbance of ground cover and to save as much vegetation as possible.
- The vegetation shall be removed in stages to retain topsoil as long as possible to prevent large areas from being eroded by wind and rain.
- At the reservoir, fallen vegetation shall be left in place over the cleared areas for as long as possible before flooding, so as to minimise sediment run-off.
- During excavations, it shall be ensured that damage to the root systems is avoided. Mitigation measures are also required to prevent damage to trunks and branches of trees.
- The plants and vegetation that can be used later in the process of revegetation and restoration and threatened or endangered flora identified in the areas to be cleared shall be conserved in temporary nurseries. The location of the nurseries shall be approved by EST.
- All remaining non-indigenous vegetation shall not be burned but disposed of at an EST approved landfill site.
- Successful land reclamation and re-cultivation of temporary used land are highly dependent on preservation of topsoil (primarily focused on spoil disposal sites, crushing plant and batching plant). Therefore, the Contractor shall remove topsoil from all areas where it shall be impacted by the construction activities, including temporary activities such as storage and stockpiling, etc.
- Stripped topsoil shall be stockpiled in locations approved by EST for later use in revegetation and reclamation, and shall be adequately protected from wind and water erosion and toxic materials.
- The Contractor shall provide a plan for timber salvage indicating the type of timber to be salvaged, methods of storage, transportation and use of timber.

- In community forests, trees shall be cut and deposited in accordance with the agreement with the affected owners.
- Trees shall be replaced in accordance with Ministry of Forest standards (2:1 ratio)
- All trees and plants deemed to have economic value to individuals or communities (for example, medicinal plants) shall be adequately compensated, according to the entitlements identified in the Land Acquisition and Livelihood Restoration Plan (LALRP) for the Project.
- Local people shall be encouraged to make use of removed vegetation such as to use as garden composts.
- The application of chemicals for vegetation clearing shall be completely avoided.
- Herbicides use in the Project shall be shown to be effective against the target vegetation species, have minimum effect on the natural environment, and be demonstrated to be safe for inhabitants and domestic animals in the treated areas, as well for personnel applying them.
- The use of chemicals and herbicides, if any, shall be approved by EST and comply with the Nepalese rules and regulation.
- The Contractor shall replace at her/his own cost the vegetation that was damaged or destroyed outside the areas approved for clearing.

1.15. SPILL PREVENTION AND RESPONSE MANAGEMENT PLAN

Environmental emergency procedures relate primarily to the event of accidental leaks, spills, emissions and other unforeseen impacts or issues. By definition, the nature of such emergencies cannot be known. Therefore, the Contractor shall respond on a case-by-case basis to such emergencies and shall initiate event-specific measures in terms of notifications and reactions.

In the event that accidental leakage or spillage of diesel/chemicals/chemical wastes takes place, standard response procedures shall be followed immediately by the Contractor such as:

- The person who identified the leakage/spillage shall immediately check if anyone is injured and then inform the SEO and EST.
- The Contractor shall ensure that all injured persons, if any, are treated and assess the nature of the substance that has spilled/leaked.
- Whenever the accidents/incidents generate serious environmental pollution or potential risks resulting in serious environmental pollution problems (e.g. spillage/leakage of toxic or chemicals, large scale spillage/leakage, or spillage/leakage into the nearby water bodies which are used for irrigation / portable water), the SEO shall immediately inform the EST.
- In such cases, the Contractor shall take immediate action to prevent the spillage/leakage and divert the spilled/leaked liquid to a nearby non-sensitive area.
- The Contractor shall arrange maintenance staff with appropriate protective clothing to clean up the chemicals/chemical waste. This may be achieved through covering the area with

sawdust (if the quantity of spillage/leakage is small), or sand bags (if the quantity is large); and/or using a shovel to remove the topsoil (if the spillage/leakage occurs on bare ground).

- Contract Environmental Health and Safety team shall identify the possible accidental leak/spill of fuel/chemicals/waste as per the type, nature of materials to be handled at site and detailed procedure for spill prevention and management to be prepared and awareness training on the same to be imparted to all responsible personal;
- Spilled chemicals must not be flushed to local surface drainage systems. Instead, government approved clean-up and disposal procedures shall be carried out.
- Depending on the nature and extent of the chemical spill, evacuation of the activity at the site may be considered. The Contractor/SEO has the authority to make the final decision.
- The Contractor shall prepare a report with root cause analysis for the spill or incident, remedial action taken, consequences/damage from the spill, and proposed corrective actions. The incident report shall be submitted to the EST for review and shall be maintained in the records.
- Workers shall receive training on environmental emergency procedures, so that they are fully aware of the various possible emergency situations in construction activities and the relevant emergency response procedures, as well as the danger and potential damages caused by the emergency to the environment and the people.

1.16. SPOIL HANDLING AND DISPOSAL MANAGEMENT PLAN

The Contractor shall follow the following for spoil disposal:

- Spoil disposal sites shall not be located near residential areas, on unstable lands, within flood plains, and shall not affect drainage and irrigation ditches or endangered/rare flora.
- Spoil disposal sites shall be constructed in locations that are not susceptible to water erosion and be designed and constructed to be stable during and subsequent to construction.
- The Contractor shall include provisions for incorporating the most appropriate stabilization techniques for each disposal site and determine the selected spoil disposal sites do not cause unwanted surface drainage.
- If the disposal site is located near a river or water course, a retaining wall and/or interception ditch or settling ponds shall be built prior to the initiation of the construction activities to prevent the deposits from being washed away by the monsoon waters. The surface runoff shall be retained and settled first before allowed discharge into the receiving water.
- The Contractor shall use excavated materials for filling purposes in the powerhouse site and remaining quantity for filling access road and regulating poundage to minimise the spoil dumps requirement.
- Spoil and excavated material generated from Project footprint shall be utilized for the following construction purposes: (1) Suitable rocks from the excavations can be used as

aggregate; (2) road construction; (3) backfilling of quarries and borrow pits, and for land reclamation.

- The construction of disposal sites and transportation of spoils at night is strictly prohibited near residential areas. The sites shall be watered for dust suppression during their operation.
- The disposal sites shall be fully rehabilitated as soon as the disposal operation is completed. The rehabilitation shall include a complete cover of the site with native soil and fully landscaped/vegetated. The stability of the sites shall be inspected and measures such as retaining walls shall be constructed as needed.
- Disposal sites close to patches of natural vegetation shall be limited in size to avoid cutting vegetation and disturbing any existing wildlife.
- Access roads, if needed, to the disposal areas shall be handled in the same manner as the construction of new access roads.

1.17. TRAFFIC MANAGEMENT PLAN

The Contractor shall:

- Make sure construction vehicles comply with speed limits.
- Ensure that all suppliers and their delivery drivers are aware of procedures and restrictions (e.g. restricted areas) while navigating through the roads near the site. Use only selected routes to the Project site, appropriately sized vehicles suitable to the class of roads in the area, and restrict loads to prevent damage to local roads and bridges used for transportation purposes.
- Maintain adequate traffic control measures throughout the duration of the construction activities.
- Clearly mark pedestrian-safe access routes.
- Promote and distribute traffic safety information to local residents.
- If school children are in the vicinity, include traffic safety personnel to direct traffic during school hours.
- Ensure traffic safety at intersections, especially near sensitive areas (schools, markets).
- Install traffic signs (including paint, easel, sign material, etc.), road marking, and guard rails to maintain pedestrian safety during construction.
- Use signs and flagmen for traffic control.
- Conduct a detailed survey of any structures along the access road in the nearby communities to verify their condition and identify any signs of structural damage before heavy truck use of the access road. Compensation shall be provided by the Contractor for any structures reported to be damaged from truck traffic and vibrations, to the extent that the structure survey did not find pre-existing damage.

- The Contractor is responsible for the costs associated with repairing any damage caused to local roads and bridges due to the transportation of excessive loads.
- Material shall be appropriately secured in the vehicles to ensure safe passage between destinations during transportation.
- The Contractor shall be responsible for any clean-up resulting from the failure by its personnel or suppliers to properly secure transported materials.
- Entry/exit routes and transportation timings for heavy transport vehicles shall be planned to minimise disturbance to the surrounding locality.
- Trucks/dumpers loads shall be covered (e.g., tarpaulin sheets) during offsite transportation.

1.18. WASTE MANAGEMENT PLAN

During the construction stage, the Contractor shall prepare a Waste Management Plan before commencement of Project work. The Plan shall include the following Sub-Plans:

1.18.1. Disposal of Construction Debris

The Contractor shall carry out the following activities:

- The disposal of construction debris shall be carried out only at sites previously identified and approved by EST.
- Debris generated due to the dismantling of existing structures shall be suitably reused, to the extent feasible, in the proposed construction program (e.g. as fill materials for embankments).
- Trash and debris shall not be buried within fill or backfill areas.
- All arrangements for transportation during construction including provision, maintenance, dismantling and clearing debris, where necessary, shall be considered incidental to the work and should be planned and implemented by the Contractor as approved and directed by the ESMC and the EST.
- A landfill is not currently proposed so all waste will be hauled away to government approved disposal sites. If the EPC or O&M Contractor determine an on-site landfill is required, that will trigger the Management of Change (MoC) provisions in this CESMMP and would require both government and lender approval and implementation of required mitigation measures and an update to the Waste Management Plan;
- Once the work is completed, all construction -generated debris shall be removed from the site.

1.18.2. Domestic Solid Waste

The Contractor shall carry out the following activities:

- The Contractor shall submit a method statement detailing a solid waste control system (storage, provision of bins, site clean-up schedule, bin clean-out schedule, etc.) to the ESMC and the EST for approval.
- The Contractor shall ensure that all facilities are maintained in a neat and tidy condition and the site shall be kept free of litter.
- Measures shall be taken to reduce the potential for litter and negligent behaviour with regard to the disposal of all refuse. At all places of work, the Contractor shall provide litter bins, containers, and refuse collection facilities for later disposal.
- Solid waste may be temporarily stored on site in a designated area approved by the EST. The storage area shall have a cover to avoid direct contact with surface runoff, and be fenced off to prevent wind-blown litter. Waste storage containers shall be covered, tip-proof, weatherproof, and scavenger proof, and should not attract wildlife.
- The Contractor shall identify and demarcate disposal areas clearly indicating the specific materials that can be deposited in each waste container.
- Waste containers shall be strategically placed in visible locations easily identified and marked. For example, recycle, organic waste, unusable waste, hazardous waste, paper, glass, etc.
- Recyclable materials (e.g. wooden plates for trench works, steel, scaffolding material, site holding, packaging material, paper, empty cement bags and containers, glass, wood, junk), shall be collected and separated on-site from other waste. Collected recyclable material shall be re-used or sold to a waste collector for recycling.
- The Contractors shall be required to separate construction waste from domestic waste. Where possible, the construction waste shall be recycled for landfilling. If possible, the domestic waste shall be transported off site-at least once a week for disposal in covered containers or trucks, by an environmental sanitary authority or by a licensed waste collector.
- If collection of waste is not practical in remote locations, a landfill may be required. As described above for construction waste, if the EPC or O&M Contractor determine an on-site landfill is required, that will trigger the MoC provisions in this CESMMP and would require both government and lender approval and implementation of required mitigation measures and an update to the Waste Management Plan.
- Burning solid waste in open air conditions shall be strictly prohibited.
- Random disposal of solid waste in within and outside the Project areas shall be strictly prohibited.
- Employees shall be educated on segregation of waste with demarcated bins for recyclables and perishables placed in common areas.

1.18.3. Hazardous and Chemical Waste

The Contractor shall carry out the following activities:

- All hazardous and chemical waste (including bitumen, disposable lubricating oil, mineral oil, organic solvent, acid and alkali, oil paint, etc.) shall be properly stored, handled and disposed of in accordance with the environmental standard, regulation and management policies of Nepal, and the producers of the chemicals.
- Only authorized personnel shall handle hazardous and chemical waste.
- The Contractor shall inform all personnel of the emergency measures to be taken in case of spills or accidents due to improper use of these substances.
- Hazardous waste shall be stored separately from other waste and warning signs shall be posted around the site.
- The Contractor shall provide disposal certificates to the EST.
- The removal of asbestos-containing materials or other toxic substances shall be performed and disposed of by trained workers.
- Used oil and grease shall be removed from site and sold to an approved used oil recycling company.
- Under no circumstances shall the spoiling of tar or bituminous products, or any other chemical or hazardous waste be allowed on the site, over embankments, in borrow pits or any burying, water bodies, agricultural land, or sensitive areas.
- Hazardous wastes shall be kept in isolated place away from active working zone.
- Ensure proper covered shed is provided with impervious floor for storage of used oil and any other identified hazardous wastes to avoid any soil contamination;
- Unused or rejected tar or bituminous products shall be returned to the supplier's production plant.
- Used oil, lubricants, cleaning materials, etc. from the maintenance of vehicles and machinery shall be collected in holding tanks and sent back to the supplier or removed from site by a specialist oil recycling company for disposal at an approved hazardous waste site.
- Transportation of hazardous waste off the site shall be done in cooperation with an approved and authorized partner. All this material shall be regularly collected, stored and transported to disposal or reuse in accordance to the regulations of Nepal.

1.19. WASTEWATER MANAGEMENT PLAN

The Contractor shall be responsible for compliance with the relevant Nepalese legislation relevant to wastewater discharges, including tunnel process water, into watercourses. Contractor shall ensure the following processes are implemented for wastewater management:

- Sewers shall be designed and installed by the Contractor in accordance with the national design code of Nepal.
- The Contractor shall submit a method statement to the EST detailing how wastewater will be collected from all wastewater generating areas, as well as storage and disposal methods. If

the Contractor intends to carry out any on-site wastewater treatment, this should also be included.

- Groundwater intercepted from tunnelling area shall be collected through sump and treated prior to discharge to the river or tributaries;
- Wastewater from mixing stations, concrete batching plants, crushing plants, warehouses, material washing, and tunnel construction shall be collected into settling tanks, treated, and disposed according to national rules and regulations.
- Runoff from fuel depots/workshops/machinery washing areas, concrete batching plants, mixing station, and similar areas shall be collected into a settling basin and disposed of at a site approved by the EST.
- Domestic sewage from site office and chemical toilets for construction workers shall either be collected by a licensed waste collector or treated by on-site treatment facilities. Discharge of treated wastewater must comply with the discharge limit according to Nepalese wastewater discharge standards.
- Wastewater shall not be discharged into water bodies without treatment.
- Water usage shall be optimised by creating awareness among the labour force through construction supervisors;

1.19.1. Site Drainage System

The Site Drainage System Plan shall contain details regarding the following:

- A review of the preliminary site drainage design prepared during the detailed design.
- An update of the preliminary design based on the actual construction program and the site specific conditions (e.g. the geographical conditions, location of slopes and the nature of construction work).
- A detailed implementation program, approved by ESMC and EST, of the proposed drainage system shall need to be maintained.
- Detailed design including drawings, location maps, and specifications of drainage collection channels, pumping systems, temporary water pipes, and wastewater treatment facilities shall need to be prepared.
- Proposed discharge locations and treatment standards.
- As part of the design of the site drainage system, surface runoff within the construction site shall be diverted in order to avoid flushing away soil material. The runoff water shall be treated by device such as sediment trap before discharge.
- Storm water and wastewater systems shall be separated. The rainwater shall be collected through a ditch and discharge into any adjacent body of water. The maximum flow velocity for a rainwater ditch shall be determined in accordance with flood prevention measures.

1.20. WATER QUALITY MANAGEMENT PLAN

The Contractor shall be fully responsible for any contamination to the existing water quality within the Project site. The Contractor shall ensure that the following mitigation measures are implemented:

1.20.1. Hazardous and Chemical Substances

- The Contractor shall provide a method statement detailing the hazardous substances/material that are to be used during construction, as well as the storage, handling, and disposal procedures for each substance / material and emergency procedures in the event of misuse or spillage that might have impact on the environment. In general terms, the following activities shall be carried out:
- All hazardous material/substances (e.g. petrochemicals, oils, paints, solvents, etc.) shall be stored on site only under controlled conditions and with appropriate secondary containment.
- All hazardous material/substances shall be stored in a secured, appointed area that is fenced and has restricted entry.
- All storage shall take place using suitable containers as prescribed by the manufacturers or regulatory authority.
- Hazard signs indicating the nature of the stored materials (Material Safety Data Sheets [MSDSs]) shall be displayed on the storage facility or containment structure.
- Areas for the storage of fuel or lubricants and any maintenance workshop shall be fenced and have a compacted/impervious floor to prevent the escape of accidental spillage of fuel and or lubricants from the site.
- Surface water drainage from fenced areas shall be discharged through purpose designed and constructed oil traps.
- Empty fuel or oil drums shall not be stored on site.
- Fuel shall be stored in a steel tank supplied and maintained by the fuel suppliers. The tank shall be located in a secure, demarcated area. It can also be stored in overhead tanks of 5,000 litres maximum on flat ground at least 50 metres from a waterway.
- Dikes to capture 100 percent of fuel must be placed around fuel storage area
- Herbicides shall be appropriately packaged, labelled, handled, stored, disposed of, and applied according to national standards.
- During servicing/repair of equipment or vehicles, a suitable drip tray shall be used to prevent oil/grease spills onto the soil, especially in case of emergency repairs.
- Leaking equipment shall be repaired immediately or be removed from the site to facilitate repair.

1.20.2. Concrete Batching, and Surfacing Materials

- Concrete mixing shall take place on impermeable surfaces or compacted soil such.
- In case of spillage of the concrete mix, the area shall be cleaned immediately. The waste shall be collected and deposited in approved sites assigned to it by the EST. It is prohibited to place these mixtures in water courses, cultivated land, parks, protected areas, etc.
- All runoff water from the batching plant areas shall be strictly controlled, and cement-contaminated water shall be collected, stored and disposed of at a site approved by the EST.
- Unused cement bags shall be stored in a weather-proof area where it will not be impacted by rain. Used (empty) cement bags shall be collected and stored in weatherproof containers to prevent windblown cement dust and water contamination. The bags shall not be used for any other purpose and shall be disposed of on a regular basis via the solid waste management system.
- All excess concrete shall be removed from site on completion of concrete works and disposed of as approved by the EST. Washing of the excess concrete into the ground is not allowed. All excess aggregate shall also be removed from site.
- Stone chip/gravel excess shall not be left on road/paved area verges. This shall be swept/ raked into piles and removed to an approved disposal site.
- The Batching Plant shall be set up at a location downwind away from any residential set up at a sufficient distance.
- The Plant shall be set up away from any drain inlet and a perimeter bund shall be erected all around the batching plant. The drainage from the bund shall be subjected to a sump which will be cleaned on periodic basis to minimise potential surface runoff from stockpiles.
- The Plant shall be enclosed with temporary barriers (3 metres high) to minimise spread of emissions of noise and dust particles.
- Unloading from cement delivery trucks shall be done on pallets, which shall be covered with tarpaulin sheets during non-working periods.
- The Batching Plant shall be operated under supervision and periodical monitoring of dust levels and noise shall be conducted at the periphery of the construction site twice on weekly basis.
- The area surrounding the temporary concrete batching plant shall be swept on daily basis.

1.20.3. Working in the Proximity of Community Springs/Water Sources

A number of springs have been identified along the tunnel alignment. These springs are used by local communities for drinking water, irrigation and as water supply for livestock and wildlife. The following measures shall be taken by the Contractor to minimise potential impacts on these water sources:

- Identification and flagging of the location of these springs.

- Ensuring that minimum earth works and any other disturbance in the area around the springs is carried out and sedimentation is avoided.
- Monitoring and documentation of water yield before, during and after construction to detect impacts.
- Advance notification and coordination with the respective communities if any impact or temporal access restriction to the springs is expected.
- The Contractor is responsible for providing water to local villages if the supply source is affected due to Project-related activities.
- Contractor shall ensure that the effluents released from the operations of the crusher and other sources will be settled into a sedimentation tank, before being released into water sources.
- An appropriate drainage system shall be established in and around the spoil and muck disposal area to ensure that it does not impact the water quality.
- Liquid waste discharged from the labour camp shall be treated as per the standards set in the regulations of Nepal.
- Washing, bathing, urination, and toilet facilities shall be provided at the worker camps to ensure there is no open urination or defecation in open areas and water bodies by the workers.
- The Contractor shall establish a solid waste management system to ensure proper collection, segregation, and disposal of solid waste so that there is no contaminated surface run off from the waste.
- Liquid waste generated on site such as lubricants, paints, cleaning chemical, and other aqueous oil-based materials, shall be collected separately, stored in a suitable storage tank (i.e. on a concrete platform with secondary containment), and disposed of in a government approved facility.
- Semi-liquid waste generated from the batching plant shall be settled in a sedimentation tank before realised into a water source.
- The Contractor shall ensure that there is no haphazard disposal of waste on site.
- Sufficient and suitable toilet facilities for workers shall be maintained for proper standards of hygiene.
- Bund shall be provided around excavated soil or loose construction material to prevent runoff to nearly water bodies.
- Storage area shall be kept away from the water course to prevent any washes away.
- All the debris resulting from construction activities shall be removed from the site on regular basis to prevent their runoff.

1.21. ROCK CUTTINGS MANAGEMENT PLAN

The post-earthquake revised Project design involves significant tunnelling, the rock cuttings from which have not been tested to see if they are potentially acid generating. A Rock Cuttings Management Plan will be prepared by the contractor to manage the risk of acid rock drainage. The Contractor shall ensure that the following mitigation measures are implemented:

- During the tunnelling process, the Contractor shall perform a visual geological/geotechnical evaluation of the rock type for a preliminary determination of its acid generating potential.
- Sample collection should be done from the interior of every tunnel (for example, every 500 meters) during excavation, and from every area where there is a significant change in rock type, and sent to an accredited laboratory for analysis.
- The Contractor should test the pH of the seepage water on a regular basis, and have a contingency plan in order to contain and treat the water if it exceeds the discharge standards set forth in the MP.
- Material disposal (source and final disposal location) shall be monitored and documented daily.
- Material shall be disposed of based on the visual inspection; however, all material's disposal locations shall be recorded until lab results have been obtained and the geologist's initial assessment verified.
- The Contractor shall establish a cuttings disposal plan so that materials with acid drainage potential are not disposed of in areas for inert materials.
- Material with potential acid drainage shall be disposed of in areas where they are not exposed to conditions where they can generate acid leachate and where leachate can be collected and treated/disposed of appropriately.

1.22. WORKER ACCOMMODATIONS MANAGEMENT PLAN

1.22.1. Site Selection

The Contractor shall plan, design and build workers' camps and work sites to meet the following requirements:

- The Contractor shall submit for approval the designs and location of the proposed camps and work sites including details of all buildings, facilities, materials used, the construction methodology and work schedule, at least two months before the start of the construction works.
- The sites for the labour camps shall be identified keeping in mind the risk of landslides. For this purpose, the geological survey results of the Technical Team of Ministry of Federal Affairs and Local Development shall be taken into account.

- The permits and approvals shall be obtained in accordance with relevant local laws and regulations, applicable standards and environmental requirements in order to meet legal obligations for the construction of the camps and work facilities of Nepal.
- Camps, work sites, and access roads shall be located so as to avoid clearing as many major trees and vegetation as possible from the areas and to avoid important aquatic habitats. These areas shall be located to allow effective natural drainage.
- Offices and workers' camps shall be located at least 50 metres from watercourses and operated so that no pollutants enter watercourses, either overland or through groundwater seepage, especially during the rainy season. This can be achieved by recycling lubricants and building a ditch or canal around the area with an oil separator or settling pond/oil trap at the outlet of the ditch.
- Offices and workers' camps be located at least 100 metres from residential areas and shall never be located near schools.
- Offices and workers camps shall not be located in environmentally sensitive areas such as nature reserves, forests, water source protection areas, agricultural land, etc.
- Drainage systems, wastewater treatment and solid waste disposal shall be carried out according to Nepal national laws and regulations and the Waste Management Plan.

1.22.2. Facilities

- The Contractor shall provide suitable, safe, and comfortable facilities for the labour force.
- The facilities shall include dormitories, rest areas, lavatory facilities, and canteens adequate for the numbers of workers in the camps.
- The Contractor shall present the design of the facilities, to ESMC for approval and shall be in general conformance with the IFC Guidance Note on Worker Accommodations (IFC 2009).
- The Contractor shall provide adequate and suitable facilities for washing clothes and utensils for the use of contract labour employed therein.
- The Contractor shall provide recreational facilities to the workforce. Such facilities shall help reduce potential conflict and impact on the local population as the incentive to go outside the camp shall be reduced.
- Adequate power, heating, air conditioning and telecom system shall also be provided.
- The Contractor shall provide nutritious meals that shall take into account ethnical and cultural differences of the workforce.

1.22.3. Potable Water

- It shall be the Contractor's responsibility to carry out all the works necessary for the provision of a water supply system. A gravity flow water supply system can be constructed using water sources from the upper ridges. In any case, the water supply system shall be approved by ESMC.

- The Contractor shall verify the availability of water in the area to determine the scope of the works to be done.
- The Contractor shall supply water to the camps without impacting the water supply of neighbouring towns and villages.
- Water at sources shall be tested and treated as necessary.
- The Contractor shall provide potable water for food preparation, drinking, and bathing in all labour camps, administrative offices, medical facilities, canteens, etc. Potable water shall comply with the Nepal national standards for human consumption.
- Public taps shall be installed at appropriate locations
- The drinking water system shall be cleaned and maintained on a regular basis by the Contractor.

1.22.4. Sanitary Facilities

- Separate and adequate toilet and bathing facilities shall be provided for the use of male and female workers. Notices shall be displayed outside each block of latrines and urinals, in the language understood by the majority of the workers stating "For Men Only" or "For Women Only" as the case may be.
- Toilet and bathing facilities shall be provided with adequate supply of running water, soap, toilet paper, and drainage.
- Such facilities shall be conveniently accessible and shall be kept in a clean and hygienic condition on a regular basis. Latrines shall also be constructed in areas that are likely to be visited frequently by the construction workers.
- The Contractor shall provide portable toilets in all construction sites in the following scale: one latrine for maximum 15 women and one latrine for maximum 15 men.
- A dry system of sewage disposal, such as ventilated improved pit latrine, shall be appropriate for the Project area. It is easy to construct and does not require a flushing system. The latrines shall be located at a distance of at least 10 metres away from residential areas and at least 50 metres away from water sources.
- If septic tank systems are used for any residential labour camps, the seepage pits shall be located at a safe distance from water sources to avoid contaminating them. Wastewater shall not be disposed into water bodies without treatment.
- The wastewater treatment plants shall be designed, installed, operated and maintained in accordance with the regulations and specifications of Nepal.

1.22.5. Medical Facilities

The Contractor shall establish a medical centre located at the main construction camp for the diagnosis and treatment of communicable diseases, simple medical complaints, and the handling

of medical emergencies and accidents, prior to transportation to the hospital. The medical centre shall have:

- A 7 to 10 bed health facility fully equipped to provide emergency medical care to stabilize emergency patients before they can be referred to district or provincial hospital.
- Essential medical equipment for the centre to provide emergency care.
- Short term care of patients requiring hospitalization.
- Isolation room (one bed) for any infectious disease patient (in epidemic situations, district and provincial facilities shall have to be used).
- An ambulance or an appropriate motor vehicle to transport patients to the nearest health care centre or hospital.
- One medical officer, one trained nurse of senior level, two medical auxiliaries, and one laboratory technician (who may be also responsible for monitoring water quality in construction camp areas).

In addition, the Contractor shall ensure the following:

- The smaller construction camps shall have first aid posts staffed by either a trained nurse or a locally trained personnel, as required.
- All biomedical waste from the medical centre and the first aid posts shall be packed in containers designated for that purpose and discarded according to the rules and regulations established for the disposal of medical waste.
- All the facilities shall be provided with first aid kits that are regularly checked for medicine expiry, etc.

1.22.6. Maintenance of Camp Facilities

The Contractor shall implement the following measures to ensure that the construction camp and its facilities shall be organized and maintained to acceptable and appropriate standards:

- Meals and drinks shall be provided in the areas designated for this purpose (canteens) and during the established schedule. Cooking or preparation of food shall be prohibited in accommodation quarters.
- Designated rest times and recreational hours shall be established.
- Appropriate areas shall be designated for smoking. NO SMOKING signs shall be placed in areas where smoking is prohibited, for example, in the dormitories and medical facilities.
- The dormitories, medical and health facilities as well as canteens, kitchens, administrative offices, and other facilities shall be kept clean and free of debris, solid wastes and contaminants.
- The latrines and urinals shall be adequately lighted and shall be maintained in a clean sanitary condition at all times.

- Reserve water shall be kept in drums or barrels in or near the latrines and urinals.
- The Contractor shall establish a grievance redressal mechanism to receive and respond to complaints from the construction camp residents regarding the maintenance of facilities and services provided (food, medical care, recreation, etc.). This mechanism shall be in compliance to the principles identified in the GRM for the Project.
- The Contractor shall not purchase or serve to workers any fish caught in the Trishuli River or any wild/bush meat.

1.23. STOCKPILES, QUARRIES, AND BORROW PITS MANAGEMENT PLAN

The Contractor shall prepare an overall Stockpiles, Quarries and Borrow Pits Management Plan for the total work. Operation of a new borrowing area, on land, in a river, or in an existing area, shall be subject to prior approval by ESMC and the operation shall cease if so instructed by the EST. Stockpiles, Quarries and borrow pits shall be prohibited where they might interfere with the natural or designed drainage patterns. River locations shall be prohibited if they might undermine or damage the river banks, or carry too much fine material downstream. Rock or gravel taken from a river shall be limited to the depth equal to one-tenth of the width of the river at any one location, and not disrupt the river flow, or damage or undermine the river banks. The Plan shall include:

- A map showing the extent of the area to be developed.
- A method statement defining the proposed working methods shall be developed and approved by EST/ESMC.
- The proposed access and haulage routes between the borrow pits and the destination for the extracted materials shall be developed and approved by EST/ESMC.
- A justification for the quantities of materials to be extracted, an estimation of the waste material to be generated and disposal details for such waste materials.
- Details of the drainage system (ditches, culverts, etc.) to be submitted to EST.
- Details of the measures taken to minimise the borrow pit areas and their visual impact on the surrounding area.
- Details of the measures to be taken for the long-term rehabilitation of the borrow pit areas to avoid situations that could constitute a threat to health and safety and cause environmental pollution.

In general terms, the Contractor shall:

- Identify and demarcate locations for stockpiles and borrow pits, ensuring that they are 50 metres away from critical areas such as steep slopes, erosion-prone soils, and areas that drain directly into sensitive water bodies.
- Not locate borrow pits also close to roads.

- Locate stockpiles, quarries and borrow pits in non-productive land to the maximum extent possible and as approved by EST.
- Locate stockpiles, quarries, and borrow pits so as to avoid sensitive areas such as nature reserves, scenic spots, forest parks, water source protection areas, woodlands, or grasslands, etc.
- Locate stockpiles, quarries, and borrow pits in non-productive land to the maximum extent possible, and avoid agricultural land
- Limit extraction of material to approved quantity and demarcated borrow pits area.
- Stockpile topsoil when first opening the borrow pit. After all usable borrow has been removed, the previously stockpiled topsoil shall be spread back over the borrow area and graded to a smooth, uniform surface, sloped to drain. On steep slopes, benches or terraces shall be used to help control erosion.
- Stabilize and revegetate excess overburden. Wherever appropriate, organic debris and overburden shall be spread over the disturbed site to promote revegetation. Natural vegetation is preferred to the extent practicable.
- Keep existing drainage channels in areas affected by the operation free of overburden. These shall be cleaned regularly.
- Ensure that all borrow pits used are left in a trim and tidy condition with stable side slopes, re-establishment of vegetation, restoration of natural water courses, and avoidance of flooding of the excavated areas wherever possible so no stagnant water bodies are created which could breed mosquitoes.
- When the borrow pits or the local depressions created by the construction activities cannot be refilled or reasonably drained, consult with the local community to determine their preference for reuse such as fish farming or other community purposes.
- Reinstate areas affected by stockpiling to the satisfaction of EST.

1.24. MAINTENANCE MANAGEMENT PLAN

The Contractor shall carry out the following activities:

- Establish and enforce daily site clean-up procedures, including maintenance of adequate disposal facilities for debris.
- Collect construction, demolition, clearing, grubbing debris, and other trash weekly for disposal off–site. No on-site burning shall be permitted.
- Maintain silt fence and other temporary erosion and sediment controls in working order throughout the Project.
- Remove and properly dispose of excess sediment behind silt fences and Bio Rolls of when sediments reach one-third the height of the structure.
- Maintain construction entrances/exits daily.

- Remove all remaining temporary and accumulated silt fences 30 days after site has undergone final stabilization.
- In the event any debris or silt from the sites is deposited on adjacent land, immediately remove debris or silt and restore the affected area to its original state to the satisfaction of the EST.

1.24.1. Maintenance of Equipment during Construction Phase

To ensure the maintenance of equipment during construction, the Contractor shall:

- Identify and demarcate equipment maintenance areas (50 metres from rivers, streams, lakes, or wetlands). Fuel storage shall be located in proper areas approved by EST.
- Ensure that all instruments, machines, and construction equipment meet quality standards before they are put into use.
- Maintain the equipment and machinery used for earthmoving activities s in very good operating conditions, and periodically revises them for controlling emissions and avoiding possible mechanicals faults during operation that could lead to oil, lubricant, or fuel leaks.
- Ensure that all equipment maintenance activities, including oil changes, are conducted within demarcated maintenance areas.
- Never dispose spent oils on the ground, in water courses, drainage canals or in sewer systems.
- Dispose of all spills and collected petroleum products in accordance with standard environmental procedures/guidelines. Fuel storage and refilling areas shall be located at least 50 metres from all cross-drainage structures and important water bodies or as directed by the EST.
- Maintain and wash vehicles and other transport equipment only at sites having impermeable protective layers and collection system for oils, lubricants, detergents, solvents. The use of solvents and detergents shall be avoided to a minimum.

1.25. PROJECT COMMISSIONING AND CONSTRUCTION CLOSE OUT MANAGEMENT PLAN

The Contractor shall propose and develop methods and actions that will be implemented during the Project commissioning to ensure environmental, social, health, and safety risks are properly managed. The Contractor shall ensure the following minimum elements are included:

- Notify local residents at least a week in advance that project commissioning will be occurring and that filling the reservoir will begin. Provide appropriate safety briefings in each of the nearby villages;
- Ensure all project safety signage is in place prior to commissioning beginning;
- Clear and remove vegetation within the inundation zone of the reservoir;

- Look for and relocate any wildlife that could be caught in the rising reservoir water levels;
- Conduct survey of soil and geologic condition at the future reservoir margin to identify erosion and landslide-prone formations and areas and implement appropriate stabilization of those areas;
- Ensure Project operates in a true Run-of-River manner without any pulses of flows either in the diversion reach or downstream of the powerhouse;
- Ensure the required Environmental Flows appropriate for the month(s) during which commissioning occurs are released; and
- Ensure the fish ladder and the downstream fish guidance system are fully functional and operational, especially if commissioning occurs during the period when Common snowtrout are typically moving through the Project area (i.e., March through October).

Upon receiving the Performance Certificate as described in the EPC Contract, the Contractor shall:

- Remove any remaining Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works from the Site for reuse, recycling, or disposal at a Government of Nepal approved disposal facility;
- Complete all re-grading, slope stabilization, and revegetation of disturbed areas so as to prevent any post-construction erosion, including, but not limited to, the spoil disposal areas, Batch Plant, Crusher Plant, worker camps, temporary access roads, and lands below the transmission line; and
- Address any ESHS non-conformaties as identified by the Employer or Lenders.

1.26. EPC CONSTRUCTION MONITORING AND REPORTING PLAN

The Contractor shall be responsible for monitoring and reporting on its performance throughout the entire construction period. The list of required monitoring in Table B.2-2 represents the Lenders minimum requirements. The Contractor shall perform the required monitoring and retain documentation of the monitoring, which can be reviewed during Employer or Lender monitoring visits.

Table B.2-2: Summary of Minimum Contractor Monitoring Requirements

Resource	Monitoring Requirement/ Indicator	Frequency	Reporting Requirement	Entity Responsible
Air	Dust accumulation: Inspect for and record dust accumulation on structures or vegetation in the surrounding area	Monthly	Monitor, record, and report exceedances	EPC Contractor
Air	Air quality inside the tunnel including PM_{10}, CO, SO_x, NO_x	Monthly	Report concentrations in excess of parameters in ESIA	EPC Contractor
Air	Install an online real-time gas monitoring system, including	Continuous	Monitor, record, and report the situation of	EPC Contractor

Resource	Monitoring Requirement/ Indicator	Frequency	Reporting Requirement	Entity Responsible
	analysis equipment, to detect elevated concentrations of hazardous gases (coal gas)		hazardous gas to make sure that the emission has not exceeded the established standards	
Air	Monitor air quality (PM_{10}) at nearest receptors in Hakubesi-Fulbari, Gogane, and Mailun Villages.	3 times a year	Record and compare with ambient standards in the ESIA.	EPC Contractor
Noise	Noise Level Meter installed at Hakubesi-Fulbari, Gogane, and Mailun Villages.	3 times a year	Record and monitor noise levels.	EPC Contractor
Noise	Maintain noise levels associated with all machinery and equipment at or below 90 decibels.	3 times a year	Record and monitor noise levels.	EPC Contractor
Noise	Construction site noise shall be monitored with portable detecting devices	Continuous	Monitor the noise level at the sensitive receptors	EPC Contractor
Waste	Monitor volume of waste generated at worker camp	Weekly	Retain records on-site indicating where all waste has been disposed of	EPC Contractor
Water	Maintain continuity of at least minimum Environmental Flow at all times during construction	Continuous	Install flow gauge to confirm continuous release of flow	EPC Contractor
Water	Maintain flow through diversion tunnels to allow for upstream and downstream migration of fish	Continuous	Visual inspection	EPC Contractor
Water	Sample for DO, pH, BOD, turbidity, total suspended solids, and fecal coliforms: upstream of weir, between weir and power house, and downstream of power house	4 times a year	Record and compare with Standards for Effluents Discharged in the ESIA.	EPC Contractor
Water	DO, pH, BOD, turbidity, total suspended solids (TSS), and hardness. Sample immediate points after treatment units of tunnel discharge, discharge from aggregate, crushing plant and batching plant, settling ponds, and sanitary discharge.	Monthly	Report concentrations in excess of parameters listed in the World Bank EHS General Guidelines or Nepal regulations	EPC Contractor
Water	pH, TSS, and metal concentrations in seepage or discharge from the Spoil Disposal Areas	Monthly	Report concentrations in excess of parameters listed in the World Bank EHS General Guidelines or Nepal regulations	

Resource	Monitoring Requirement/ Indicator	Frequency	Reporting Requirement	Entity Responsible
Water	Water quantity in Community Springs/Water Sources	Before, during and after construction	Monitor water yield to detect impacts and provide alternate water supplies to villages/communities if water supply is affected	EPC Contractor
Water	Monitor rock excavated from the tunnel for Potential for Acid Generation. Rock samples should be sent to lab for analysis	Every 500 m of tunnel excavation and whenever there is a change in rock type	Records must be kept on site	EPC Contractor
Water	Monitor water quality of any discharge from Batch or Crushing Plant treatment facilities for pH and TSS	Weekly	Records must be kept on site	EPC Contractor
Water	Domestic wastewater discharges for compliance with World Bank EHS General Guidelines	Weekly	Records must be kept on site	EPC Contractor
Water and Soil	Pollution Prevention: open defecation and garbage/solid waste disposal	Daily	Visual monitoring of nearby villages and headwork and powerhouse areas.	EPC Contractor
Water and Soil	Hazardous materials/Waste use as well as the storage, handling, and disposal procedures	Daily	Records must be kept on site.	EPC Contractor
Water and Soil	Tunnel excavation material disposal (source and final disposal location) shall be monitored and documented	Daily	Records must be kept on site.	EPC Contractor
Soil	Landslide and slope stability – access roads and tunnel	Daily in vicinity of any blasting	Record and monitor number of incidence of landslides, slope failure and debris flow.	EPC Contractor
Soil	Erosion of soils and deposition in downslopes of the access roads, tunnels, spoil disposal areas, and quarries	6 times a year	Monitor via frequent mapping and site observations	EPC Contractor
Biodiversity	Monitor to confirm successful migration of Common snowtrout (and Dinnawah snowtrout if present) upstream and downstream through diversion tunnel	During upstream and downstream migration periods	Visual monitoring of successful passage through tunnel and presence of fish congregating at entrance to tunnel	Owner and EPC Contractor

Resource	Monitoring Requirement/ Indicator	Frequency	Reporting Requirement	Entity Responsible
Health & Safety	Sample water supply reservoir and end tap of the Worker Camps.	Monthly	Report concentrations in excess of parameters listed in the World Bank EHS General Guidelines or Nepal regulations	EPC Contractor
Health & Safety	Monitor structural stability of tunnels	Continuous	Record visual observations	EPC Contractor
Health & Safety	Maintain records and reports concerning health, safety and welfare of persons, and damage to property, as the Environmental Supervision Team may reasonably require	Monthly	Records must be kept on site.	EPC Contractor
Health & Safety	Visually monitor number of houses, construction material, development of cracks and house owner information near road construction and blasting areas	Pre-blasting survey and then in response to complaints	Document structured through write ups, maps, and photographs.	EPC Contractor
Health & Safety	Monitor dust at the Crushing and Batching Plants	Regularly	Maintain records	EPC Contractor
Health & Safety	Visually inspect workers camps for adequate water, wastewater, and solid waste facilities	Weekly	Record visual observations	EPC Contractor
Labour	Compliance with Code of Conduct	Monthly	Maintain records	EPC Contractor
Labour	Review records of Worker Grievance Redressal Mechanism	Annually	Maintain records	EPC Contractor

In accordance with the requirements of the EPC Contract, the Contractor shall provide:

- Monthly Progress Reports to the Employer
- Quarterly Environmental and Social Issues Compliance Reports

These reports shall include, at a minimum, the following ESHS information:

- Health and Safety Performance – including hours worked, recordable incidents (e.g., lost time accidents, medical treatment cases) and corresponding Root Cause Analysis, first aid cases, high potential near misses, and injuries to the public or visitors, and remedial and preventative actions taken (e.g., new equipment, updated training).
- Environmental Performance – air/water/noise/vibration/slope stability monitoring results, specifically identifying any results exceeding Nepal or World Bank Group EHS General Guidelines; any incidents in which the required minimum flow of 3.8 m^3/s was not met, for what duration, and why; any hazardous material spills or discharges of untreated wastewater or process water

- Social Performance – including the number, type, status, and outcome of any community grievances that were filed;
- Labour Performance - including the number, type, status, and outcome of any worker grievances that were filed; number, type, status, and outcome of any Code of Conduct violations; number of workers disaggregated by place of origin (i.e., expatriate, local, or non-local Nepalis), gender, and skill level (e.g., unskilled, skilled, supervisory, professional, management); EHS training provided, including the dates, location, number of trainees, and topics;
- ESHS Staffing – including identifying any new hires or departures, and a listing of current ESHS staff and titles;
- ESHS Requirements – including any non-compliance incidents with permits or national law, project commitments, or other ESHS requirements; and identificiation of any impacts outside the Project's approved footprint;
- ESHS Inspections and Audits – including any by the Contractor, Employer, Lender, or the Lender's Independent Engineer, and providing the date, sites visited, major findings, and any actions taken;
- Stakeholder Engagement – including any formal or informal meetings or information disclosure with stakeholder, including the date, location, number of attendees, and topics discussed;
- Major Changes – including any changes to the CESMMP or general ESHS practices, and any actions taken in response to previous notices of deficiency.

Appendix B.3
Operation Environmental and Social Management and Monitoring Plan Framework

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LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AoI	Area of Influence
BMP	Biodiversity Management Plan
CIA	Cumulative Impact Assessment
CIMP	Cumulative Impacts Management Plan
CITES	Convention on International Trade in Endangered Species
CR	Critically endangered
DRIFT	Downstream Response to Induced Flow Transitions
Eflow	Environment flow
EFMP	Environmental Flow Management Plan
EIA	Environmental Impact Assessment
EN	Endangered

EPC	Engineering, procurement, and construction
ERP	Emergency Response Plan
ESIA	Environmental and Social Impact Assessment
ESMC	Environmental and Social Management Cell
ESMMP	Environmental and Social Management and Monitoring Plan
ESMS	Environmental and Social Management System
EST	Environmental Supervision Team
ha	Hectare
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
km/hr	kilometres per hour
LALRP	Land Acquisition and Livelihood Restoration Plan
LC	Least Concern
LNP	Langtang National Park
MSDS	Material Data Safety Sheet
NT	Near Threatened
NWEDC	Nepal Water and Energy Development Company
O&M	Operations and maintenance
PDA	Project Development Agreement
PH	Power House
PS	Performance Standards
RLNM	Red List of Nepal's Mammals
SEO	Safety and Environmental Officer
VU	Vulnerable

B.3 OPERATION ESMMP

1.1. KEY HIGHLIGHTS OF OPERATION PHASE MITIGATION MEASURES

This appendix describes the requirements for Operation ESMMP (OESMMP). Table B.3-1 lists the Management Plans required for this phase, which should be prepared by the Owner's (NWEDC) operations and maintenance (O&M) Contractor. This operational phase ESMMP shall be implemented in addition to, and in keeping with, the other management plans prepared for the Project and the requirements of the applicable reference framework.

This document presents a framework (hereafter referred to as the "Framework") of, and represents the minimum Lender's requirements for, the Operation Environment and Social Management and Monitoring Plan (hereafter referred to as the OESMMP) for the operation phase of the Upper Trishuli-1 Hydropower Project (Project). This OESMMP Framework has been formulated based on the Project understanding and the findings and recommendations of the Project Environmental and Social Impact Assessment (ESIA). The OESMMP Framework specifies the Management Plans, and the minimum requirements for these plans, to be developed in greater detail by the Operations & Maintenance Contractor (herein referred to as the Contractor), and which are required, as part of the contract between the Owner and the Contractor, to be implemented and complied with by the Contractor during the operations phase of the Project.

1.2. OESMMP PROCEDURES AND RESPONSIBILITIES

This section describes the process for approving and, as needed, modifying the OESMMP, and each party's responsibilities relating to the OESMMP.

1.2.1. OESMMP Approval Process

The development and approval of the OESMMP will be conducted in a timely manner in accordance with the dates specified in the Environmental and Social Action Plan (ESAP). The general development and approval process is as follows:

- The Contractor will develop a detailed Draft OESMMP, using this Framework to establish the minimum Lender's requirements;
- The Contractor will provide the Draft OESMMP to the Owner for its review;
- The Owner will provide the Draft OESMMP to the Lenders for its review;
- The Owner will incorporate any Lenders' comments along with its own comments and provide an integrated set of comments to the Contractor;
- The Contractor will address all comments provided by the Owner and provide a Final OESMMP to the Owner for its review;
- The Owner will review and, if acceptable, approve the Final OESMMP.
- Hard and soft signed copies of the Final OESMMP will be distributed by the Owner to the Contractor and the Lenders.

1.2.2. Management of Change

The need may arise to modify the OESMMP. The process below establishes Management of Change requirements for any and all changes to the OESMMP.

It is anticipated that most proposed changes to the OESMMP will be initiated by the Contractor, or its Subcontractors. The Management of Change process, however, does allow for the Owner or the Lenders to propose changes when it is reasonably likely that the current OESMMP is not sufficient to prevent:

- Serious health and safety incidents
- Impacts above those disclosed in the ESIA;
- New impacts not disclosed in the ESIA;
- Violation of Nepal law;
- Non-conformance with Lenders requirements, including the:
    - IFC Performance Standards
    - World Bank Environmental, Health, and Safety (EHS) General Guidelines (2007); and/or
    - Other Lender requirements.

Table B.2-1 below defines three categories of potential changes to the OESMMP and the review and approval process associated with each.

Table B.3-1: Project OESMMP Management of Change Process

Category of Change	Change Description	Action Required
Category 3	Changes that have the potential to, or are reasonably likely to, result in decreased Contractor ESHS performance, and/or are likely to result in an increase in ESHS impacts above those disclosed in the ESIA, result in new impacts not disclosed in the ESIA, require the acquisition of rights to use additional lands, or require additional permits/approvals from the government.	The Contractor will notify the Owner of the proposed change and provide the rationale and justification for the change. The Owner will notify the Lenders within one week of the receipt of the request for an OESMMP change. This category of change requires Owner and Lender approval before implementation.
Category 2	Changes which have the potential to, or are reasonably likely to result in, decreased Contractor ESHS performance, but are unlikely to result in any increase	The Contractor will notify the Owner of the proposed change and provide the rationale and justification for the change. The Owner will notify the Lenders within

	in environmental/social impacts above those described in the ESIA, or result in new impacts not described in the ESIA, or require the acquisition of rights to use additional lands.	one week of receipt of request for an OESMMP change. This category of change only requires approved by the Owner before implementation, unless the Lenders object within 30 days of receipt of the notice of change.
Category 1	Changes will are expected to result in similar or improved ESHS performance and are unlikely to result in any increase in environmental or social impacts above those described in the ESIA	The Contractor will notify the Owner of the proposed change and provide the rationale and justification for the change. The Owner will notify the Lenders as part of its quarterly Environmental and Social Issues Compliance Report. This category of change only requires Owner approval before implementation.

The Contractor is required to maintain a copy of the current version of the OESMMP at its site management office at all times. The Contractor understands that the Owner and/or Lender will use the current version of the OESMMP as the basis for conducting its periodic monitoring inspections.

1.2.3. OESMMP Responsibilities

The list below indicates the OESMMP-related responsibilities of each entity:

- Contractor (EPC) Requirements
    - Develop a Draft OESMMP, which addresses all applicable operations phase ESHS commitments based on the ESHS Compliance Registry to be completed by the Owner (see below under Owner's Requirements), and revise it as needed in order to obtain Owner approval;
    - Maintain a copy of the current approved OESMMP at the site management office at all times;
    - Follow the Management of Change process described above for any changes to the OESMMP;
    - Include language requiring full compliance with this OESMMP in any and all subcontracts the Contractor signs for the Project. If a Subcontractor proposes any changes to the current approved OESMMP, those changes must go through the approved Management of Change Process;
    - Provide appropriate training so as to assure that its workforce understands the requirements of OESMMP;

- Ensure all new project personnel as part of their induction process receive environmental and cultural sensitivity training as described in the Operations Worker Induction Training and Code of Conduct Management Plan and are provided a copy of the Worker Code of Conduct. All new personnel are required to provide written verification (induction sign-off) that they have completed the Project induction, understand their environmental and social obligations and the Code of Conduct, commit to comply with the Code, and understand the penalties for failure to comply with the Code;
- Employ qualified ESHS staff to oversee the Project's ESHS performance and ensure that staffing and resources are adequate, commensurate with the magnitude and timing of work and potential ESHS risks;
- Construct the Project in accordance with the OESMMP;
- Comply with the Owner's Community Grievance Mechanism by either referring person's with grievances to the Owner's designated representative (e.g., Community Liaison Officer) or logging and promptly submitting the grievance to the Owner's designated representative;
- Erect notification boards at the powerhouse and dam sites providing information for the local communities about the Project, as well as instructions on how to log any grievances or make suggestions along with contact information for the site managers, and environmental and social staff;
- Establish a Worker's Grievance Mechanism to provide a way for worker's to file grievances or make suggestions;
- Notify the Owner of any significant incidents or accidents in accordance with the requirements and timing of the Environmental and Social Issues Compliance Report;
- Comply with the applicable operations phase requirements in the Owner's Environmental and Social Management Plan;
- Monitor and report on the ESHS performance of the project during operations as described in the Operations Monitoring and Reporting section of this OESMMP;
- Participate in regular (at least quarterly) ESHS performance meetings with the Owner to review ESHS performance;
- Proactively implement corrective actions to address any situations where the Contractor is not meeting the requirements of the OESMMP;
- Retain documentation of Project compliance with the OESMMP to facilitate Owner and Lender compliance audits;
- Cooperate fully with all compliance audits conducted by the Owner, the Lenders, or the Lenders Independent Engineer (who is also responsible for serving as the Independent Environmental and Social Consultant); and

  - Cooperate fully and implement any Corrective Action Plans required by the Owner or the Lenders to address any situations where the Contractor is not meeting the requirements of the OESMMP or complying with the laws of Nepal.

- Owner (Owner) Requirements
  - Include language requiring the Contractor to comply with the approved OESMMP in the EPC Contract;
  - Prepare and maintain an Environmental, Social, Health, and Safety Compliance Registry, which includes all Project commitments in response to Government approvals, Lenders requirements, and discussions with local communities;
  - Review and approve the Contractor's OESMMP;
  - Comply with the Management of Change process described above for any proposed changes to the OESMMP;
  - Monitor contractor and subcontractor E&S performance and ensure the contractor monitors its own and all subcontractors' E&S performance throughout operations;
  - Monitor contractor and subcontractor ESHS performance and conformance with the OESMMP, and ensure the Contractor monitors its own and its subcontractors' ESHS performance throughout, including mobilization, operations, and decommissioning;
  - Hold regular (at least quarterly) ESHS performance meetings with the Contractor to review ESHS performance;
  - Notify the Contractor of the need for any corrective actions;
  - Issue a stop work order if the Contractor has not taken appropriate action to achieve compliance with ESHS requirements after repeated notices of violation and warnings of noncompliance, and significant ESHS impacts are occurring or imminent, until the Contractors ESHS performance is brought up to acceptable standards;
  - Provide the Lenders with copies of the Contractor's monitoring reports;
  - Cooperate fully with all compliance audits conducted by the Lenders or the Lenders Independent Engineer (who is also responsible for serving as the Independent Environmental and Social Consultant); and
  - Fully cooperate with any Lenders' Corrective Action Plans.
- Lender Requirements
  - Review and provide comments to the Owner on the Draft OESMMP;
  - Comply with the Management of Change process described above for any changes to the OESMMP;
  - Conduct periodic monitoring visits; and

- Provide the Owner with all Operations Monitoring Trip Reports and notify the Owner of the need for any Corrective Action Plans.

1.3. OPERATIONS MANAGEMENT PLANS REQUIREMENTS

This section identifies the Lender's required minimum requirements for each operations phase environmental and social management plan for the Project. The O&M Contractor will prepare detailed management plans based on these minimum requirements.

This OESMMP Framework includes minimum Lender requirements for each of the following Management Plans:

- Operation Worker Induction Training and Code of Conduct Management Plan
- Disaster Management and Emergency Preparedness and Response Management Plan
- Spill Prevention and Response Management Plan
- Community Health and Safety Management Plan
- Occupational Health and Safety Management Plan
- Worker Accommodation Management Plan
- Site Security Management Plan
- Traffic Management Plan
- Waste Management Plan
- Air and Noise Management Plan
- Biodiversity Management Plan
- Sediment Management Plan
- O&M Monitoring and Reporting Plan

1.3.1. Operation Worker Induction Training and Code of Conduct Management Plan

The Contractor is responsible for providing appropriate health and safety (H&S) and environmental and cultural sensitivity training to its workers, as described below:

- All new Project personnel shall receive appropriate H&S training during their induction (i.e., within their first week of work). The training shall be conducted by an experienced and qualified H&S professional. The H&S training shall involve a detailed review of the Contractor's Occupational Health and Safety Management Plan (see Section 1.3.10), a detailed description of the H&S risks each employee will be exposed to given their work assignment, identification of the appropriate Personal Protective Equipment (PPE), and the proper use of the PPE. The Occupational Health and Safety Management Plan provides additional requirements relative to ongoing and refresher H&S training.

- All new Project personnel shall receive appropriate environmental and cultural sensitivity training during their induction (i.e., within their first week of work). The training shall be conducted by an experienced and qualified environmental science professional and a social science professional. This training shall involve a description of the sensitive environmental setting of the Project (i.e., adjacent to the Langtang National Park) and the potential presence threatened and endangered species. The new personnel shall be informed about these species and what actions they should take if they were to encounter any of these species, or wildlife in general. The new personnel will also receive training regarding the customs and practices of the Tamang people and the Contractor's requirements regarding any interactions with the Tamang of other local residents.
- The Contractor shall develop a Worker Code of Conduct, which emphasizes the importance of appropriate behaviour, respect for local communities and customs, protection of the environment, including fish, wildlife, and trees, and compliance with all Nepalese laws and regulations. This Code of Conduct shall be reviewed and approved by the Owner and the Lenders prior to the initiation of operations. The Code of Conduct should be available to local communities at the Public Information Centres (PIC) established for the Project. All new Project personnel shall receive appropriate training in the Worker Code of Conduct during their induction (i.e., within their first week of work). The Code of Conduct should address at least the following topics:
    - Expectations for workers to carry out their work in a safe manner, and to look after the safety of others.
    - Expectations of workers to look after, be aware of, and minimize their impacts on the environment. This includes a prohibition on unauthorized entrance to Langtang National Park or Community Forest lands, hunting, fishing, poaching, logging, collection of firewood, clearing of vegetation, collection of/trade in plants, animals, and non-timber forest products.
    - Urination and defecation in open areas and water bodies and haphazard disposal of solid waste shall be prohibited.
    - All the workers/labourers shall comply with the laws and regulations of Nepal.
    - Possession of illegal substances, abuse of drugs and alcohol, gambling, carrying of firearms, and involvement with prostitutes shall be prohibited.
    - Workers shall respect local customs and traditions. Workers visiting the local communities or interacting with local residents shall follow appropriate standards of dress and personal hygiene, must behave in a manner consistent with the Code of Conduct. Fighting (physical or verbal), creating nuisances and disturbances in or near communities, and disrespecting local customs and traditions shall be prohibited.
    - As part of the Code of Conduct, the Contractor must include sanctions (e.g. penalties up to dismissal) for workers violating this Code of Conduct.

- The Contractor shall retain documentation demonstrating that every Project employee, including subcontractor personnel, has received the required H&S training, environmental and cultural sensitivity training, and has signed the Code of Conduct.
- The Contractor shall also establish a worker grievance redressal mechanism to enable workers to file complaints. The Contractor shall inform the workers of the grievance mechanism at the time of recruitment and make it easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned, without any retribution. The mechanism should also allow for anonymous complaints to be raised and addressed. The mechanism should not impede access to other judicial or administrative remedies that might be available under the law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.
- The Contractor shall provide a grievance mechanism for workers (and their organizations, where they exist) to raise workplace concerns. The Contractor shall inform the workers of the grievance mechanism at the time of recruitment and make it easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned, without any retribution. The mechanism should also allow for anonymous complaints to be raised and addressed. The mechanism should not impede access to other judicial or administrative remedies that might be available under the law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.

1.3.2. Disaster Management and Emergency Preparedness and Response Management Plan

This Management Plan shall address all reasonably foreseeable emergencies that may occur at the Project, including dam break, Glacial Lake Outburst Flood, natural flood, sudden unexpected release of water from the dam or powerhouse (e.g., from improper spillway gate operation), earthquake, landslide, fire, landslides, tunnel collapse, hazardous material spills, drowning or other medical emergency, traffic accident, bomb threat, and similar events.

For each of these emergency situations, the Management Plan shall describe the:

- Contractor's Command Structure for responding to the emergency;
- Measures the Contractor will take to prevent the emergency from occurring, if possible;
- Monitoring the Contractor will conduct in order to detect developing emergency conditions (e.g., monitor flow in the river, real-time gas monitoring system in the tunnel);
- Equipment the Contractor will ensure is available and well-maintained at the Project site;
- Alarms, including both visual and auditory alerts, to notify personnel and the public of emergency conditions;

- Communication procedures and equipment that the Contractor shall use for notifying its personnel, nearby and downstream residents, and local and national government of impending or actual emergency conditions;
- Training exercises and drills the Contractor will conduct to ensure workers are aware of and prepared in the event of each type of emergency;
- Awareness and other training for local residents so they know how to protect themselves in the event of an emergency;
- Evacuation plans for its personnel as well as nearby or downstream residents;
- Rescure procedures;
- Records the Contractor will maintain onsite documenting the training exercises and drills it has conducted;
- Detailed procedures the Contractor will follow in the event of each type of emergency;
- Conditions under which the Project can return to normal operations and the procedures to document those conditions;
- Measures the Contractor will take to document lessons learned from training exercises, drills and actual emergencies.

The O&M Contractor shall prepare this Emergency Preparedness and Response Management Plan in consultation with appropriate National and Local government agencies. The O&M Contractor shall conduct periodic review and update of these plan on no less than an annual basis.

1.3.3. Spill Prevention and Response Management Plan

Environmental emergency procedures relate primarily to the event of accidental leaks, spills, emissions. Therefore, the Contractor shall respond on a case-by-case basis to such emergencies and shall initiate event-specific measures in terms of notifications and reactions.

In the event that accidental leakage or spillage of diesel or other hazardous materials/wastes takes place, standard response procedures shall be followed immediately by the O&M Contractor such as:

- The O&M Contractor should stockpile at the Project site the equipment and materials necessary to respond to potential range of potential accidents/spills.
- The person who identified the leakage/spillage shall immediately check if anyone is injured and then inform the SEO and EST;
- The O&M Contractor shall ensure that all injured persons, if any, are treated and assess the nature of the substance that has spilled/leaked;
- Whenever the accidents/incidents generate serious environmental pollution or potential risks resulting in serious environmental pollution problems (e.g. spillage/leakage of toxic or

chemicals, large scale spillage/leakage, or spillage/leakage into the nearby water bodies which are used for irrigation / portable water), the SEO shall immediately inform the EST.

- In such cases, the Contractor shall take immediate action to prevent the spillage/leakage and contain or divert the spilled/leaked liquid to a nearby non-sensitive area;
- The Contractor shall arrange maintenance staff with appropriate protective clothing to clean up the spill. This may be achieved through covering the area with sawdust (if the quantity of spillage/leakage is small), or sand bags (if the quantity is large); and/or using a shovel to remove the topsoil (if the spillage/leakage occurs on bare ground);
- Contractor Environmental Health and Safety team shall identify the possible accidental leak/spill of fuel/chemicals/waste as per the type, nature of materials to be handled at site and detailed procedure for spill prevention and management to be prepared and awareness training on the same to be imparted to all responsible personnel;
- Spilled chemicals must not be flushed to local surface drainage systems. Instead, government approved clean-up and disposal procedures shall be carried out;
- Depending on the nature and extent of the chemical spill, evacuation of the activity at the site may be considered. The Contractor/SEO has the authority to make the final decision.
- The Contractor shall prepare a report with root cause analysis for the spill or incident, remedial action taken, consequences/damage from the spill, and proposed corrective actions. The incident report shall be submitted to the EST for review and shall be maintained in the records.
- Workers shall receive training on environmental emergency procedures, so that they are fully aware of the various possible emergency situations during Project operations and the applicable emergency response procedures, as well as the danger and potential damages caused by the emergency to the environment and the people.

1.3.4. Waste Management Plan

The O&M Contractor shall prepare a Waste Management Plan before commencement of Project work including the following minimum lender requirements:

1.3.4.1. Domestic Solid Waste

- Submit a method statement detailing a solid waste control system (e.g., storage, provision of bins, site clean-up schedule, bin clean-out schedule, etc.) to the Owner for approval.
- Ensure that all facilities are maintained in a neat and tidy condition and the site shall be kept free of litter. At all places of work, the Contractor shall provide litter bins, containers, and refuse collection facilities for later disposal;
- Waste containers shall be strategically placed in visible locations easily identified and marked (e.g., recycle, organic waste, unusable waste, hazardous waste, paper, glass). Waste storage containers shall be covered, tip-proof, weatherproof, and scavenger proof, and should not attract wildlife. Solid waste may be temporarily stored on site in a designated area

approved by the Owner. The storage area shall have a cover to avoid direct contact with surface runoff, and be fenced off to prevent wind-blown litter;

- Educate employees on segregation of waste with demarcated bins for recyclables and perishables placed in common areas.
- Collect and separate on-site recyclable materials from other waste. Collected recyclable material shall be re-used or sold to a waste collector for recycling.
- Transport domestic waste off site-using a license waste collector in covered containers or covered trucks at least once a week for at an appropriate and permitted waste disposal facility;.
- If collection of waste is not practical in remote locations, a landfill may be required. As described above for construction waste, if the EPC or O&M Contractor determine an on-site landfill is required, that will trigger the MoC provisions in this OESMMP and would require both government and lender approval and implementation of required mitigation measures and an update to the Waste Management Plan; and
- Prohibit burning of solid waste in open air conditions and random disposal of solid waste within and outside the Project areas.

1.3.4.2. Hazardous Waste

The Contractor shall carry out the following activities:

- Ensure all hazardous waste (e.g., used oil, lubricants, cleaning materials, transformer oil, oil soaked cloths, paint) is properly labelled; stored separately from other solid waste onsite at a location provided with impervious surface, a roof/covering, secondary containment system, and appropriate warning signs; transported offsite by an approved transporter; and disposed at a government approved and licensed disposal facility. Maintain records/manifest/disposal certificates to document proper handling and disposal of all hazardous wastes;
- Provide oil and grease trap at vehicle, machinery and equipment maintenance area and provide regular upkeep and removal.
- Recycle used oil and grease to the extent possible through an approved used oil recycling company;
- Maintain vehicles, machineries and equipment only at designated areas;
- Only allow authorized and trained personnel to handle hazardous waste;
- Inform all personnel of the emergency measures to be taken in case of spills or accidents due to improper use of these substances.

1.3.4.3. Wastewater

- Provide adequate and appropriate wastewater treatment either in the form of a package wastewater treatment facility or if soils conditions and waste loads are adequate, a

community septic system, which is designed, installed, operated and maintained in accordance with the regulations and specifications of Nepal;

- Provide proper maintenance and ensure effective operation of the domestic wastewater treatment plant/system;
- Provide regulator monitoring of treated wastewater effluent quality to ensure it complies with Nepal and World Bank standards; and
- No untreated /raw sewage shall be discharged to any waterbody and prohibit open defecation.

1.3.5. Community Health and Safety Management Plan

The O&M Contractor shall undertake at least the following actions to protect the public from Project operations:

- Place warning signs to alert the public to potential dangers (e.g., upstream of the dam, immediately downstream of the dam, near the desander discharge, below the tailrace, near the powerhouse, near the takeoff yard, and at transmission towers);
- Install a warning system for sudden water level fluctuations at major locations/communities downstream of the proposed dam site (to include a siren network to inform those in the diversion reach in case of a sudden release of water);
- Install appropriate traffic control and warning signs to notify vehicular drivers and local communities of traffic risks and hazards;
- Ensure adequate and timely disclosure of information to the local community in terms of Project activities and available opportunities, in keeping with Stakeholder Engagement Plan formulated for the Project.

1.3.6. Occupational Health and Safety Management Plan

The Contractor shall prepare and implement an Occupational Health and Safety (OHS) Management Plan to address matters regarding the health and wellbeing of workers, Project staff and nearby communities during Project operations. The OHS Management Plan shall:

- Describe potential health and safety hazards based upon the specific project works/activities;
- Describe the procedures and equipment which are technically appropriate to deal with such works/activities;
- Describe all major responsibilities and authorities relating to the implementation of the OHS Management Plan;
- Describe the specific project supervision methods (including audits, documentation and record-keeping, on-site monitoring and medical surveillance) to be implemented to ensure that the plan is completely and properly implemented;
- Describe the specific health and safety training that will be provided to any persons involved and the minimum levels of training required;

- Describe the emergency response procedures that will be implemented; and
- Describe the estimated cost, time schedule and assigned responsibility for implementing each component of the plan.

The O&M Contractor shall:

- Provide robust health and safety training to all personnel appropriate for their job responsibilities;
- Provide all personnel with the proper Personal Protective Equipment (e.g. safety boots, safety glasses, helmets, hearing protection, gloves, respirators), or PPE;
- Alternate work schedule to avoid continuous exposure of workers to higher noise levels.
- Only use trained and authorized personnel for cranes and other lifting equipment;
- Carry out health screening and fitness test of all workers at the time of recruitment. This health screening shall be undertaken in keeping with the work profiles of the workers. The fitness test shall screen for communicable diseases and any health risks which may create issues in undertaking the task assigned. In addition to this, regular annual health check-ups shall be undertaken of all workers;
- Provide appropriate information and education to the workforce on basic personal hygiene, prevention of diseases, including respiratory diseases, water and food borne diseases such as diarrhoea and tuberculosis;
- Implement a program for workers and local communities for the prevention, detection, screening, and diagnosis of sexually transmitted diseases, especially with regard to HIV/AIDS. The program shall also include information on alcohol abuse and human trafficking;
- Distribute educational materials to all workers including brochures, and leaflets which provide information on symptoms of disease, and available counselling and treatment services;
- Provide basic first-aid services to the workers as well as emergency facilities for work-related accidents, including medical equipment suitable for the personnel, type of operation, an ambulance or motorized vehicle, and the degree of treatment likely to be required prior to transportation to a hospital or health care centre;
- Use appropriate safe and decent transportation mode to transport workers to Project sites, during the operation phase. Labourers shall be provided with transportation in vehicles equipped with canopy (closed vehicles) and seating facility;
- Provide proper marking for identification of locations of flammable storages;
- Provide sufficient number of personnel with first aid training to respond emergency;
- Send details of any accident to the Owner as soon as practicable after its occurrence;

- Maintain records and reports concerning health, safety incidents, and damage to property, as the Owner may reasonably require;
- Provide training to the workers on climbing techniques, and rescue of fall-arrested workers;
- Use appropriate tool bag for raising or lowing tools to workers on elevated structures;
- Lifting devices, including equipment, slings, ropes, chains, and straps, shall be inspected, certified, and labelled to confirm their weight capacities;
- Provide proper lighting in tunnel and other underground areas;
- Provide adequate sanitary facilities to prevent any health ailments and to meet the emergency needs;
- Provide safe drinking water to the workers at residential accommodations and other facilities meeting Nepal and WHO drinking water quality standards;
- The Contractor will notify and provide training to all appropriate personnel of any changes to the Occupational Health and Safety Management Plan per the Management of Change process.
- The safety training shall be accompanied by regular refresher trainings;
- The speed of vehicles moving within the Project site shall be limited to 15-20 km/hr;
- MSDSs for each chemical present on the worksite shall be maintained; and
- The Contractor shall keep records of attention and issues covered and provide such records when required by ESMC or SEO.

1.3.7. Worker Accommodations Management Plan

The O&M Contractor shall provide suitable, safe, and comfortable facilities for its workers, which shall be in general conformance with the IFC Guidance Note on Worker Accommodations (IFC 2009). The worker accommodations shall include:

- Dormitories, rest areas, lavatory facilities, canteens, recreation facilities, and a health/first aid clinic adequate for the numbers of personnel;
- Prohibit the purchase or serving to workers any fish caught in the Trishuli River or any wild/bush meat.
- Adequate and suitable facilities for washing clothes and utensils;
- Adequate power, heating, air conditioning and telecom system;
- Adequate and safe potable water receiving appropriate treatment;
- Adequate and appropriate wastewater treatment either in the form of a package wastewater treatment facility or if soils conditions and waste loads are adequate, a community septic

system, which is designed, installed, operated and maintained in accordance with the regulations and specifications of Nepal;

- No untreated /raw sewage shall be discharged to any waterbody and prohibit open defecation; and
- Recycle/reuse water to the extent possible.

1.3.8. Site Security Management Plan

The O&M Contractor is responsible for maintaining the safety and security of all Contractor personnel and visitors to the Project site. The Contractor shall be responsible for the following:

- Prepare a Security Risk Assessment identifying the key security risks to the Project;
- Ensure the project is compliant with IFC Performance Standard 4 and the UN Voluntary Principles on Security and Human Rights (http://www.voluntaryprinciples.org/);
- Keep unauthorized persons off the Project site. Authorized persons shall be limited to the Contractor's and the Owner's personnel, and any visitors with prior notification of the Contractor and approval by the Owner;
- Provide adequate night-time lighting;
- Install a perimeter security fence around the Worker's Accommodations with guards to restrict access to public;
- Arrange guided tours whenever required to inform people about Project operations;
- Ensure that security personnel on-site are not armed, and receive detailed training on community engagement and the community grievance mechanism; and
- Ensure that security personnel are trained in the Disaster Management and Emergency Preparedness and Response Management Plan.

1.3.9. Traffic Management Plan

The O&M Contractor shall:

- Make sure Project vehicles, including service vehicles making deliveries to the Project, comply with designated speed limits;
- Ensure that all suppliers and their delivery drivers are aware of reduced speed zones (e.g., near schools, markets, villages), procedures, and restrictions (e.g. restricted areas) while navigating through the roads near the site. Use only designated routes to the Project site, appropriately sized vehicles suitable to the class of roads in the area, and restrict loads to prevent damage to local roads and bridges used for transportation purposes;
- Clearly mark pedestrian-safe access routes and crossing locations;
- Promote and distribute traffic safety information to local residents;

- Install traffic signs (including paint, easel, sign material), road marking, and guard rails to maintain pedestrian safety during construction;
- Appropriately secure materials in the vehicles to ensure safe passage between destinations during transportation;
- Clean up any spills or damage caused by Project-related vehicles; and
- Entry/exit routes and transportation timings for heavy transport vehicles shall be planned to minimise disturbance to the surrounding locality.

1.3.10. Air and Noise Management Plan

- Regularly maintain vehicles and avoid idling time to minimise emissions
- Service or replace vehicle emitting significant black smoke in their exhausts;
- Restrict unnecessary use of vehicle horns;
- Use rubber padding underneath high noise and vibration generating machines.

1.3.11. Biodiversity Management Plan

The O&M Contractor shall coordinate with the Owner and comply with the applicable elements of the overall Project's Biodiversity Management Plan (BMP, see Owner's Environmental and Social Management and Monitoring Plan). While the Owner has primary responsibility for the BMP, the O&M Contractor has a critical role in assuring that the required Environmental Flow (Eflow), fish ladder flow, and attraction flow are all provided as described in *Design Advice on Fish Ladder and Associated Spillway Designs at the Upper Trishuli-1 Hydropower Project* (SWECO 2018), or as may be subsequently modified if the Adaptive Management Program is triggered.

The O&M Contractor also shall:

- Avoid any clearing of trees or vegetation not specifically identified in the Project ESIA;
- Designate routes for movement of O&M vehicles to avoid additional soil compaction in other areas.
- Prohibit the serving to its employees any wild fish or game caught in the Project Area, including the Trishuli River and Langtang National Park;
- Maintain appropriate drainage and stabilize any eroding or unstable slopes due to Project facilities (e.g., Project roads, transmission line) and along the margins of the reservoir;
- Enforce the Worker Code of Conduct, which prohibits unauthorized entrance to Langtang National Park or Community Forest lands, hunting, fishing, poaching, logging, collection of firewood, clearing of vegetation, and collection of/trade in plants, animals, and non-timber forest products;
- Regular checking of the vacuums or holes in the transmission towers to avoid nesting by the birds;

- Install signage and speed humps in areas where wildlife crossing is likely;
- Train vehicle drivers regarding the driving risks through biodiversity sensitive areas and along remote roads;
- Any significant increase in vehicle strikes of wildlife shall require review of location of signage and training efficacy of drivers;

1.3.12. Sediment Management Plan

The O&M Contractor shall develop a detailed Sediment Management Plan describing the methods that shall be used to properly manage sediment at the Project. The purpose of the Sediment Management Plan is (1) to maintain the life expectancy of the project reservoir; (2) protect the turbines from exposure to sediment; and (3) flush the sediment in a manner that minimizes adverse impacts on fish and aquatic ecology in the diversion reach and downstream of the tailrace. The Sediment Management Plan shall specifically:

- Try to mimic natural sediment transport in the Trishuli River to the extent possible in terms of timing and quantities;
- Describe how large coarse material (e.g., cobble, boulders) will be managed;
- Stabilize any areas subject to river channel or bank erosion in the diversion reach or immediately downstream of the tailwaters;
- Flush sediment from the desander only during periods when sufficient flow is occurring in the diversion reach to transport the sediment through the diversion reach. The O&M Contractor shall determine the flow threshold required to transport sediments from the desander based on its partical size, and only flush the desander when flows in the diversion reach exceed this threshold;
- Flush sediment from the reservoir during the monsoon season when spillage is occurring to help transport the sediment through the diversion reach. More frequent releases of small quantities of sediment from the reservoir is preferred to less frequent release of slugs of sediment; and
- Avoid releases of sediment from the reservoir and the desander during snowtrout migration and spawning periods (e.g., late February through early May).

1.3.13. O&M Monitoring and Reporting Management Plan

The O&M Contractor shall conduct at least the following monitoring and report the findings to the Owner in accordance with the table below:

Number	Resource Area	Required Monitoring	Responsibility	Frequency
1	Land and Soil	Monitor reservoir shoreline stability and stabilize slopes as needed	O&M Contractor	Quarterly

2	Water Quality	Monitor treated wastewater effluent quality	O&M Contractor	Weekly or at any sign of upset condition
3	Water Quality	Monitor reservoir water quality	O&M Contractor	Weekly
4	Water Quality	Monitor water quality in the diversion reach and downstream of the powerhouse	O&M Contractor	Annual
5	Hydrology	Install flow gauge to monitor Environmental Flow release	O&M Contractor	Continuous
6	Sediment	Monitor sediment deposition in reservoir	O&M Contractor	Semi-annually
7	Sediment	Monitor deposition and accumulation of sediment in the diversion reach	O&M Contractor	After flushing sediment from reservoir or the desander
8	River Erosion	Monitor diversion reach and area downstream of powerhouse for any signs of stream channel or bank erosion	O&M Contractor	Quarterly and after large flow events
9	Biodiversity	Monitor bird carcasses electrocuted and records of any threatened or migratory species injury or mortality.	O&M Contractor	Monthly
10	Biodiversity	Monitor number of vehicle strikes of wildlife and species of wildlife injured or killed	O&M Contractor and Owner	Ongoing
11	Biodiversity	Monitor ability of fish to navigate the diversion reach and access fish ladder	O&M Contractor and Owner	During spring migration period (late February – May)

12	Biodiversity	Monitor ability and number of fish to successfully navigate through the fish ladder	O&M Contractor and Owner	During spring migration period (late February – May)
13	Biodiversity	Monitor ability of fish to successfully move downstream pass the dam without injury or mortality	O&M Contractor and Owner	During Fall migration period (August – October)
14	OHS	Monitor noise level in the powerhouse area to ensure proper PPE is provided to personnel	O&M Contractor	Once upon full operation
15	OHS	Monitor potable water quality at end of tap in worker accommodations	O&M Contractor	Upon start up and then annually

The O&M Contractor shall provide:

- Monthly Progress Reports to the Owner
- Quarterly Environmental and Social Issues Compliance Reports

These reports shall include, at a minimum, the following ESHS information:

- Health and Safety Performance – including hours worked, recordable incidents (e.g., lost time accidents, medical treatment cases) and corresponding Root Cause Analysis, first aid cases, high potential near misses, and injuries to the public or visitors, and remedial and preventative actions taken (e.g., new equipment, updated training);
- Environmental Performance – air/water/noise/vibration/slope stability monitoring results, specifically identifying any results exceeding Nepal or World Bank Group EHS General Guidelines; any incidents in which the required Environmental Flow was not met, for what duration, and why; any hazardous material spills or discharges of untreated wastewater or process water;
- Social Performance – including the number, type, status, and outcome of any community grievances that were filed;
- Labour Performance - including the number, type, status, and outcome of any worker grievances that were filed; number, type, status, and outcome of any Code of Conduct violations; number of workers disaggregated by place of origin (i.e., expatriate, local, or non-local Nepalis), gender, and skill level (e.g., unskilled, skilled, supervisory, professional,

management); EHS training provided, including the dates, location, number of trainees, and topics;

- ESHS Staffing – including identifying any new hires or departures, and a listing of current ESHS staff and titles;
- ESHS Requirements – including any non-compliance incidents with permits or national law, project commitments, or other ESHS requirements; and identification of any impacts outside the Project's approved footprint;
- ESHS Inspections and Audits – including any by the Contractor, Owner, Lender, or the Lender's Independent Engineer, and providing the date, sites visited, major findings, and any actions taken;
- Stakeholder Engagement – including any formal or informal meetings or information disclosure with stakeholder, including the date, location, number of attendees, and topics discussed;
- Major Changes – including any changes to the OESMMP or general ESHS practices, and any actions taken in response to previous notices of deficiency.

Appendix C
Flora within the Environmental Area of Influence

FLORA WITHIN THE ENVIRONMENTAL AREA OF INFLUENCE

Table 1: Tree Species

SN	Scientific name	Nepali name
1	*Aesandra butyracea*	Chiuri
2	*Albizia chinensis*	Kalo siris
3	*Alnus nepalensis*	Utis
4	*Bauhinia purpurea*	Tankee
5	*Boehmeria rugulosa*	Dar
6	*Bombax ceiba*	Simal
7	*Callicarpa arborea*	Maas Gedaa
8	*Cassia fistula*	Raajbriksha
9	*Castanopsis indica*	Dhalne katus
10	*Cinnamomum spp.*	Sinkaulee
11	*Engelhardia spicata*	Mauwa
12	*Ficus semicordata*	Khanayo
13	*Lagerstroemia* spp.	Asare
14	*Lyonia ovalifolia*	Angeri
15	*Machilus duthiei*	Kaulo
16	*Mallotus* spp.	Sindure
17	*Mangifera indica*	Aanp
18	*Melia azadirach*	Bakainu
19	*Myrica esculenta*	Kafal
20	*Phyllanthus emblica*	Amala
21	*Pinus roxburghii*	Rani sallo
22	*Populus ciliata*	Bhote pipal
23	*Rhododendron arboreum*	Lali gurans
24	*Rhus wallichii*	Bhalayo
25	*Salix spp.*	
26	*Schima wallichii*	Chilaune
27	*Shorea robusta*	Sal
28	*Symplocos pyrifolia*	Seti kath
29	*Syzygium cumini*	Jamun
30	*Terminalia alata*	Saaj
31	*Toona ciliata*	Tunee
32	*Unidentified 1*	Maletro
33	*Unidentified 2 (Araliaceaea)*	
34	*Unidentified 5*	Dipath (Tamang)
35	*Unidentified Rosaceae*	

Table 2: Shrub Species

SN	Scientific name	Nepali name
1	*Achyranthes aspera*	Datiwan
2	*Agave americana*	Ketuki
3	*Ageratina adenophora*	Banmara
4	*Berberis asiatica*	Chutro
5	*Boehmeria platyphylla*	Kamle
6	*Chromolaena odorata*	Aule banmara
7	*Clerodondron serratum*	
8	*Colebrookia oppositifolia*	Dhusure
9	*Cotoneaster microphyllus*	
10	*Desmodium tiliaefolium*	Rato bakre ghans
11	*Euphorbia royleana*	Siundee
12	*Gaultheria fragrantissima*	Dhasingare
13	*Hypericum cordifolium*	Areli
14	*Indigofera constricta*	
15	*Indigofera dosua*	Phusre ghans
16	*Inula cappa*	Gaitihare
17	*Lonicera quinquelocularis*	Bangjhi
18	*Maesa chisia*	Bilauni
19	*Mimosa* spp.	
20	*Murraya paniculata*	
21	*Osbeckia stellata*	Rato chulsi
22	*Osyris wightiana*	Nun Dhicki
23	*Oxyspora paniculata*	
24	*Phyllanthus parvifolius*	Khareto
25	*Prinsepia utilis*	Dhatelo
26	*Rhamnus virgatus*	Kande painyu
27	*Rubia manjith*	Majitho
28	*Rubus ellipticus*	Ainselu
29	*Rubus foliolosus*	Kalo ainselu
30	*Sarcococca coriacea*	Fiti fiya
31	*Senna occidentalis*	Thulo Tapre
32	*Senna tora*	Tapre
33	*Solanum aculeatissimum*	Kantakaari
34	*Viburnum erubescens*	Ganmane
35	*Woodfordia fruticosa*	Dhainyaro
36	*Zanthoxylum acanthopodium*	Boke timmur
37	*Unidentified 4 (Urticaceae)*	

6 Table 6.2-5: Herb Species Report from the Environmental Area of Influence

SN	Scientific name	Nepali name
1	*Ageratum conyzoides*	Gandhe
2	*Amaranthus spinosus*	Lunde kanda
3	*Arisaema concinnum*	Sarpa ko makai
4	*Arisaema tortuosum*	Sarpa ko makai
5	*Artemisia vulgaris*	Titepati
6	*Arthraxon lancifolius*	Chitre bans
7	*Arundinaria* spp.	
8	*Arundinella nepalensis*	Phurke Khar
9	*Begonia picta*	Magar kanche
10	*Bidens pilosa*	Tikhe kuro
11	*Boenninghausenia albiflora*	Daampate
12	*Brachiaria ramosa*	Likhe Banso
13	*Calanthe puberula*	
14	*Carex cruciata*	Lamo hat katuwa
15	*Cheilanthes* spp.	
16	*Chrysopogon gryllus*	Dhaple ghans
17	*Cissampelos pareira*	Batul pate
18	*Clematis spp.*	
19	*Commelina benghalensis*	Kane
20	*Crassocephalum crepidioides*	Anikale jhar
21	*Curcuma angustifolia*	Kalo besar
22	*Cynodon dactylon*	Dubo
23	*Cynoglossum zeylanicum*	Kanike kuro
24	*Cyperus niveus*	Seto mothe
25	*Delphinium altissimum*	Bikhadi ghans
26	*Dicranopteris linearis*	
27	*Dioscorea bulbifera*	Gitthe tarul
28	*Dioscorea deltoidea*	Bhyakur tarul
29	*Drepanostachyum falcatum*	Sano nigalo
30	*Dryoathyrium* spp.	Kalo neuro
31	*Dryopteris chrysoc*oma	
32	*Eulaliopsis binata*	Babiyo
33	*Fragaria nubicola*	Bhuin ainselu
34	*Galium asperuloides*	
35	*Geranium nepalense*	
36	*Girardinia diversifolia*	Allo sisnu
37	*Hedychium ellipticum*	Rato saro
38	*Impatiens amplexicaulis*	Tiuree
39	*Imperata cylindrica*	Siru
40	*Ipoemea* spp.	
41	*Iris decora*	Padam pushkar
42	*Leucostegia immersa*	
43	*Lindelofia longiflora*	
44	*Malaxis muscifera*	
45	*Mentha* spp.	
46	*Murdannia edulis*	Nigale gava
47	*Nephrolepis cordifolia*	Paniamala
48	*Oleandra wallichii*	
48	*Onychium* spp.	
50	*Osbeckia stellate*	Rato chulsi
51	*Persicaria* spp.	

SN	Scientific name	Nepali name
52	*Phyllanthus urinaria*	Bhuin amala
53	*Polypodium* spp.	
54	*Polystichum prescottianum*	
55	*Pteris* spp.	
56	*Saccharum spontaneum*	Kans
57	*Satyrium nepalense*	
58	*Selaginella* spp.	
59	*Selinum tenuifolium*	Bhutkesh
60	*Sida* spp.	
61	*Spilanthus acmella*	Marati
62	*Thalictrum foliolosum*	Dampate
63	*Thalictrum punduanum*	Dampate
64	*Thalictrum spp.*	
65	*Thysanolaena maxima*	Amreso
66	*Unidentified 3 (Poaceae)*	
67	*Urena lobate*	Nalu kuro
68	*Urtica dioica*	Sisnu
69	*Xanthium strumarium*	Bhende kuro

7

Appendix D
Fish Ladder Reports

Appendix D.1
Principles For Design Of Fish Ladder For UT-1 HPP

SWECO

REPORT

NWEDC

NEPAL WATER & ENERGY DEVELOPMENT COMPANY

Upper Trishuli-1

14685001

Principles for design of Fish ladder for **UT-1 HPP**

DECEMBER 2017

Sweco Norway AS

OSL MILJØRÅDGIVNING

HALVARD KAASA

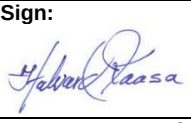
SWECO

REPORT

Report no.:	Project no.:	Date:
4	14685001	December 2017
Client: NWEDC		

Principles for design of Fish ladder
for
Upper Trisuli-1 HPP

This report describes the principles of the fish ladder at the UT-1 intake site, and as requested by NWEDC the report give comments to other challenges connected to the UT-1 HP development and to the river connectivity.

Created by:	Sign:
Halvard Kaasa	
Project responsible / dept.:	**Manager approval:**
Sweco Norway AS	Karel Grootjans

Content

Attachments

1) Fish Ladder- conceptual design, Sweco, 26.04.2017
2) Illustration of overflow trough flapped gates

1 Introduction

The 216 MW upper Trishuli-1 Hydropower Project is located in the Rashuwa District of Nepal. It is a run-of-the-river project, and the developer is the Nepal Water & Energy Development Company Private Limited (NWEDC).

As a part of the process to ensure compliance of the Upper Trishuli-1 Hydropower Project (UT-1HPP) with Nepal national regulations and the IFC's Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Resources, NWEDC are required to build a fish passage across the intake weir.
This report give comments and recommendations for technical solutions to keep river connectivity when the UT-1 is in operation.

2 Conditions for design

A) Fish species

The overall dominat species in the UT-1 area of Trisuli is Asala (Shizothorax richardsonii). Shizothorax progastus per the EIA with recordings from 2011, and a report from DoFD from 2008/2009, has been detected in the area of UT-1 for 6 and 9 years ago.
In the agreement between NWEDC and Sweco Norge AS it is clearly mentioned that the fish ladder design shall be accommodated for the target species Shizothorax richardsonii and also for the Shizothorax progastus if this species is present in the area.
The last years S. progastus is not registered during field studies connected to the environmental program of UT-1.
Normally S.progastus has its preferred biotopes in lower altitudes (300 -850 m above sea level) and in warmer waters than at UT1. It might therefore be a possible explanation that S.progastus can be observed in the UT-1 area in varying degree depending of ecological conditions as water temperature, flow and population size.
Another important measure might be the possibilities of upstream migrating obstacles as the cross-section dam at UT3 just downstream the UT-1 area. This UT3 dam site has been without a fish ladder the last years, but a fish ladder is planned to be built.
As discussed with NWEDC the design of the fish ladder for UT-1 will be with focus on Shizothorax richardsonii and, as last years of registrations show, not accommodated for S. progastus.

B) Flow through the fish ladder

The decision about e-flows is not finalised, and in this report the fish ladder flow proposal interplay with the NWEDC minimum release proposal that is 10% of mean monthly flow which men approximately 4 m^3/s during the spring season. On that basis, the flow in the fish ladder will approximately be 1 m^3/s and with additional attraction water to the entrance of the fish ladder of 1 m3/s. This mean that the total flow connected to the fish ladder entrance is approximately 50% of the minimum flow.

The rest of the e-flow that will be released from the weir shall flow into the pool at the entrance of the fish ladder. The fish ladder flow might vary over the year cycle, and the ladder might also be closed during the period when there is now upstream fish migration in the UT-1 area.

C) Available space

The space along the riverside downstream the dam is per information from NWEDC restricted and there is not available area to prepare a nature liker fish way. Due to the height of the dam and the available space there is need to design a compact fish ladder.

3 The fish ladder

The fish ladder shall mainly serve the upstream migration of the target species Snow Trout (Shizothorax richardsonii). The total height of the fish ladder will be approximately 30 m. The exact height will be decided when the design of the fish ladder entrance pool is settled. To meet the requirements for migration of Snow Trout the total number of pools will be close to 100.

3.1 The entrance pool outside the fish ladder

In principle, the entrance pool just outside the fish ladder shall be attractive for Snow Trout. Substantial flow and spurt of water are qualities needed to attract this species. Approximately 50% of the proposed minimum flow will enter the pool from the fish ladder. Rest of the e-flow passing the weir shall also enter the pool outside the fish ladder. See figure 1.

The conditions in the pool outside the fish ladder entrance is crucial for the functionality of the fish ladder.

A. The conditions in the river up to the outlet from the fish ladder must be adapted to the behaviour of the migrating fish species during the whole upstream fish migrating season.
B. The fish ladder entrance pool shall be situated close to the upper part of the fish migrating section.
C. Water velocity in the pool where water passing outside of the entrance of pool no 1, shall be no more than 0,3m - 0,6 m/s during the upstream migrating period.
D. The pool shall be equipped with some hiding-places for fish
E. The spillway design shall meet the requirements mentioned in Sweco report of 15.08.2016, Fish Passage, Evaluation of plans and recommendations, chapter 2.4, and of point B and C
F. The depth outside the entrance of the fish ladder shall be at least 2m.
G. If needed this pool shall be sheltered from high flows and high current velocities originated from the spillway and from the radial gates. This to prevent damage on the fish ladder entrance and to avoid bad conditions for fish.

3.2 Fish ladder pool no 1

The pool no 1 is 5m x 4,3 m and the inside height is 2,5 m (see Figure no 1 and the enclosed drawings in attachment 1).
The outlet from the chamber has two vertical slots with the ability to let trough 1,5 m3/s with highest water velocity of 1m/s and that the step between water level in the outside pool and in the chamber no 1 is between 0,20 – 0,25 m dependent of the flow variations. The width of the openings is 0,6 m (Figure 2).

At the bottom of the chamber there shall be constructed hiding places for Shizothoracx richardsonii. Where they can hide during daytime. This hiding places must be constructed to make it possible to clean for sediments if needed.

Attraction water shall be added at the top of the concrete roof that is covering chamber 1 and 2. (see Figure 4). Water shall fall from the 5 m wide front of the distributor bay and hit the water surface just outside the vertical slot entrance. Attraction water shall also enter Pool no 1 trough pipes in the concrete roof. The total amount of attraction water added shall be approximately the same flow as in the fish ladder. See figure 1 and attached drawing of the fish ladder entrance (Attachment 1).

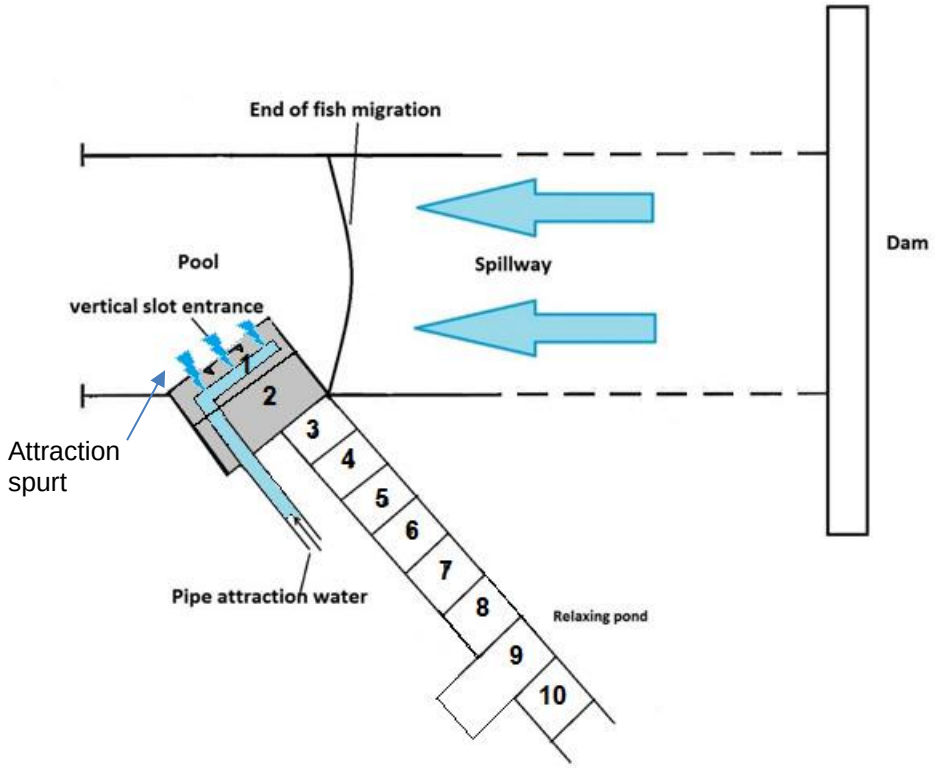


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Fig. 1 The principal of the fish ladder entrance.

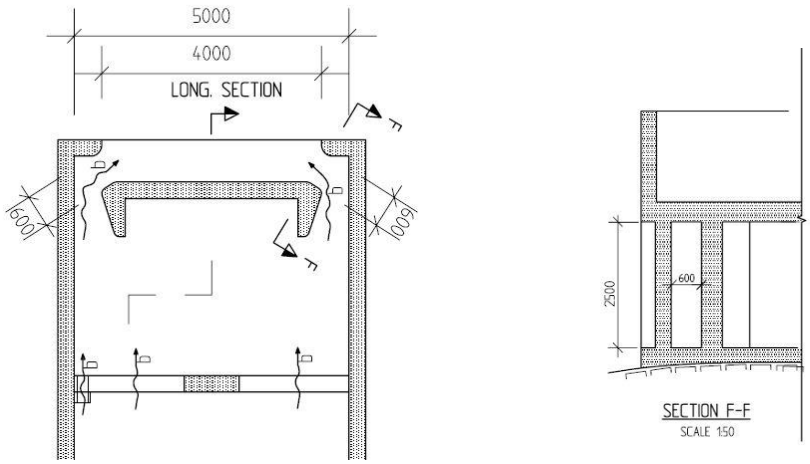


Figure 2. Transekt med vertical slots

3.3 Fish ladder pool no 2

The pool no 2 is 5m x 3 m and the inside height is 2,5 m. Here are two notches in the front wall to slow down the water velocity, see figure 3. The water velocity shall be below 1,5m/s and the step between chamber 1 and chamber 2 shall be between 0,23 – 0,27 m dependent of the flow variations.
There is an orifice at the right side and close to the bottom of 0,2m x 0,2 m that is possible for fish to enter and also serve as a drainage of the upstream chamber.

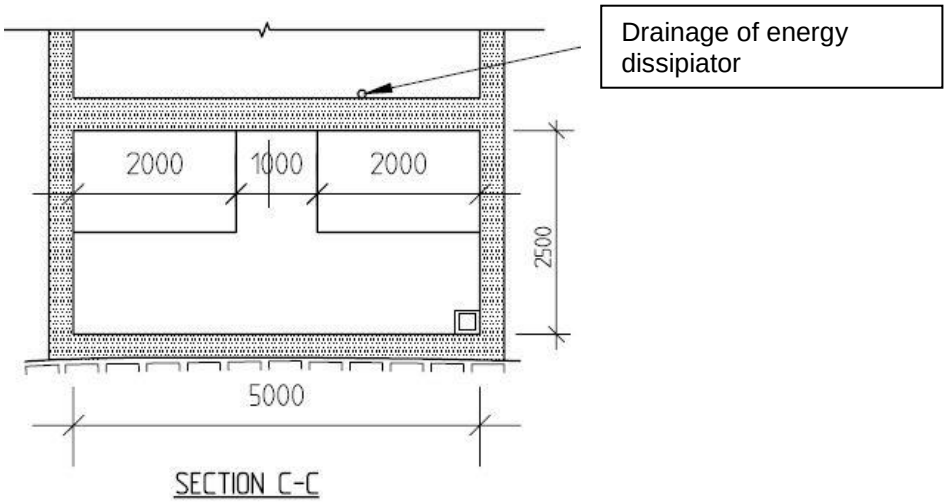


Fig. 3 Outlet from pool no 2 have 2 overflow notches.

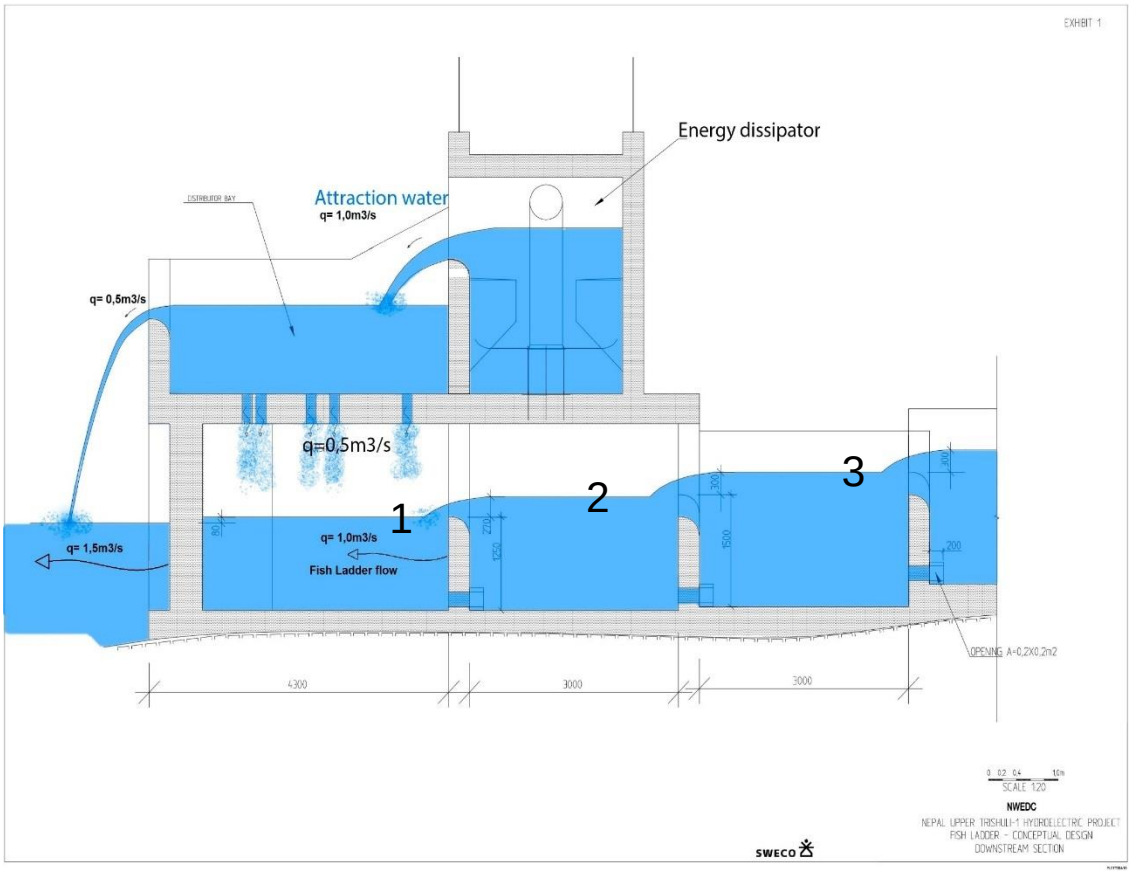


Figure 4. The 3 first fish ladder pools, the attraction water energy dissipiator as well as visualization of the distribution of the attraction water in front of pool no 1 and also direct to pool no 1.

3.4 Fish ladder pool no 3 to 8

The pool no 3 to no 8 is 4 m x 3 m with inside height of 2,5 m. Here is one notch in the front wall as shown in Figue 5. The design give good hydraulic conditions for Snow Trout (Shizothorax richardsonii) with flow up to 1m^3/s. In the front wall in each pool it is an orifice close to the bottom of 0,2m x 0,2 m that is possible for fish to enter, and that also serve as a drainage of the upstream chamber. Maximum velocity trough the overflow notch shall be 2m/s. The step between the overflow notch to the water level downstream shall be approximately 0,3m (see figure 3), and the notch alters between right and left position se Figure 6.

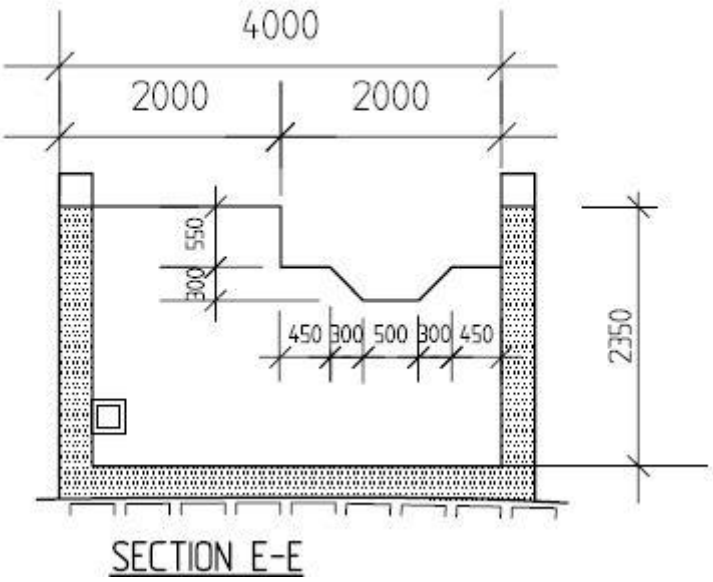


Figure 5 The outlet from fish ladder pool no 3 to no 8 has a notch designed to give good hydraulic conditions with flow up to 1m³/s. This notch is alternating right and left as moving upstream.

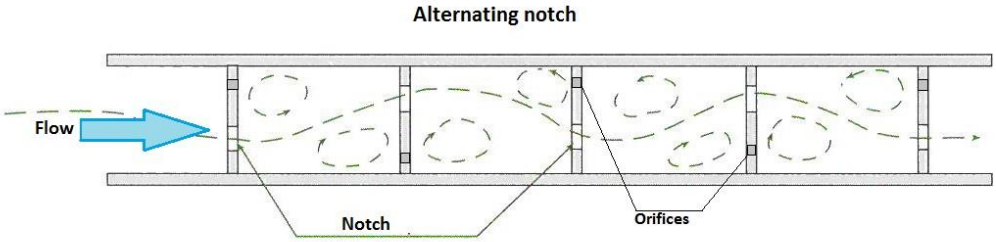


Figure 6 Principal of altering notches in a fish ladder

3.5 Fish ladder pool no 9

The fish ladder pool no 9 is a resting pool of 5 x 4m and inside height 2,5 m see Figure 1. The inlet and outlet notches of this chamber is as in chamber nr 3 to 8. See figure 5 and 7. At the bottom of the chamber there shall be constructed hiding places for Shizothoracx richardsonii. This hiding places must be constructed so as it is possible to clean the pool for sediments. This type of resting pools shall be repeated upstream in the fish ladder with 6 normal pools in-between.

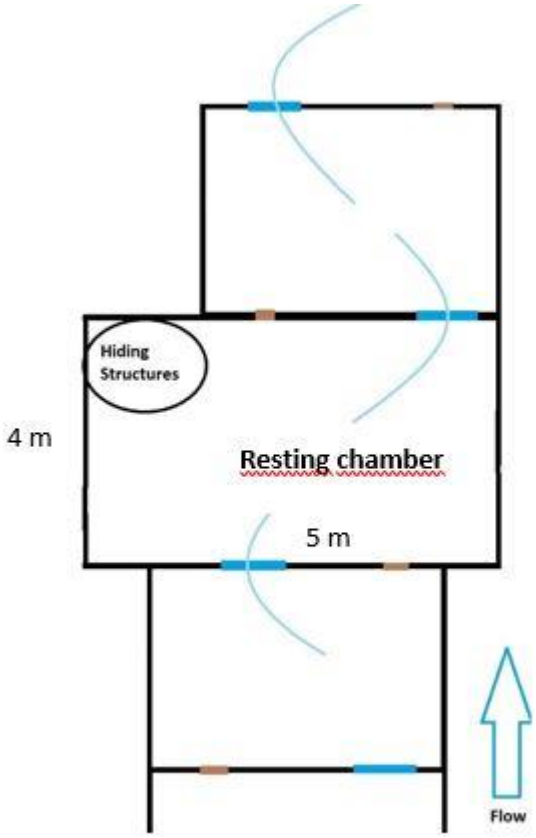


Figure 7 Resting camber or resting pool is bigger than the normal fish ladder pools and is equipped with hiding structures at the bottom level in the calm part of the pool.

3.6 Fish ladder pool no 10 and to the top of the ladder

After pool no 9 every seventh pool shall be a resting pool, the other pools shall be of same size and principle as chamber 3 with alternating notches. The pools might be built in other combinations than straight after each other. For instance, different compact solutions, see examples Fig. 8. This way of preparing the design must be decided by NWEDC as a function of the available space at Haku site.

At the top of the fish ladder where the ladder enters the weir there shall be a technical solution that may adjust the flow into the ladder according to the water level in the intake pond. The top fish ladder pool shall be 4m x 3m as pool no 3, and the flow from the inlet weir head pond approximately 1 m^3/s with relative slow velocities with maximum 0,7m/s from the weir head pond to the top fish ladder pool. This make it easy for migrating fish to enter the weir head pond.
The inlet from the head pond to the fish ladder must be equipped with a gate to control and finetune the flow in the fish ladder. It must also be possible to turn of the fish ladder flow and if necessary to include an automatic adjustment of the fish ladder flow as a function of the

water level in the weir head pond. As described by NWEDC the normal elevation in the intake pond is EL 1255.
The exit from the fish ladder at the top of the weir shall be localized as far away from the HP intake site as possible and in an area where the water velocities upstream the weir and outside the topmost chamber in the intake pond shall be not more than 0,3m/s. These conditions must be considered by design of the weir.
The design of these technical facilities shall be done by NWEDC.

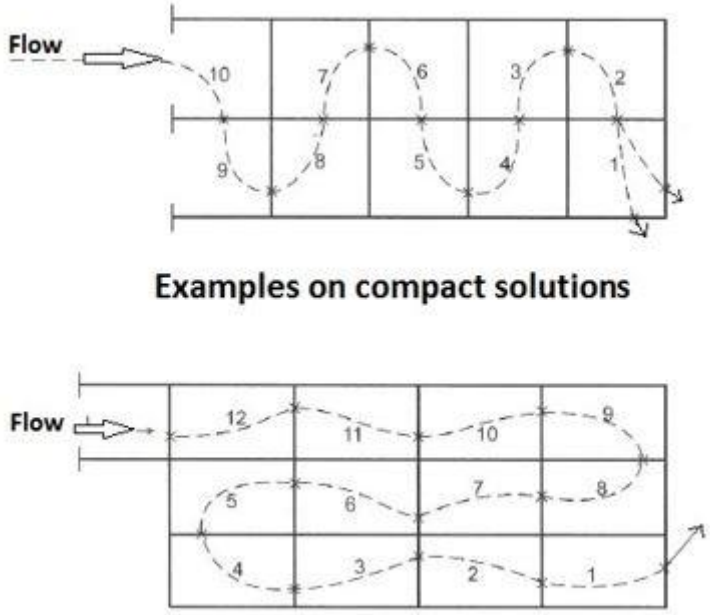


Figure 8. Examples of compact design of fish ladders.

4 Upstream migrating challenges not connected to the fish ladder

A fish ladder might be well designed and well-built but the success depends on the conditions in the river downstream the fish ladder and of technical solutions of the entrance area and exit area of the fish ladders.

- In case of UT-1 the conditions at the confluence of the tailrace and the river should be prepared so as the upstream migrating fish choose the old riverbed instead of choosing the tailrace. Might be necessary to evaluate need for adjustments in the river bed or to build guiding mechanisms.
- The dewatered river section should be examined for possible obstacles that might hinder upstream fish migration during the period of minimum flow release.
- The river section just downstream the weir should be adapted to the behavior of the migrating fish species so as the upper part of the fish migrating section meet the fish ladder entrance, see paragraph 3.1.
- The water level in the pool of the fish ladder entrance will by existing design fluctuate between 1229.1 (5m^3/s) to 1,231,5 (154.4m^3/s). Fluctuations of up to 2,4m might lead to challenges concerning fish migration.

5 Downstream fish migration

When making an investment in an expensive fish ladder to keep the upstream eco-corridor open, it requires mitigating actions to also keep the sustainability of the downstream eco-

corridor. If the mortality of downstream migrating fish is high, the eco-system services will suffer, and over a relatively short time span the fish population using this eco-corridor will be decimated or extinct. If the mortality of downstream migrating fish is high and if mitigation of these harmful effects has low success it is better not letting the fish migrate upstream through a fish ladder.

To prevent a damaging fish population development the following topics should be considered:

1) Current in the intake pond
The main surface current entering the intake pond and weir shall point at the overflow gates and the spillway See figure 9. The reason is that downstream adult fish probably migrate downstream in the main current during monsoon. It is during high flow when debris enter the weir that also fish are migrating downstream. As reported by NWEDC this Flapped gates might be in frequent use during monsoon.
If needed a current guiding mechanism should be designed. Normally a concrete structure will be perfect. The fish ladder with low flow compared to the flow entering the settling basin is not suitable as a downstream migrating corridor.

2) Pool downstream of the weir
An important point is that fish migrating downstream across the weir should follow a smooth spillway and meet a soft landing in a downstream pool (see Sweco report of 15.08.2016, Fish Passage, evaluation of plans and recommendations, chapter 2.4).
The designed pool downstream the UT-1 weir does not serve as a soft-landing area for downstream migrating fish that are passing through the flapped gates. This is due to two reasons:
1)The flapped gates designed at the top of the radial gates will lead fish to fall 15 m and then hit the concrete basement. Heights above 5m will led to increased injurie and mortality. It might also be a risk for the fish to hit the steel construction of the radial- and flapped gates. (see illustration, attachment 2)
2) With a free fall of 15 m the fish will reach a velocity that even if hitting a water surface there will be high grade of injurie and mortality.

As reported by NWEDC the flapped gates might be in frequent use during monsoon, and the present weir design (DAELIM&KYERYONG, C. 16.11, Detail design) will probably lead to high fish mortality when fish are passing downstream through the flapped gates.

3) Tunnel entrapment
During low flow season and during early and late monsoon most of the flow are passing through the power station. This means that most of the down migrating fish, fry and eggs also follow the flow to the settling basins before they enter the HP tunnel and the point of no return. Francis turbines show relatively high fish mortality, but it is a hope that fry and eggs have a reasonable survival rate. To reduce this mortality significantly is possible to prepare fish guiding mechanisms in the settling basins. In the settling basins, the water velocity is slow which normally give good conditions for building guiding mechanisms.

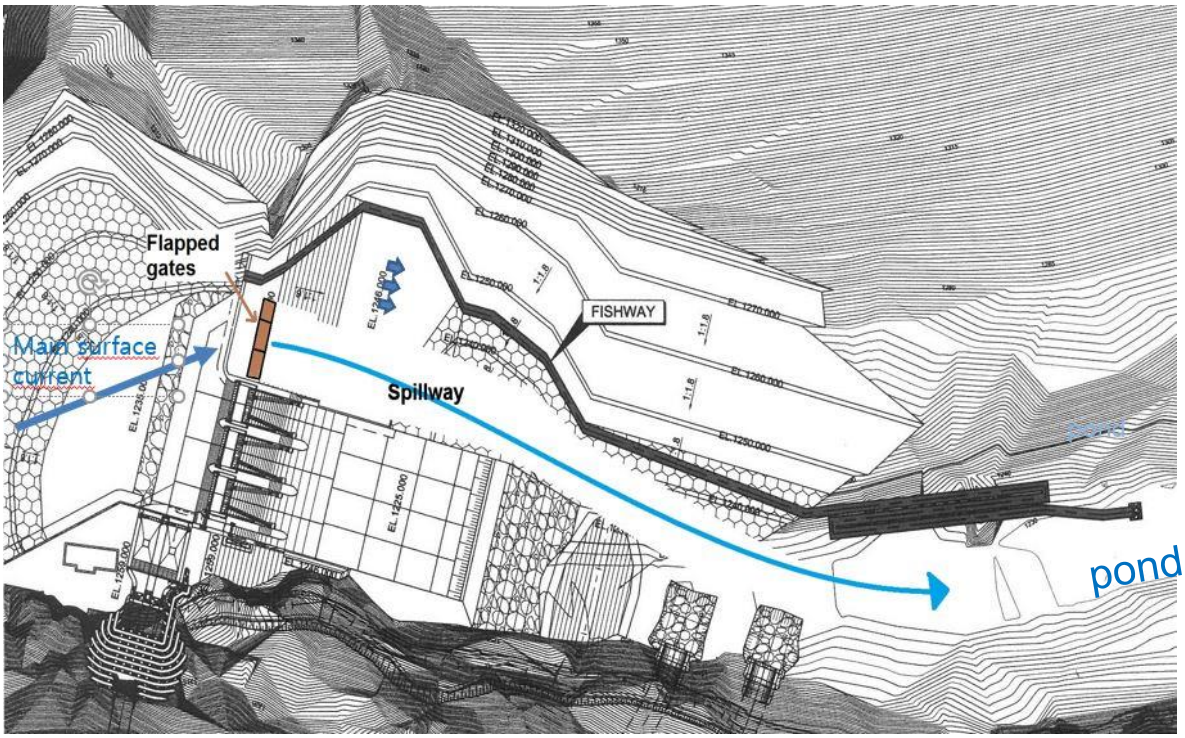


Figure 9 Upstream and downstream fish migration possibilities across the Upper Trisuli dam.

For more detailed information and discussions connected to the upstream and downstream migrations se the Sweco report of 15.08.2017. See also the emails of 19th of April and 3rd of May from Halvard Kaasa to NWEDC.

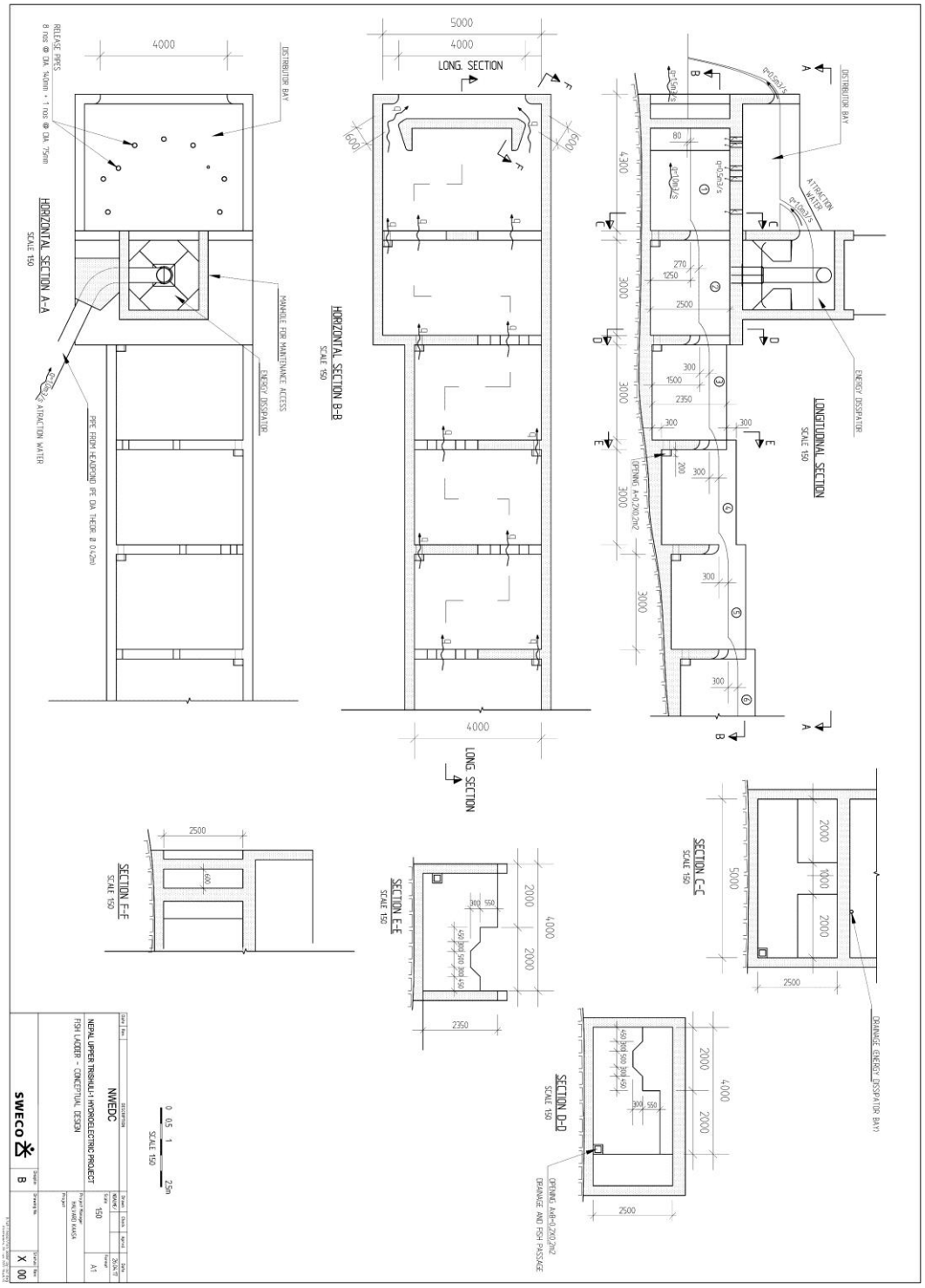
To be able to give good recommendations concerning the **management of the fish ladder** it is still some data missing:

- High resolution flow data and temperature data as: hourly flow data of a wet year, a medium wet year and a dry year, and hourly water temperatures. This is to understand functionality according to timeline and to be able to recommend technical solutions for the inlet and the outlet of the fish ladder.
  The fish do not respond to average values of flow and temperature.

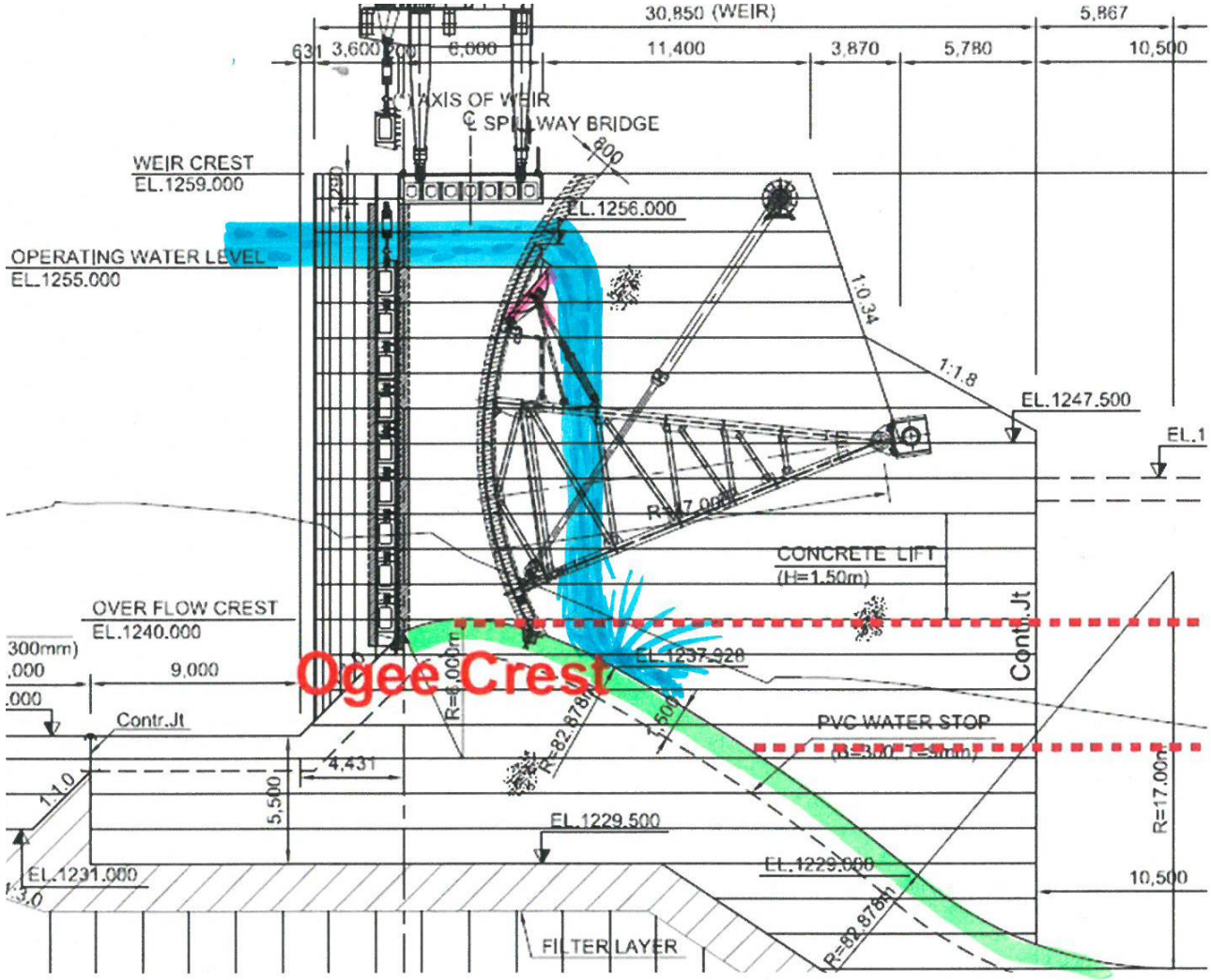
- Detection of the upstream fish migration season. Important for technical solutions of the fish ladder entrance and for the management plan.

- Detection of the downstream fish migration data. This will give good basis for management recommendations. The fish migrations are probably fluctuating between years and are probably related to temperature. Until better data of fish migration is available it is not possible to restrict the fish migration period to the low flow situation.

Attachment 1. Conceptual fish ladder design



Attachment 2. **Illustration of overflow trough flapped gates at the top of the radial gates.**



Appendix D.2
Design Advice On Fish Ladder
And Associated Spillway Designs
at the Upper Trishuli-1
Hydropower Project

SWECO

REPORT

NWEDC

NEPAL WATER & ENERGY DEVELOPMENT COMPANY

Upper Trishuli-1

14685001

Design Advice on Fish Ladder and Associated Spillway Designs at the Upper Trisuli-1 Hydropower Project

JANUARY 2018

Sweco Norway AS

DEPARTMENT OF ENVIRONMENT

HALVARD KAASA

REPORT

Report no.:	Project no.:	Date:
4	14685001	January 2018
Client: NWEDC		

Design Advice on Fish Ladder and Associated Spillway Designs at the Upper Trisuli-1 Hydropower Project

This report describes the design advice on fish ladder and associated spillway at the UT-1 intake site, and as requested by NWEDC the report give comments to other challenges connected to the UT-1 HP development and to the river connectivity.

NWEDC comments 19th of January 2018	**Report revised 29th of January 2018**
Created by: Halvard Kaasa	**Sign:** 
Project responsible / dept.: Sweco Norway AS	**Manager approval:** Karel Grootjans

Content

Attachments

1) Fish Ladder- conceptual design, Sweco, 26.04.2017
2) Illustration of overflow trough flapped gates

1 Introduction

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As a part of the process to ensure compliance of the Upper Trishuli-1 Hydropower Project (UT-1HPP) with Nepal national regulations and the IFC's Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Resources, NWEDC are required to build a fish passage across the intake weir.
This report gives comments and recommendations for technical solutions to keep river connectivity when the UT-1 is in operation.

2 Conditions for design

A) Fish species

The overall dominat species in the UT-1 area of Trisuli is Asala (Shizothorax richardsonii). Shizothorax progastus per the EIA with recordings from 2011, and a report from DoFD from 2008/2009, has been detected in the area of UT-1 for 6 and 9 years ago.
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The last years S. progastus is not registered during field studies connected to the environmental program of UT-1.
Normally S.progastus has its preferred biotopes in lower altitudes (300 -850 m above sea level) and in warmer waters than at UT1. It might therefore be a possible explanation that S.progastus can be observed in the UT-1 area in varying degree depending of ecological conditions as water temperature, flow and population size. Another important measure might be the possibilities of upstream migrating obstacles as the cross-section dam at UT3A just downstream the UT-1 area. This UT3A dam site has been without a fish ladder the last years, but a fish ladder is planned to be built. Information given by NWEDC indicate that there is another HP planed just upstream of UT-1 Called UT-2 HEP that shall be developed with a cross section dam and a fish ladder.

As discussed with NWEDC the design of the fish ladder for UT-1 will be with focus on Shizothorax richardsonii and, as last years of registrations show, not accommodated for S. progastus.

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In this report, the fish ladder flow proposal interplay with the NWEDC minimum release proposal that is 10% of mean monthly flow which mean a little bit less than 4 m^3/s during the spring season (UT-1 Detail Design Report 2017). On that basis, the flow in the fish ladder will approximately be 1 m^3/s and with additional attraction water to the entrance of the fish ladder of 1 m^3/s. This mean that the total flow connected to the fish ladder entrance is approximately 50% of the minimum flow. The rest of the e-flow that will be released from the head pond, shall flow into the pool at the entrance of the fish ladder. From an ecological point of view the fish ladder do not need to be operated during the period when there is now upstream fish migration in the UT-1 area.

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The space along the riverside downstream the dam is per information from NWEDC restricted and there is not available area to prepare a nature liker fish way. Due to the height of the dam and the available space there is need to design a compact fish ladder.

3 The fish ladder principles

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The pool no 1 is 5m x 4,3 m and the inside height is 2,5 m (see Figure no 1 and the enclosed drawings in attachment 1).
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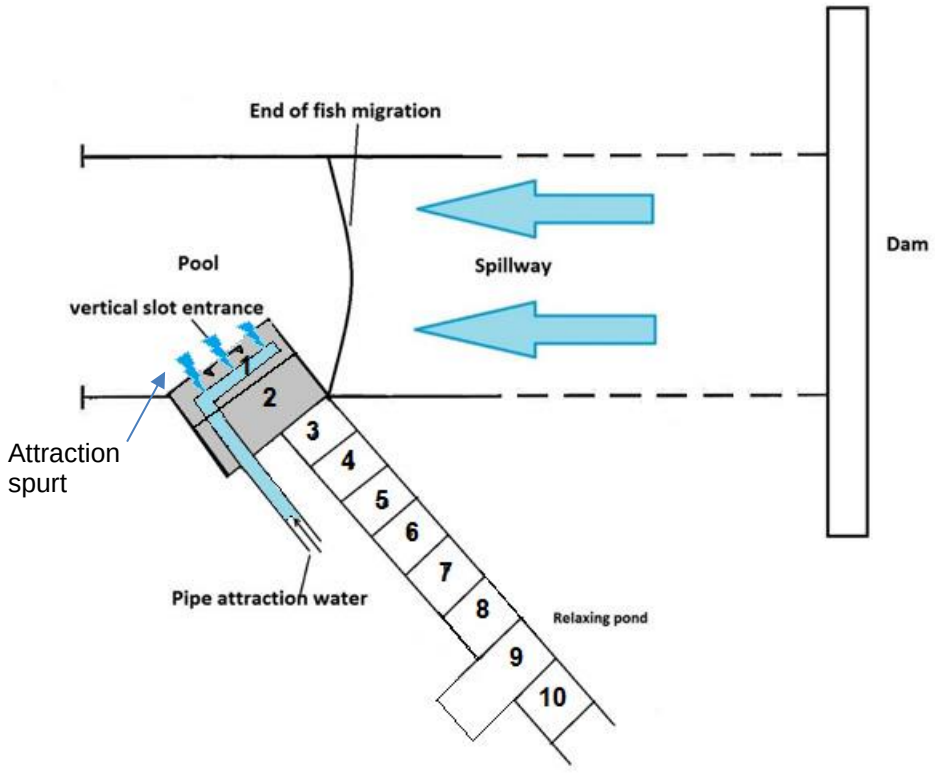

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Fig. 1 The principal of the fish ladder entrance.

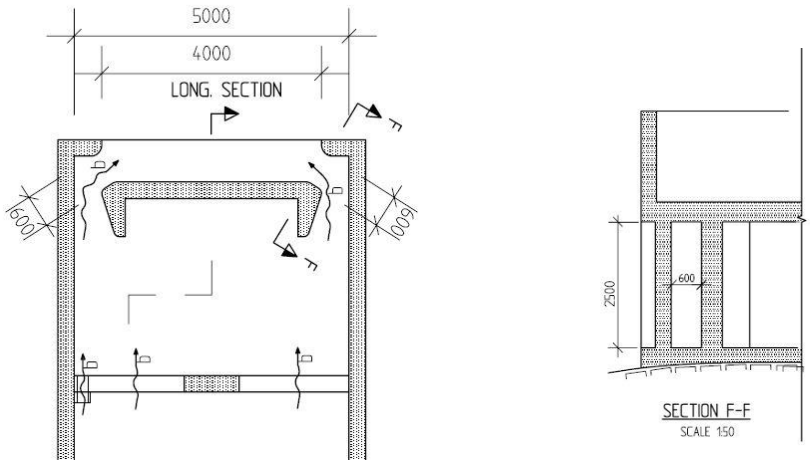


Figure 2. Transekt including vertical slots

3.3 Fish ladder pool no 2

The pool no 2 is 5m x 3 m and the inside height is 2,5 m. Here are two notches in the front wall to slow down the water velocity, see figure 3. The water velocity shall be below 1,5m/s and the step between chamber 1 and chamber 2 shall be between 0,23 – 0,27 m dependent of the flow variations.
There is an orifice at the right side and close to the bottom of 0,2m x 0,2 m that is possible for fish to enter and also serve as a drainage of the upstream chamber.

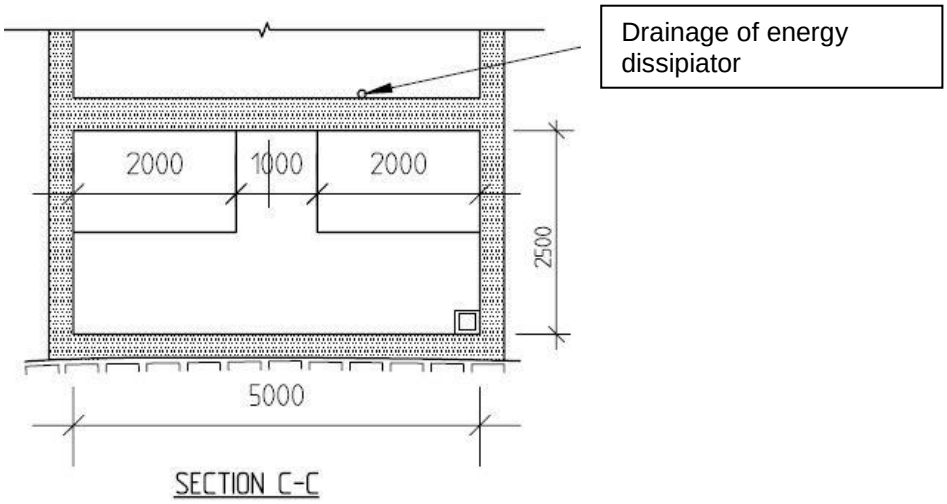


Fig. 3 Outlet from pool no 2 have 2 overflow notches.

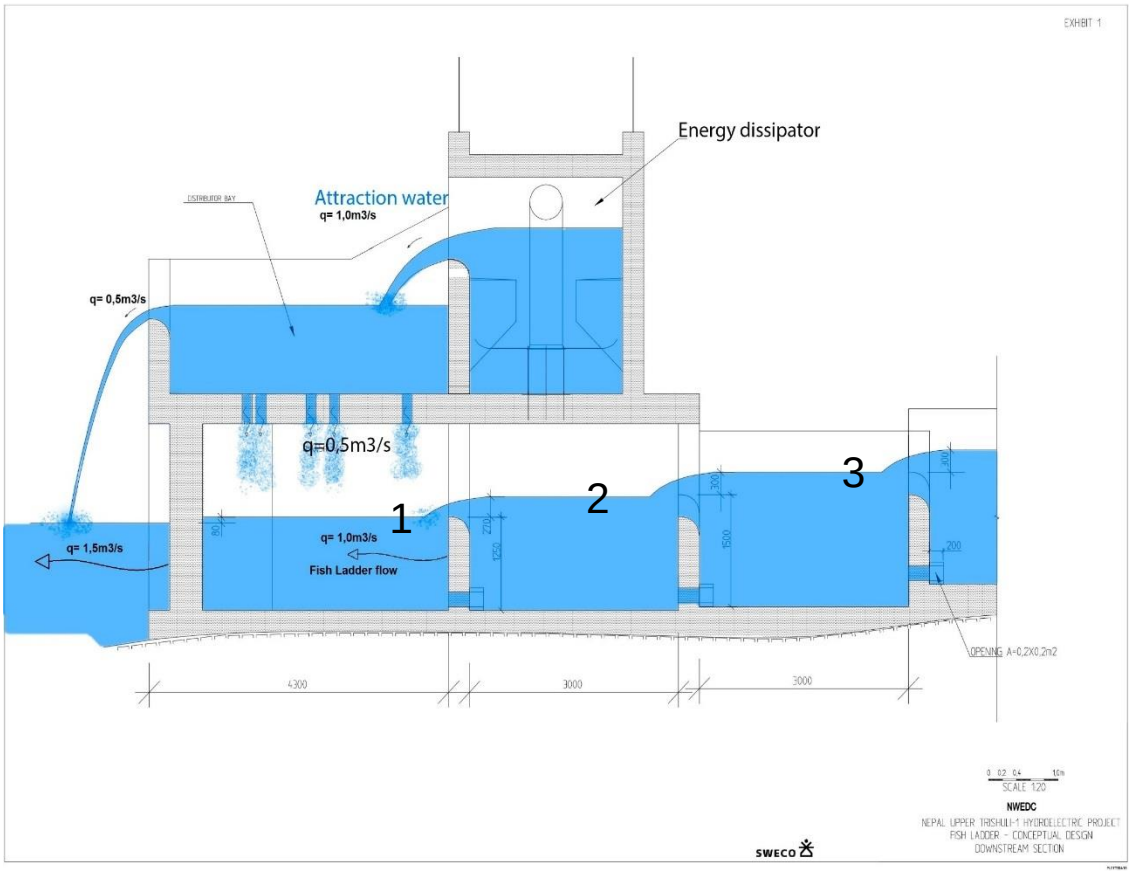


Figure 4. The 3 first fish ladder pools, the attraction water energy dissipiator as well as visualization of the distribution of the attraction water in front of pool no 1 and also direct to pool no 1.

3.4 Fish ladder pool no 3 to 8

The pool no 3 to no 8 is 4 m x 3 m with inside height of 2,5 m. Here is one notch in the front wall as shown in Figue 5. The design gives good hydraulic conditions for Snow Trout (Shizothorax richardsonii) with flow up to 1m^3/s. In the front wall in each pool it is an orifice close to the bottom of 0,2m x 0,2 m that is possible for fish to enter, and that also serve as a drainage of the upstream chamber. Maximum velocity trough the overflow notch shall be 2m/s. The step between the overflow notch to the water level downstream shall be approximately 0,3m (see figure 3), and the notch alters between right and left position se Figure 6.

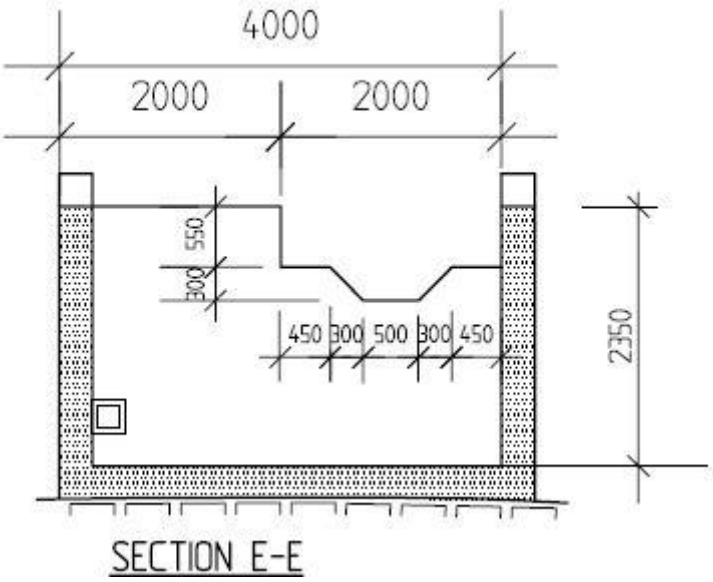


Figure 5 The outlet from fish ladder pool no 3 to no 8 has a notch designed to give good hydraulic conditions with flow up to 1m³/s. This notch is alternating right and left as moving upstream.

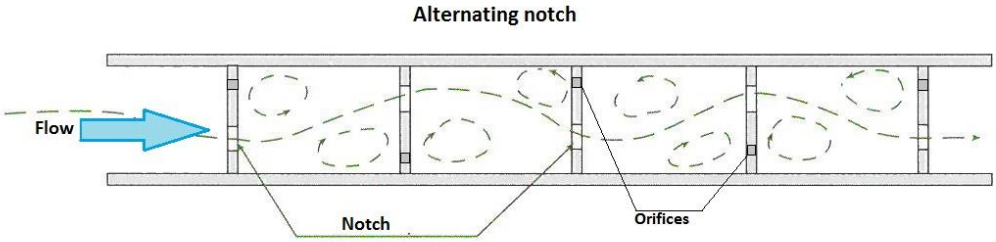


Figure 6 Principal of altering notches in a fish ladder

3.5 Fish ladder pool no 9

The fish ladder pool no 9 is a resting pool of 5 x 4m and inside height 2,5 m see Figure 1. The inlet and outlet notches of this chamber is as in chamber nr 3 to 8. See figure 5 and 7. At the bottom of the chamber there shall be constructed hiding places for Shizothoracx richardsonii. This hiding places must be constructed so as it is possible to clean the pool for sediments. This type of resting pools shall be repeated upstream in the fish ladder with 6 normal pools in-between.

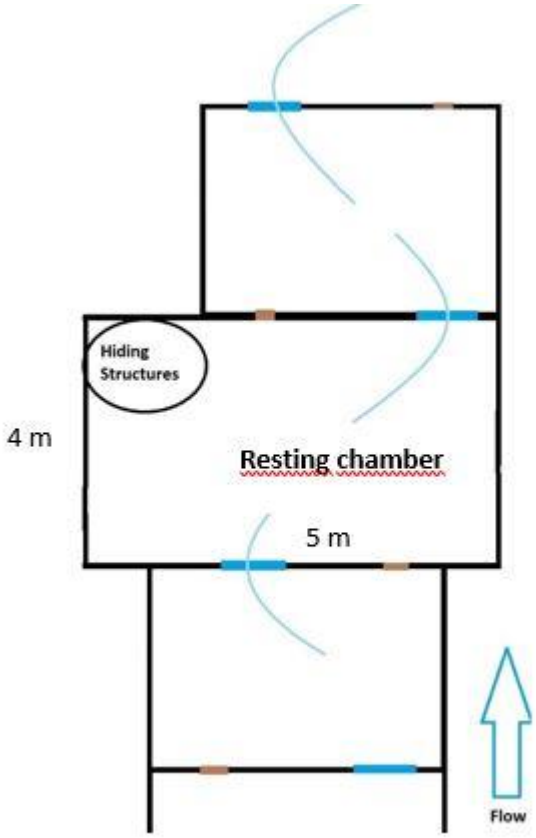


Figure 7 Resting camber or resting pool is bigger than the normal fish ladder pools and is equipped with hiding structures at the bottom level in the calm part of the pool.

3.6 Fish ladder pool no 10 and to the top of the ladder

After pool no 9 every seventh pool shall be a resting pool, the other pools shall be of same size and principle as chamber 3 with alternating notches. The pools might be built in other combinations than straight after each other. For instance, different compact solutions, see examples Fig. 8. This way of preparing the design must be decided by NWEDC as a function of the available space at Haku site.

At the top of the fish ladder where the ladder enters the weir there shall be a technical solution that may adjust the flow into the ladder according to the water level in the intake pond. The top fish ladder pool shall be 4m x 3m as pool no 3, and the flow from the inlet weir head pond approximately 1 m^3/s with relative slow velocities with maximum 0,7m/s from the weir head pond to the top fish ladder pool. This make it easy for migrating fish to enter the weir head pond.
The inlet from the head pond to the fish ladder must be equipped with a gate to control and finetune the flow in the fish ladder. It must also be possible to turn of the fish ladder flow and if necessary to include an automatic adjustment of the fish ladder flow as a function of the

water level in the weir head pond. As described by NWEDC the normal elevation in the intake pond is EL 1255.
The exit from the fish ladder at the top of the weir shall be localized as far away from the HP intake site as possible and in an area where the water velocities upstream the weir and outside the topmost chamber in the intake pond shall be not more than 0,3m/s. These conditions must be considered by design of the weir.
The design of these technical facilities shall be done by NWEDC.

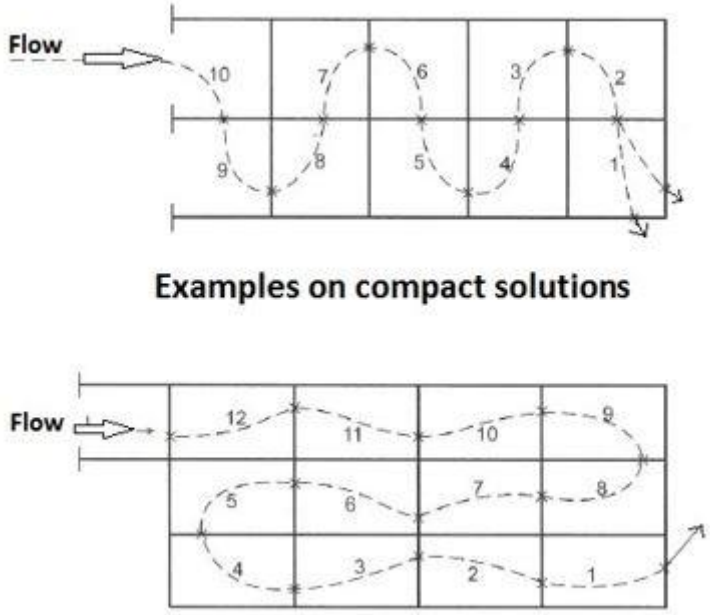


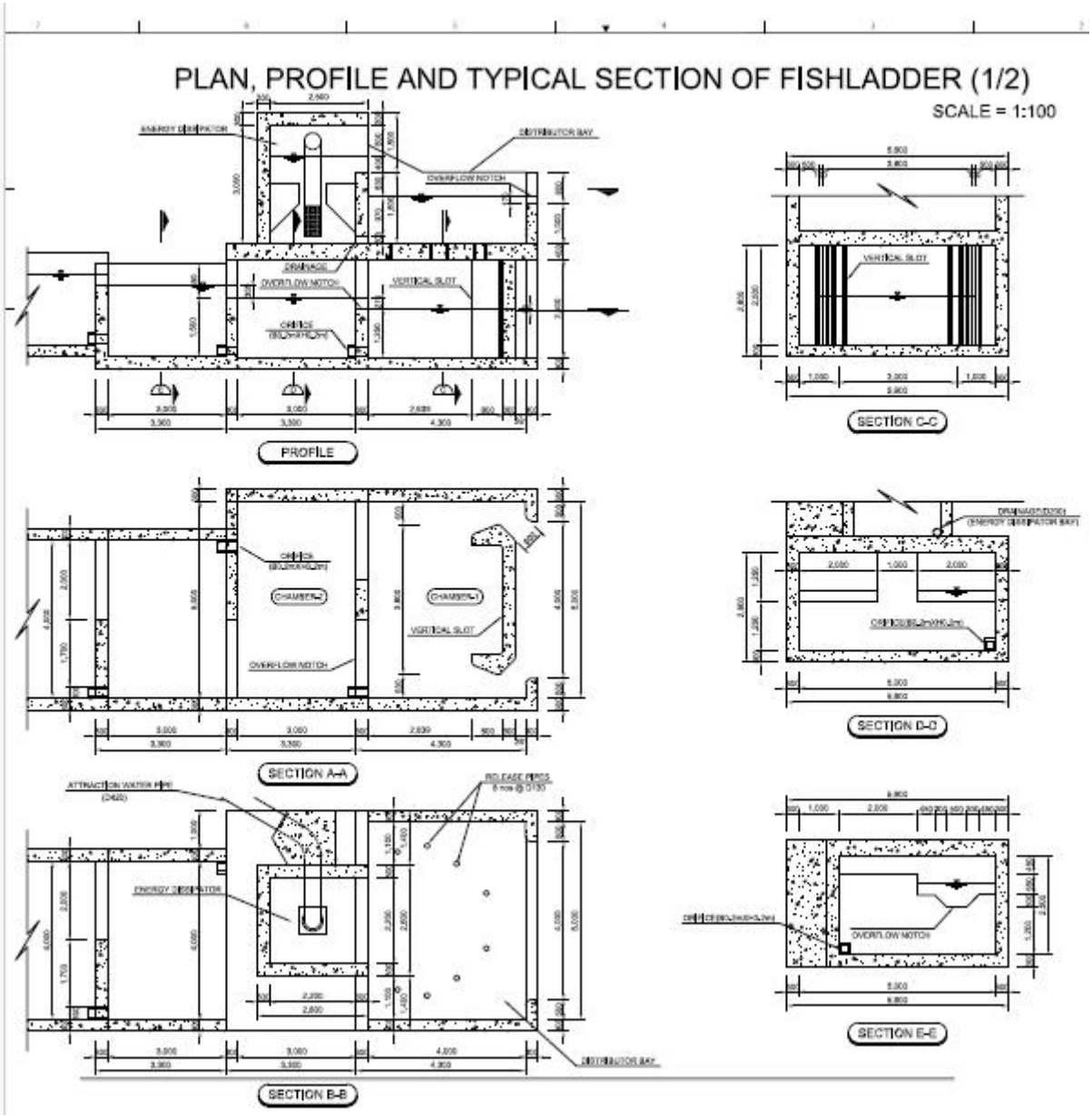
Figure 8. Examples of compact design of fish ladders.

4 Evaluation of the fish ladder design prepared by NWEDC's Design engineers (DKJV).

Based on the principles of the fish ladder design prepared by Sweco, se chapter 3 and attachment 1 in this report, NWEDC's design engineers in DKJV has prepared the fish ladder drawings shown in figure 9. Review of this drawings by SWECO gave 2 comments:

1) The overflow weirs are shown with square edges. They should preferably be given a rounded upstream face as shown on the Sweco-drawing (Conceptual design, attachment 1). A square edge will raise the water level more than the estimated level,
2) The outlet of the attraction water pipe (in the energy dissipator box) should be fixed with bars of stainless steel (as shown on the Sweco-drawing). Design engineer shall incorporate these two points.

Looking at fish ladder design in figure 9 (1/2 and 2/2), prepared by DKJV, it seemed that principles of fish ladder design suggested is incorporated and that design as such is appropriate for fish migration.


PLAN, PROFILE AND TYPICAL SECTION OF FISHLADDER (1/2)
SCALE = 1:100
PROFILE
SECTION A–A
SECTION B–B
SECTION C–C
SECTION D–D
SECTION E–E
OVERFLOW NOTCH
VERTICAL SLOT
CHAMBER-1
CHAMBER-2
DRAINAGE
ENERGY DISSIPATOR
DISTRIBUTOR BAY
RELEASE PIPES

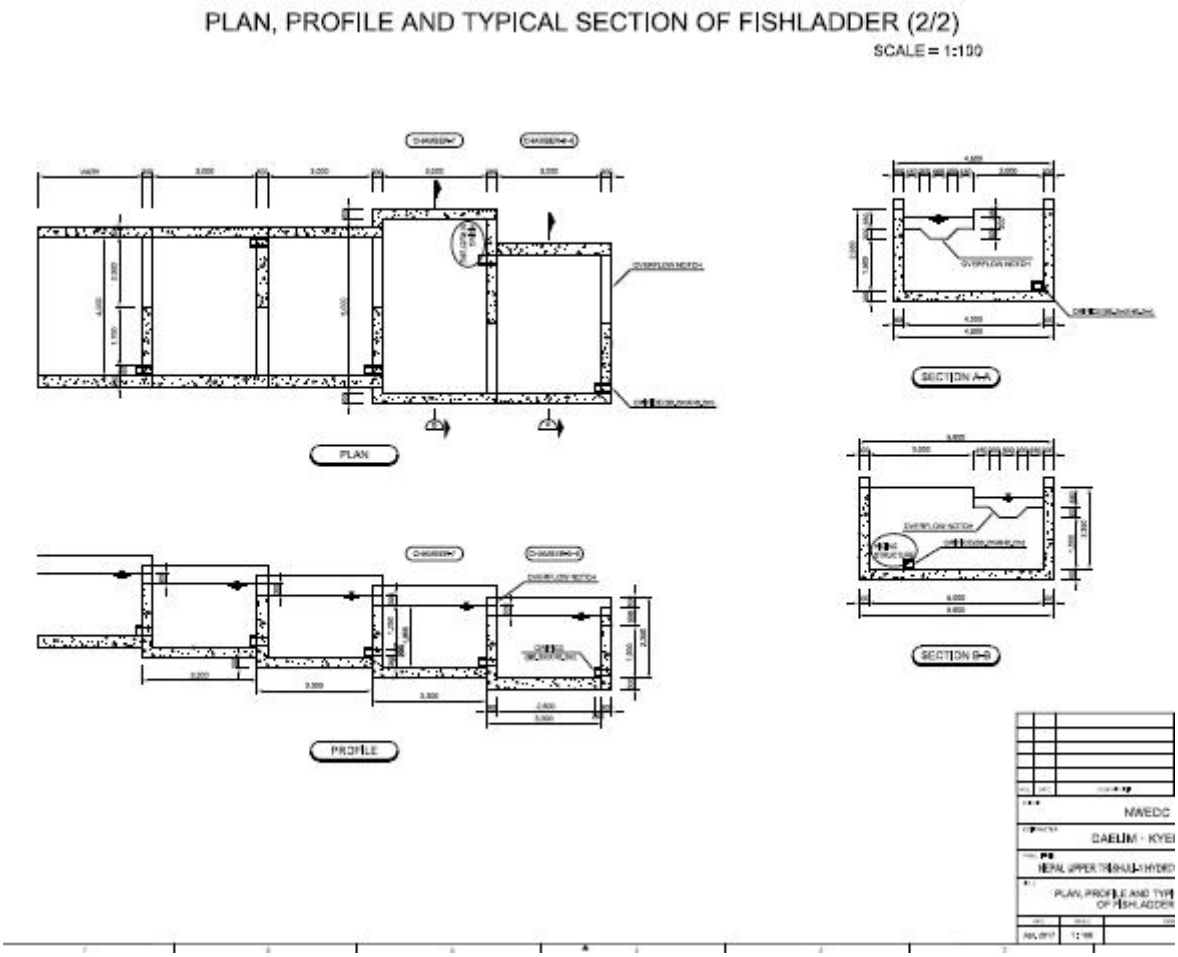


Figure 9, consisting of two parts 1/2 and 2/2. Plan Profile and Typical Section of Fish Ladder prepared by NWEDC's Design Engineer (DKJV)

5 Upstream migrating challenges not connected to the fish ladder

A fish ladder might be well designed and well-built but the success depends on the conditions in the river downstream the fish ladder and of technical solutions of the entrance area and exit area of the fish ladders.

- The conditions at the confluence of the tailrace and the river should be paid attention so as the upstream migrating fish easily find the old riverbed.
- The dewatered river section should be examined for possible obstacles that might hinder upstream fish migration during the period of minimum flow release.
- The river section just downstream the weir should be adapted to the behavior of the migrating fish species so as the upper part of the fish migrating section meet the fish ladder entrance, see paragraph 3.1.
- The water level in the pool of the fish ladder entrance will by existing design fluctuate between 1229.1 (5m^3/s) to 1,231,5 (154.4m^3/s). Fluctuations of up to 2,4m might lead to challenges concerning fish migration.

6 Downstream fish migration

When making an investment in an expensive fish ladder to keep the upstream eco-corridor open, it requires mitigating actions to also keep the sustainability of the downstream eco-corridor. If the mortality of downstream migrating fish is high, the eco-system services will

suffer, and over a relatively short time span the fish population using this eco-corridor will be decimated or extinct. If the mortality of downstream migrating fish is high and if mitigation of these harmful effects has low success it is better not letting the fish migrate upstream through a fish ladder.

To prevent a damaging fish population development the following topics should be considered:

1) Current in the intake pond
The main surface current entering the intake pond and weir should preferably point at the spillway See figure 10. The reason is that downstream adult fish probably migrate downstream in the main current during monsoon.
If needed a current guiding mechanism could be designed.

A question raised is if the fish ladder might be an attractive point to enter for downstream migrating fish. Due to the low flow in the fish ladder compared to the flow entering the settling basin a fish ladder would not serve as a suitable downstream migrating corridor.

2) Pool downstream of the weir
An important point is that fish migrating downstream across the weir should follow a smooth spillway and meet a soft landing in a downstream pool (see Sweco report of 15.08.2016, Fish Passage, evaluation of plans and recommendations, chapter 2.4).
The designed pool downstream the UT-1 weir does not serve as a soft-landing area for downstream migrating fish that are passing through the flapped gates.
When the flapped gates as designed at the top of the radial gates are used, they might serve as an opportunity for downstream migrating fish to pass over the weir. This will lead fish to fall 15 m and then hit the concrete basement. Heights above 5m will led to increased injurie and mortality. (see illustration, attachment 2). With a free fall of 15 m the fish will reach a velocity that even if hitting a water surface there will be high grade of injurie and mortality. To reduce the frequency of fish mortality due to passing through the flapped gates during monsoon, it is recommendable to use the flapped gates only short periods and to direct the excess water to a spillway at the left side of the weir, see figure 10. It might also be a positive solution to put one or more flapped gates at the top of the spillway as indicated in figure 10.

3) Tunnel entrapment
During low flow season and during early and late monsoon most of the flow are passing through the power station. In these periods most of the down migrating fish, fry and eggs also follow the flow to the settling basins before they enter the HP tunnel and the point of no return. Francis turbines show relatively high fish mortality, but it is a hope that fry and eggs have a reasonable survival rate. To reduce this mortality significantly a possibility might be to prepare fish guiding mechanisms in the settling basins. In the settling basins, the water velocity is slow which normally give good conditions for building guiding mechanisms.

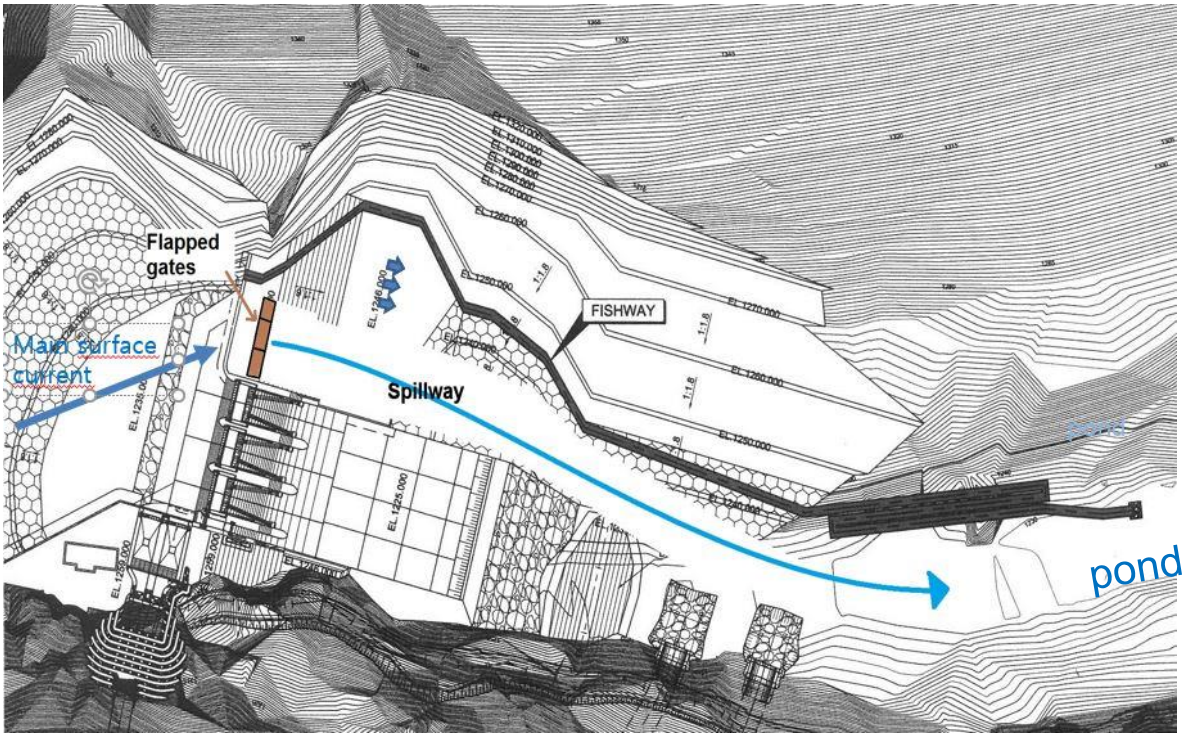


Figure 10 Upstream and downstream fish migration possibilities across the Upper Trisuli dam.

For more detailed information and discussions connected to the upstream and downstream migrations se the Sweco report of 15.08.2016.

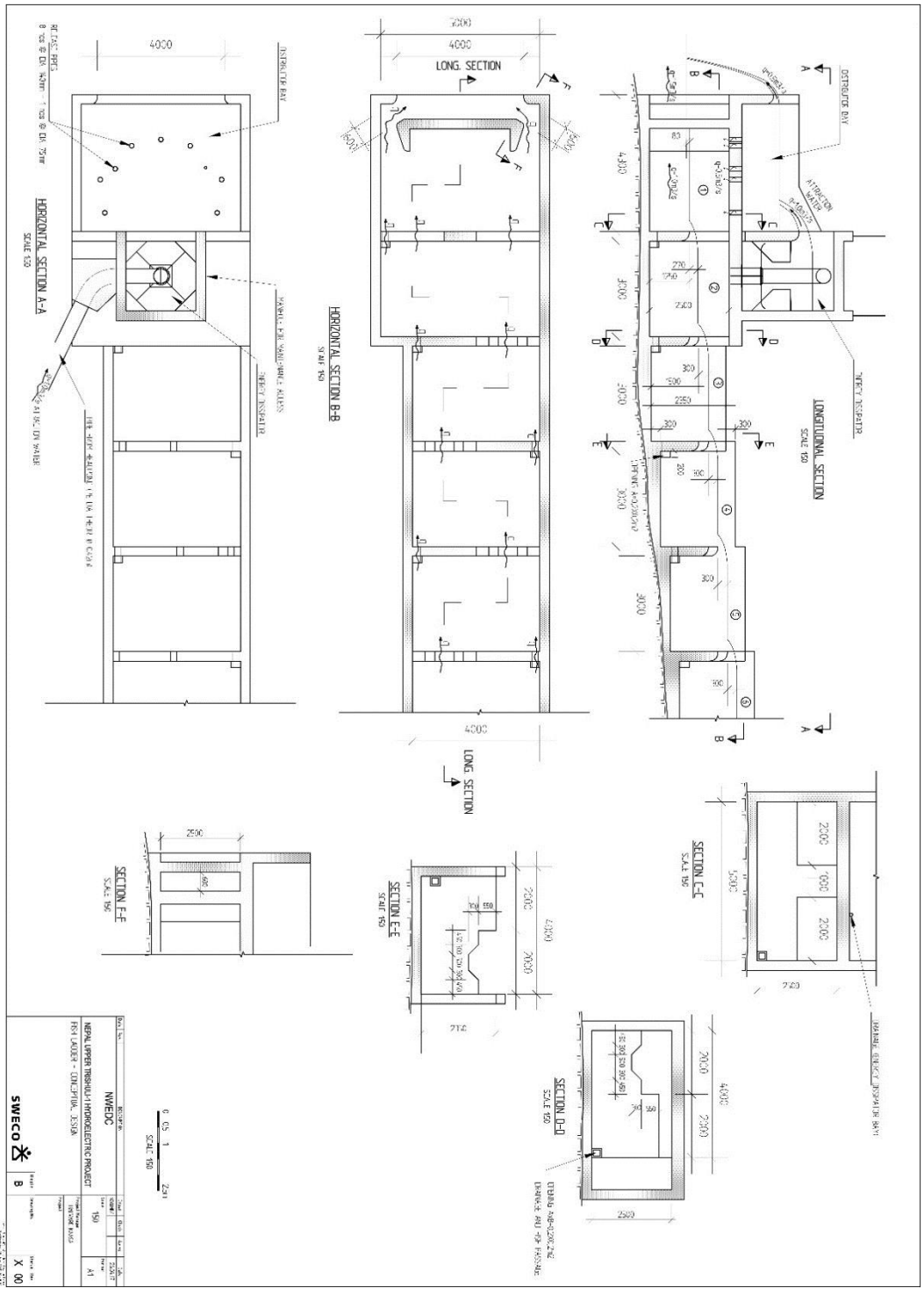
Some recommendations concerning the **management of the fish ladder:**

- High resolution flow data and temperature data will be good fish ladder management tools. Hourly flow data of a wet year, a medium wet year and a dry year, and hourly water temperatures give ability to understand functionality according to timeline and to be able to recommend technical solutions for the inlet and the outlet of the fish ladder.
  The fish do not respond to average values of flow and temperature.

- Detection of the upstream fish migration season is important to decide technical solutions of the fish ladder entrance and for the management plan as operating periods of the fish ladder.

- Detection of the downstream fish migration will give good basis for management recommendations. The fish migrations are probably fluctuating between years and are probably related to temperature. Until better data of fish migration is available it is not possible to restrict the fish migration period to the low flow situation.

Attachment 1. **Conceptual fish ladder design, made by SWECO.**



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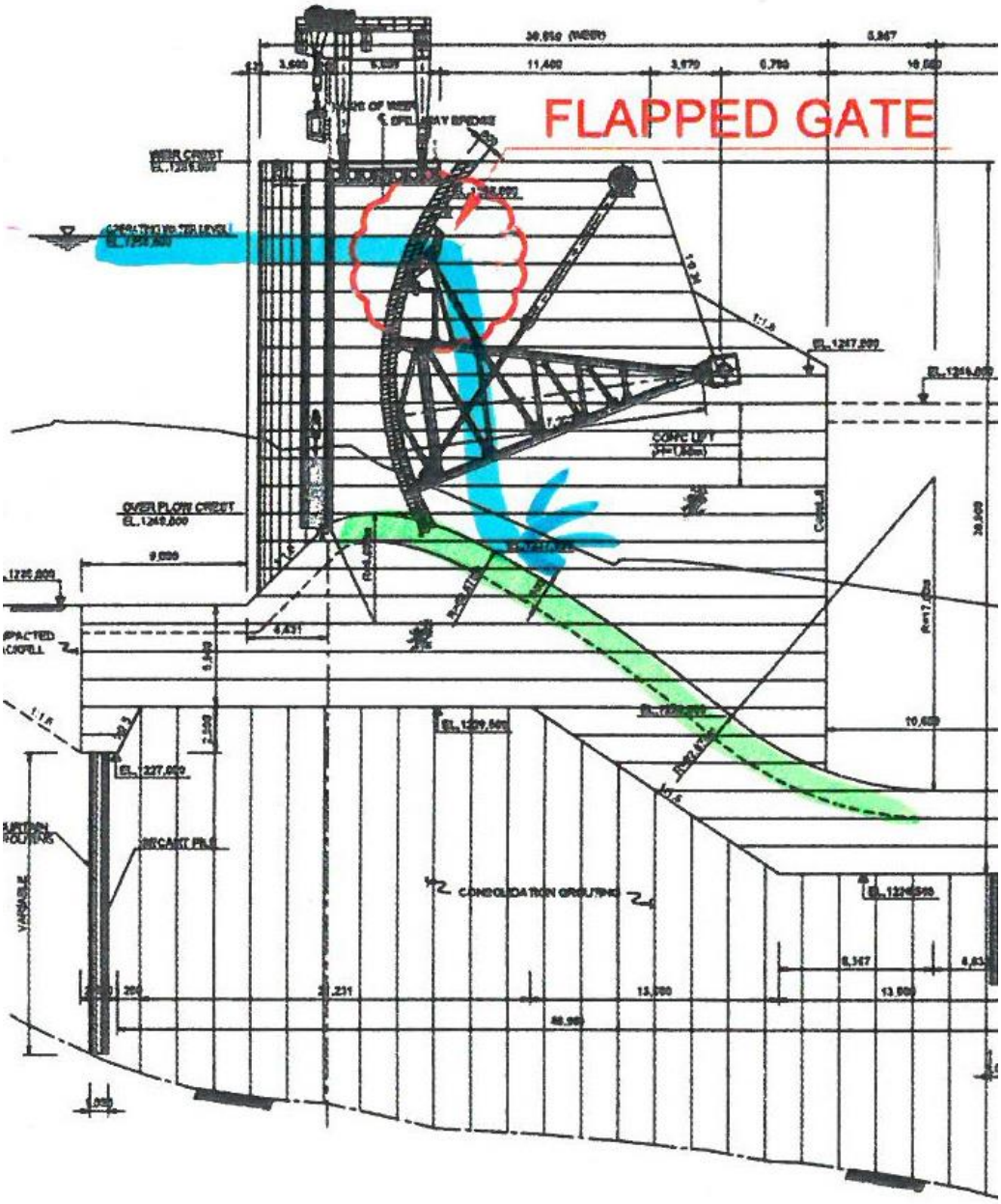
Attachment 2. **Illustration of overflow trough flapped gates at the top of the radial gates.**



SWECO

NOTE

14.05.2018

Upper Trisuli HP-1

Suplementary information concerning Schizothorax progastus.

In general
Upper Trisuli as a snow feed river is cold and muddy most of the year. This means that the ecological conditions in the main river are not optimal both concerning fish production or invertebrate production.
This is probably the reason why the population of Schizothorax richardsonii is low in the main river. In the tributaries with warmer and more clear water the fish densities are high.

Moving downstream in Trisuli the temperature showed slightly increased values, still low densities of fish but with higher species diversity. Al examined tributaries showed higher temperature and far higher fish densities than in Trisuli.
These findings indicate that temperature is a major factor in the fish population spreading and for the species dominance. Since the registered density of S. richardsonii is very low in Upper Trisuli it might be an indication that the river ecology conditions are not far from the species spreading boundary.

Schizothorax progastus
This species normally lives in in lower altitudes where the water temperatures are higher than in the Upper Trisuli area. Presence of a species is connected to natural adaptions and spreading ability. Temperature, that is vital for the ability to generate muscle power in cold-blooded animals, is also very well known as a major limiting factor in most ecosystems.
S. progastus was not registered when I was doing my field studies in Upper Trisuli. According to other studies and when taking the ecological conditions into account, it seems natural that the UT-1 area is outside the normal living area of this species.

It might be that in years with warmer water the species could be able to reach the UT-1 area in low numbers, but probably it would only be a temporary visit with no effect for the species spreading process.
The designed fish ladder at UT-1 will get hydraulic conditions making it possible to climb for S. progastus if the water temperature satisfy the species requirements.

Halvard Kaasa

Scientific manager
Aquatic ecology expert

Sweco Norge AS

Appendix D.3
Swimming Performance of
Schizothorax Sp.

SWECO

RAPPORT

14685001

UPPER TRISULI -1 HP

SWIMMING PERFORMANCE OF SCHIZOTHORAX SP

[STATUS]

28.03.2017

NWEDC

[NAME]

SWECO

Sammendrag:

This report summarises knowledge on swimming performance of Shizothorax richardsonii (Snow trout) with focus on qualities connected to design of fish ladders.

Data on swimming performance for many of the native fish species in Nepal are scarce which complicates the design of suitable eco-adapted fishways. In general, nature like fish passages allow most of the species to migrate, followed by vertical slot fishways and thereafter of fish ladders of pool-and-weir type. The key is to construct fish ladders that give hydraulic conditions in the fish ladder that is adapted to the available energy output that the target species can perform under the actual ecological conditions.

☐ Final
☒ Draft

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	Sign.:
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1 Background

In many countries around the Himalayas the fish, commonly named snow-trout, is an important species for various fisheries activities. The name may refer to various species with different local names within the native genus *Schizothorax sp*. In a literature review by Rufford (2015) the species *S. richardsonii* is described to be found both in Nepal and India, often inhabiting the cold mountain rivers at altitudes up to 2800 masl (meter above sea level) (FAO Fisheries paper 431). Fish sizes of up to its maximum length of 60 cm have been reported from Nepal at an altitude of ca 2800 masl. (Ranjan Jah 2006).
The species inhabits mountain streams and rivers of about 4-20 °C, where the adults generally prefer to live among rocks at stream depths of around 1-2 m (Rufford 2015, Froese & Pauly 2016). The adult fish have powerful muscular streamlined body and the spawning of mature fish (common sizes of 120-350 mm) might happened twice a year during spring an early monsoon, and during autumn or late monsoon (Shekhar et al. 1993). Koshi et al. (2016) say that spawning also may take place twice in a year from June-October and January-March. These documentations point at a species with high flexibility and good adaptability to local ecological conditions.
Since both S. richardsonii and S. progastus are mentioned as species in Upper Trisuli section some basic information about these two species shall be mentioned.
With refernce to the Gandaki river system the S. richardsonii zone is between 850m – 2810 m above sea level, while the S.progastus zone is in between 300m and 850 m above sea-level. In the FAO fisheries technical paper 431 it is stated that in the lover S.progastus zone the S.richardsonii will gradually be replaced by S. progastus. This difference in habitat selection seems to point at that S.progastus might be a species adapted to higher water temperatures than is the S. richardsonii.

Although *S. richardsonii* is widely spread along the Himalayan, observations over the last 5-10 years indicate a severe decline of the populations in many areas and the species is now categorized under “vulnerable category” (IUCN 2006).

2 General considerations on fish swimming speeds

Commonly the fish swimming speeds are classified into five categories: 1) Optimum Swimming Speed, 2) Maximum Sustained Swimming Speed, 3) Critical Swimming Speed, 4) Maximum Domed Swimming Speed, and 5) Burst Swimming Speed (references in Gui et al. 2014). The maximum speed of fish (Burst), is an anaerobic process and can be sustained only for periods of around 15-20 seconds, related to fish size and water temperature. As stated by Gui et al. (2014) the Burst Swimming Speed (BSS) can be estimated to a upper limit of 10 body lengths per second (BL/s) for many fish species. Yet the BSS depends on the duration of the performed burst, which declines exponentially with time and increases with size in absolute units (cm/s), but decreases in relative units (BL/s). Temperature affect the fish physiology and thereby also the swimming speed of the fish.

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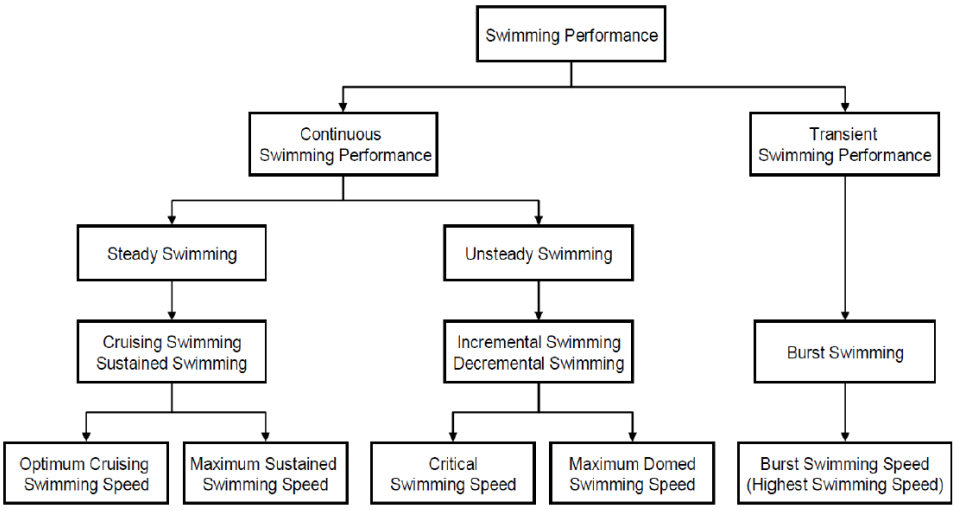

Figure 1. Various modes of fish swimming as presented by Gui et al. (2014).

The swimming speed of fish is related to: 1) species capability 2) an increase with fish size and 3) be temperature dependent (references in Rodríguez et al. 2006). Here various curves have been developed and are widely used to support reliable fishway designs. As demonstrated for salmonids (Figure 2), these describe the maximum swimming velocities of different sizes of fish at different water temperatures, all in relation to the maximum time that a fish can maintain the actual velocities (see Rodríguez et al. 2006). Based on empirical data the estimated maximum distances (Dmax) swimmable against currents of different velocities for fish various sizes of fish have been estimated to for salmon (*Salmo salar*) and brown trout (*Salmo trutta*) as follows:

$$Dmax = \max\{(v - u)t, 0\}$$

where Dmax is the maximum distance swimmable (m), v the maximum swimming velocity (m/s), u the flow velocity (m/s), and t is the time over which v can be maintained (s). as demonstrated by Figure 4 these curves may be applied in fishway designs since fish in the passes generally only need to swim short distances against fast currents. Given the estimates of fish swimming capability (Figure 4) the next step is to relate the curves to water velocities and energy profile in the fishway (for details see Rodríguez et al. 2006).

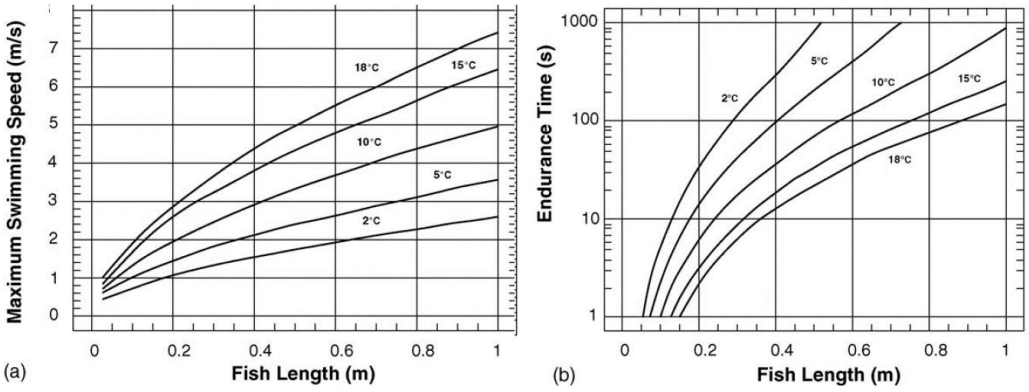

Figure 2. Graphs for salmonids a) maximum swimming velocity v compared to fish length and b) maximum endurance time for which v can be maintained (also compared to fish length), in both cases at different temperatures (modified from Rodríguez et al. 2006).

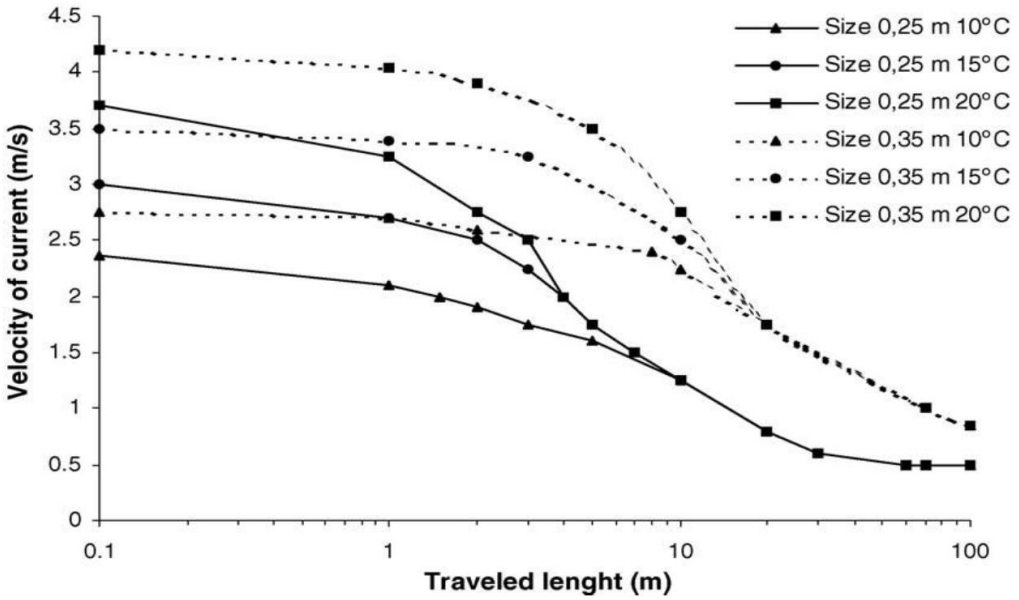

Figure 3. Illustration of maximum swimmable distance (D_{max}, m) compared to different water velocities, for 25- and 35-cm fish, at a water temperature of 10, 15 or 20 °C (from Rodríguez et al. 2006).

3 Swimming performance of Schizothorax sp. and resembling species

The adult *Schizothorax sp*. in the Himalayas have powerful muscular streamlined bodies and are generally dwelling in rapid high volume of water. Studies have demonstrated that Cyprinids living in these types of rapid-flow habitats generally have adapted to a higher swimming speed than fish originating from lentic areas: In total there are currently 64 recognized species in the *Schizothorax sp.* genus of which the swimming capability of most of the species has not been studied. The detailed data that was found in various reports are listed below.

3.1 Interspecific variation in hypoxia tolerance, swimming performance and plasticity in cyprinids that prefer different habitats

Fu et al. (2014) quantified and compared hypoxia tolerance and swim performance among cyprinid fish species from rapid-, slow- and intermediate-flow habitats (four species per habitat) in China. The data demonstrated that Cyprinids living in rapid-flow habitats generally have higher swimming performance than fish originating from lentic areas. This was expressed as maximum velocities where fish can maintain their position and are not swept downstream, abbreviation U crit-values. Critical swimming speed (U crit) for juvenile *S. prenanti* (85 mm in length) was found to be around 6-7 body lengths (BL)/s.

3.2 Effect of temperature on swimming performance of juvenile *Schizothorax prenanti*

Cai et al. (2014) estimated the swimming performance of *S. prenanti* at four temperatures (15, 19, 23, 27 °C), and numerical models were used to characterize the effect of temperature on swimming performance. As temperature increases, critical swimming speed (U crit) increased from 15 to 23 °C and then decreases significantly. The highest U crit (around 7.7 BL/s) was at 24 °C. Swimming efficiency was similar from 19 to 23 °C, but decreases significantly at 27 °C. The results of the investigation advance the knowledge of fish metabolism while swimming provides data critical for fishway design.

3.3 Aerobic swimming performance of juvenile *Schizothorax chongi* (Pisces, Cyprinidae) in the Yalong River, southwestern China

Tu et al. (2010) studied *Schizothorax chongi* that is found in rapid stream of southwestern China, and rely on energy reserves to carry out their upriver spawning migration. Energy-saving behavior may thus be crucial for upriver migrants at difficult passage and be valuable for designing effective fishways. Their bioenergetic model (fish of body length c. 10-13 cm and body mass from 14 to 36 g) demonstrated an optimal swimming speed (U opt) of 5.5 BL/s, whereas at the highest velocities usually > 9-10 BL/s the swimming became less steady and darting bursts were used to maintain position, causing rapid movement forward in the flume before resuming continuous swimming. The authors conclude that fishway design must take into account the kinematics of fish swimming ability in terms of swim pattern including tail beat frequency (TBF) and tail beat amplitude (TBA). This means that the minimal slot width (in the vertical slot fishway), should be calculated for the largest individuals of S. chongi (60 cm) and thus not be less than 60 cm x TBAmax. Since the authors found TBAmax to around 0.27 BL/s this means that a fishway for the species should have slot widths of minimum 16 cm, yet the authors mention the need for further research to support the design of effective and comprehensive fishways.

3.4 Evaluation of the swimming ability of wild caught *Onychostoma barbatula* (Cyprinidae) and applications to fishway design for rapid streams in Taiwan.

Lin et al. (2008) evaluated the swimming of *Onychostoma barbatula*, a migratory Cyprinid found in mountain rivers of Taiwan in order to obtain data that be applied to the design fishways. They found that swimming speed increased progressively to 13 BL/s at 16 °C) for the studied fish of total body length from 5 to 21 cm. The stated that for these small fish a suitable fishway should have a minimal width of 9 cm (for individual fish) and a maximal water velocity of c. 1.27 m/s.

3.5 Swimming capability of *Schizothorax oconnori*

Ye et al. (2013) tested swimming of the endemic species *Schizothorax oconnori* in the Yarlung Zangbo River. The results showed that the absolute critical swimming speed increased with the body length and the relational relationship was Y1=-39.369+13.23X-

0.371X2+0.004X3(Y1 was cruising swimming speed, X was body length), while the relative critical swimming speed declined with the increase of body length .Absolute burst swimming speed increased with the increase of body length and the relation was approximately linearity, but the relative burst swimming speed declined with the increase of body length. Under three tested velocities the sustained swimming speed of the fish was 60 cm/s, while the endurance swimming speeds were 80 cm/s and 100 cm/s. The authors claim that the information can be useful for fishway designs.

4 General concerns in fisheries management projects at regulated sites

In general, both large and small scale run of the river hydropower schemes have resembling impact on the local river environment. Most studies in regulated rivers have focused on how the longitudinal connectivity affects the migrations of fish species which involves up- and downstream movements along river corridors. To maintain river connectivity fish ways can be constructed. Nevertheless, relatively few studies have evaluated their efficiencies and only a handful have looked at the overall effect of re-establishing or maintaining the connectivity. Furthermore, just facilitating longitudinal connectivity will not have any long-term effects unless essential requirements for affected species and life-stages are considered. For fish this should include appropriate habitats for spawning, rearing and foraging. The flow alterations occurring in regulated rivers may stress the aquatic fauna and cause limited amounts of appropriate habitats. The effects of hydropower on the biota are likely to vary dependent on the type of the hydropower facility and the specific river environment. Still, the knowledge on the ecodynamic situation in regulated rivers seems rather scarce.

At present a variety of fish ways exist. Common bypasses for upstream migrating fish consist of technical ladders, which are normally designed in three varieties: 1) Pool and weir, 2) Denil slot, and 3) Vertical slot. In addition, nature-like bypasses are being developed and seems to be the preferable solution if space and areal conditions are available.
In river ecosystems with many fish species it is favourable that the fish ladder designs are adapted to the weakest swimmers in the run, or if one target species is selected the hydraulic situation in the fish passage shall be adapted to the ecological situation that statistically require the lowest burst speed of the target species. The effectivity of the fish passage should aim to pass more than 95% of the adult upstream migrants in a safe and rapid manner (see Rivinoja et al. 2010).
Mature migrating adult fish generally search for the highest flows, and as a result passage problems can arise due to low attraction flows in bypasses. This might hinder fish if they are attracted towards impassable routes from turbine outlets or dams rather than to bypasses. Delays at power stations may be considerable in terms of increased energy costs, which may lead to a lowered reproductive fitness during spawning. For fishways to function properly not only must the fish be able to find the fishway (attraction efficiency) but they must also be able to successfully ascend it (passage efficiency). To guide fish towards fishways is often complicated, especially when fish must leave the main stem of the river. In many cases, and particularly in larger rivers, channels and

dewatered sections are associated with low residual flow conditions and may have partial obstacles that may cause the fish to move slowly or even stop and return downstream (see Rivinoja 2005). When the fishway is situated in the main stem, close to a power station, or close to a spillway with high flows, the design of the fishway entrance and its position in relation to the tail-race or the spillway water is crucial for the effect of the fish path.

In the Himalayas the main objective of many fishery development plans is to improve the habitat and to ensure the up- and downstream migrations of fish, especially *Schizothorax richardsonii* that constitutes an important food resource.

5 Conclusions

Data on swimming performance for many of the native fish species in Nepal are scarce which complicates the design of suitable eco-adapted fishways. In general, nature like fish passages allow most of the species to migrate, followed by vertical slot fishways and thereafter of fish ladders of pool-and-weir type. The key is to construct fish ladders that give hydraulic conditions in the fish ladder that is adapted to the available energy output that the target species can perform under the actual ecological conditions.

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Appendix D.4
Fish Ladder For Upper Trishuli-1 HPP, Margenex International Review Memo

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Margenex International

January 16, 2018

Dr. Leeanne Alonso
4618 Duncan Drive
Annandale, VA 22003

Re: Fish ladder for Upper Trishuli-1 HPP

Dear Dr. Alonso:

Thank you for the opportunity to review the report entitled "Principles for Design of Fish ladder for UT-1 HPP" by Halvard Kaasa, a civil engineer and fish scientist for Sweco Norway AS. I have reviewed this report in detail, with focus on the fish ladder design.

This report gives comments and recommendations for technical solutions to keep river connectivity when the Upper Trishuli-1 Hydropower project (UT-1) is in operation. The dominant species in the UT-1 area of Trishuli River is the Asala (*Shizothorax richardsonii*), a species of Snow Trout that migrates upstream and downstream for breeding, feeding and rearing purposes on a seasonal basis. The total height of the fish ladder will be approximately 30 m. The exact height will be decided when the design of the fish ladder entrance pool is settled. To meet the requirements for migration of Snow Trout, the total number of pools will be close to 100.

The report provides adequate details of the conditions for the fish ladder design, considering the characteristics of the target fish species, flows through the fish ladder, and available space in the geophysical setting. The report lays out details of the crucial lower entrance of the ladder and explains, with appropriate figures, the design of each of the ten pools at the lower end, as well at the set up for the water of attraction. The latter is key to enticing fish to enter the facility.

Regarding the design of the proposed fish ladder, I like the alternating weir notches in each of the pools. The maximum water level drop of just under 12 inches, coupled with the 8 inch square drain openings near the bottom of each pool, should allow adequate upstream passage of adult Snow Trout during low flows of March and April. In my experience in Washington State, a very conservative weir drop is 9 inches is desired to accommodate small salmonids (mainly Cutthroat Trout, which would be analogous to

adult Snow Trout, in this case), but most Pacific NW professionals would say that 12 inches should be satisfactory. I am also fine with the lower entrance pool and upper exit pool schemes.

The report provides a reasoned description of upstream fish migration challenges not related to the proposed fish ladder, and notes considerations for downstream fish migration, including current in the intake pond, the pool downstream of the weir, and tunnel entrapment. It also outlines the types of data that should be obtained in order to properly manage the fish ladder.

My main concerns mirror what has been stated in the report:

- The conditions in the pool outside the fish ladder entrance is crucial for the functionality of the fish ladder; and

- The water level in the pool of the fish ladder entrance will, by existing design, fluctuate between 1229.1 m (5 m^3/s) to 1,231.5 m (154.4 m^3/s). Fluctuations of up to 2.4 m (8.9 ft) might lead to challenges concerning fish migration.

In conclusion, it is my opinion that there is reasonable likelihood this fish ladder will function to meet the project objective of allowing Asala connectivity above and below the hydropower project, based on the approach described in the Sweco Norway AS report.

I would like to see the details of how they plan to carry out monitoring to quantify fish use of the ladder, such as conventional tagging, sonic tagging or observations. If the latter, I recommend two to four fish viewing windows, evenly spaced along the ladder, for quantifying upstream migration.

I look forward to working with you on this project in the future. Please contact me if you have any questions.

Sincerely,

Margenex International

S/S Mark G. Pedersen

Mark G. Pedersen, M.S. FP-C.
President
and Senior Fisheries Consultant to the IFC

Appendix E
Scenario-Based Evaluation of Flow Impacts on S. richardsonni in the Trishuli River

Nepal Water and Energy Development Company (NWEDC) Limited

Naxal, Kathmandu

A Final Report

on

Upper Trishuli-1 HEP, Nepal: Scenario-based evaluation of flow impacts on *S. richardsonii* in the Trishuli River

Report Prepared by:

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April 2017

Executive Summary

Nepal has a huge potential for hydropower development. After the introduction of Hydropower Development Policy, 2001 there has been active involvement of private sector in hydropower development of Nepal. Most of the projects are being constructed by the local hydropower developers whereas some of the projects with greater installed capacities are being developed under the financial assistance by international funding agencies such as the World Bank and Asian Development Bank.

The Upper Trishuli-1 Hydroelectric Project (216 MW) is a Run-of-River type project being developed by Nepal Water and Energy Development Company (NWEDC). The project is funded by the International Finance Corporation (IFC). As a requirement of sustainable hydropower development and to meet the performance standards of IFC with regards to biodiversity conservation, an Eflows assessment followed by formulation of Environmental Flows Management Plan (EFMP) is carried out.

The Eflows assessment is carried out at three sites, viz.: upstream of dam site, in the dewatered river reach and downstream of the powerhouse site. About 12 km of the dewatered river reach is considered for eflows assessment. DRIFT model developed by Southern Waters is used to study the consequences of flow alteration due to project development on the life of *Schizothorax richardsonii*. Thus, the ecosystem indicators that are likely to be influential in the life of *S. richardsonii* as a result of flow changes are considered in this study. Similarly, baseline ecological status of each study site is evaluated and possible ecological changes of these sites due to flow alteration after the hydropower project is in place are evaluated.

The results of the study shows that the baseline ecological status of eflows site 1 (upstream of dam site) and site 3 (downstream of powerhouse site) are not changed significantly and seems to have minimum effect on the life of *S. richardsonii*. On the other hand, the ecological integrity and fish populations will be impacted in the dewatered river reach due to flow diversion for power generation. However, with the provision of efficient and functional fish passage the effects can be minimized. The results of the EFlows assessment also show that the best EFlows scenario for the *S. richardsonii* is the release of more water during the winter (low flow) months. However, power generation will be negatively impacted with the release of more water, with a loss of approximately 4.9 % of power if 20% of mean monthly flow is released. And, it is highly unlikely that the project will be financially viable with this power loss.

As NWEDC has exhibited commitment to biodiversity management for UT-1 through extensive baseline data collection, inclusion of a fish ladder that will meet international standards, a cumulative impacts assessment and this EFlows assessment, release of agreed eflows followed by appropriate mitigation measures during the project implementation shall be recommended for reducing the impacts on *S. Richardsonii* in the dewatered river reach.

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Acronyms

DRIFT	Downstream Response to Imposed Flow Transformation
EFlows	Environmental Flows
EFMP	Environmental Flows Management Plan
HEP	Hydroeletric Project
IFC	International Finance Corporation
NWEDC	Nepal Water and Energy Development Company
VDC	Village Development Committee

1 Introduction

1.1 Background

1.1.1 The Trishuli River

The Trishuli River is a trans-boundary river and is one of the eight sub-basins of the Gandaki River basin in Central Nepal. It covers an area of 32 000 km^2, which is 13% of the total Gandaki area. The Trishuli watershed lies within the physiographic Highland and Midland zones defined by average altitudes of ~2000 m and high valley landscapes.

The Trishuli River originates in the Tibet Autonomous Region of the People's Republic of China, where it is known as Bhote Koshi. The catchment area of Bhote Koshi in Tibet is ~3 170 km^2 for a river length of 120 km. The ~106 km of Trishuli River within Nepal shows a high gradient in the initial 40 km with rapids dominating the longitudinal profile but there are no impassable falls (CIA UT-1, 2014, ESSA).

1.1.2 The Project

The proposed Upper Trishuli-1 HEP (216 MW) is a 'Run-of –River' type project being developed by Nepal Water and Energy Development Company (NWEDC) Ltd. The main project features are the headworks (including diversion weir, intake, and diversion tunnel), desander basin, headrace tunnel (including surge tank, vertical shaft) and powerhouse, including the tailrace tunnel. The project is located in Rasuwa District, Bagmati Zone 80 km northeast of Kathmandu. The intake site is located at Hakubesi of Haku VDC and powerhouse site at Mailun of Haku VDC. The catchment area at the intake site is 4 350.88 km^2 and the design discharge at Q51 is 76 m^3/s. By utilizing the net head of 333.93 m, an average annual energy of 1533.1 GWh could be produced. The total project cost is estimated to be around US$ 382.583 Million and is expected to be completed within 5 years from the start of construction. The location map of Upper Trishuli-1 HEP is given in Figure 1.1.

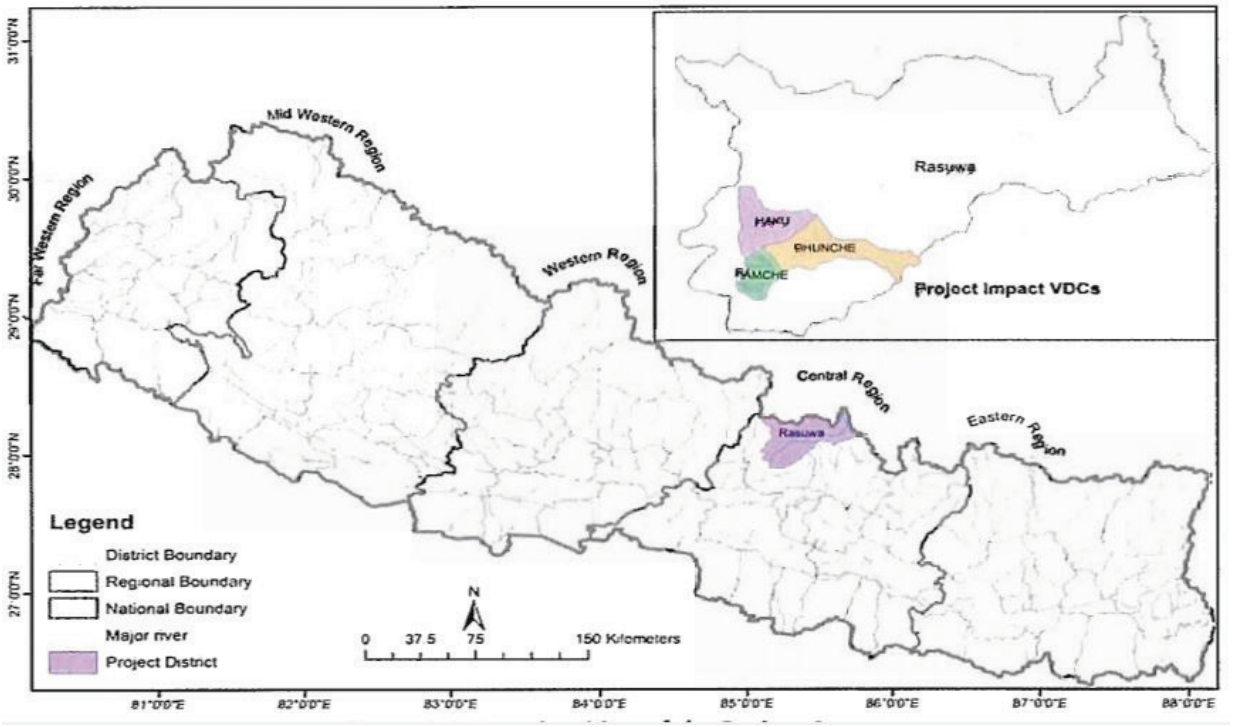


Figure 1.1 Location of Upper Trishuli-1 HEP, Nepal (Approved EIA Report of UT-1 HEP)

The design features of the project are shown in Table 1.1.

Table 1.1 Upper Trishuli-1 HEP design features (NWEDC)

Item	Description
Catchment area at intake site	4350 km^2
Design Discharge at Q51	76 m^3/s
Net Head	324 m
Plant Capacity	216 MW (72 MW x 3 units)
Average Annual Energy	1 533.1 Gwh
Saleable Energy	1 456.4 Gwh
Diversion Structure	Concrete Gravity Dam/Weir of height 32.0 m and overall length of 100.90 m.
Intake	2 Nos. each of 3.25 m wide and 6.5 m high
Desanding basin	Underground(3 chambered) with effective length of 115 m
Headrace Tunnel	9.715 km long, 6.5 m diameter
Surge tank	292 m deep, 8.5 m diameter on top, restricted orifice type
Tailrace tunnel	178 m long, 6.5 m diameter
Penstock	3 steel lined penstock tunnels
Powerhouse	Underground

1.2 The EFlows assessment

1.2.1 Terms of Reference

The contract agreement for preparation of Environmental Flows Management Plan (EFMP) of UT-1 HEP between Nepal Water and Energy Development Company (NWEDC), the client and S.A.N. Engineering Solutions Pvt. Ltd. (the consultant) was signed between the two parties based on the following Terms of Reference.

(i) Introduction

As a part of process to ensure compliance of the Upper Trishuli-1 Hydroelectric Project (UT-1HEP) with Nepal national regulations and the IFC's Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Resources, NWEDC is required to develop environmental flow management to maintain viable populations during construction and operations of the Upper Trishuli-1 Hydropower Project.

(ii) Objectives

In line with IFC's Performance Standard, the objective of this scope of work is to develop an Environmental Flows Management Plan (EFMP) to maintain viable fish populations during construction and operations of the Upper Trishuli -1 Hydroelectric Project (UT-1 HEP), Nepal.

(iii) Approach to the study

The Consultant's effort was streamlined to meet the objectives as outlined by the Scope of Work.

The Hydropower Development Policy (HDP 2001) is the guiding document for EFlows releases in the design of hydropower projects in Nepal. According to HDP, a developer is required to release 10% of the minimum monthly average flow or the quantum stated in the Environment Impact Assessment (EIA) Report, whichever is higher, as a minimum flow criterion. This minimum flow, in fact, does not constitute an EFlows provision as it does not consider the aquatic ecosystem in the study reach, nor any potential knock-on effects downstream of that reach. With the involvement of donor agencies such as Asian Development Bank and the World Bank Group in hydropower development in Nepal, however, there has been a growing concern about ensuring sustainable hydropower development and adherence to the performance standards of these donor agencies.

The Consultant will develop EFMP for UT-1 HEP to meet IFC Performance Standard 6, i.e., no net loss of biodiversity. That said, the timing and other limitations that define the study necessitate a rapid approach that focuses on the mitigation of any residual impacts on *Schizothorax richardsonii* with a 10% of minimum monthly average flow release in place and a reliance on existing information, including unpublished relationships between *S. richardsonii* and flow established for similar rivers in the Himalayan region. To this end, the evaluation of flow scenarios comprising different minimum flow releases will be done used the DRIFT Method (Brown *et al*. 2013), which has been successfully implemented in the Neelum/Jhelum Basin in Pakistan-administered Kashmir.

The key questions addressed were:

- At what time of the year, and in what part of its life cycle, does *S. richardsonii* utilise the study reach?
- Does a minimum release of 10% of minimum monthly average flow adversely affect *S. richardsonii*'s migration and, by inference, its breeding success?
- If so, is it possible to implement a regime whereby the flow is increased beyond 10% of minimum monthly average flow releases during certain days in the period March to May to mitigate any potential negative impacts to the onset of upstream migration as well as to reduce potential impairment of the overall spring upstream migration process, while maintaining economically-viable power generation?

Evaluation of the above was based on the assumption that there were no major negative impacts to the river morphology and/or spawning sites that could either impede or improve migration and/or spawning. An additional question related to whether or not changes to stream channel morphology as a result of the various flow rates evaluated would directly or indirectly alter physical habitats used by *S. richardsonii*, and whether there is any scope to improve existing habitat downstream of UT-1 HEP.

The results of the evaluations will inform discussion and agreement on an EFlows regime for the study reach, which will then form the basis of the EFMP.

The EFlows assessment focuses on three sites, viz.: upstream of UT-1 HEP, the dewatered reach and downstream of the tailrace as indicated in Figure 1.2. The other two sites, one at headworks of Mailun Khola Hydropower Project and the other at confluence of the Trishuli River and Mailun Khola were considered simply as the places where snow trout migrate to and from.

Figure 1.2 Study area for the Upper Trishuli-1 HEP EFlows assessment

The sites marked 1, 2 and 3 are located upstream of the dam, in the dewatered section and downstream of the powerhouse, respectively.

1.3 Limitations of the study

The level of detail achieved in this assessment is commensurate with available data and information, budget and programme. Thus, although the process applied in this assessment is similar to that used in more detailed EFlows assessments, it is a coarse-level assessment, with the focus on the identification of major risks to the ecosystem associated with the Upper Trishuli HEP using responses to flow and sediment changes developed for a different but similar river.

The following exclusions, limitations and assumptions apply:

- The study:
    - focuses on *S. richardsonii*
    - uses existing information
    - excludes any hydraulic modelling or topographical survey of the study reach
- Changes to stream channel morphology are evaluated qualitatively only.
- Scenarios include UT-1 HEP only.

The Client provided the following:

- 20-30 years daily flow data for pre-UT-1 conditions in the study reach.
- Flow regime, including spills, with UT-1 HEP in place with a minimum monthly average release of 10%, covering the same period as the per-UT-1 hydrological time-series.
- Information related to sediment supply to and deposition in the UT-1 reservoir.
- Operational rules related to flushing sediments.
- The number of scenarios evaluated is limited to six, plus baseline.
- Offsets were not evaluated in terms of feasibility, effectiveness or cost, and detailed design was not be undertaken
- Stakeholder engagement was excluded

Finally, data are always a limiting factor in environmental studies. With contemporary understanding of how aquatic ecosystems function, it has become easier to predict what will change and the direction of change. It is less easy to predict by how much ecosystem components will change and how long it will take. For this reason:

- all predictions should be evaluated with due cognizance of the assumptions necessitated by the constraints of the study; and
- it is better to evaluate the outcome of the scenarios relative to one another rather than as absolute individual predictions of change.

2 EFlows sites

An EFlows assessment was carried out at three sites, *viz*.: upstream of the dam site, dewatered river reach and downstream of the powerhouse. Due to the diversion of flow from intake, natural flow conditions in the section of the river between the dam site and the power house site will be impaired. This impairment is greatest in the dewatered river reach, but there will also be effects at upstream of the dam site and downstream of the tailrace. Thus, the EFlows study considered the three sites shown in Figure 1.2. The locations of these sites are as follows:

i) Site 1: 28º 07' 36.40"N, 85º 17' 52.41"E Upstream of Dam site
ii) Site 2: 28º 05' 27.76"N, 85º 14' 7.87"E Dewatered Zone
iii) Site 3: 28º 04' 13.87"N, 85º 12' 28.63"E Downstream of Power House Site.

Since the EFlows sites 1 and 3 are located close to the headworks site and the powerhouse site respectively, the length of the river that was considered for the eflows study is approximately 12 km. As mentioned in the Terms of reference for EFMP formulation, the dewatered river reach was only considered for the eflows assessment.

3 Hydrology

The baseline hydrological and scenario daily time-series data were provided by NWEDC. These are based largely on flow data obtained from the Department of Hydrology and Meteorology (DHM) gauging station at Betrawati, located 12 km D/s of intake. The best available long-term hydrological data were for the period 1967 to 2013, and so this was the period on which the EFlows assessment was based.

Details of the hydrological data available for the Upper Trishuli River and the procedures undertaken to obtain then are covered in **Hydrological Analysis of Detail Design Report-II, Civil of UT-1 HEP**.

The hydrological record for the Trishuli River suggests that this is a flood-pulse system, with four well-defined seasons (Figure 3.1). Figure 3.2 provides some examples of the year-on-year variation in flow and flow seasons at one of the EFlows sites. The seasonal divisions shown in these figures are those identified in DRIFT using the parameters listed in Table 3.1.

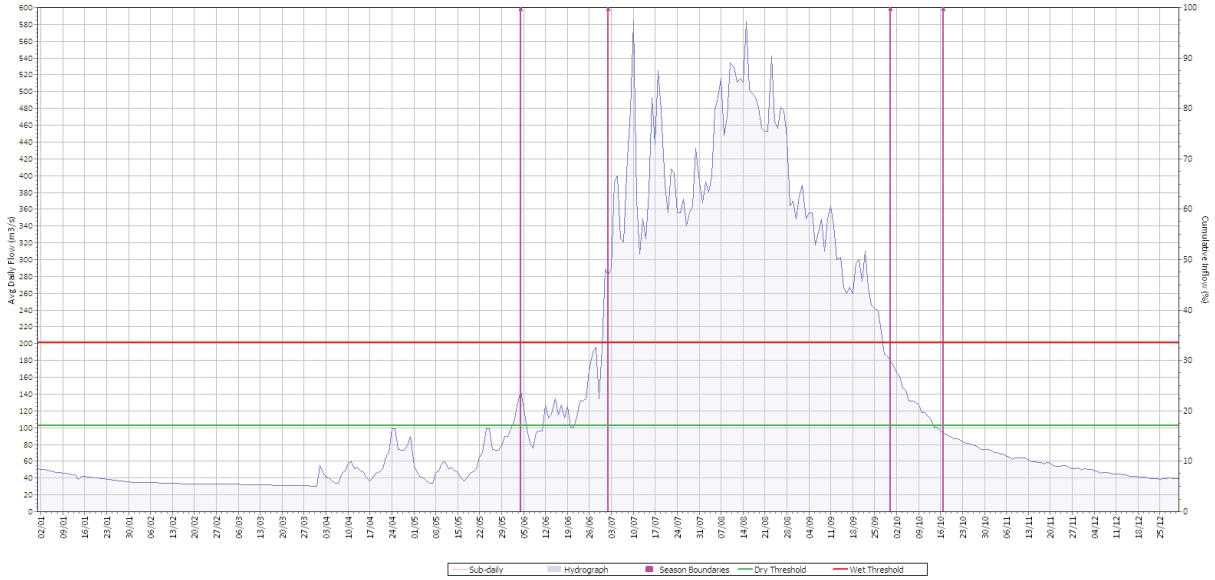


Figure 3.1 One year (1967) of the baseline hydrological record at Site 2, showing the seasonal divisions, from left to right, into: Dry, Transitional 1, Wet, Transitional 2, and back into Dry.

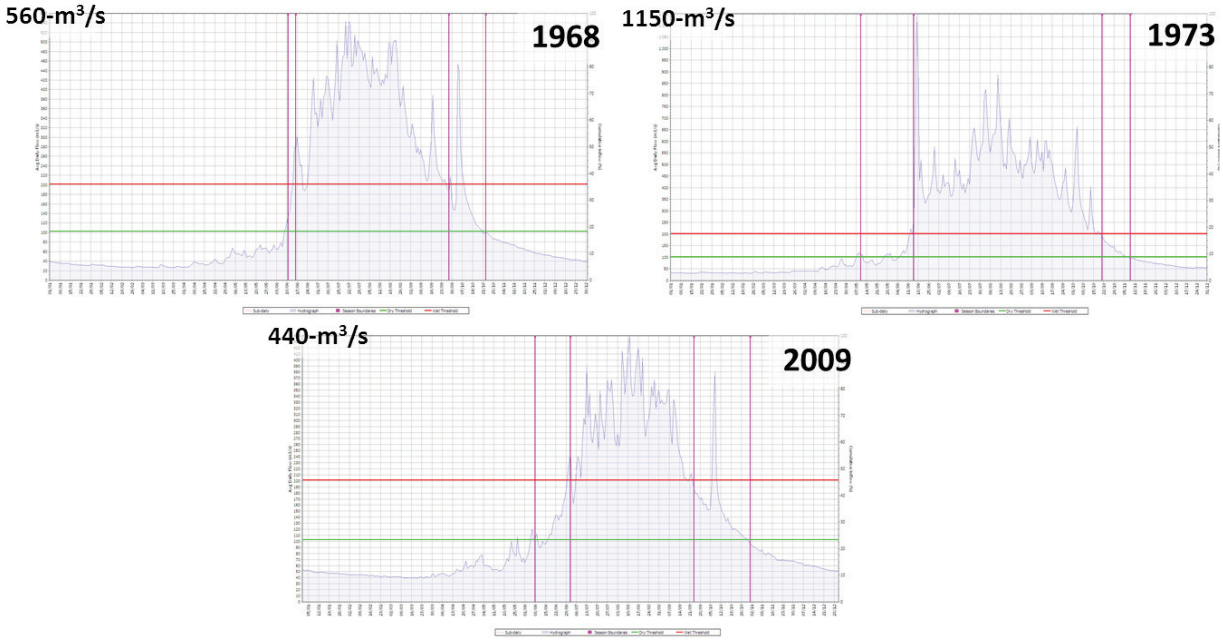


Figure 3.2 Examples of year-on-year variation in flows and flow seasons in the baseline time-series at Site 2. The maximum discharge is indicated at the top left of each example.

Table 3.1 Parameters used for seasonal divisions

Division	Parameter
Start of the hydrological year	January
End of Dry season	4 x minimum dry season discharge
Start of Wet season	1.1 x mean annual discharge
End of Transition 2	4 x minimum dry season discharge, and the recession rate < 0.1 m^3/day over 10 days

Once the seasons were defined, DRIFT calculated a suite of ecologically-relevant flow indicators that were used by the specialists to determine the flow-related links to the ecosystem indicators (Section 7). The flow indicators and the reasons for their selection as indicators are given in Table 3.2. Each flow indicator was calculated for each year in the hydrological record, thereby deriving an annual times-series of 47 years for each flow indicator (see examples in Figure 3.3).

The flow indicators are used as drivers of change in other aspects of the river ecosystem. They are reported in the results to provide context for and understanding about the ecosystem responses. They are not used in the calculation of ecosystem integrity.

Table 3.2 Flow indicators used in the Upper Trishuli River

Indicator	Reason for selection as indicators
Mean annual runoff	Gives an indication of annual abstraction/addition of water, if any.
Dry season minimum 5-day discharge	Dry season minimum 5-day average flows influence available habitat area, fish movement, and winter temperatures (buffering)
Dry season onset	Onset and duration of seasons: • link with climatic factors • cues fruiting and flowering • cues migration/breeding • support life-history patterns.
Dry season duration	The dry season is typically the harshest season for aquatic life to survive. This is the time when flows are low, water quality influences potentially stronger and temperatures (either hot or cold) are most challenging. Increases in the duration of this harsh period can have significant influence on overall chances of survival.
Dry season average daily volume	Dry periods • promote in-channel growth • support larval stages • maintain intra-annual variability.
Wet season onset	Onset and duration of seasons: • link with climatic factors • cues fruiting and flowering • cues migration/breeding • support life-history patterns.
Wet season duration	Important for supporting life-stages, such as hatching and growth of young. The wet season is also when most erosion and deposition occurs due to the higher shear stress and sediment loads in the river.
Wet season flood volume	Floods: • dictate channel form • flush and deposit sediment and debris • promotes habitat diversity • support floodplains • distribute seeds • facilitate connectivity • control terrestrial encroachment.
Transition1 and Transition2 average daily volume	Dry-wet-dry transitions: • distribute sediments and nutrients flushed from the watershed • distribute seeds • support migration of adults and larvae
Transition 2 recession slope	Transition 2 recession shape refers to the speed at which the flows change from wet season flows to dry season flows. Under natural conditions this is usually a relatively gentle transition, but this can change with impoundments. If it is a very quick transition then there can be issue of bank collapse and/or stranding similar to those described for 'within-day range in discharge'.

Flow changes in the dry and transition seasons are included as this when water resource infrastructure has the potential to exert a large effect on water-level fluctuations. The Trishuli Scenarios did not include consideration of peaking-power operations. Had this been necessary then additional flow indicators linked to within-day range in discharge: Wet, transition and dry seasons would also have been selected. Changes in water level over short periods are important for a number of reasons:

- the shear stress changes rapidly as flow rate changes affecting both the water surface slope and the depth of the river. Thus conditions, for erosion but also for animals and plants, change rapidly over this time, often to a point where they can no longer maintain their position in the channel, resulting is wash-away.
- rapid decreases flow can also lead to stranding of animals as flows recede from an area quicker than the animals can respond.
- as water levels decrease, riverbanks may not drain as quickly as the river recedes, leading to an over pressuring within the banks that reduces bank stability.

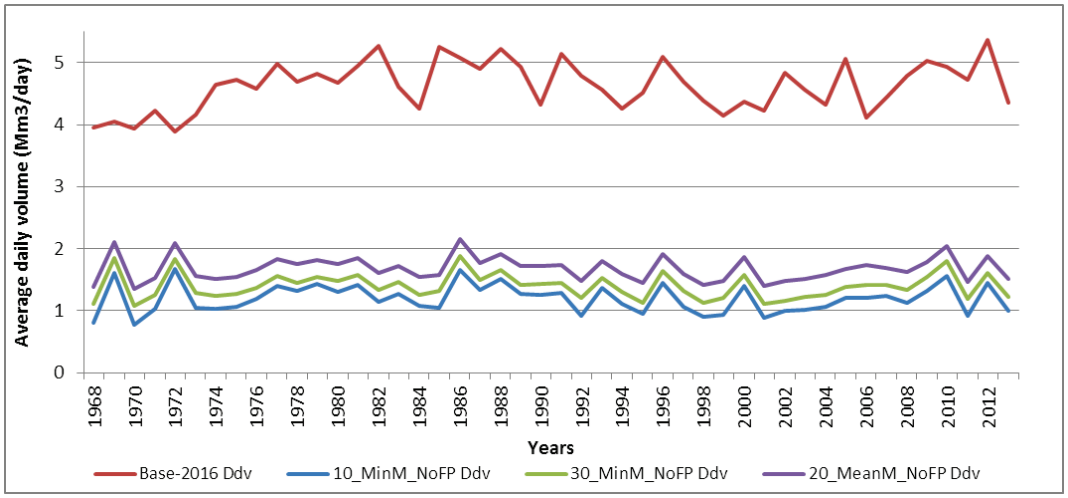


Figure 3.3 Examples of annual time-series of a DRIFT flow indicator: average daily volume in the dry season (showing four scenarios).

4 Life history considerations – *Schizothorax richardsonii*

Schizothorax richardsoni, which is locally known as the snow trout or Asla (together with other *Schizothorax* species) is found in the rivers and streams of mountainous areas of the Himalayas, India, Afghanistan and Nepal.

It is listed as Vulnerable in the IUCN Red Data List (www.iucnredlist.org). The justification provided is: "*Although S. richardsonii is widely distributed along the Himalayan foothills and previous studies have indicated that it is abundantly and commonly found, recent observations over the last 5 to 10 years indicate drastic declines in many areas of its range due to introduction of exotics, damming and overfishing. While in some areas the declines are more than 90%, the overall reduction is inferred to be less than 50% with similar rates predicted in the future. The species is therefore assessed as Vulnerable. However, there is a strong belief that if alien species introductions are carried out throughout its range, this species may completely be displaced by exotic salmonids*" (Vishwanath 2010).

S. richardsonii prefers to live among rocks and is primarily a bottom feeder, preferably near big submerged stones. It is mainly herbivorous, feeding mainly on algal slimes, aquatic plants and detritus, but also aquatic insect larvae encrusted on the rocks (Vishwanath 2010). Asla has two spawning periods (March-April and October-November). It migrates from lakes and rivers of the valley to the adjoining tributaries to find suitable places for breeding, mainly in side streams or a side channels along the main river bed (Jhingran 1991; Welcomme 1985 and Sunder 1997).

A summary of key life history aspects of *S. richardsonii* is provided in Table 4.1.

Introduction of exotic salmonids, such as Rainbow Trout, in hill streams and reservoirs of the Himalayan foothills are a serious threat to the survival of *S. richardsonii*. Fishing for ornamental trade is also a threat in Nagaland and they are widely utilised as food (Vishwanath 2010).

4.1 Presence of *S. richardsonii* at EFlow Site 1 and 2 in winter

One of the key aspects of snow trout life history of relevance for this project is its temperature tolerances. Some studies suggest that *S. richardsonii* will not be found in the upper reaches of Himalayan rivers in the cold winter months (e.g., Shrestha 1990; Sivakumar 2008; Talwar and Jhingran 1991) as it has a low tolerance for temperatures lower than 7-10^{o}C (Shrestha and Khanna 1976, http://nmcg.nic.in/BioFish.aspx). However, *S. richardsonii* was recorded in the vicinity of EFlow Site 1 and 2 in this study (Kaasa, 2015), and in the EIA for the Upper Trishuli-1 HEP (Approved EIA, Feb. 2013), in the winter at temperatures of ~7^{o}C.

Table 4.1 Summary of key life history aspects of *S. richardsonii*

Habitat, food and temporal pattern		Juveniles		Adults (non-breeding)		Spawning	
		Information/ data	References	Information/data	References	Information/data	References
Habitat and flow preferences	Description of habitat	-	-	Found in rivers and streams of mountainous areas of the Himalayas, India, Afghanistan and Nepal	Menon (1999); Sunder et al. (1999); Talwar and Jhingran (1991)	Clear water on gravelly/stony grounds or on fine pebbles (50-80 mm diameter)	Shrestha and Khanna (1976)
	Altitude	-	-	In Trishuli River, snow trout abundant in the 1875 m-3125 mamsl zone and prefers rapid, pool and riffle types of habitats.	IUCN Red List of Threatened Species (Vishwanath, W.)		
	Substrate	Stones and gravels	Raina and Petr (1999)	Rocks and big submerged stones	IUCN Red List of Threatened Species (Vishwanath, W.)	Developing eggs and larvae have been seen in semi-stagnant nursery beds along riverbanks interspaced with gravel and stones.	Raina and Petr (1999)
	Depth	<0.75 m	Shrestha and Khanna (1976)	1-3 m	http://nmcg.nic.in/BioFish.aspx	1-3 m	Shrestha and Khanna (1976)
	Velocity	0-2 m/s	Shrestha and Khanna (1976)	2-8.4 m/s	http://nmcg.nic.in/BioFish.aspx	2-8.4 m/s	Shrestha and Khanna (1976)
	Temperature	10-18 0C	Shrestha and Khanna (1976)	7.2-22 0C	http://nmcg.nic.in/BioFish.aspx	12-15 0C	Shrestha and Khanna (1976)
	Dissolved O2	6-8 mg/l	http://www.fao.org/docrep/005/y3994e/y3994e0q.htm	6-8 mg/l	http://www.fao.org/docrep/005/y3994e/y3994e0q.htm	10-15 mg/l	Sunder (1997); Shrestha and Khanna (1976)
Food preferences		Invertebrates, algae		Omnivorous and opportunist feeder. Mainly algae, fish and invertebrates	Shrestha (1990); Jhingran (1991)	n/a	n/a
Additional information	Information/data					References	
Migration	Snow Trout migrate upstream at the start of the monsoon season in March-April (gravel/pebble spawning and downstream at the end of this season in October-November for spawning					Shrestha (1990); Negi (1994); Talwar and Jhingran (1991)	

Habitat, food and temporal pattern		Juveniles		Adults (non-breeding)		Spawning	
		Information/ data	References	Information/data	References	Information/data	References
Triggers	Breeding is triggered by snow melt and rise in turbidity. Fish move to breeding grounds in shallow side pools, side-channels and tributaries of the river with cobbles and gravely beds. Eggs hatch in this season, and fries and fingerlings remain in shallow waters in side channels					Jhingran (1991); Welcomme (1985); Sunder (1997)	
Spawning behaviour	Snow Trout spawns when two years old, depending on food supply. Mature Asla has a change in colour during the breeding time. Mature males develop tubercles on either side of the snout, faint yellow colour of the body, and reddish colour of fins. Females spawn in natural as well as in artificial environments. *S. richardsonii* can spawn naturally or by stripping the wild/cultured mature female during the spawning season. It spawns in September/October and March/April.					http://www.fao.org/docrep/005/y3994e/y3994e0q.htm	

Months	Flow Conditions	Fish Behaviour	References
May/June	Onset of flood season	Snow Trout spawns in spring. By this time of the year, the fish eggs reach to its final stage of maturity provided the aquatic system provides sufficient food required for proper development of eggs. Once the eggs reach to their final stage of maturity, the fish is ready to spawn under various triggers like the snowmelt, rise in water temperature, comparatively higher turbidity level, swelling of rivers, creation of side channels etc. mainly linked with the monsoon rains and snow melt in the upper reaches of the Himalayan rivers	Negi (1994); Rafique and Qureshi (1997); Talwar and Jhingran (1991)
October November	Onset of winter season	Snow Trout migrates downstream during winter as water temperatures decline in the upper reaches of the rivers, and may spawn again at this time. It is not found in the upper reaches of the rivers in the cold winter months	EF Assessment UT-1 HEP, ESSA, Nov. 2014; Shrestha (1990); Sivakumar (2008); Talwar and Jhingran (1991)

5 Ecosystem indicators

Ecosystem indicators are comprised of riverine components that respond to a change in river flow (or sediment) by changing their abundance; concentration; or extent (area).

The focus of this assessment is *S. richardsonii* and so the ecosystem indicators selected to capture the response to changes in water flow and longitudinal connectivity are limited to those considered to be most influential in the life history of *S. richardsonii.* Thus, the supporting ecosystem indicators focus on *S. richardsonii* habitat and food.

The ecosystem indicators and the reasons for selection are provided in Table 5.1.

Table 5.1 Ecosystem indicators

Discipline	Indicators	Reason for selection as indicators
Geo-morphology	Suspended sediment load	Suspended load is important for creating and maintaining various habitats.
	Exposed sand and gravel bars	Sand and gravel bars during provides habitat for invertebrates and fish. Cobble and boulder bars provide habitat for invertebrates and fish.
	Exposed cobble and boulder bars	
	Median bed sediment size (armouring)	The average size of river bed sediment is an important habitat component for many fish species.
	Area of secondary channels, back waters	Secondary channels and backwaters provide important instream habitat for many fish species. These slower velocity areas, usually with well-developed marginal vegetation, act as refugia for juvenile fish.
Algae	Algae	*S. richardsonii* feeds on algae and invertebrates
Macro-invertebrates	EPT abundance	*S. richardsonii* feeds on algae and invertebrates
Fish	Snow trout (*S. richardsonii*) abundance	*S. richardsonii* is listed as Vulnerable in the IUCN Red Data List. It is widely distributed along the Himalayan foothills (India, Afghanistan, Pakistan, Nepal), but drastic declines have been recorded over the last 5 to years in many areas of its range due to: • introduction of alien species, • damming, and • overfishing.

Each indicator is linked with other indicators deemed to driving change. The aim is not try to capture every conceivable link, but rather to restrict the linkages to those that are most meaningful and can be used to predict the bulk of the likely responses to a change in the supply of water, sediment or longitudinal connectivity.

6 Ecological Status

The scores and descriptions for Ecological Status categories are provided in Table 6.1.

Table 6.1 Categories for Baseline Ecological Status (after Kleynhans 1997)

Ecological category	Description of the habitat condition
A	Unmodified. Still in a natural condition.
B	Slightly modified. A small change in natural habitats and biota has taken place but the ecosystem functions are essentially unchanged.
C	Moderately modified. Loss and change of natural habitat and biota has occurred, but the basic ecosystem functions are still predominantly unchanged.
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	Critically / Extremely modified. The system has been critically modified with an almost complete loss of natural habitat and biota. In the worst instances, basic ecosystem functions have been changed and the changes are irreversible.

6.1 Baseline Ecological Status of the EFlows sites

The Baseline Ecological Status (BES) used for the Trishuli River in this assessment is summarised in Table 6.2.

Table 6.2 BES of the EFlows sites on the Upper Trishuli River at 2016.

Discipline	1	2	3
Geomorphology	A/B	A/B	A/B
Algae	B	B	B
Macronvertebrates	A/B	A/B	A/B
Fish	B	B	B
Overall BES	B	B	B

7 Response curves

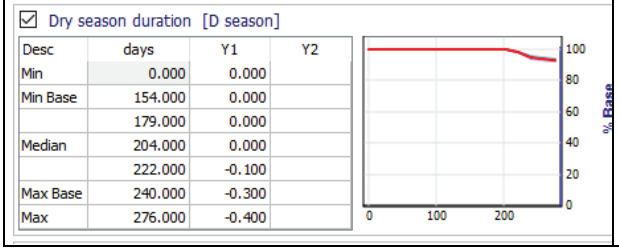
The response curves do not address any of the scenarios directly. The curves are drawn for a range of possible changes in each linked indicator, regardless of what is expected to occur in any of the scenarios. For this reason, some of the explanations and/or X-axes refer to conditions that are unlikely to occur under any of the scenarios but are needed for completion of the Response Curves. In addition, each response curve has a shape that assumes that all other conditions (indicators) remain at baseline.

The relationships are similar across all areas, although the actual curves may differ slightly from what is shown here. For the exact relationship used for each focus area please refer to the DSS. The focus area used as an example is denoted in the caption.

The response curves relationships used for this assessment were not derived specifically for the assessment for the Upper Trishuli River. They were derived for Alwan Snow Trout in similar Himalayan river (the Neelum-Jhelum River) and used in this assessment. Links to sediment supply were excluded from the DSS because the EFlows team was assured by the Client that the sediment regime upstream and downstream of Upper Trishuli HEP would remain at baseline levels. Rainbow Trout were also excluded from the assessment. This was because there were no curves for rainbow trout for the Neelum-Jhelum, and because rainbow trout in the study area are escapees from nearby trout farms.

The linked indicators, the response curves and the explanations of the shape of the response curves for each of the indicators, using Site 2 as an example, are tabulated as follows:

Table 7.1 Exposed sand and gravel bars

Linked indicator and response curve	Explanation
	During the dry season when sediment levels are low, finer sediment is scoured from the active channel, leading to a slow loss of sand/gravel bars. The longer the dry season, the more erosion of bars will occur.

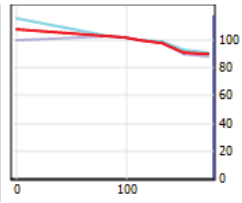
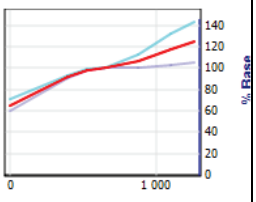
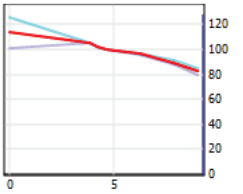
Linked indicator and response curve	Explanation
☑ Wet season duration [F season] Desc / days / Y1 / Y2 Min 0.000 0.500 Min Base 84.000 0.100 98.000 0.050 Median 112.000 0.000 131.500 -0.100 Max Base 151.000 -0.500 Max 173.650 -0.600 	Longer wet seasons mean a longer period of high flows with relatively lower sediment loads (in this river observed data suggest that the peak sediment loads generally occur early in the wet season, prior to peak discharge). Thus longer wet seasons may mean greater erosion (widening/deepening) in the main channel, causing some reduction of sand/gravel.
☑ Max 5d wet season Q [F season] Desc / m3/s / Y1 / Y2 Min 0.000 -2.000 Min Base 391.480 -0.500 522.460 -0.100 Median 653.440 0.000 873.940 0.300 Max Base 1094.440 1.200 Max 1258.606 1.500 	Larger floods are associated with higher sediment loads, and with widespread channel instability and reworking of the channel bed and banks. Large floods will thus introduce more sediment and create more sand/gravel bars during the flood season (which can be exposed as sand/gravel bars during the dry season).
☑ Dry season ave daily vol [D season] Desc / Mm3/d / Y1 / Y2 Min 0.000 1.000 Min Base 3.890 0.200 4.283 0.100 Median 4.675 0.000 6.286 -0.200 Max Base 7.896 -0.600 Max 9.081 -1.000 	Lower flows mean that more bars will be exposed.

Table 7.2 Exposed cobble and boulder bars

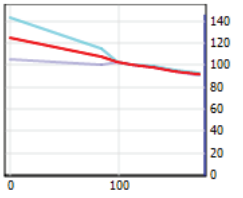
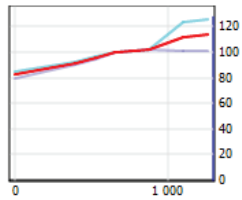
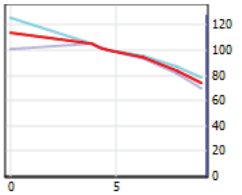
Linked indicator and response curve	Explanation
☑ Wet season duration [F season] Desc / days / Y1 / Y2 Min 0.000 1.500 Min Base 84.000 0.500 98.000 0.100 Median 112.000 0.000 131.500 -0.100 Max Base 151.000 -0.300 Max 173.650 -0.500 	Longer wet seasons mean a longer period of high flows with relatively lower sediment loads (in this river observed data suggest that the peak sediment loads generally occur early in the wet season, prior to peak discharge). Thus longer wet seasons may mean greater erosion (widening/deepening) in the main channel, with some potential loss of cobble bars.
☑ Max 5d wet season Q [F season] Desc / m3/s / Y1 / Y2 Min 0.000 -1.000 Min Base 391.480 -0.500 522.460 -0.250 Median 653.440 0.000 873.940 0.100 Max Base 1094.440 0.900 Max 1258.606 1.000 	Very large floods tend to redistribute sediments across the channel, and in rivers with a cobble matrix these events should enlarge existing and create additional bars. Very small floods may not overcome thresholds to redistribute bed sediments across the valley floor, allowing bars to over time be incorporated in to the bank.
☑ Dry season ave daily vol [D season] Desc / Mm3/d / Y1 / Y2 Min 0.000 1.000 Min Base 3.890 0.200 4.283 0.100 Median 4.675 0.000 6.286 -0.300 Max Base 7.896 -0.900 Max 9.081 -1.500 	Lower flows mean that more bars will be exposed

Table 7.3 Median bed sediment size

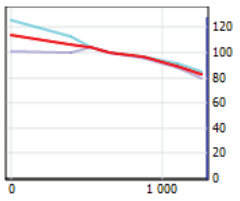
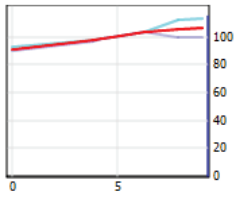
Linked indicator and response curve	Explanation
☑ Max 5d wet season Q [F season] Desc m3/s Y1 Y2 Min 0.000 1.000 Min Base 391.480 0.350 522.460 0.150 Median 653.440 0.000 873.940 -0.200 Max Base 1094.440 -0.600 Max 1258.606 -1.000 	Larger floods are associated with higher sediment loads, and with widespread channel instability and reworking of the channel bed and banks. Large floods will thus reset the channel sediments, resulting in overall finer average bed sediment conditions.
☑ Dry season ave daily vol [D season] Desc Mm3/d Y1 Y2 Min 0.000 -0.500 Min Base 3.890 -0.150 4.283 -0.050 Median 4.675 0.000 6.286 0.150 Max Base 7.896 0.250 Max 9.081 0.350 	The lower the dry season discharge, the more fines that can deposited on the channel bed and thus the smaller the mean bed sediment size will become. The higher the dry season discharge, the more fines that will be removed and the coarser the (now armoured) channel bed will become.

Table 7.4 Area of secondary channels and backwaters

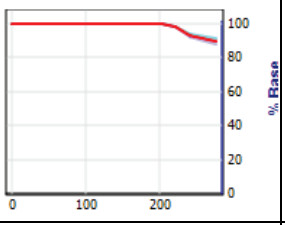
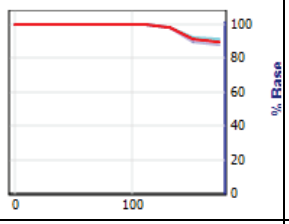
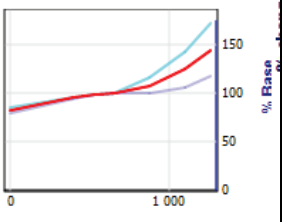
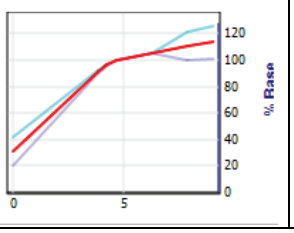
Linked indicator and response curve	Explanation
☑ Dry season duration [D season] Desc days Y1 Y2 Min 0.000 0.000 Min Base 154.000 0.000 179.000 0.000 Median 204.000 0.000 222.000 -0.100 Max Base 240.000 -0.400 Max 276.000 -0.600 	During the dry season when sediment levels are low, the active channel bed slowly erodes, increasing capacity and leading to a slow abandonment of secondary channels. The longer the dry season, the more secondary channel abandonment will occur. This process will be exacerbated by reductions in sediment from upstream dams.
☑ Wet season duration [F season] Desc days Y1 Y2 Min 0.000 0.000 Min Base 84.000 0.000 98.000 0.000 Median 112.000 0.000 131.500 -0.100 Max Base 151.000 -0.500 Max 173.650 -0.600 	longer wet seasons mean a longer period of high flows with relatively lower sediment loads (in this river observed data suggest that the peak sediment loads generally occur early in the wet season, prior to peak discharge). Thus longer wet seasons may mean greater erosion (widening/deepening) in the main channel, causing some loss of secondary channels.
☑ Max 5d wet season Q [F season] Desc m3/s Y1 Y2 Min 0.000 -1.000 Min Base 391.480 -0.300 522.460 -0.100 Median 653.440 0.000 873.940 0.500 Max Base 1094.440 1.500 Max 1258.606 2.000 	Very large floods will overwiden the channel and erode areas for secondary channels to form. Very small/failed floods may not be able to counteract channel narrowing of the low flow season.
☑ Dry season ave daily vol [D season] Desc Mm3/d Y1 Y2 Min 0.000 -4.000 Min Base 3.890 -0.500 4.283 -0.200 Median 4.675 0.000 6.286 0.200 Max Base 7.896 0.800 Max 9.081 1.000 	The higher the average dry season flows, the more secondary channels will remain active during the low flow season (and thus available for instream biota).

Table 7.5 Algae

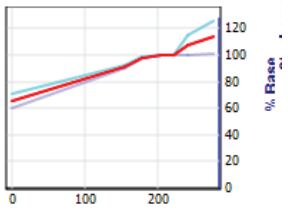
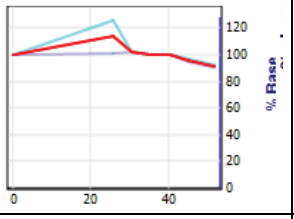
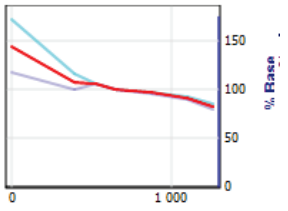
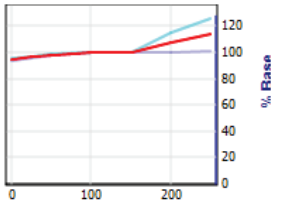
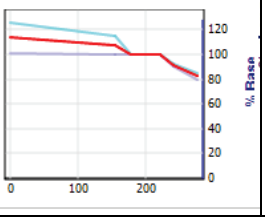
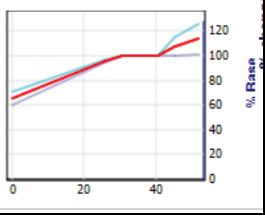
Linked indicator and response curve	Explanation
☑ Dry season duration [D season] Desc / days / Y1 / Y2 Min 0.000 -2.000 Min Base 154.000 -0.500 179.000 -0.100 Median 204.000 0.000 222.000 0.000 Max Base 240.000 0.500 Max 276.000 1.000 	Longer dry season - more time for algae to become established and temperatures also favourable towards the end of the dry season.
☑ Min 5d dry season Q [D season] Desc / m3/s / Y1 / Y2 Min 0.000 0.000 Min Base 25.620 1.000 30.570 0.100 Median 35.520 0.000 40.260 0.000 Max Base 45.000 -0.250 Max 51.750 -0.500 	Lower discharge - calmer conditions, better for algae, to a point. At 0 cumecs the river will freeze.
☑ Max 5d wet season Q [F season] Desc / m3/s / Y1 / Y2 Min 0.000 2.000 Min Base 391.480 0.500 522.460 0.200 Median 653.440 0.000 873.940 -0.200 Max Base 1094.440 -0.500 Max 1258.606 -1.000 	Lower peak flows and warm conditions will favour algae growth. Higher turbidity and currents will adversely affect the population.
☑ Median bed sediment size (armouring) [F season] Desc / %Base / Y1 / Y2 Min 0.000 -0.300 Min Base 25.000 -0.200 50.000 -0.100 Median 100.000 0.000 150.000 0.000 Max Base 200.000 0.500 Max 250.000 1.000 	The more stable (armoured) the bed, the greater the flows necessary to remove algae.

Table 7.6 EPT (Ephemeroptera, Plecoptera and Trichoptera)

Linked indicator and response curve	Explanation
☑ Dry season duration [D season] Desc / days / Y1 / Y2 Min 0.000 1.000 Min Base 154.000 0.500 179.000 0.000 Median 204.000 0.000 222.000 0.000 Max Base 240.000 -0.500 Max 276.000 -1.000 	Aquatic invertebrates have life-histories that are adapted to wide variations in seasonal flows, but populations are likely to drop slightly if the low-flow period is too long. A longer period of low-flows is also likely to increase the risks of mortality as a result of high water temperature once the seasons change.
☑ Min 5d dry season Q [D season] Desc / m3/s / Y1 / Y2 Min 0.000 -2.000 Min Base 25.620 -0.250 30.570 0.000 Median 35.520 0.000 40.260 0.000 Max Base 45.000 0.500 Max 51.750 1.000 	With less discharge there is less wetted area.

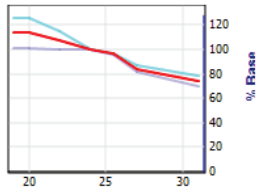
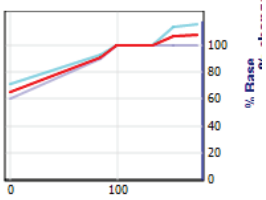
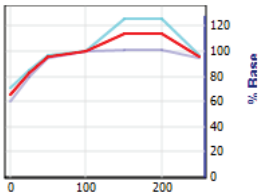
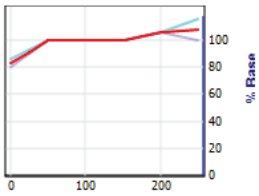
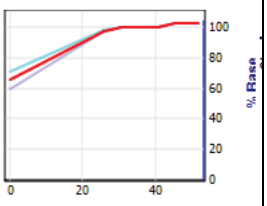
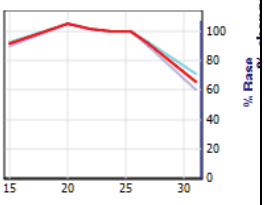
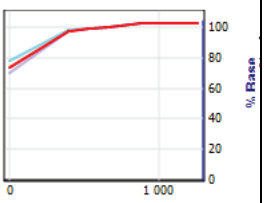
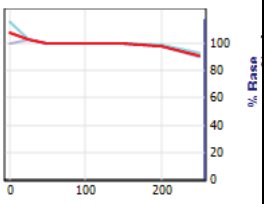
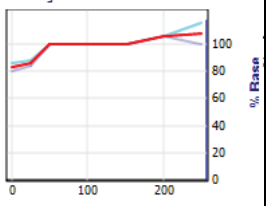
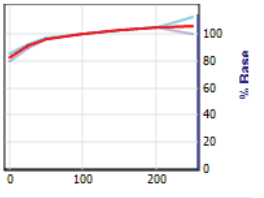
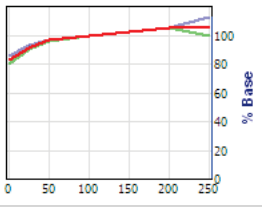
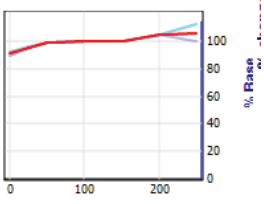
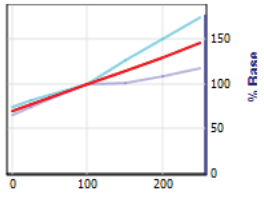
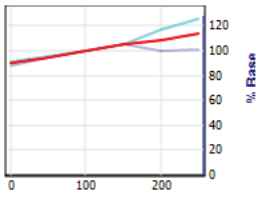
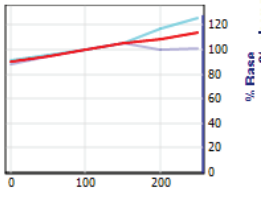
Linked indicator and response curve	Explanation
☑ Wet season onset [F season] Desc / cal week / Y1 / Y2 Min 19.000 1.000 Min Base 20.000 1.000 22.000 0.500 Median 24.000 0.000 25.500 -0.200 Max Base 27.000 -0.900 Max 31.050 -1.500 	Delayed onset will affect cues for emergence/laying eggs
☑ Wet season duration [F season] Desc / days / Y1 / Y2 Min 0.000 -2.000 Min Base 84.000 -0.500 98.000 0.000 Median 112.000 0.000 131.500 0.000 Max Base 151.000 0.400 Max 173.650 0.500 	The absence of a wet period will not provide the cues needed for hatching of eggs. Sufficient wet season duration is required to provide time for eggs to mature and hatch.
☑ Median bed sediment size (armouring) [D season] Desc / %Base / Y1 / Y2 Min 0.000 -2.000 Min Base 25.000 -1.000 50.000 -0.250 Median 100.000 0.000 150.000 1.000 Max Base 200.000 1.000 Max 250.000 -0.250 	Fine sediments are difficult to attach to, EPT will do better with a more armoured bed to a point beyond which they will decline again..
☑ Algae [F season] Desc / %Base / Y1 / Y2 Min 0.000 -1.000 Min Base 25.000 -0.500 50.000 0.000 Median 100.000 0.000 150.000 0.000 Max Base 200.000 0.200 Max 250.000 0.500 	EPT eat algae.

Table 7.7 Snow trout - *S. richardsonii*

Linked indicator and response curve	Explanation
☑ Min 5d dry season Q [D season] Desc / m3/s / Y1 / Y2 Min 0.000 -2.000 Min Base 25.620 -0.150 30.570 0.000 Median 35.520 0.000 40.260 0.000 Max Base 45.000 0.100 Max 51.750 0.100 	Lower flows = lower water levels, low temperatures as a result of lack of buffering. Can tolerate low temperatures and high turbidity. Field surveys in winter recorded temperatures of around 8oC, and air temperatures around 8-9oC.

Linked indicator and response curve	Explanation
☑ Wet season onset [F season] Desc / cal week / Y1 / Y2 Min 15.000 -0.500 Min Base 20.000 0.200 22.000 0.050 Median 24.000 0.000 25.500 0.000 Max Base 27.000 -0.500 Max 31.050 -2.000 	The snow trout breeds during summer season from May to August (Negi 1994). By this time of the year, the fish eggs reach to its final stage of maturity provided the aquatic system provides sufficient food required for proper development of eggs. Once the eggs reach to their final stage of maturity, the fish is ready to spawn under various triggers like the snowmelt, rise in water temperature, comparatively higher turbidity level, swelling of rivers, creation of side channels etc. mainly linked with the monsoon rains and snow melt in the upper reaches of the Himalayan rivers (Rafique and Qureshi 1997). The breeding triggers, however, should coincide with the maturity of eggs in the ovary of fish for successful spawning. Early onset of the flood season (a month before the median) is predicted to lead to better food availability early in the season, which would help the proper development of eggs leading to improved breeding. In years when there is a delayed onset of the flood season, it is predicted that the fish would have mature eggs but could miss the necessary triggers for breeding. Eggs could perish within the fish and be reabsorbed. Failure of the flood season would mean that breeding habitats in the side channels do not become available, resulting in the failure of breeding.
☑ Max 5d wet season Q [F season] Desc / m3/s / Y1 / Y2 Min 0.000 -1.500 Min Base 391.480 -0.150 522.460 -0.050 Median 653.440 0.000 873.940 0.100 Max Base 1094.440 0.100 Max 1258.606 0.100 	Lower flows in the wet season = lower water levels: may result in higher water temperatures as a result of lack of buffering. Can tolerate a range of water temperatures 8°C to 22°C (Sharma, 1989) [optimal temperature 15-16°C]. Field surveys in summer recorded temperatures of around 14-16oC.
☑ Exposed sand and gravel bars [D season] Desc / %Base / Y1 / Y2 Min 0.000 0.500 Min Base 25.000 0.100 50.000 0.000 Median 100.000 0.000 150.000 0.000 Max Base 200.000 -0.100 Max 250.000 -0.500 	Prefer breeding habitat is side streams and back waters with gravel, rocky, cobbly bed. Pools and crevices preferred for wintering. Expanding sand and gravel bars will deteriorate habitat quality (pools and riffles).

Linked indicator and response curve	Explanation
☑ Median bed sediment size (armouring) [F season] Desc %Base Y1 Y2 Min 0.000 -1.000 Min Base 25.000 -0.800 50.000 0.000 Median 100.000 0.000 150.000 0.000 Max Base 200.000 0.200 Max 250.000 0.500 	The fish favour areas with gravel and algae. Gravel beds, free of fine sediment, provide habitat for attached algae and are the feeding and breeding grounds for snow trout. Armouring would increase the availability of food for this fish, while fine sediment in the bed would reduce the area available for algal growth (Talwar and Jhingran 1991; Raina and Petr 1999). With decreasing particles size, there would be a higher chance of embeddedness of the spawning areas. The smaller particles fill the interstitial spaces and make it hard for attached algae to grow on the gravely and cobble bed resulting in less fish food production and hence a considerable decrease in fish population. Accumulation of larger particles in the river bed (armouring) result in a growth of attached algae which is food for the fish. It also becomes the breeding habitat for fish as it prefers the gravely and cobble bed for breeding. Consequently, the armouring of the bed results in a modest increase in fish population.
☑ Area of secondary channels,back waters [D season] Desc %Base Y1 Y2 Min 0.000 -1.000 Min Base 25.000 -0.500 50.000 -0.200 Median 100.000 0.000 150.000 0.100 Max Base 200.000 0.200 Max 250.000 0.300 	
☑ Algae [D season] Desc %Base Y1 Y2 Min 0.000 -1.000 Min Base 25.000 -0.500 50.000 -0.200 Median 100.000 0.000 150.000 0.100 Max Base 200.000 0.200 Max 250.000 0.300 	Snow trout are omnivorous and feed on algae and aquatic invertebrates (mainly EPT; Raina and Petr 1999). Its mouth is adapted to scraping algae from stones (Rai et. al. undated)).
☑ EPT abundance [F season] Desc %PD Y1 Y2 Min 0.000 -0.500 Min Base 25.000 -0.250 50.000 -0.050 Median 100.000 0.000 150.000 0.000 Max Base 200.000 0.200 Max 250.000 0.300 	Snow trout are omnivorous and feed on algae and aquatic invertebrates (mainly EPT; Raina and Petr 1999). They are opportunist feeders and their dependence on invertebrates varies depending on the season and stage of maturity. In years with low EPT productivity, the fish would have less invertebrate food and the population would be compromised (Jhingran 1991). In years with high EPT productivity, all age classes of fish would have better growth and fattening for overwintering and a high fecundity rate, which would lead to overall higher numbers.
☑ Alwan snow trout [T1 season, Site=Site3, Step= -1] Desc %Base Y1 Y2 Min 0.000 -1.737 Min Base 25.000 -1.303 50.000 -0.868 Median 100.000 0.000 150.000 1.000 Max Base 200.000 1.640 Max 250.000 2.020 	Alsa migrates to Site 2 from downstream

Linked indicator and response curve	Explanation
☑ Comp: Alwan snow trout [T2 season, Site=Site1] Desc %Base Y1 Y2 Min 0.000 -0.579 Min Base 25.000 -0.434 50.000 -0.289 Median 100.000 0.000 150.000 0.189 Max Base 200.000 0.625 Max 250.000 1.000 	Alsa migrates to Site 2 from upstream
☑ Comp2: Alwan snow trout [F season, Site=Site4, Step= -1] Desc %Base Y1 Y2 Min 0.000 -0.579 Min Base 25.000 -0.434 50.000 -0.289 Median 100.000 0.000 150.000 0.189 Max Base 200.000 0.625 Max 250.000 1.000 	Alsa migrates to Site 2 from the Mailun tributary

8 Scenarios

The Upper Trishuli-1 EFlows assessment comprises consideration of a series of design and operational scenarios for the proposed Upper Trishuli-1 HEP against a **2016 Baseline**.

The scenarios include permutations of:

i. Operating rules – different levels and patterns of EFlows releases
ii. Fish passages – presence/absence of fish passages.

The option of including permutations of sediment maintenance rules were considered but excluded because the EFlows team was assured by the Client that the sediment regime upstream and downstream of Upper Trishuli HEP would remain at baseline levels[1].

Eleven scenarios were selected for assessment as summarised in Table 8.1.

Table 8.1 Scenarios selected for assessment

#	Code	Description	Fish Passage
1	Base-2016	-	-
2	10_MeanM_NoFP	10% of mean baseline monthly flow	No
3	10_MinM_NoFP	10% of minimum baseline monthly flow	No
4	30_MinM_NoFP	30% of minimum baseline monthly flow	No
5	20_MeanM_NoFP	30_MinM, except : 20% of baseline dry season mean monthly flow (10.60 m^3/s) until calendar week 22 (end May) and after week 44 (end October), unless 30_MinM was higher. Aim: Test a higher dry season flow, as Scenarios 2, 3, and 4 all had very low flows and severe effects.	No
6	202_W_noFP	30_MinM, except if 30_MinM was below $202m^3/s$ (The T1/W threshold) between weeks 26 (end June) and week 40 (beginning October), in which case $202m^3/s$ was supplied. Aim: To test the ameliorating effects of a less severely shortened wet season	No
7	10_MeanM_FP	10% of mean baseline monthly flow	Yes
8	10_MinM_FP	10% of minimum baseline monthly flow	Yes
9	30_MinM_FP	30% of minimum baseline monthly flow	Yes
10	20_MeanM_FP	30_MinM, except : 20% of baseline dry season mean monthly flow (10.60 m^3/s) until calendar week 22 (end May) and after week 44 (end October), unless 30_MinM was higher. Aim: Test a higher dry season flow, as Scenarios 2, 3, and 4 all had very low flows and severe effects.	Yes
11	202_W_FP	30_MinM, except if 30_MinM was below $202m^3/s$ (The T1/W threshold) between weeks 26 (end June) and week 40 (beginning October), in which case $202m^3/s$ was supplied. Aim: To test the ameliorating effects of a less severely shortened wet season	Yes

[1] This is an important assumption as it is rare that in-channel weirs have no effect on the downstream movement of suspended or bedload sediments, and changes in sediment supply can be a major cause of impact to rivers downstream of dams and weirs.

8.1 Assumption for barriers to fish

The influence of the Upper Trishuli-1 HEP weir and reservoir on Asla populations at the various sites is partially attributable to the barrier created to the movement of fish between breeding and feeding areas, or between the main steam and tributaries. To account for this influence, the DRIFT DSS considered the influence of Upper Trishuli-1 HEP on the movement of Asla snow trout between the EFlows sites.

Within the DRIFT DSS, the barrier effect of water resource developments is modelled through specifying percentage reductions (or increases) in the "connectivity" between one site and another. Connectivity effects are specified per indicator. For the purposes of illustrating *potential* impacts of fish passage the following applied:

- With UT weir in place and no fish passage: 100% reduction in both upstream and downstream connectivity for *S. richardsonii* between Site1 and Site2.
- With UT weir in place with a fish passage: 50% reduction in both upstream and downstream connectivity for *S. richardsonii* between Site1 and Site2.

The change in connectivity that was modelled in DRIFT does not imply that this level is achievable.

The impact of the barrier on fish is dictated by a combination of migration success and dependence on migration. For instance, a population of fish may depend on getting past a barrier in order to access spawning / breeding grounds, and there may be no other location where the fish breed: this population would be highly dependent on migration.

9 Results of scenario analyses

For each scenario, the predicted changes in the river ecosystem are evaluated per site as:

1. estimated mean percentage change from baseline in the abundance, area or concentration of key indicators, and;
2. a time-series of abundance, area or concentration of key indicators under the flow regime resulting from each scenario.

Site 1 is not affected by flow changes as a result of Upper Trishuli-1 HEP, but depending on the scenarios, they may be affected by the barrier effect of the Upper Trishuli-1 Weir. Similarly Sites 3 and 4 (on the Mailun Tributary) are not affected by flow changes as a result of Upper Trishuli-1 HEP, but may be affected by the barrier created by the weir. Site 2 is expected to be affected by flow changes as a result of Upper Trishuli-1 HEP, plus by the barrier created by the weir.

9.1 Site 1[2]

9.1.1 Characteristics of the flow regime of each scenario at Site 1

The main characteristics (median values) of the flow regimes associated with each of the scenarios are summarised in Table 9.1.

If constructed, Upper Trishuli-1 HEP would not affect flows or sediment supply at Site 1. Thus, all the scenarios have the same flow regime at Site 1.

Table 9.1 Characteristics of the baseline flow regime at Site 1. Median values are given for the flow indicators.

Flow indicators	Units	Baseline
Mean annual runoff	m^3/s	177.33
Dry season onset	week	44.00
Dry season duration	days	204.00
Min 5d dry season Q	m^3/s	35.52
Wet season onset	week	24.00
Wet season duration	days	112.00
Max 5d wet season Q	m^3/s	653.44
Flood volume	MCM	3947.17
Dry season ave daily vol	MCM	4.68
T1 ave daily vol	MCM	12.88
Wet season ave daily vol	MCM	36.06
T2 ave daily vol	MCM	11.74
T2 recession slope	-	-3.52

[2] Site 1 is upstream of dam/weir site

9.1.2 Mean percentage changes

The mean percentage changes (relative to Baseline) for the indicators for each scenario at Site 1 are given in Table 9.2.

Table 9.2 Site 1: The mean percentage changes (relative to Baseline, which equals 100%) for the indicators for each scenario. Change representing an improvement in condition relative to baseline is marked in green[3]. Change representing a decline in condition relative to baseline is marked as follows: Orange = change >40-70%; red = change >70%.

Indicators		10_MeanM_NoFP	10_MinM_NoFP	30_MinM_NoFP	20_MeanM_NoFP	202_W-NoFP	10_MeanM_FP	10_MinM_FP	30_MinM_FP	20_MeanM_FP	202_W_FP
Geo-morphology	Bedload inflows	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Suspended Sediment inflow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Suspended sediment load	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
	Exposed sand and gravel bars	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Exposed cobble and boulder bars	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
	Median bed sediment size (armouring)	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
	Area of secondary channels and back waters	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Algae	Algae	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Macro-invertebrates	EPT abundance	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9
Fish	Snow trout: *S. richardsonii*	-92.0	-92.0	-92.0	-92.0	-92.0	-49.8	-49.8	-49.8	-49.7	-49.7

The results indicate that the fate of the snow trout population upstream of the Upper Trishuli River is largely dependent on the efficacy of the fish passage provided in facilitating movement of these fish from their over-wintering areas downstream of Upper Trishuli-1 HEP to their breeding areas upstream. Provided this passage will allow 50% of the mature migrating fish up past the weir and through the reservoir, and adults and juveniles back down through the reservoir and down past the weir, then the Asla are expected to survive upstream of Upper Trishuli-1 HEP.[4]

9.1.3 Overall Integrity

The Overall Integrity for each of the scenarios at Site 1 is illustrated in Figure 9.1. Given that the trout would survive at Site 1, the impact on overall integrity is expected to be minor provided there is a fish passage that allows for 50% of both upstream and downstream migrants to pass Upper Trishuli HEP.

3 These predictions report the last 10 years of the hydrological record used as the basis for scenarios.

4 But see comment on rainbow trout in Section 11.1

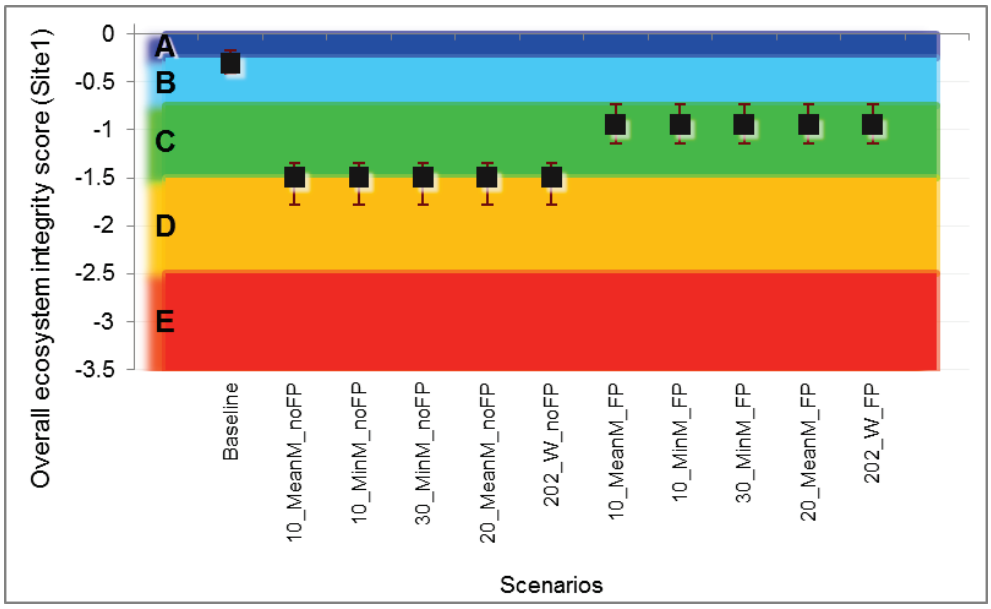


Figure 9.1 Overall ecosystem integrity scores for the scenarios at Site 1.

9.2 Site 2[5]

9.2.1 Characteristics of the flow regime of each scenario at Site 2

The main characteristics (median values) of the flow regimes associated with each of the scenarios are summarised in Table 9.3.

Table 9.3 Characteristics of the baseline and scenario flow regimes at Site 2. Median values are given for the flow indicators.

	Units	Baseline	10_MeanM	10_MinM	30_MinM	20_MeanM	202_W
Mean annual runoff	m^3/s	177.33	116.87	116.22	117.58	119.73	119.46
Dry season onset	week	44.00	41.00	41.00	41.00	41.00	41.00
Dry season duration	days	204.00	243.00	243.00	243.00	243.00	243.00
Min 5d dry season Q	m^3/s	35.52	3.88	3.88	3.88	10.60	3.88
Wet season onset	week	24.00	25.00	25.00	25.00	25.00	25.00
Wet season duration	days	112.00	91.00	91.00	91.00	91.00	99.00
Max 5d wet season Q	m^3/s	653.44	577.44	577.44	577.44	577.44	577.44
Flood volume	MCM	3947.17	3012.46	3012.46	3012.46	3012.46	3147.06
Dry season ave daily vol	MCM	4.68	1.29	1.21	1.39	1.68	1.37
T1 ave daily vol	MCM	12.88	15.01	15.01	15.01	15.01	15.53
Wet season ave daily vol	MCM	36.06	33.27	33.27	33.27	33.27	31.50
T2 ave daily vol	MCM	11.74	11.83	11.83	11.83	11.83	11.53
T2 recession slope	-	-3.52	-6.00	-6.00	-6.00	-6.00	-9.51

[5] Site 2 is in the dewatered zone

9.2.2 Mean percentage changes

The mean percentage changes (relative to Baseline) for the indicators for each scenario at Site 2 are given in Table 9.4.

The values provided in Table 9.4 are for the year round population of *S. richardsonii*, which means that they are fairly severe. This is almost wholly due to the low dry season releases for this 12 km reach of river, which negatively affects habitat availability and food supply. As already reported (Section 4), there was some suggestion at the outset of this study that the trout would have migrated downstream from this section at the onset of winter to avoid the cold temperatures, but that they were in fact recorded here in this and other studies. It is, however, likely that, with the decrease in winter low flows as a result of Upper Trishuli-1 HEP, the snow trout will in fact vacate this reach in winter; i.e. migrate downstream for the winter months, provided such migration is possible, i.e., is not blocked by other HEPs.

Table 9.4 Site 2: The mean percentage changes (relative to Baseline, which equals 100%) for the indicators for each scenario – assuming *S. richardsonii* is resident at Site 2 year-round. Change representing an improvement in condition relative to baseline is marked in green6. Change representing a decline in condition relative to baseline is marked as follows: Orange = change >40-70%; red = change >70%**.**

Indicators		10_MeanM_NoFP	10_MinM_NoFP	30_MinM_NoFP	20_MeanM_NoFP	202_W-NoFP	10_MeanM_FP	10_MinM_FP	30_MinM_FP	20_MeanM_FP	202_W_FP
Geo-morphology	Bedload inflows	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Suspended Sediment inflow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Suspended sediment load	-16.2	-16.2	-16.2	-16.2	-9.6	-16.2	-16.2	-16.2	-16.2	-9.6
	Exposed sand and gravel bars	8.4	8.7	8.2	7.5	7.5	8.4	8.7	8.2	7.5	7.5
	Exposed cobble and boulder bars	19.1	19.4	18.8	18.0	15.5	19.1	19.4	18.8	18.0	15.5
	Median bed sediment size (armouring)	-10.0	-10.3	-9.7	-8.8	-9.8	-10.0	-10.3	-9.7	-8.8	-9.8
	Area of secondary channels and back waters	-77.0	-79.4	-74.9	-68.7	-75.4	-77.0	-79.4	-74.9	-68.7	-75.4
Algae	Algae	8.1	8.0	8.1	10.1	7.9	8.1	8.0	8.1	10.1	7.9
Macro-invertebrates	EPT abundance	-49.1	-49.1	-49.1	-41.8	-44.7	-49.1	-49.1	-49.1	-41.8	-44.7
Fish	Snow trout: *S. richardsonii*	-85.2	-86.0	-84.6	-68.3	-83.9	-82.0	-82.8	-81.4	-64.3	-80.7

A key factor for Site 2 is that the Upper Trishuli-1 HEP, provided it is operated as indicated by the scenarios, is not expected to impinge of the onset of the wet season (~1 week delay expected; see Table 9.3). This means that it is not expected to seriously disrupt the migration cues for the snow trout, which, as far as is known, are a combination of flow, sediment and

[6] These predictions report the last 10 years of the hydrological record used as the basis for scenarios.

temperature cues (e.g., Jhingran 1991; Welcomme 1985; Sunder 1997). Thus, if fish do migrate out of the Site 2 reach in winter, they should migrate back up in the spring.

Other important findings are:

- increasing the dry season low flow release from Upper Trishuli-1 HEP (i.e., 20_MeanM_FP) will result in a ~14% improvement in the outcome of the snow trout at Site 2;
- reducing the impact on onset and duration of dry season, through provision of T1/W and W/T2 at 202m^3/s seasonal cusps (i.e., 202_W_FP) improves the predicted outcome for the snow trout by ~7%.

If the assessment is run assuming that, under baseline conditions, the snow trout migrate away from Site 2 in the cold winter months, then the predicted outcomes are those shown in Table 9.5.

Table 9.5 Site 2: The mean percentage changes assuming *S. richardsonii* migrates downstream and away from Site 2 in the winter

Indicator		10_MeanM_NoFP	10_MinM_NoFP	30_MinM_NoFP	20_MeanM_NoFP	202_W-NoFP	10_MeanM_FP	10_MinM_FP	30_MinM_FP	20_MeanM_FP	202_W_FP
Fish	Snow trout: *S. richardsonii*	-38.1	-39.3	-37.1	-33.6	-36.3	-34.1	-35.3	-33.1	-29.6	-32.4

9.2.3 Overall Integrity

The Overall Integrity for each of the scenarios at Site 2 is illustrated in Figure 9.2. As is the case for Table 9.4, the integrity reflects the fact that the overwintering population of *S. richardsonii* is expected to be impacted by (mainly) the low flow releases from Upper Trishuli-1 HEP.

The summer integrity of this reach would be better (Figure 9.3). That said, the results of the field work done in this study indicate that the snow trout DO reside at Site 2 all year round. However, long term field measurements should be carried out to justify the results obtained from the field study since different literatures mention that S. richardsonii is a mid-distant migratory fish species.

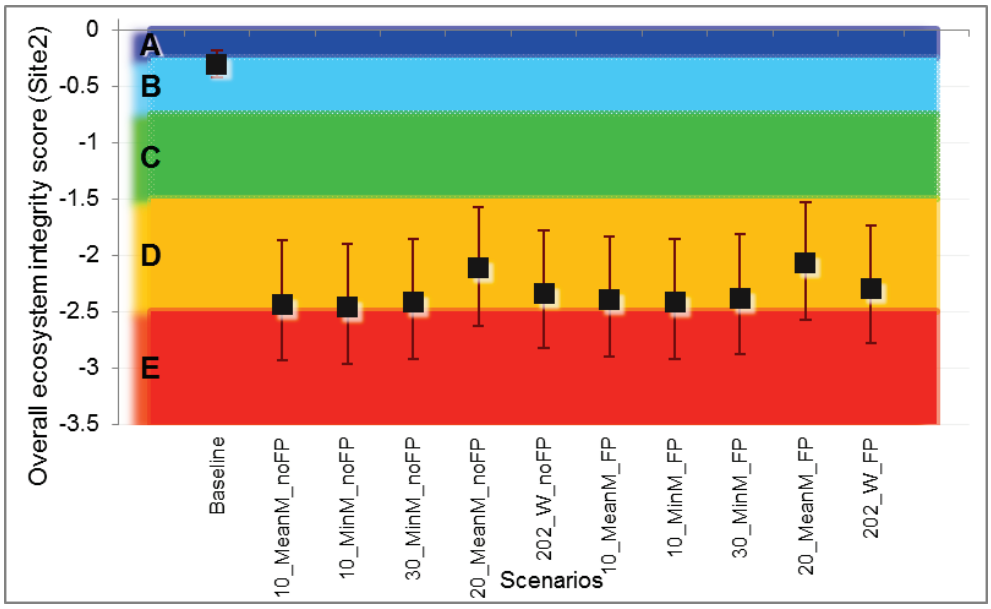


Figure 9.2 Overall ecosystem integrity scores for the scenarios at Site 2 – assuming *S. richardsonii* is a year-round resident.

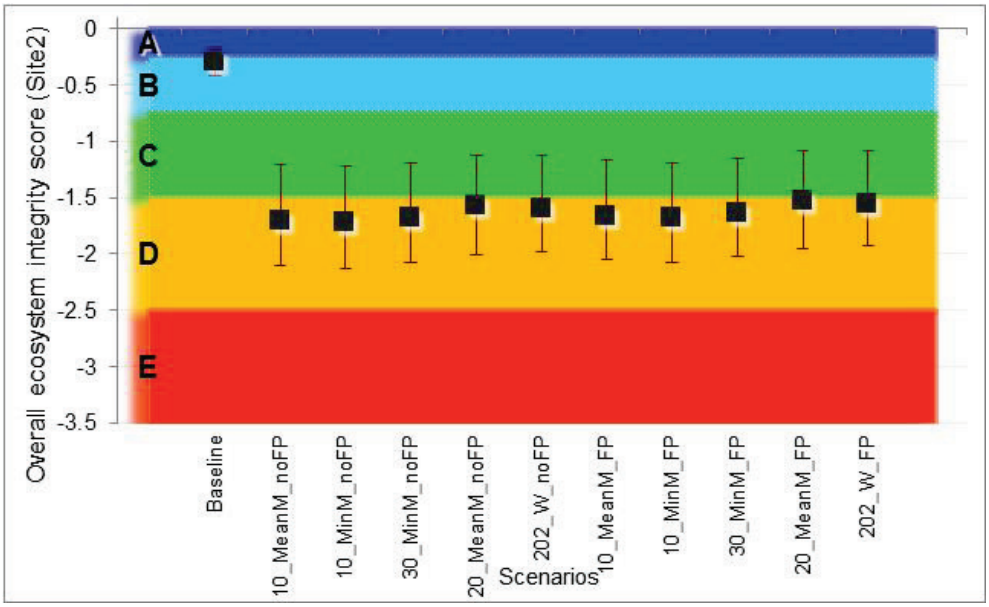


Figure 9.3 Overall ecosystem integrity scores for the scenarios at Site 2 – assuming *S. richardsonii* is a summer resident.

9.3 Site 3[7]

9.3.1 Characteristics of the flow regime of each scenario at Site 3

The main characteristics (median values) of the flow regimes associated with each of the scenarios are summarised in Table 9.6.

Table 9.6 Characteristics of the baseline flow regime at Site 3. Median values are given for the flow indicators.

Flow indicators	Units	Baseline
Mean annual runoff	m^3/s	179.81
Dry season onset	week	44.00
Dry season duration	days	204.00
Min 5d dry season Q	m3/s	36.02
Wet season onset	week	24.00
Wet season duration	days	112.00
Max 5d wet season Q	m3/s	662.58
Flood volume	MCM	4002.38
Dry season ave daily vol	MCM	4.74
T1 ave daily vol	MCM	13.06
Wet season ave daily vol	MCM	36.57
T2 ave daily vol	MCM	11.90
T2 recession slope	-	-3.57

9.3.2 Mean percentage changes

The mean percentage changes (relative to Baseline) for the indicators for each scenario at Site 3 are given in Table 9.7.

The predicted impacts of Upper Trishuli-1 HEP are small at Site 3, and are mainly related to the barrier effects of Upper Trishuli weir, which are minor at the downstream site.

9.3.3 Overall Integrity

The Overall Integrity for each of the scenarios at Site 3 is illustrated in Figure 9.4. The change in integrity with Upper Trishuli-1 HEP in place is related to that slight impact that the barrier is expected to have on downstream populations. This is expected to be relatively minor because there is breeding habitat downstream of Upper Trishuli-1 HEP.

[7] Site 3 is immediately Downstream of the Powerhouse site

Table 9.7 Site 3: The mean percentage changes (relative to Baseline, which equals 100%) for the indicators for each scenario. Change representing an improvement in condition relative to baseline is marked in green[8]. Change representing a decline in condition relative to baseline is marked as follows: Orange = change >40-70%; red = change >70%.

Indicators		10_MeanM_NoFP	10_MinM_NoFP	30_MinM_NoFP	20_MeanM_NoFP	202_W-NoFP	10_MeanM_FP	10_MinM_FP	30_MinM_FP	20_MeanM_FP	202_W_FL
Geo-morphology	Bedload inflows	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Suspended Sediment inflow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Suspended sediment load	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
	Exposed sand and gravel bars	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Exposed cobble and boulder bars	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
	Median bed sediment size (armouring)	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
	Area of secondary channels and back waters	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Algae	Algae	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Macro-invertebrates	EPT abundance	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
Fish	Snow trout: *S. richardsonii*	-18.8	-18.8	-18.8	-18.6	-18.8	-13.9	-13.9	-13.9	-13.6	-13.9

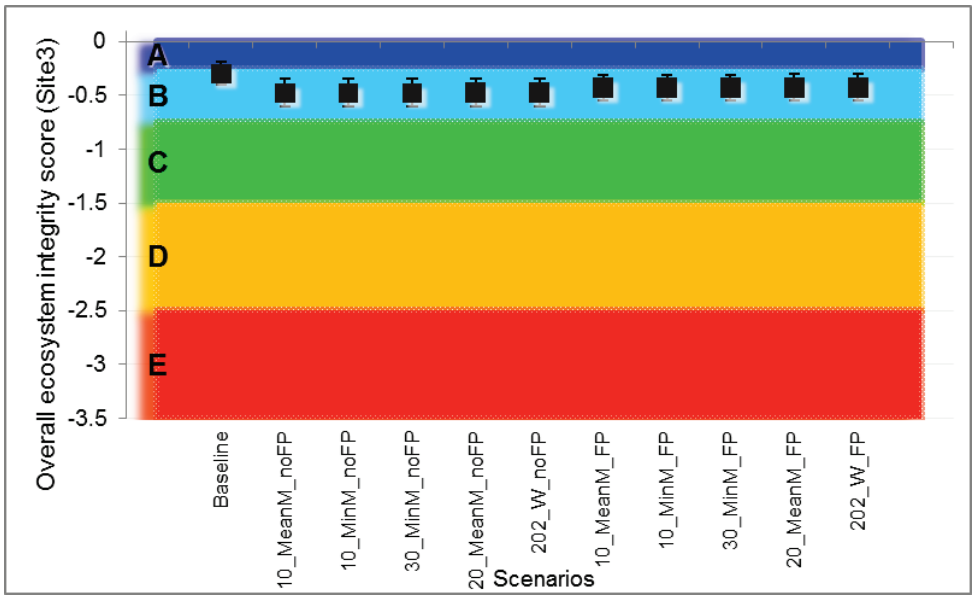


Figure 9.4 Overall ecosystem integrity scores for the scenarios at Site 3.

[8] These predictions report the last 10 years of the hydrological record used as the basis for scenarios.

10 Energy production and ecosystem Integrity at Site 2

The effect of different levels of EFlows releases on energy production was evaluated for different scenarios with the assumption that a fish passage will be constructed. The scenarios selected for comparison of energy production are: 10_MeanM_FP, 10_MinM_FP, 30_MinM_FP, 20_MeanM_FP and 202_W_FP. The descriptions of these scenarios are given in Table 8.1. The calculated energy production under each is shown in Table 10.1.

Table 10.1 Energy Production under different EFlows scenarios

Eflows Scenarios	Energy Production (GWh)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	% Change
10_MeanM_FP	84.5	68.9	74.8	91.0	133.6	153.8	162.7	162.8	157.5	161.3	137.8	105.0	**1493.6**	0.0
10_MinM_FP	85.6	69.0	74.8	93.1	139.9	156.7	162.8	162.8	157.5	162.4	142.9	108.3	**1515.6**	1.5
30_MinM_FP	84.5	68.9	74.8	77.4	129.5	153.8	162.7	162.8	157.5	161.3	137.8	105.0	**1475.9**	-1.2
20_MeanM_FP	71.2	55.8	60.4	77.4	129.5	153.8	162.7	162.8	157.5	161.3	134.1	94.0	**1420.4**	-4.9
202_W_FP	84.5	68.9	74.8	77.4	129.5	131.0	154.1	161.5	136.2	161.3	137.8	105.0	**1422.1**	-4.8

The headloss data were not available from the Client, and a fixed amount of headloss for different flow conditions, i.e., 3% of the gross head, was assumed. This is not true in reality because headloss varies with the change in discharge passing through different project components from headworks to the powerhouse, but is sufficiently correct to allow for comparison between scenarios.

Table 10.1 shows that the 10_MinM_FP scenario (legally binding criteria) allows for generation of about 1.5% of annual energy than the 10_MeanM_FP scenario (the Client's commitment in the EIA report). Similarly, relative to 10_MinM_FP, 30_MinM_FP 20_MeanM_FP and 202_W_FP scenarios result in about 1.2%, 4.9% and 4.1% less annual energy, respectively.

Energy production decreases in the order of increasing EFlow releases (Figure 10.1 and Figure 10.2). Figure 10.2 shows the relationship between energy production and overall (median of the sites) ecosystem Integrity for the five scenarios.

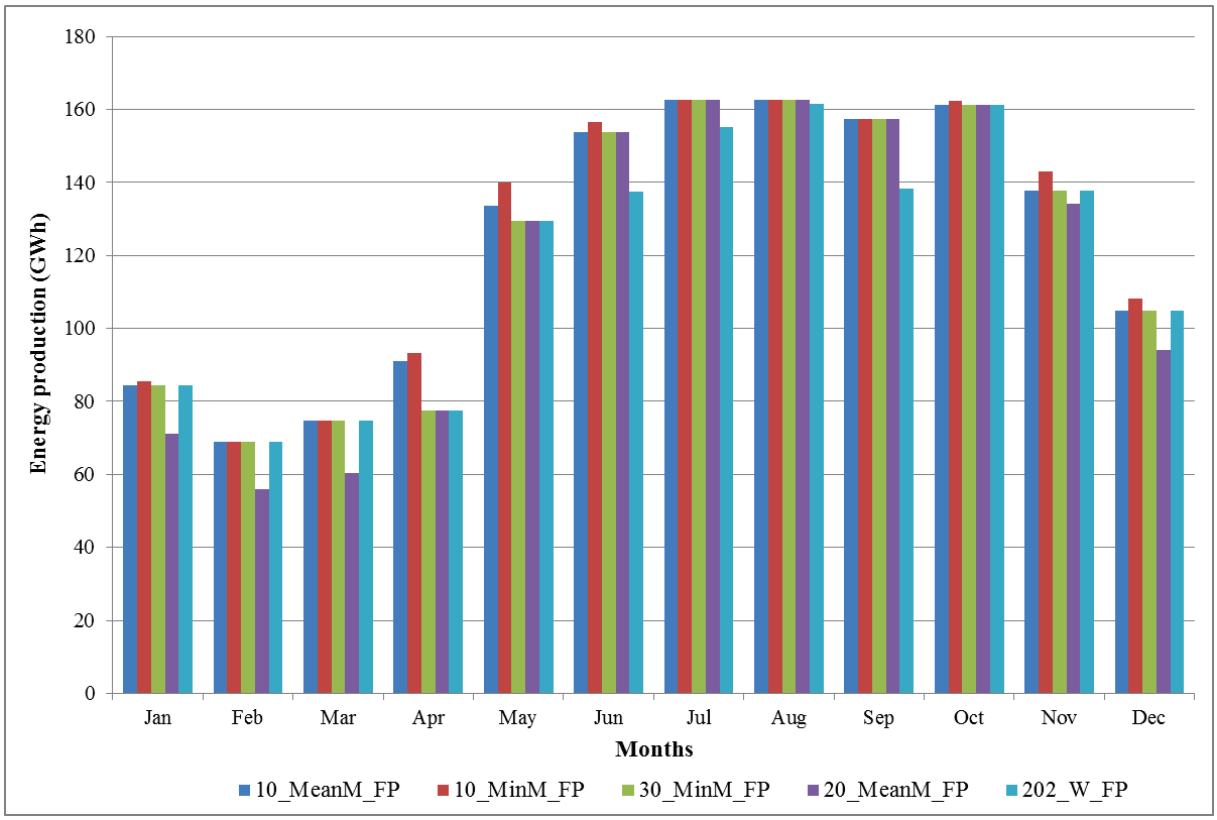


Figure 10.1 Energy production under different EFlows scenarios

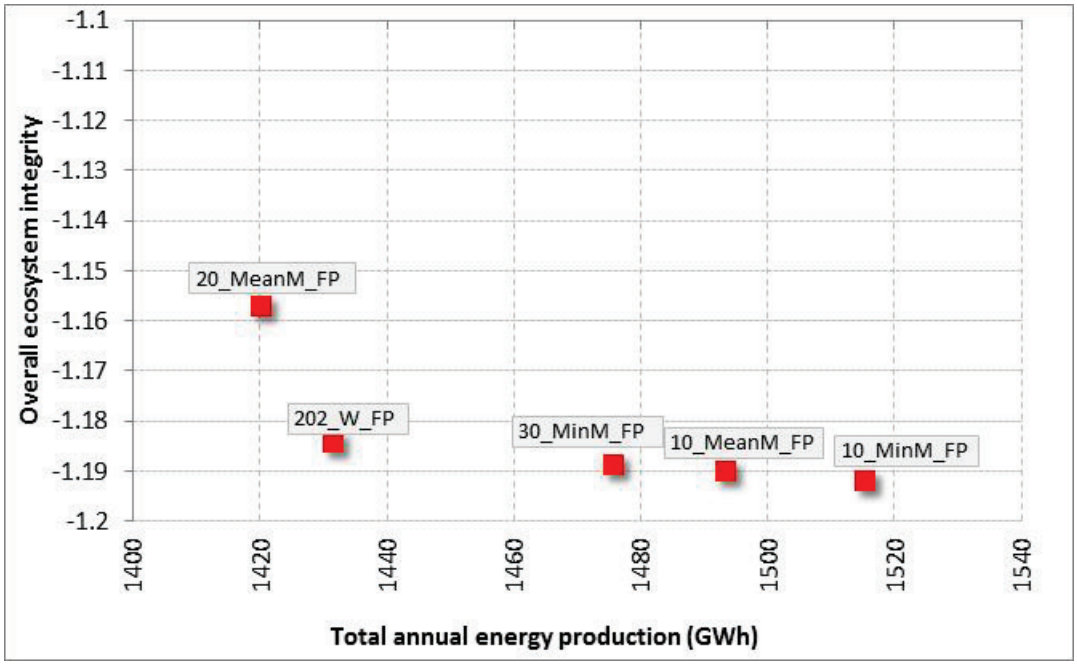


Figure 10.2 Ecosystem Integrity (median of the Sites) vs energy production

11 Additional Considerations

11.1 The effect of rainbow trout

It is important to highlight that the potential impacts of the exotic rainbow trout on snow trout have not been considered in this study, and could be severe. Rainbow trout are known to favour cold clear waters, and prey on snow trout. It is possible that the conditions created by Upper Trishuli-1 HEP and other HEPs in the Trishuli River will favour rainbow trout that escape from aquaculture farms in the area to the detriment of snow trout.

11.2 The effect of downstream and tributary HEPs

The results presented here assume that *S. richardsonii* will be able to migrate down the Trishuli River downstream of Upper Trishuli-1 HEP, and upstream in the tributary between Sites 2 and 3 (i.e., the Mailun River). If this is not the case, then the outcome for the trout will be significantly worse. A study on the cumulative impacts of all the HEPs planned for the Trishuli watershed is currently being undertaken by NWEDC and collaborators.

11.3 Contributions from Tributaries

A recent study on discharge measurement of tributaries of the UT-1 HEP in the dewatered zone conducted by S.A.N. Engineering Solutions Pvt. Ltd. (unpublished report) indicates that tributaries contribute to the main river flow in the dewatered zone. The contribution is, however, small relative to the main river flow and it is not considered during the EFlows modelling. The Fisheries Migration Research Field Visit Report by Halvard Kassa (March 2015) reveals low fish densities in the main river and high in the tributaries. The report concluded *"The data sampled in February/March give indications of a relatively small fish population in the main river with low fish densities compared to high fish densities in the tributaries. More data from other parts of the year are needed. Data so far are weak."* Therefore, flow available in the tributaries during the lean season (March, April and May) is likely to favour fish migration and breeding and the severe impacts on *S. richardsonii* are expected to be reduced with increase in EFlows of the main river though to a lesser extent.

11.4 Fish Passage

The fish passage modelled here allowed for an approximately 50% success rate. A fish passage in Nepal (Khimti Khola), which has particularly favourable design features, has achieved a higher success rate than this (Halvard Kaasa, unpublished presentation). Some of the findings of the Khimti Khola Fish Passage are also reported in the Environmental Monitoring Report published by Himal Power Limited in November, 2006. A fish passage for UT-1 is currently being designed by Halvard Kaasa, who is following good international practice.

11.5 *S. richardsonii* migration patterns

It was anticipated that the snow trout would not be resident immediately downstream of Upper Trishuli-1 HEP in the winter months, and therefore would not be impacted by the low flow releases from the weir, but this could not be proven in the time available for the study. It is, however, highly likely that the trout would migrate away from this reach in winter once Upper Trishuli-1 HEP is in place, particularly if low flow releases remain at design levels. More research is needed on the migration pattern of *S. richardsonii* in the Upper Trishuli River, particularly for the larger fish.

12 Conclusions and Next Steps

As represented by the indicators used in this study, Upper Trishuli-1 HEP is likely to affect the aquatic ecology of the Trishuli River. However, provided adequate provision is made for successful upstream and downstream passage of snow trout past the HEP, then the bulk of its impact should be within the 12-km dewatered stretch of the river.

Five EFlows scenarios were evaluated at three EFlows sites ([1] upstream of dam site; [2] downstream of the powerhouse site and; [3] in the dewatered section of the river). Upstream and downstream of UT-1, the ecological integrity and fish populations will not be impacted much, and the main impacts will be on the overwintering fish populations in the 12-km dewatered stretch. Inclusion of an effective fish passage will assist in maintaining the *S. richardsonii* migration within the watershed and ensure solid populations upstream and downstream of the project area.

The results of the EFlows assessment not surprisingly conclude that the best EFlows scenario for the *S. richardsonii* is the release of more water during the winter (low flow) months. However, power generation will be negatively impacted with the release of more water. Given the conditions of the Power Development Agreement between NWEDC and the Government of Nepal, and the financial situation of the project, it is highly unlikely that the project will be financially viable with this level of power loss. Furthermore, NWEDC has committed to a higher EFlows (10 % of baseline mean monthly flow) than is legally required by the Hydropower Development Policy, 2001. NWEDC has also exhibited commitment to biodiversity management for UT-1 through extensive baseline data collection, inclusion of a fish ladder that will meet international standards, a cumulative impacts assessment and this EFlows assessment.

Thus, the impacts on *S. richardsonii* within the 12 km dewatered zone will be mitigated by ensuring that migration is relatively unimpeded and that fish populations persist in the area. Apart from increased EFlows, the mitigation measures could include provision of a functional and efficient fish passage, fish hatcheries, and effective monitoring mechanism and adaptive management. Once decided upon, the agreed mitigation measures will be detailed in an Environmental Flow Management Plan.

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Appendix A. OVERVIEW OF DRIFT

This appendix is a generic overview of DRIFT and as such may use examples from areas other than the Upper Trishuli River. The Upper Trishuli EFlows assessment was completed using Drift2-v2.97.exe.

DRIFT is a process and data-management DSS, allowing data and knowledge to be used to their best advantage in a structured way. Within DRIFT, discipline specialists use their own discipline-specific methods to derive the links between river flow and river condition. The central rationale of DRIFT is that different aspects of the flow or sediment regime of a river elicit different responses from the riverine ecosystem. Thus, removal of part or all of a particular element of the flow or sediment regime will affect the riverine ecosystem differently than will removal of some other element.

In DRIFT, the long-term daily-flow time-series is partitioned into parts of the flow regime that are thought to play different roles in sculpting and maintaining the river ecosystem, such as the onset of important flow seasons, which may affect breeding cycles, or the magnitude of the annual flood, which may inundate a floodplain. This makes it easier for ecologists to predict how changes in the flow regime could affect the ecosystem. The 'parts' of the flow regime used in DRIFT are called flow indicators. The indicators used for the Upper Trishuli River are presented in Section 5.

The variability of the flow regime in timing and magnitude, both in its natural state and in any future scenario, is captured automatically through algorithms within the hydrological module of the DSS that identify the nature of the flow indicators year-by-year. Thus, the 47 annual values of each flow indicator are provided for the 47 years of flow record. This means the specialists can consider a response to a condition for a particular time-step rather than thinking of an averaged response over several years. They can also use data from a particular year or season to calibrate time-series responses.

The study process was structured as follows:

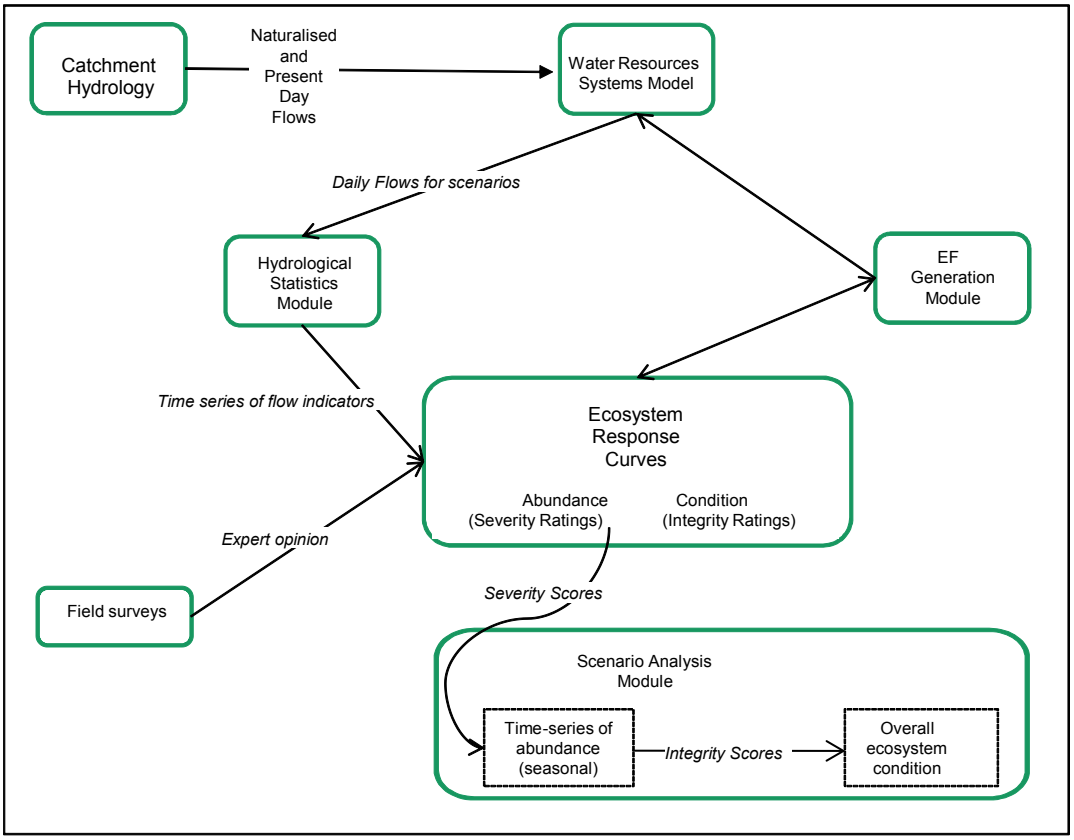
1. The study focused on five focus areas in the Upper Trishuli River (Section 1.2.1).
2. The flow changes were converted to ecologically-relevant summary statistics that highlighted:
    i. Changes in magnitude.
    ii. Changes in duration.
    iii. Changes in timing of seasons (e.g., delayed onset of wet season).
    iv. Changes within day ranges in discharge (i.e., for peaking power releases).
3. Specialists provided opinion on the consequences of these changes in the form of Response Curves. The disciplines represented were:
    i. Geomorphology
    ii. Macro invertebrates
    iii. Fish

Each specialist provided a list of ecosystem attributes that they believe could change with flow change. These are called ecosystem indicators.

4. The database was used to evaluate changes in these indicators for each scenario listed in Section 8.
5. The outputs of the DRIFT database are written up in Section 9.

The basic sequence of activities in the DRIFT DSS can be summarised as follows (Appendix Figure 1):

1. Collect data for the study at the river.
2. Augment with expert knowledge for similar river systems and a global understanding of river functioning.
3. Model current catchment hydrology and scenarios of future changes.
4. Calculate annual flow indicator time-series for all scenarios.
5. Construct relationships for the expected response of individual ecosystem indicators to changes in aspects of the flow regime (Response Curves). The Response Curves show the extent of change (i.e. severity of change – on a scale of 0 (no change) to 5 (very high change)) from baseline that would be expected from an ecosystem indicator in response to specific changes in flow.
6. Use Response Curves to predict time-series of abundance changes in each ecosystem indicator as a response to flow and consequent other changes.
7. Calculate Integrity for each indicator by assigning a direction of change, i.e., whether an increase in abundance will be expected to move the indicator away from the natural ecosystem condition or the opposite, and from this calculate discipline and site level Integrity.



Appendix Figure 1 Flow chart of DRIFT process

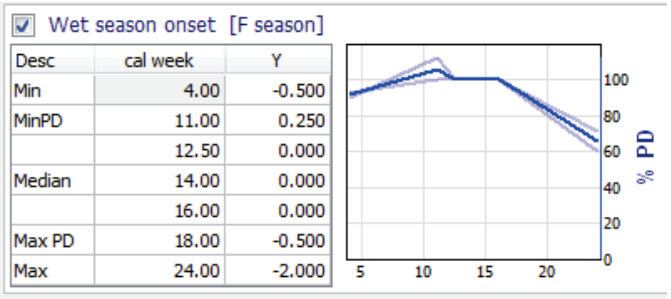
A.1. RESPONSE CURVES9

Response Curves depict the relationship between a biophysical indicator and a driving variable (e.g., flow). In this EFlows assessment, Response Curves linked an indicator to any other

9 The bulk of this section is taken from Joubert *et al.*, 2009.

indicator deemed to be driving change. The aim is not try to capture every conceivable link, but rather to restrict the linkages to those that are most meaningful and can be used to predict the bulk of the likely responses to a change in the flow or sediment regimes of the river.

A Response Curve for the relationship between relative fish (e.g., Alwan Snow Trout) abundance (given as a severity rating – see Section A.2 for an explanation of the scoring system used) and a flow category, in this case, onset of the wet season, is shown in Appendix Figure 2. In this figure, an early or late start to the wet season would lead to decreased abundance.



Appendix Figure 2 Example of a Response Curve – in this case of the relationship between the calendar week when the wet season begins and the abundance of Alwan Snow Trout.

The units on the x-axis depend on the driving variable under consideration. For instance, in the case of wet season onset (Appendix Figure 2), these are weeks of the year.

The y-axis may refer to abundance as in Appendix Figure 2, but also to other measures such as concentration or area, depending on the indicator. Response curves are constructed using severity ratings (Section A.2).

The number of Response Curves constructed for an EFlows assessment depends on the level of detail at which a flow assessment is done. In the NJHEP assessment, for example, the specialists collectively completed 57 Response Curves for Site 2. These were used to evaluate scenarios by taking the value of the flow indicator for any one scenario and reading off the resultant values for the biophysical indicators from their respective Response Curves. Once this had been done the database combined these values to predict the overall change in each biophysical indicator and in the overall ecosystem under each scenario.

A.1.1. Construction of the Response Curves

The Response Curves used in this project were constructed based on response curves constructed for the Neelum River, Pakistan. The Response Curves and explanations for their shape are contained in the DRIFT DSS, and in Section 7.

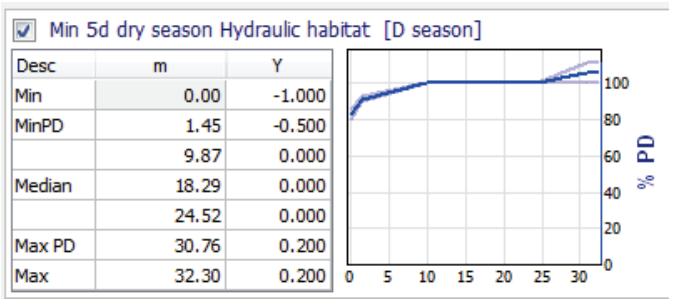
A.1.2. Response Curves and cumulative change

The time-series approach means that the Response Curves are used to predict the likely seasonal change in an ecosystem indicator in response to the flow/sediment conditions experienced in that, or possibly preceding, seasons. For instance, the kind of questions and discussion typically

addressed to facilitate setting the Response Curves the effect of changes in dry season discharge on Alwan Snow Trout are:

- "If the dry season discharge declines from baseline values, what will be the consequences for the abundance of Alwan Snow Trout?"
  - Do Alwan Snow Trout use the main river in the dry season?
  - Do Alwan Snow Trout abundances change noticeably over the climatic range covered in the baseline, i.e., are they noticeably more abundant in wet years than in dry years, or vice versa?
  - What kinds of habitat do adult Alwan Snow Trout use in the main river?
  - Do Alwan Snow Trout breed in the dry season?
  - Do they breed in the main river or in the tributaries?
  - Where do Alwan Snow Trout lay their eggs?
  - What sorts of habitat do fry, fingerlings and juvenile trout use in the main river?
  - At what discharge(s) does the favored habitat(s) disappear?
  - What is the consequence of these habitats not being available for one season?
  - If discharge reaches zero for one season, are there pools that the trout will be able to survive in?
  - Can the Alwan Snow Trout survive for a dry season in pools?
  - Is water temperature a concern, i.e., would the river freezing be an issue for Alwan Snow Trout if discharge decreased?
  - What do Alwan Snow Trout adults/juveniles/fingerlings/fry eat?
  - How will the food base be affected by changes in dry season low flows?
  - Etc.

Often, a species such as Alwan Snow Trout will be expected to survive even an extremely-dry dry season, with possibly only minor changes (5-10%) in overall abundance, resulting in a Response Curve similar to that shown in Appendix Figure 3, which predicts a 20-40% seasonal decline in trout abundance if dry season flows drop to zero, even though the lowest 5-day minimum ever recorded at the Line of Control under baseline is 11.78 m^3/s. If, however, the flows drop to this level in the dry season year after year, then the cumulative effect on trout populations is likely to be far greater. The time-series enable the DSS to capture this cumulative effect.



Appendix Figure 3 Response curve for Alwan Snow Trout response to changes in minimum 5-day dry season discharge.

A.2. SCORING SYSTEM

Into the foreseeable future, predictions of river change will be based on limited knowledge. Most river scientists, particularly when using sparse data, are thus reluctant to quantify predictions: it is relatively easy to predict the nature and direction of ecosystem change, but more difficult to predict its timing and intensity. To calculate the implications of loss of resources to subsistence and other users in order to facilitate discussion and trade-offs, it is nevertheless necessary to quantify these predictions as accurately as possible.

To aid this, two types of information are generated for each biophysical indicator, *viz*.:

- Severity ratings, which describe increase/decreases for an indicator in response to changes in the flow indicators, and;
- Integrity ratings, which indicate whether the predicted change is a move towards or away from the natural ecosystem condition, i.e., how the change influences overall ecosystem condition.

The severity ratings are used to construct the Response Curves. The Integrity ratings are used to predict changes in overall ecosystem condition/health.

A.2.1. Severity ratings

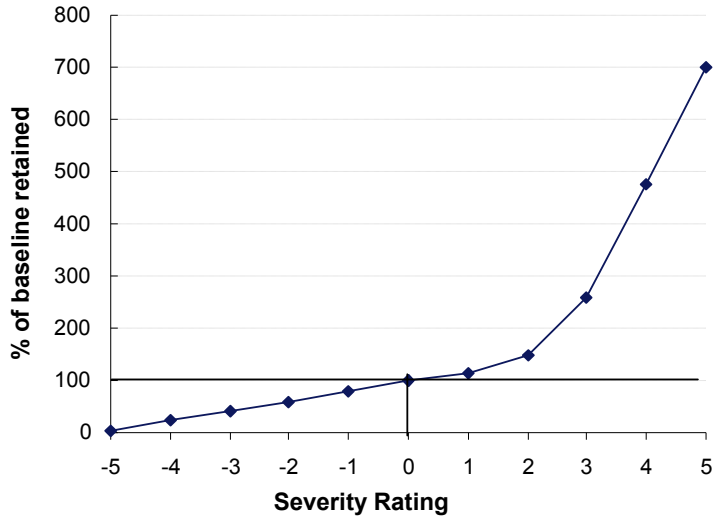
The severity ratings are on a continuous scale from -5 (large reduction) to +5 (very large change; Brown *et al*., 2008; Appendix Table 1), where the + or – denotes an increase or decrease in abundance or extent. These ratings are converted to percentages using the relationships provided in Appendix Table 1. The scale accommodates uncertainty, as each rating encompasses a range of percentages; however, greater uncertainty can also be expressed through providing a range of severity ratings (i.e. a range of ranges) for any one predicted change (after King *et al.*, 2003).

Appendix Table 1 DRIFT severity ratings and their associated abundances and losses – a negative score means a loss in abundance relative to baseline, a positive means a gain.

Severity rating	Severity	% abundance change
5	Critically severe	501% gain to ∞ up to pest proportions
4	Severe	251-500% gain
3	Moderate	68-250% gain
2	Low	26-67% gain
1	Negligible	1-25% gain
0	None	no change
-1	Negligible	80-100% retained
-2	Low	60-79% retained
-3	Moderate	40-59% retained
-4	Severe	20-39% retained
-5	Critically severe	0-19% retained includes local extinction

Note that the percentages applied to severity ratings associated with gains in abundance are strongly non-linear[10] and that negative and positive percentage changes are not symmetrical (Appendix Figure 4; King *et al*. 2003).

For each year of the hydrological record, and for each ecosystem indicator, the severity rating corresponding to the value of a driving indicator is read off its Response Curve and converted to a percentage change. The severity ratings for each driving indicator are then combined to produce an overall change in abundance for each season, which combined provide an indication of how abundance, area or concentration of an indicator is expected to change under the given flow conditions over time, relative to the changes that would have been expected under baseline conditions in the catchment.



Appendix Figure 4 The relationship between severity ratings and percentage abundance lost or retained as used in DRIFT and adopted for the DSS. (Baseline is always = 100%).

A.2.2. Integrity ratings

Integrity ratings are on a scale from 0 to -5.

The integrity ratings are calculated by assigning a positive or negative sign to changes in abundance depending on whether an increase in abundance is a move towards natural or away. The integrity ratings for each indicator are then combined to provide a discipline level Integrity score. Discipline level integrity scores are in turn combined to provide an overall site level Integrity Score, which is used to place a flow scenario within a classification of overall river condition, using the South African Eco-classification categories A to F (Appendix Table 2; Kleynhans 1996; Kleynhans 1999; Brown and Joubert 2003).

The ecological condition of a river is defined as its ability to support and maintain a balanced, integrated composition of physico-chemical and habitat characteristics, as well as biotic components on a temporal and spatial scale that are comparable to the natural characteristics of

[10] The non-linearity is necessary because the scores have to be able to show that a critically-severe loss equates to local extinction whilst a critically severe gain equates to proliferation to pest proportions.

ecosystems of the region. As an example, if the baseline ecological status (BES) of a river is a B-category, and there is a decrease in a fish species which is a move away from natural, this will cause the integrity score to be more negative, representing movement in the direction of categories C to F.

Appendix Table 2 Definitions of the Baseline Ecological State (BES) categories (after Kleynhans 1996).

Ecological category	Corresponding DRIFT Overall Integrity Score	Description of the habitat condition
A	>-0.25	Unmodified. Still in a natural condition.
B	>-0.75	Slightly modified. A small change in natural habitats and biota has taken place but the ecosystem functions are essentially unchanged.
C	>-1.5	Moderately modified. Loss and change of natural habitat and biota has occurred, but the basic ecosystem functions are still predominantly unchanged.
D	>-2.5	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.
E	>-3.5	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	<-3.5	Critically / Extremely modified. The system has been critically modified with an almost complete loss of natural habitat and biota. In the worst instances, basic ecosystem functions have completely altered and the changes are irreversible.

Overall Integrity Scores are calculated for the ecosystem as a whole, i.e., the combined effect of changes in the indicators at each site. The results can be plotted as overall Integrity Score (y-axis) vs. percentage or volume of MAR (x-axis) or, where there are relatively few points, as a plot of Integrity Scores per site, which allows for easy comparison between sites. The categories represent points along a continuum, thus the 'divisions' between the categories are only guides as to the general position at which the ecological condition might be expected to shift from one category to the next. Furthermore, the rules for the integrity categories were developed on rivers outside of the Republic of Congo, and have not been tested on the Upper Trishuli River. They provide an indication of the relative categories associated with each scenario and should not be misconstrued as an absolute prediction of future condition.

A.3. IDENTIFICATION OF ECOLOGICALLY-RELEVANT ELEMENTS OF THE FLOW REGIME

One of the main assumptions underlying the DRIFT EFlows process is that it is possible to identify ecologically-relevant elements of the flow regime and isolate them within the historical hydrological record. Thus, one of the first steps in the DRIFT process is to identify these ecologically-important flow indicators. To do this, the flow provided for the river in question is used.

The seasons used in DRIFT are:

- Dry season
- Transitional season 1
- Flood season
- Transitional season 2

The rules for defining the seasons are provided in Appendix Table 3. Due to the moving nature of the seasons, start and end dates are defined for every year of the hydrological time-series.

Appendix Table 3 Rules for defining the end of the four ecological seasons

Season	How the end of the season was defined
Dry Season	A multiple of the minimum dry season discharge
Transition 1	A multiple of the minimum dry season discharge
Flood Season	A multiple of the mean annual discharge
Transition 2	A multiple of the mean annual discharge, together with the recession rate calculated over a number of days

A.4. MAJOR ASSUMPTIONS AND LIMITATIONS OF DRIFT

Predicting the effect of flow changes on rivers is difficult because the actual trajectory and magnitude of the change is additionally dependent on so many other variables, such as climate, sediment supply and human use of the system. Thus, several assumptions underlie the predictions. Should any of these assumptions prove to be invalid, the actual changes may not match the predicted changes. This does not necessarily make the predictions themselves incorrect or invalid, but simply means that the surrounding set of circumstances that support the predictions has changed.

The following important major assumptions apply:

- The baseline hydrology closely approximates the actual flow conditions in the river over the period of record.
- Different parts of the flow regime sustain the river ecosystem in different ways. Changing one part of the flow regime will change the river in a different way than will changing another part.
- It is possible to identify ecologically-relevant elements of the flow regime and isolate them within the historical hydrological record (see Section A.3)
- 2016 conditions were used as a Baseline for predicting change, and change was expressed as a percentage move towards or away from the BES.
- Predicted changes in ecological status are relative to the BES (2016).
- Predictions are based on a 47-year horizon.

The main limitation is the paucity of data. This is a universal problem, as ecosystems are complex and we will probably never have complete certainty of their present and possible future characteristics. Instead it is essential to push ahead cautiously and aid decision-making, using best available information. The alternative is that water resource development decisions are made without consideration of the consequences for the supporting ecosystems, eventually probably making management of sustainability impossible. Data paucity is addressed in the DRIFT process by accessing every kind of knowledge available - general scientific understanding, international scientific literature, local wisdom and specific data from the river under consideration or from similar ones – and capturing these in a structured process that is transparent, with the DSS inputs and outputs checked and approved at every step. The Response

Curves used (and the reasoning used to construct them) are available for scrutiny within the DSS and they, as well as the DRIFT DSS, can be updated as new information becomes available.

A second aspect of the paucity of data is that it is neither known what the river was like in its pristine condition nor exactly how abundant each ecosystem aspect (sand bars, fish, etc.) was then or is now. To address this, all DRIFT predictions are made relative to the baseline situation (there will be a little more, or a lot less, than today, and so on).

These inherent uncertainties also mean that the trends and relative position of the scenarios are more reliable predictors of the impacts of the scenarios than are their absolute values. Also, DRIFT is designed to predict overall condition, and focusing on one indicator to the exclusion of others is not recommended.

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Appendix F
Climate Change Risk Assessment

Upper Trishuli-1 Hydropower Facility

Climate Change Risk Assessment

Final Report

Cloudwater, LLC

23 November 2016

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Acronyms and Abbreviations

APHRODITE	Asian Precipitation - Highly Resolved Observation Data Integration Towards Evaluation
CMIP3	Coupled Model Intercomparison Project Phase 3
CMIP5	Coupled Model Intercomparison Project Phase 5
DHM	Nepal Department of Hydrology and Meteorology
GCM	General (Global) Circulation Model
GPCC	Global Precipitation Climatology Centre
HYMOD_DS	Hydrologic Model for Distributed System with Glacier Module
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
MGHPCC	Massachusetts Green High-Performance Computing Center
NWEDC	Nepal Water and Energy Development Company
RGI	Randolph Glacier Inventory
SNOW-17	Snow Accumulation and Ablation Model adapted for HYMOD_DS
UT-1	Upper Trishuli 1 hydropower facility

1. **Problem Description and Risk Context**

1.1 Introduction

This document describes the methods and initial results for the comprehensive climate change risk assessment of the Upper Trishuli-1 hydropower project. The methods described here represent the most advanced approach for assessing climate change risks and its uncertainty. The approach uses a risk assessment framework that accounts for risks and uncertainty associated with climate change and observational uncertainty that characterizes development in the Himalaya.

The focus of this analysis is to identify possible risks to the UT-1 design that may arise due to climate change. Risk screening will consist of literature review, data analysis, and original modeling and risk analysis using the decision-scaling methodology. In addition, where plausible risks are identified, adaptation options will be proposed and reviewed. Adaptation is discussed in Chapter 3 of this report. The primary risks to be addressed include:

- Reductions in streamflow, especially low flow season
- Extreme streamflows, including floods
- Changes to rain, snow and snow melt
- Changes in streamflow and effects on sedimentation and landslides
- Disease risks

The priority risks associated with climate change are: (1) increases in extreme streamflows that could jeopardize the physical integrity of the headworks; and (2) decreases in low season flows that could jeopardize the success of the project. Thus of primary importance is understanding the hydrologic response of the system to climate change. This section presents early findings of hydrologic modeling aspects of the risk assessment, and presents no hydropower, economic, or other results from the water system model. Results from the system model will be forthcoming in subsequent versions of the climate change risk assessment and risk management reports.

Other non-climate factors (e.g., economic, political, demographic) are not modeled probabilistically (i.e., using the stress test approach), but are described based on information collection and literature review. These potential impacts include: 1) potential irrigation development upstream of the dam site; 2) potential ecosystem services alteration as addressed in Yonzon (2010); 3) dam structure safety; and 4) public health (as concerns are identified). The expectation is that at this stage of analysis the concerns are likely to be adequately addressed through the information investigation and summarized in the final report. Hydro Lab, based in Kathmandu, has provided background and input on the dam safety and structural failure related concerns. HydroLab has expertise in dam structure, physical modeling and sedimentation, and have provided data and information as needed. We do not anticipate the need for physical modeling of sedimentation processes within this analysis.

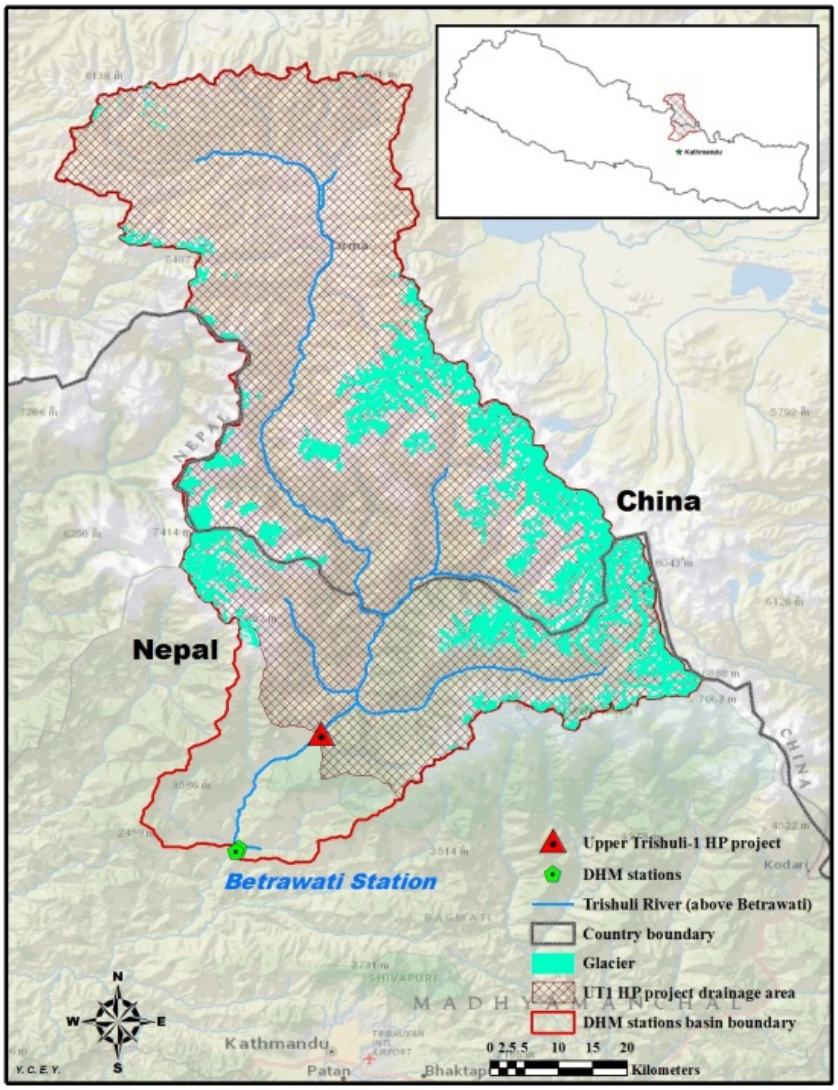


Figure 1. The Upper Trishuli Basin includes territory in Nepal and China. The Betrawati station is the source of hydrologic data. The UT-1 project site is indicated by the red triangle.

1.2 The Upper Trishuli-1 Hydropower Project

The Upper Trishuli-1 Hydropower Project (UT-1) is a proposed hydropower project at the upstream of Trishuli River in Nepal (Figure 1). It is a run-of-the-river project with average gross head of 342 meters (NWEDC, 2014). The nearest Department of Hydrology and Meteorology (DHM) station is Betrawati with drainage area of 4850 km^2 (apprx. 38% in Nepal). Drainage area for the dam site is about 4157 km^2 (1251 km^2 in Nepal). Based on the Randolph Glacier Inventory (RGI version 3.2) database, the total area covered by glaciers is about 642 km^2 (above Betrawati). Sharma (1993) explained that the lowest streamflow occurs in March, which indicates the beginning of the melting season for snow and glacier. Snow and glacier meltwater continue to contribute significantly to streamflow through May and into June.

There are up to 14 projects planned for the Upper Trishuli River, representing 838 MW of hydropower capacity, a number greater than the total current hydropower capacity of Nepal. The UT-1 project is the largest project among these 14. Since it is a run-of-the-river project, the amount of power it generates will be sensitive to changes in the volume and timing of streamflow. Both climate change and changes due to socio-economic shifts are possible sources of change to streamflow, though current upstream development levels are relatively small in the watershed. To the best of our knowledge, there is no major development planned in the undeveloped Chinese part of the basin (Jilong County), and there is little current or planned irrigation in the Nepalese part of the basin. Therefore, the potential effects of climate change, including possible effects on sedimentation rates and extreme flows, are the major concerns for decision-making.

1.2 Hydrological and Meteorological Data

Hydrologic and meteorological data were collected from a variety of sources. Meteorological data such as precipitation and temperature are primary inputs to the hydrologic model. Gridded daily temperature and precipitation products with a spatial resolution of 0.25º are available for the period 1961-2007 from the Asian Precipitation Highly Resolved Observational Data Integration Towards Evaluation (APHRODITE) dataset (Yatagai et al., 2012). The APHRODITE daily temperature data are directly used in the modeling process. However, our preliminarily data analysis confirmed the downward bias in APHRODITE precipitation previously reported by Palazzi et al. (2013). Therefore, for precipitation input to the hydrologic model the precipitation product from the Global Precipitation Climatology Centre (GPCC) dataset (Schneider et al., 2014) was downscaled both spatially (from 0.5º to 0.25º) and temporally (from monthly to daily) using the APHRODITE's spatial and temporal pattern.

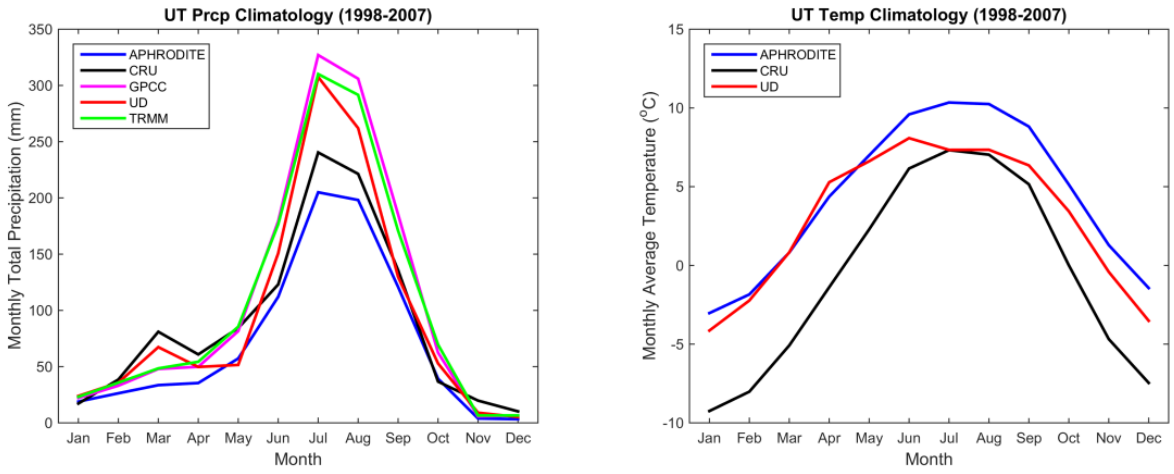


Figure 2. Comparison of precipitation and temperature data from multiple sources. The differences between datasets reflect the difficulties associated with estimating meteorological data in locations with sparse observations and challenging terrain.

Hydrologic data were collected for the two DHM stations located within the basin (Table 1). Finally, climate change projections provided by the current and previous generations of

climate modeling intercomparison projects were utilized to explore feasible climate conditions in the future.

Table 1 Two DHM station at the Upper Trishuli River.

Station NO	River	Location	Lat (deg)	Lon (deg)	Elev (m)	Drain area (km^2)	Start year	End year
446.8	Phalankhukhola	Betrawati	27.97	85.19	630	162	1971	1995
447	Trishuli	Betrawati	27.97	85.18	600	4110	1977	2006

1.3 Background on Climate Change in the Himalaya

This section provides a brief description of climate change within a regional context based on the latest peer reviewed scientific literature. The "Greater Himalaya" is defined as the region including the Hindu-Kush-Karakorum mountains and the Himalayan mountains. More than 1.3 billion people rely on the water originated from the Greater Himalaya. Among the challenges facing South Asia, water resources management for sustainable water supply, agricultural production and energy generation in the region's great river basins are most pressing, due to the complex climatic/hydrologic regime (snow/glacier and monsoon) vulnerable to climate change and the potential for both inter- and intra-basin political conflict.

The first step in exploring the regional climate change impact is to identify possible trends in the historical climate data. In the Indus Basin, for example, a tendency was found that the winter is warming and the summer is cooling (Flowler and Archer, 2006; Ahmad et al., 2012; Bocchiola and Diolaiuti, 2013), though there is not a general agreement on the magnitude of the precipitation change. Though previously studies have not identified a statistically significant historical trend in annual precipitation, winter precipitation may be increasing (Archer and Fowler, 2004; Ahmad et al., 2012; Bocchiola and Diolaiuti, 2013). For example, Khattak et al. (2011) and Sharif et al. (2013) explain that streamflow in the upper Indus Basin is predominantly influenced by winter precipitation, and that increasing trends in winter steamflow and decreasing trends in summer streamflow have been observed.

Jain and Kumar (2012) analyzed the precipitation data for all of India and reported that precipitation in the Ganges basin exhibits no significant trend, and that precipitation in the Brahmaputra basin is decreasing. Both the upper Ganges (India-Nepal) and lower Ganges (India-Bangladesh) show decreasing trends in precipitation extremes (Adel, 2002; Duncan et al., 2013). Following on the precipitation result, other studies suggest that the streamflow in the monsoon season also has a decreasing trend (Sharma and Shakya, 2006).

In the upper Brahmaputra Basin, there is a general agreement on the presence of an increasing trend in both temperature (especially in winter) and precipitation (especially in spring) (Ge et al., 2004; Yao, 2008; Xu et al., 2009), which results in a slightly increasing trend in streamflow (Liu et al., 2007; Gao et al., 2008; Zhang et al., 2010). However, Tsao et al. (2005) observed no streamflow change in the major rivers originating from the

Qinghai-Tibetan Plateau, and Deka et al. (2013) pointed to a decreasing historical precipitation in the lower Brahmaputra basin.

The uncertainty in the historical trend is amplified in the future projections (see Figure 3). The latest generation of climate projections of the Intergovernmental Panel on Climate Change (IPCC) is called the Coupled Model Intercomparison Project Phase 5 (CMIP5). The CMIP5 ensemble shows a very large uncertainty in climate-change-related risks to the Greater Himalaya region. In the Greater Himalaya in general, uncertainty has increased since the previous generation of IPCC emission scenarios (the Coupled Model Intercomparison Project Phase 3, CMIP3); however, this is not the case in the Upper Trishuli basin (as shown in Figure 3). This uncertainty might be mainly due to the poor ability of the General Circulation Models (GCMs, also known as Global Climate Models) to represent both the snow/glacier effects and monsoon mechanism. As a result, a number of studies have attempted to discern and summarize the climate change impacts on the Greater Himalaya region. Immerzeel et al. (2010) concluded that huge differences exist between Himalayan basins in the extent to which climate change is predicted to affect water availability and food security. This is mostly attributable to differences in snow/glacier melt contribution to the streamflow. A summary of component contribution to streamflow by Savoskul et al. (2013) concluded that though glacier and snow melt contribute only small fractions (7% and 3%, respectively) to annual runoff in the Ganges and the Brahmaputra rivers, the glacier and snow melt contribution to streamflow in the Indus basin is on the range of 35-40%. The nonrenewable component in the total glacier runoff has increased from 16-30% to 26-46% since 1961 throughout the Greater Himalaya region, suggesting that glaciers are melting down in most (if not all) basins. Miller et al. (2012) explained that climate change may increase rainfall in the future, leading to increased flows in the Ganges and Brahmaputra, but with greater variability. The expectation of reduced snow/glacier runoff with increased precipitation variability makes it difficult to estimate future water availability in the Indus. According to Kulkarni et al. (2013), large-scale modeling results indicate that rainfall may be 40–50% more variable in the Central and Eastern Himalaya at the end of this century.

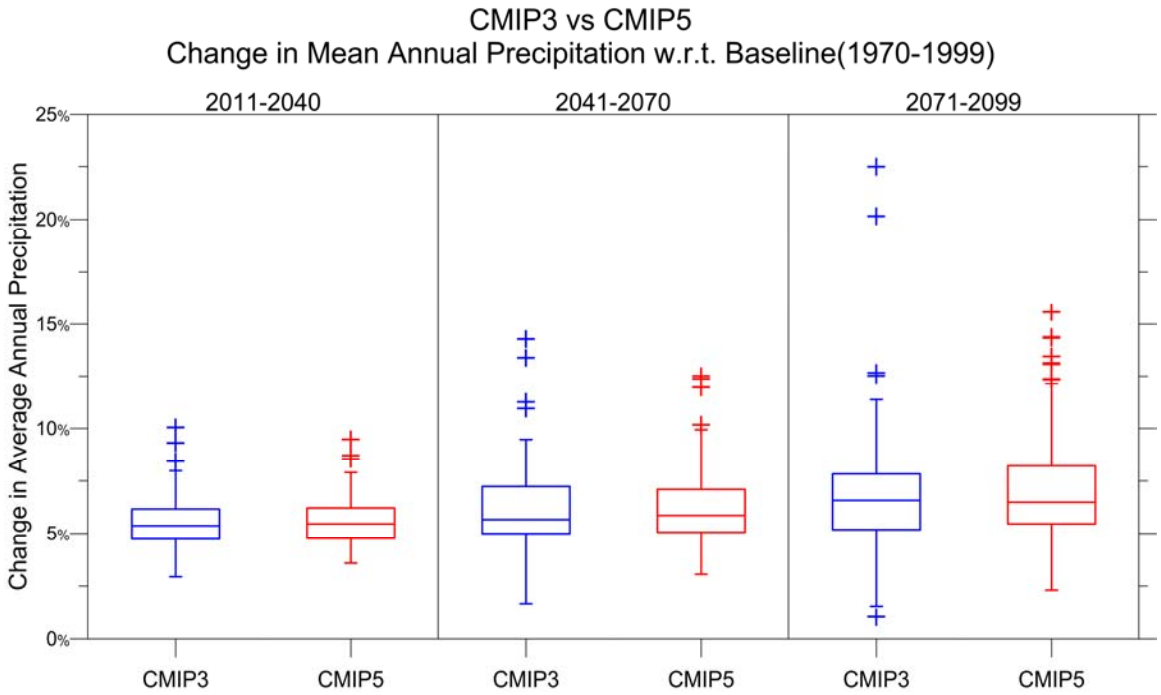


Figure 3. Change in mean annual precipitation with respect to baseline (1970-1999).

Specific to the Central Himalaya (including Nepal), Sharmar (1993) summarized the role of meltwater in major rivers of Nepal and reported that the snow-fed rivers show a rise in streamflow during the pre-monsoon period (April to mid-June) with meltwater contribution exceeding 30% in May. The role of meltwater becomes less important as compared to the role of groundwater and rainfall after May. Shrestha and Aryal (2011) explained that among the large rivers in Nepal, Karnali and Sapta Koshi show a decreasing trend, and Narayani (Kali Gandaki) shows an increasing trend. However, due to the short record and high inter-annual variability in discharge data, these observed trends in river discharge are not statistically significant. Regarding climate change impacts, Lutz et al. (2014) showed an increase in streamflow through 2050 caused primarily by an increase in precipitation in the upper Ganges. Likewise, Shrestha and Aryal (2011) projected an increasing trend in streamflow in the Kali Gandaki-Narayani river system, and argued that the catastrophic water shortages forecasted by some experts are unlikely to happen for many decades (if at all). However, the increases in precipitation and streamflow variability and the great uncertainties about future glacier meltwater availability that accompany projections of increasing streamflow indicate that the hydropower sector in Nepal continues to carry greater climate change risk than most other sectors (Bhusal, 2014). Greater unreliability of dry season flows, in particular, poses potential risks to hydroelectric energy production in the dry season when electricity prices are highest.

2. Methods

The decision scaling approach to climate change risk assessment applied to UT-1 requires four modeling subsystems: 1) a weather generator (algorithm for generating timeseries of potential future climate); 2) a hydrologic model (to translate climate timeseries into

timeseries of streamflow); 3) a water resources system model (to translate streamflow timeseries into timeseries of hydropower production and other water system performance metrics of interest); and 4) procedures for analyzing and describing the risks to the water system (such as statistical tools and graphical concepts). An example schematic of the modeling system is provided in Figure 4. The individual components are described below.

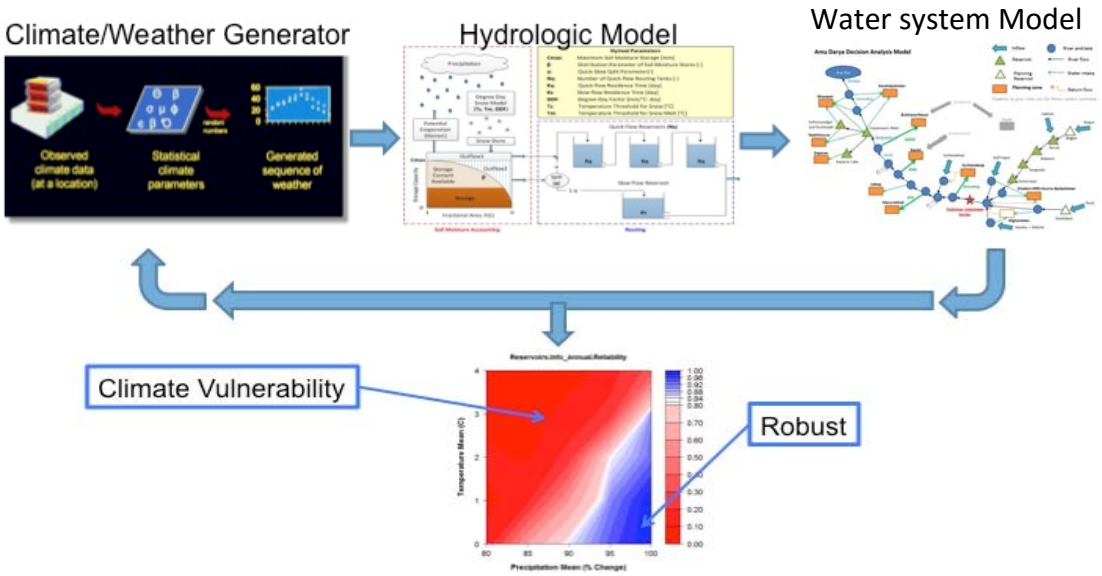


Figure 4. Schematic diagram of the decision scaling framework as applied in this study. The figure at the bottom represents a climate response function, which indicates project performance over the range of plausible climate change.

This section includes description of the glacial-hydrologic model, with calibration and validation results, the water resources system model design, and the approach for climate change stress-testing. In addition to the technical approaches described here, the work is underpinned by literature reviews, personal interviews and other non-modeling research methods. Non-modeling research methods are not described in detail here.

2.1 Distributed Glacio-hydrologic Model

The distributed glacio-hydrologic model applied for this analysis is the HYMOD_DS. The HYMOD_DS is the modeling system created by the University of Massachusetts Hydrosystems Research Group and applied by Cloudwater, LLC, to mountainous regions with sparse data. The model is designed for parallel processing on supercomputers, allowing calibration by the Massachusetts Green High-Performance Computing Center (MGHPCC), a major advantage over other modeling methods. The HYMOD_DS is particularly suited for the UT-1 project. The prototype of the model was built for a World Bank supported study of the Kabul Basin (Wi et al., 2015) and the Brahmaputra Basin (Yang et al., 2014b). The original HYMOD model (Boyle, 2001) is a lumped parameter, rainfall excess model composed of a soil moisture accounting module. Wi et al. (2015)

introduced a routing module, which allows runoff from each cell to be hydrologically traced to the basin outlet, creating a spatially-distributed version of the model. In addition, a temperature-based snow/glacier module was developed to explicitly model the dynamics of melting snowpack and glaciers, with resulting contributions to streamflow. The model structure of the HYMOD_DS modeling system is described in detail in Wi et al. (2015).

The snow/glacier module is critical for the UT-1 project, as preliminary data analysis indicates that streamflow in the basin heavily influenced by snow/glacier melt. In this application, we have modified the SNOW-17 snow accumulation and ablation model (Anderson, 2006) as an alternative to our current temperature based snow module. The SNOW-17 is a temperature index model that determines the energy exchanges across the snow-air interface. To consider the variation in the amount of snow accumulation and ablation and the timing of melt at different elevations of mountainous regions, we divide UT-1 watershed into several elevation zones and apply SNOW-17 in distributed fashion. A similar concept for the glacier module is developed and the glacier geometry, ice flow, and total glacier mass balance are modeled by elevation zone with a temperature-energy index equation. The conceptual figure of this advanced glacio-hydrologic distributed model is given in Figure 5. The initial analysis described in this report is based on the current version of the model.

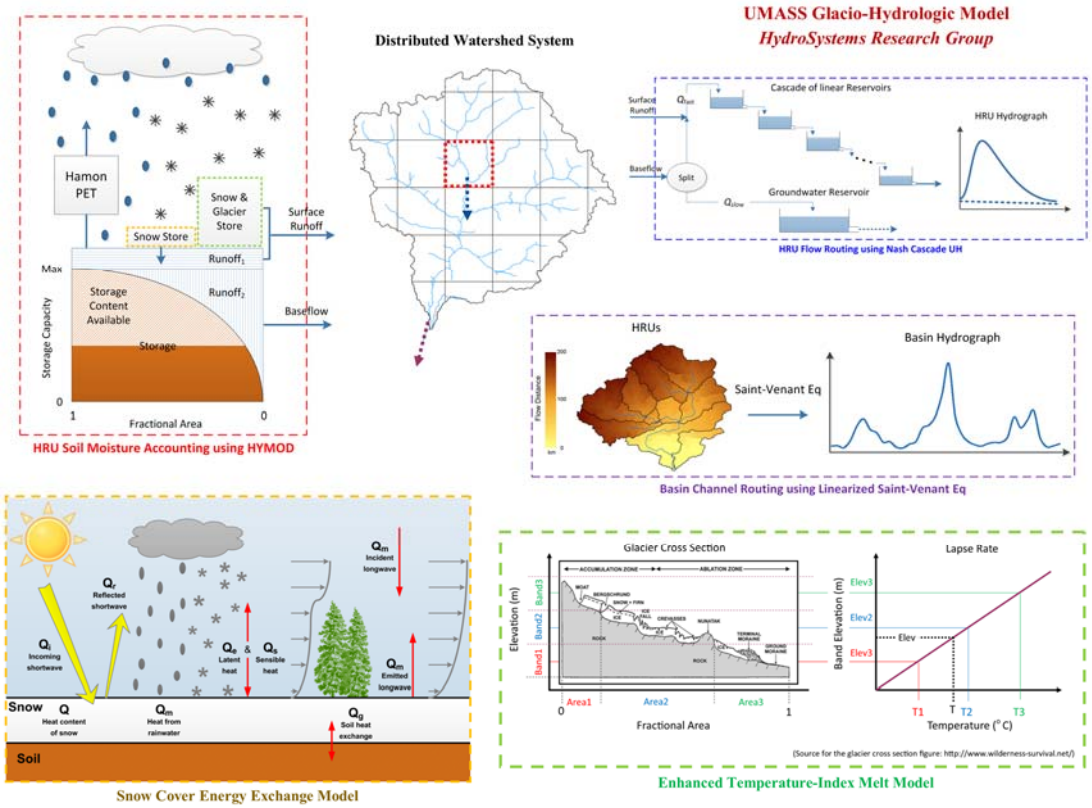


Figure 5. Advanced glacio-hydrologic distributed model by UMass Hydrosystems Research Group.

The hydrologic modeling system used to evaluate streamflow responses to climate change based on direct physically modeling. This includes changes to extreme hydrologic events (e.g., floods) as well as low season flow rates. With the enhanced snow/glacial module specifically designed for rivers originating from the Himalayan region, the results are a best available estimate of changes to streamflow as a result of plausible future temperature and precipitation conditions at the project site. Figure 6 shows the high resolution digital elevation model (DEM) used as input to the hydrologic model.

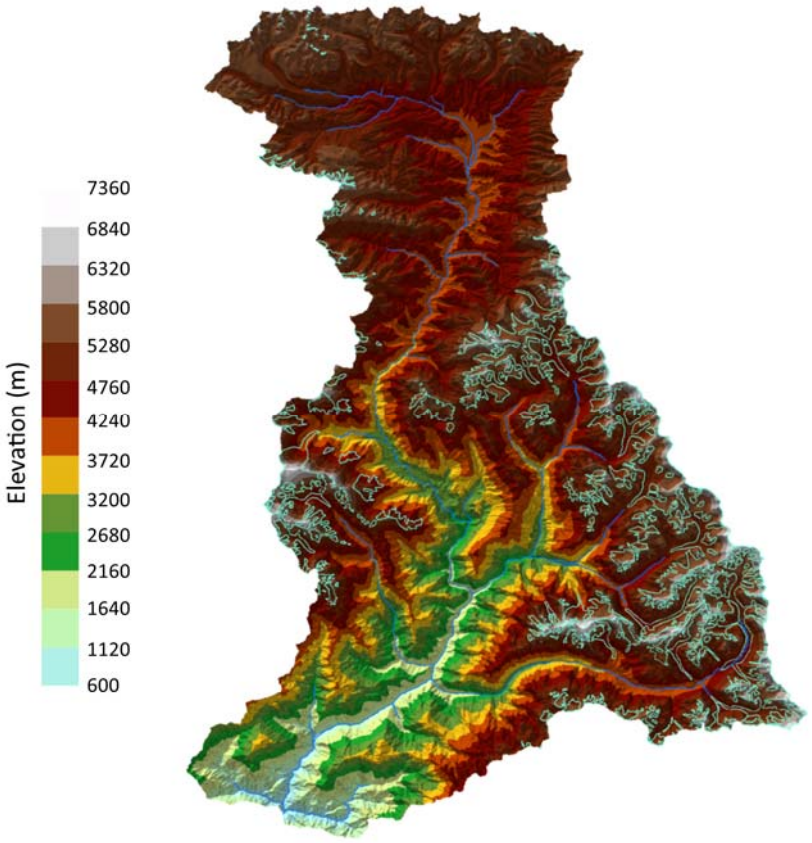


Figure 6. Digital elevation map of the Upper Trishuli Basin.

The model has been calibrated to daily streamflow data at the Betraswati basin. The thirty-eight year record was divided into a calibration and evaluation period. As shown in Figure 7, the calibration results were excellent, with a Nash-Sutcliff Efficiency statistic of 0.88 during the calibration period and 0.90 during the evaluation period. Based on the quality of the calibration and validation results, high confidence can be taken in the model's applicability in the basin.

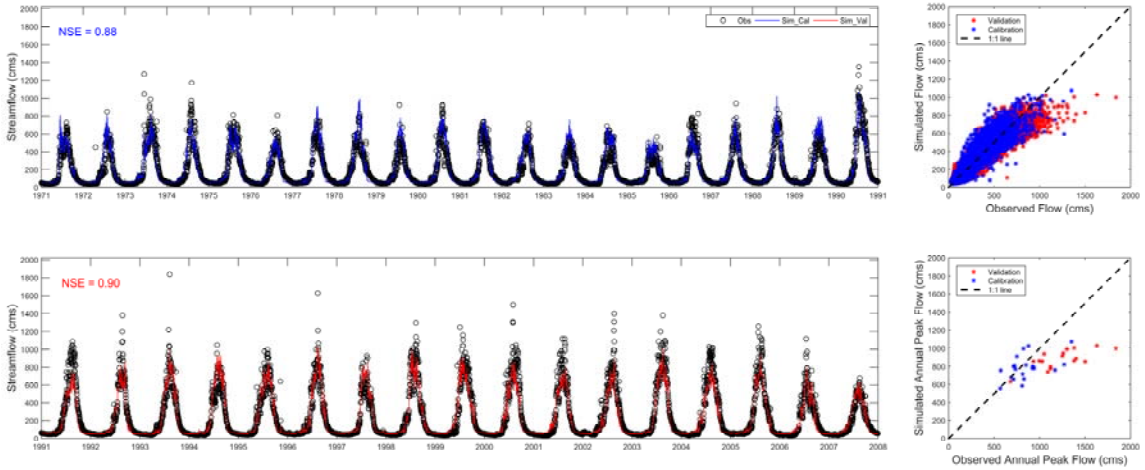


Figure 7. Streamflow from the HYMOD_DS compared to observed data. Blue circles represent the calibration period and red circles represent the results for the evaluation period. Results are generally excellent although some higher extreme flows were not captured.

Figure 8 shows the monthly average hydrograph for inflows to the UT-1 project site, including the contribution of different aspects of the hydrosphere. As expected, the hydrograph exhibits classic monsoonal and mountain hydrology, with a distinct summer peak and winter low flow period. As almost all precipitation occurs during the summer monsoon months, the low flow period is made up primarily of baseflow (groundwater or subsurface flow). Streamflow in summer months consists of meltwater from snow and glaciers due to warmer temperatures, in addition to rainfall from the monsoon. Understanding the contributions of the components of the hydrosphere allows the development of expectations regarding changes in streamflow patterns with climate change.

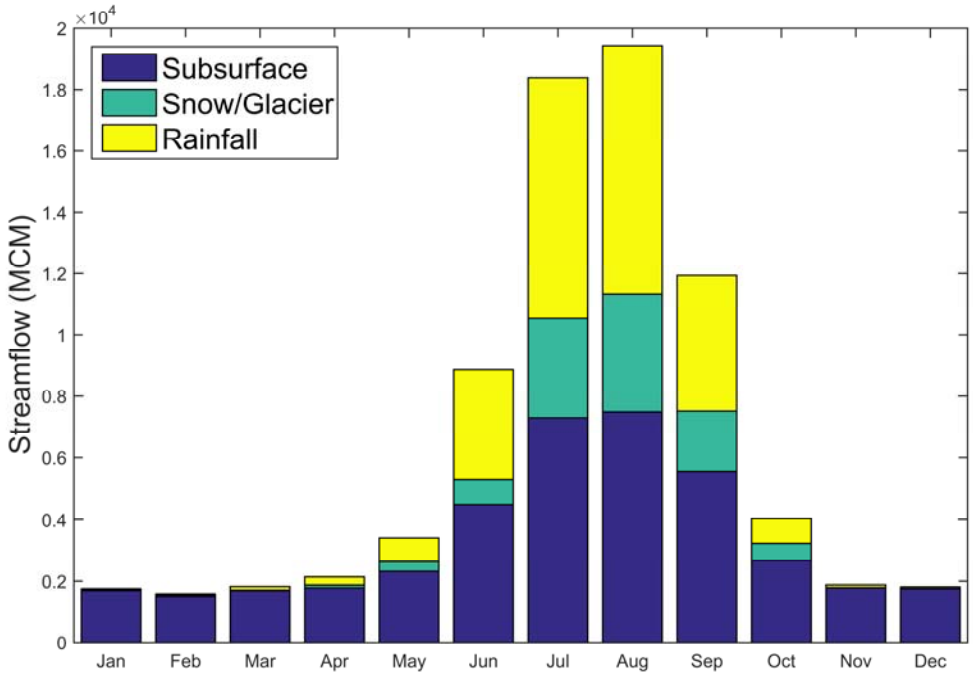


Figure 8. Annual hydrograph of streamflow in the Upper Trishuli Basin showing contributions from subsurface (blue), snow and glacial melt (green), and rainfall (yellow).

2.2. Water Resources System Model

In order to translate changes in streamflow into impacts on hydropower generation and downstream flow conditions, a water resources system model has been developed. Typically, water systems models are either constructed as simulation models, with reservoir operations following prescribed rules, or as optimization models, with reservoir operations guided by an objective function (e.g., maximization of hydropower generation subject to constraints). The model developed as part of this analysis is of the simulation type.

The water resources systems model is quite simple in this case of run-of-river hydropower with no storage or reservoir operations to be considered. For this purpose a simple system model was developed in R, the mathematical modeling language. The water resources system model computes hydropower generation and its profits under different inflow conditions, which are provided by the hydrologic model. The model could be expanded to consider downstream water requirements (agricultural, domestics and/or ecological purposes) and demonstrate tradeoffs between alternative water uses, although this is not considered needed at the moment (see Section 3.4 “Effect of changes in upstream water demand”).

Figure 9 shows the streamflow exceedance probability for the bias-corrected Betrawati[1] stream gage, just downstream of the proposed site of the UT-1. Average daily streamflow values in m^3/s were ordered and assigned exceedance probability using Weibull plotting position. The values presented are in close agreement with those presented by the client in reference to the prefeasibility study, in which the design flow was estimated to be 76 m^3/s (which in the analysis presented here has been estimated as the Q50 flow with a value of 77 m^3/s).

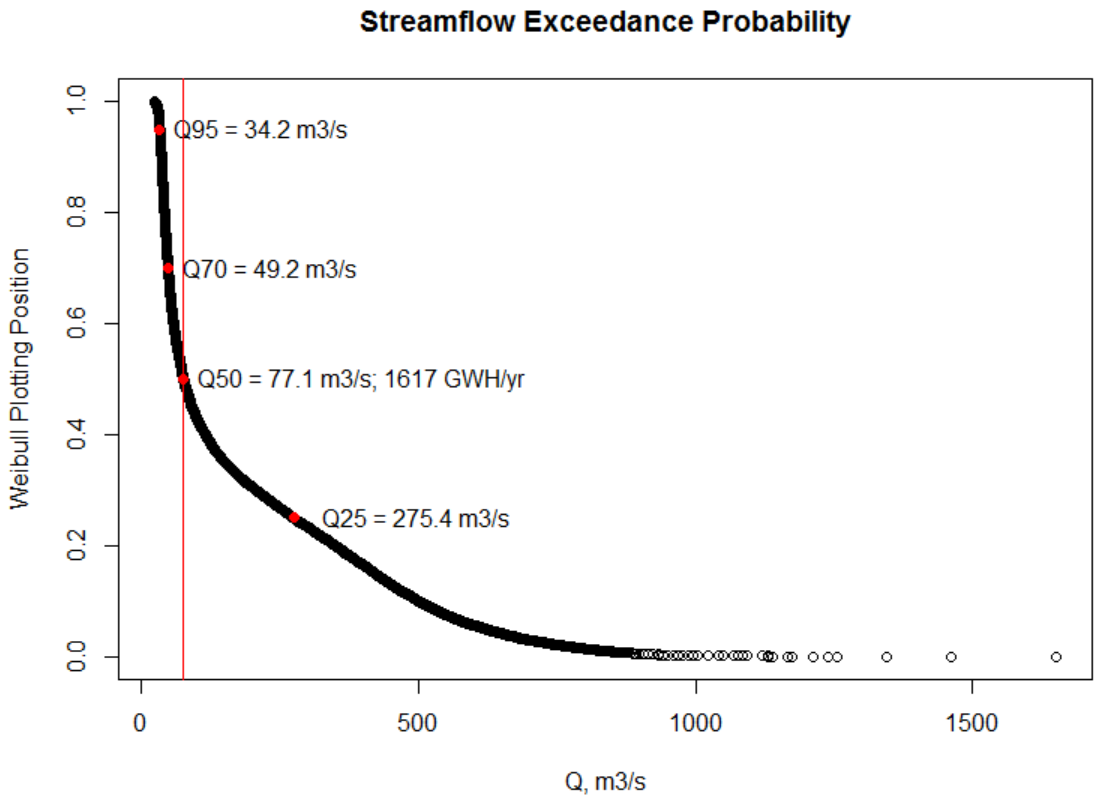


Figure 9. Bias-corrected Betrawati streamflow exceedance probability (Jan 1967-Dec 2010). Red vertical line indicates design flow of 76 m^3/s.

The streamflow data in Figure 9 were then converted to GWhr/day using equation (1), which is a simple planning relationship:

$$\frac{GWhr}{day} = 0.002725 \cdot Q\left[\frac{MCM}{day}\right] \cdot H[m] \cdot e \qquad (1)$$

with net head, H = 332 meters, and the efficiency of the conversion of mechanical energy

[1] As shown in Figure 1, Betrawati station is downstream of the proposed location of the intake for the UT-1 hydropower plant. The catchment area of Betrawati station is 4850 km^2, and the catchment area of the UT-1 facility is 4350.9 km^2. Daily flow values from the Betrawati station were therefore multiplied by the ratio 0.8971 (4350.9/4850) in better represent the amount of streamflow available at the upstream UT-1 site.

into electrical energy, e = 0.9. Equation (1) is derived from the fundamental physics describing the translation of potential energy into kinetic energy. A cubic meter of water, weighing 10^3 kg, falling a distance of one meter, acquires 9.81 x 10^3 joules (Newton-meters) of kinetic energy. A Watt is a unit of power, equal to a Joule of energy expended per second. Equation 1 expands the example of a single cubic meter of water falling a single meter to the case of many millions of cubic meters of water falling many meters each day. The coefficient 0.002725 is an aggregate unit conversion. Detailed explanation of the derivation and utility of (1) is available in *Loucks and van Beek* [2005].

The potential (un-capped) hydroelectric power exceedance probability is presented in Figure 10. The horizontal red line in Figure 10 shows the GWH50 (daily hydropower with exceedance probability of 50%) for the 216MW facility based on the prefeasibility study (Q50 = 76 m^3/s; $GWH50_{cap}$ = 4.2 GWh/day). It nearly passes through, but is somewhat less than, the red dot for GWH50 = 4.4 calculated using data available for this analysis.

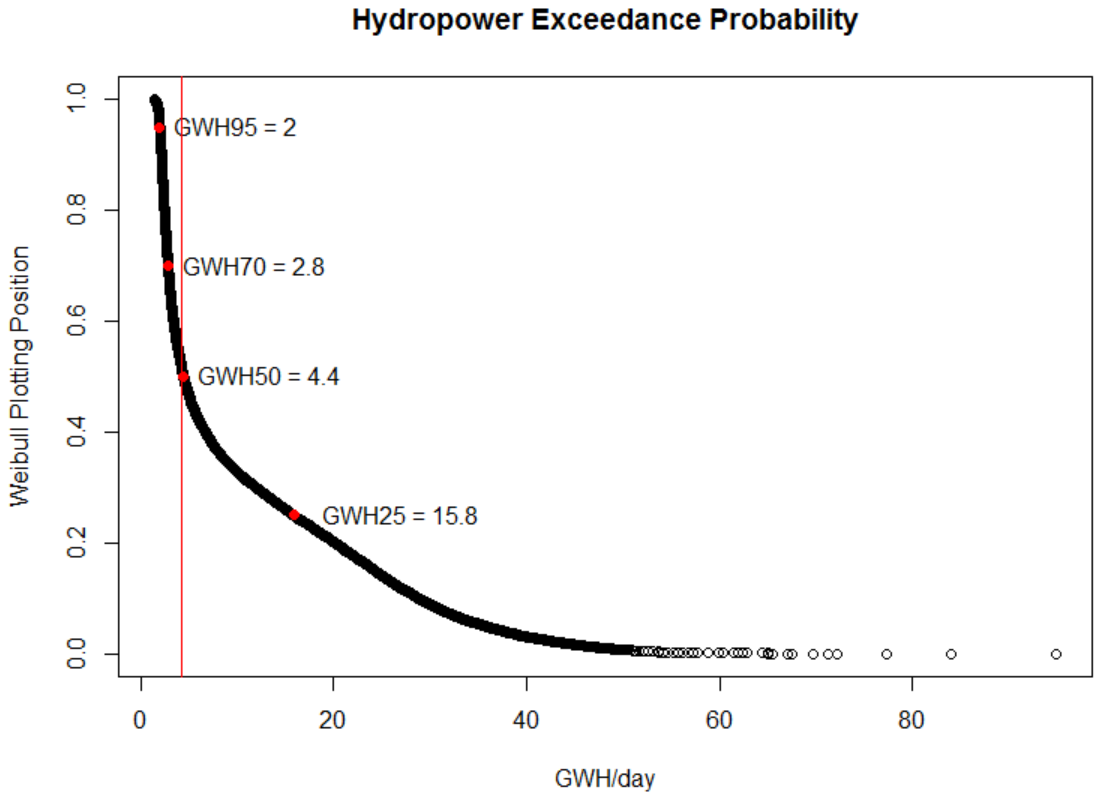


Figure 10. Theoretical potential (uncapped) hydropower exceedance probability. Red dots are calculated exceedance probabilities of uncapped hydropower production. Red line is production presented in UT-1 project documents.

Figure 11 provides perspective on the capacity of the 216 MW facility relative to the seasonal peak flows of hydropower potential at the site of the UT-1. The time series of hydropower production in Figure 11 is calculated by applying (1) to the time series of bias-corrected streamflow at Betrawati. The horizontal red line in Figure 11 locates the capacity of the 216 MW facility. Hydropower production potential in excess of the red line would

not be generated with a 216 MW facility.

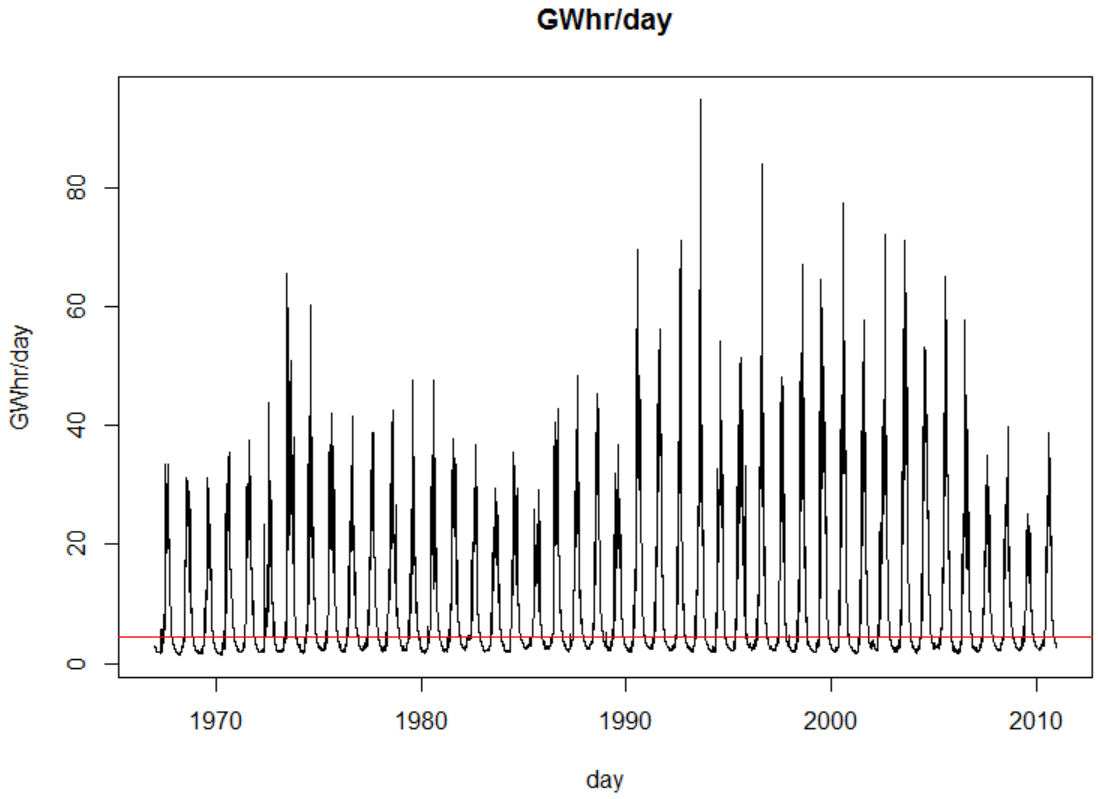


Figure 11. UT-1, 216 MW PROR @ Q_{50}, max daily GWhr/day generation relative to daily timeseries of GWhr potential (red line).

The NPV was calculated using (2):

$$NPV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0 \quad (2)$$

where:

C_t = net cash inflow during the period.

C_0 = initial investment

r = discount rate

t = number of time periods (in our case, months)

Table 2 summarizes the design parameters used by the hydropower model to estimate system performance. Most values are provided by the client, or taken from the project documents. A subset of the values (O&M cost, discount rate, and turbine efficiency) were estimated using engineering judgment and previous experience in the region (esp., the Upper Arun Hydropower Project).

Table 2 UT-1 Hydropower project design parameters.

Parameter	Value
Catchment Area	4350.9 km^2
Design Discharge	76 m^3/s
Net Head*	332 m
Installed Capacity	216 MW
Total Annual Energy Production	1532 GWh
Capital Cost	$580M
Annual O&M Cost**	$2 \cdot (125000 \cdot (kWhr\_cap/1000/24)^{0.65})$
Discount Rate	5%
Electricity Selling Price	Dry season (Nov-Mar) 0.084 $US/kWh Wet season (Apr-Oct) 0.045 $US/kWh
Project Lifetime	30 years (+ 5 yr construction time)
Plant Load Factor	0.817
Turbine Efficiency	0.90

**Gross head is 340.89-343.66 m. Project documents do not present net head. The Upper Arun Hydropower Project included gross head of 509 m and net head of 492 m, with a head "loss" of 17 m. Given the smaller size of the UT-1 facility, 10 meters of head loss was assumed here.*

***The O&M cost equation is an empirical relationship based on the experience of Jim Gordon, a World Bank-sponsored hydropower expert and preferred by hydropower project planners in the World Bank. The original empirical relationship has no coefficient of 2. The coefficient of 2 was added as a factor of safety given the additional costs of operating a hydropower facility in Nepal. The units on the kWhr_cap number are in units of kWh per day of operation. In this case $kWhr\_cap=5.184x10^6$ and $kWhr\_cap/1000/24 = 216$ MW installed capacity. The units on the O&M cost equation are $2015/year.*

2.3. Climate Stress Test

Cloudwater uses a climate stress test as the analytical engine for identifying vulnerabilities of designs or plans and better understanding the performance of a design across a wide range of possible futures. The stress test approach has been described in multiple peer-reviewed journal publications. The process was developed based on research funded by the U.S. National Science Foundation (NSF), National Oceanographic and Atmospheric Agency (NOAA), the Department of Defense (DOD), and the World Bank. The climate stress test is tailored to each study location. In the case of UT-1, the objectives are to better understand how possible climate changes could affect the performance of the investment, whether any vulnerabilities identified require adaptation, and if so, how effective the possible adaptation actions might be.

The climate stress test is an exhaustive exploration of the effects of climate changes and changes in other key factors on the performance of the system. The climate stress test is conducted using a stochastic climate/weather generator that varies weather conditions, linked to a specified climate state, to find the climate states that are problematic for a specific design. The climate/weather generator is used to create time series of daily weather data for a specified time frame (e.g., 50 years) over a specified spatial area that is consistent with a specified climate change. The climate/weather generator is designed such that the mean climate conditions can be changed and then new weather sequences generated that represent the changed climate conditions. In this way, an ensemble of weather time series

is created that will test the sensitivity of the system to changes in mean climate conditions (e.g., changes in mean precipitation and temperature) and variability effects (the natural variability of day to day weather and longer spells due to the earth's climate system). The climate stress test allows efficient and exhaustive sampling of the system's responses to all climate changes. It does not depend on climate projections or "downscaling" methods, and thus avoids all the uncertainties that they introduce, including choice of emissions scenarios, GCMs, downscaling, etc., because the climate stress test explores sensitivity to climate change (rather than sensitivity to a particular climate model's projection of the future).

The schematic diagram of the modeling chain presented in Figure 4 was adapted to the specific application of the UT-1 project. The stochastic climate/weather generator creates a timeseries of weather variables that are used as inputs to the hydrologic model. The hydrologic model in turn produces the streamflow that results from the weather trace. The streamflow is then used by the water resources system model to estimate the performance of the system, including the hydroelectricity production and the downstream flows.

The result of the climate stress test is a dataset of project outcomes and the associated values of uncertain factors that cause those outcomes to occur. This dataset is then used to identify the combinations of factors that lead to unwanted outcomes. Note that outcomes will be primarily in the form of cost-benefit analysis results, although other outcomes, such as firm energy level, etc., will also be considered. These combinations of uncertain factors represent scenarios, and since they emerge from the output of the analysis (rather than being used as inputs) they are described as *ex post* scenarios. Since they are scenarios that cause unwanted outcomes, we define them as risk scenarios. Specific data mining tools are used for the definition of ex post scenarios, including cluster algorithms such as the Patient Rule Induction Method (PRIM). With the risk scenarios identified, two additional analyses can be conducted. First, the relative probability of the scenarios can be estimated to provide a relative ranking of risks and level of concern associated with each. Second, if risks appear that are of relatively high concern, adaptations can be assessed to lower the level of concern.

3. Preliminary Assessment of Climate Risks

The focus of this analysis is to identify possible risks to the UT-1 design that may arise due to climate change. The primary risks to be addressed include:

- Reductions in streamflow, especially low flow season
- Extreme streamflows, including floods
- Changes to rain, snow and snow melt
- Changes in streamflow and effects on sedimentation and landslides
- Disease risks

This section presents modeling results on the risks posed by each of the above.

3.1 Hydrologic Response

This analysis has focused on understanding and describing the hydrologic response of the UT-1 contributing area to changes in climate. Figure 12 summarizes the response of mean total annual, dry season, and wet season streamflow to all plausible changes in climate (percent changes to mean annual streamflow are shown in Figure 13). The contours show the value of mean annual streamflow for the climate changes indicated on the x- and y-axes, with blue showing increases in streamflow and red indicating decreases in streamflow. The circles superimposed on Figure 13 indicate the mean climate changes that are projected by downscaled GCMs for this location. The uncertainty in the GCM projections for this basin are illustrated in boxplots in Figure 3.

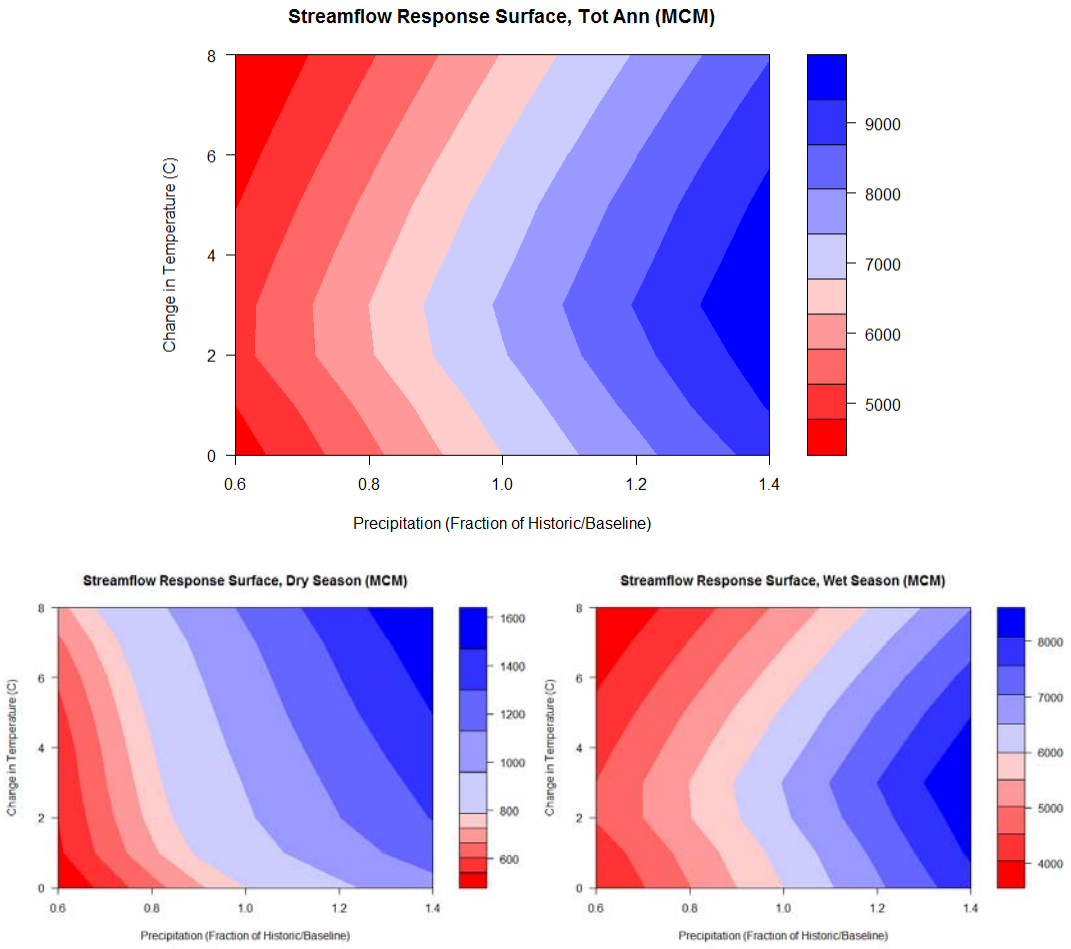


Figure 12. Climate response function of mean annual streamflow in response to changes in precipitation (x-axis) and temperature (y-axis). Streamflow units are MCM/yr (or MCM/season). Blue contours show increases in streamflow and red contours show decreases.

Figure 12 illustrates the 30 year long-term average annual, dry season, and wet season streamflow at Betrawati station, subjected to a range of climate conditions. Precipitation has the dominant effect on streamflow, as demonstrated by the largely vertical contour lines. Streamflow shows a more or less monotonic response to changes in precipitation,

i.e., increases in precipitation result in increases in streamflow and decreases in precipitation result in decreases in streamflow.

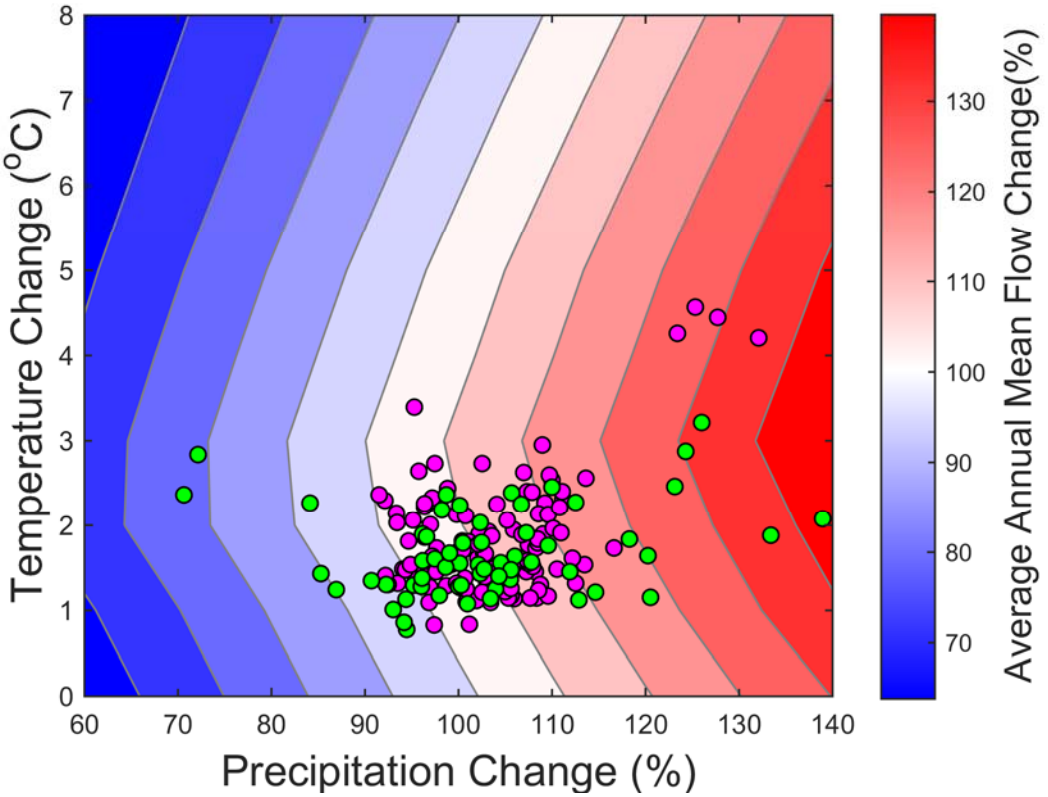


Figure 13. Change in average annual mean flow (% of baseline/historic). Green dots are all CMIP3 climate change scenarios. Purple dots are all CMIP5 climate change scenarios.

Temperature effects are smaller but more interesting. Over the course of the 30-year simulation, a critical inflection point in the flow pattern occurred at an increase in temperature of approximately 3 degrees C. When the system was simulated with temperature increases less than 3 degrees C, the "increased" temperature exhibited a positive effect on streamflow resulting from greater quantities of meltwater contribution from snow/glacier. However, with temperature increases larger than 3 degree C, the streamflow gains are reversed as increasing rates of evapotranspiration and diminishing returns from a shrinking (receding) glacier decreased the total rate of flow (see Figure 14). This phenomenon is especially evident in the wet-season response, as most of the meltwater is contributed after March, the final month of the dry season.

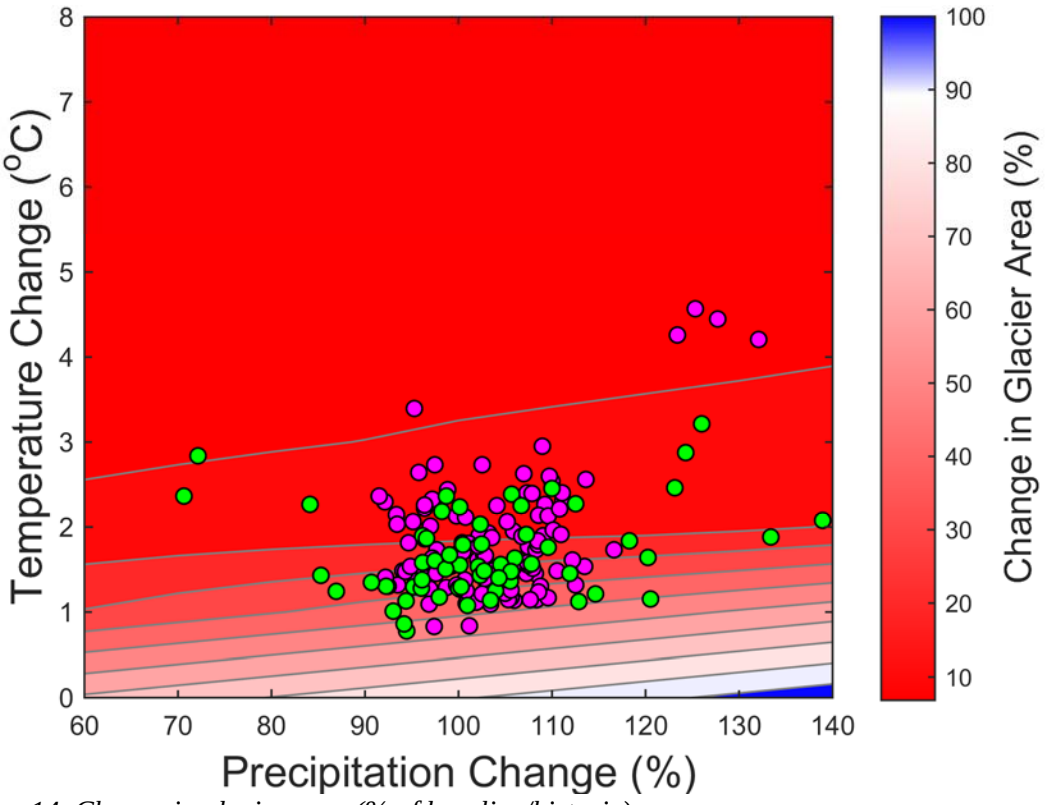


Figure 14. Change in glacier area (% of baseline/historic).

Figure 14 shows percentage change of glacier volume under a range of temperature and precipitation changes. The analysis is based on glacier coverage map data obtained from the Randolph Glacier Inventory version 3.2 (RGI 3.2, Pfeffer et al., 2014), and glacier volume was estimated using the multivariate glacier area-volume scaling relationships proposed by Grinsted (2013). Temperature is the dominated factor in the recession of the glacier area, as evidenced by the largely horizontal contour lines. Figure 14 explains the 3 degree inflection point in the streamflow response surfaces of Figure 12 and Figure 13. Because a 3 degree C temperature increase throughout the 30-year simulation reduces the glacier volume to less than 20% (relative to the initial volume), the remaining glacier area/volume is insufficient to continue to sustain streamflow at historic levels.

Climate projections from the CMIP 3 ensemble present a greater degree of uncertainty in precipitation, but less uncertainty (smaller spread) in forecasted temperature. The CMIP 5 ensemble shows mostly positive precipitation change (with less spread than CMIP3), and a temperature increase of approximately 2 degrees C. The result is substantial uncertainty in future streamflow conditions.

The climate change projections show a range of changes in precipitation from a 10% reduction in precipitation to a 20% increase in precipitation, with a few projections showing even larger increases. Projected temperature increases generally range from 1 to 3 degrees C. Because these projections have not been evaluated for their ability to

reproduce the climate in this region, they cannot be interpreted as particularly meaningful. In addition, the ensemble of climate projections is a relatively arbitrary sampling (which is typical of climate modeling) and so caution must be exercised when interpreting the location of the circles.

It is worth noting that no clear risks to the project are identified within the range of the projections, except possibly in terms of larger high flow values in the future. The range of projections in Figure 13 almost all show increases or no change in streamflow. There does not appear to be a large risk associated with reductions in streamflow that would affect the economic performance of the project. Nonetheless, the question of reduced future streamflow is explored in greater detail later in this section.

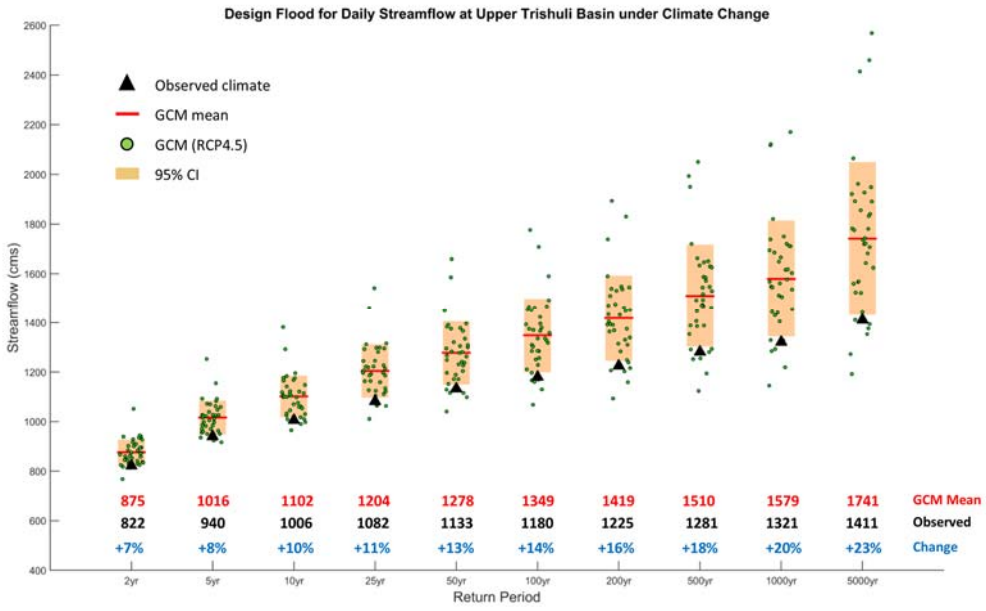


Figure 15. Design flood for daily streamflow under climate change.

The results of the streamflow response surfaces imply greater risk of increased streamflow in the 30-year lifetime of the hydropower facility (potentially with increased frequency and severity of floods that could damage the structure) than decreased streamflow. In order to examine these risks, we developed design flood estimates by fitting annual maximum streamflow series to the Log Pearson Type III distribution (the standard for the flood frequency analysis adopted by the US Army Corps Bulletin 17B). The black triangles in Figure 15 are modeling results, and therefore not a perfect reproduction of return periods for historical observations. The design flood estimates based on observed streamflow are provided in Figure 16. Due to an underestimation bias in the model representation of high flows (owing mostly to un-reconcilable data inadequacies), the absolute values in Figure 15 are not good indicators for evaluation. Nonetheless, the analysis of the percent change between modeled streamflow based on historical observations of climate and modeled streamflow based on projected future climate from GCMs is useful. The percentage change in the magnitude of flood increases approximately linearly with return periods of up to 500 years under CMIP 5 RCP 4.5. More extreme return periods (e.g., 1000, 5000 years) exhibit

nonlinear responses relative to the historic. The conclusion to examination of Figures 15 and 16 is that the 5000-year flood may increase in magnitude by between 20% and 25%. This greater magnitude of the 5000-year flood has been accounted for in the engineering design, as explained in Chapter 5.

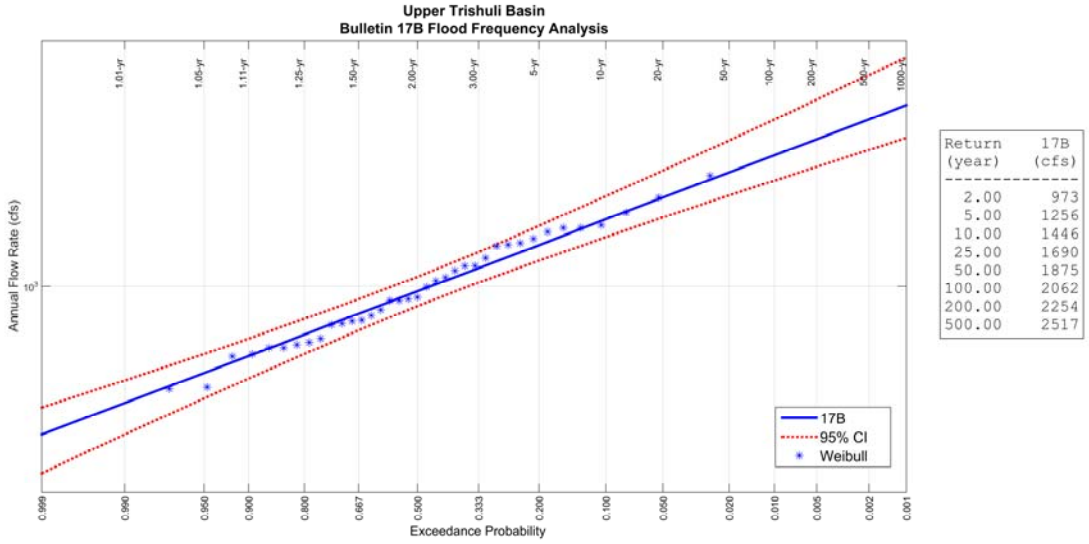


Figure 16. Flood frequency analysis (after Bulletin 17B).

Returning to the analysis of potential changes to low season flow, Figure 17 shows hydrographs for increases in temperature of 2, 4, 6 degrees C compared to current conditions. As can be seen, the warming climate causes a significant increase in dry season streamflow, likely due to melting of glaciers and the immediate runoff of additional winter rainfall (that historically fell as snowfall).

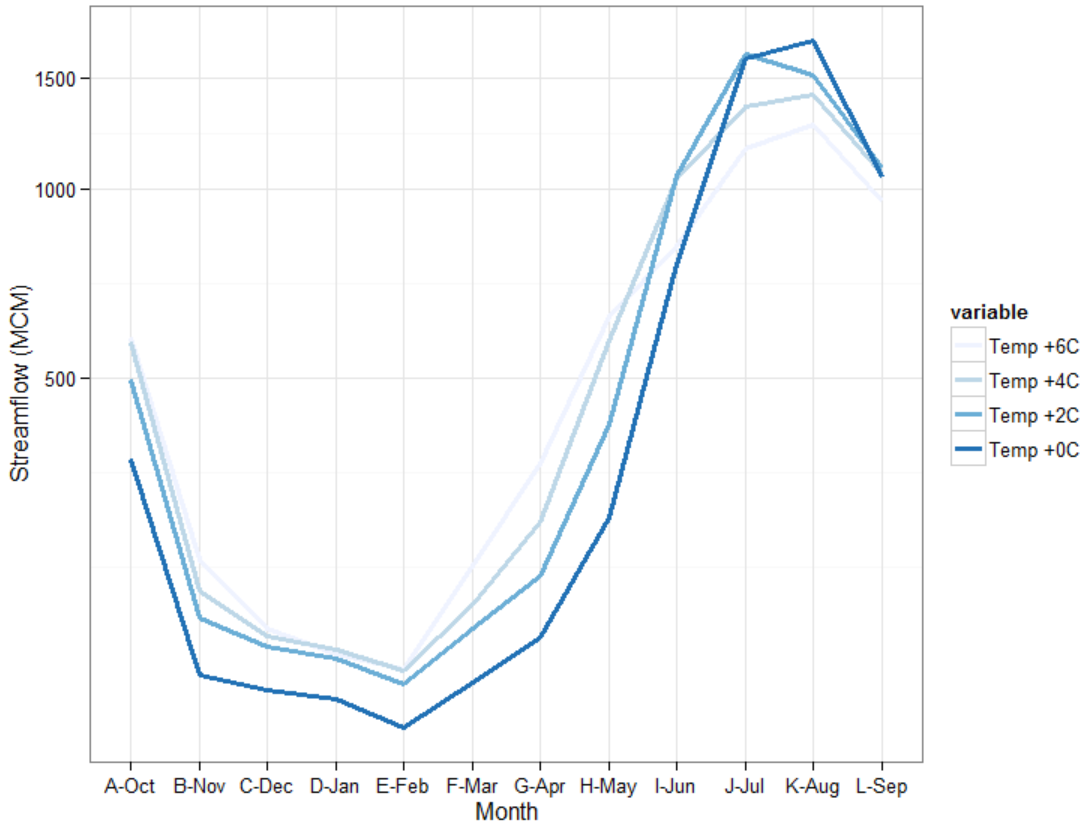


Figure 17. Shift in Seasonality due to climate change.

Figure 18 shows the number of days with flow less than the plant discharge (76 m^3/s) (a minimum requirement for generating hydropower in the full capacity) under various climate change conditions. The result indicates that there is a small chance to have increased number of days not meeting the plant discharge under the climate change conditions; i.e., precipitation decrease by 20% or more with temperature increase less than 2ºC only causes increase in the number of days below 76 m^3/s. Both precipitation and temperature are factors that substantially influence the changes in this metric. Precipitation increase by 10% greatly reduce the number of days below 76 m^3/s, even with moderate increases in temperature (e.g., increases less than 1ºC). According to the future projections of precipitation and temperature from both the CMIP 3 and 5 (purple and green dots in Figure 18, respectively), future scenarios that this system is safe from the threatening with more frequent occurrences of low flow becomes more persuasive. Since the average number of days from observed streamflow is about 160 days, the change corresponding to 12 %, which is the biggest change under GCM climate change scenario, indicates that the average number of days below 76 m^3/s throughout a year is approximately 20 days.

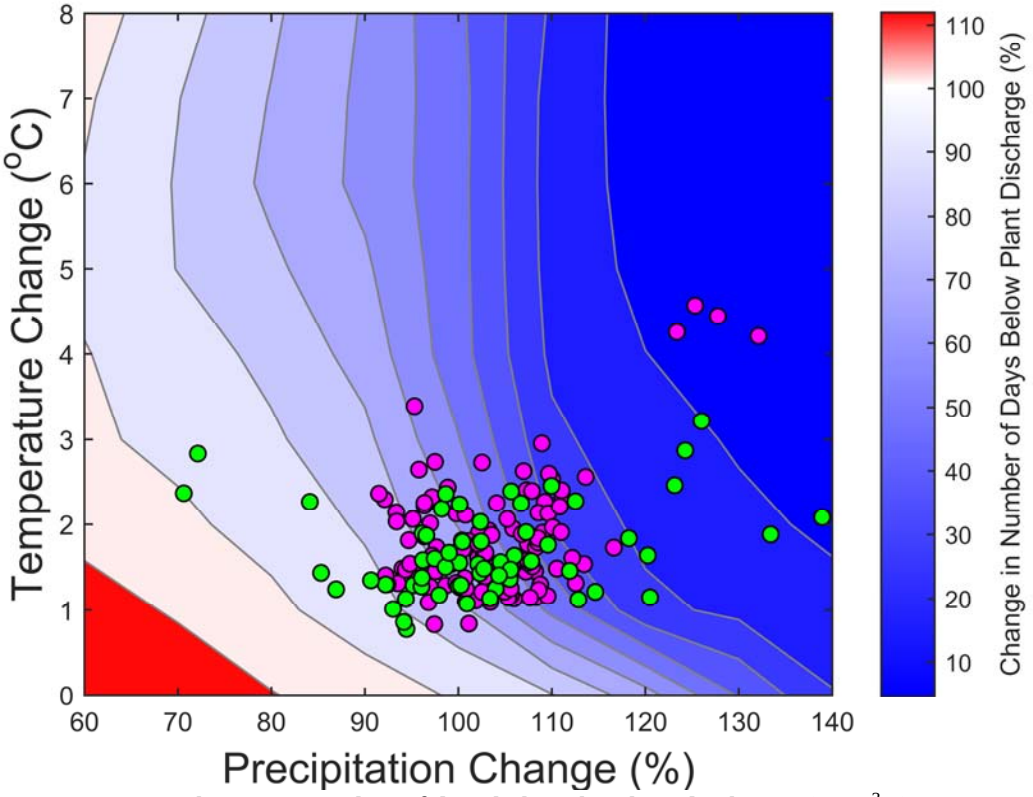


Figure 18 Percent change in number of days below the plant discharge (76 m^3/s).

For the concern of the environmental flow requirement, Figure 19 shows the results of a frequency analysis for annual minimum 7-day low flow using the Log Pearson Type III probability density function. The CMIP5 GCMs with RCP 4.5 emission scenario project an increase in the 7-day minimum flow in the future. Analysis of the percent change between modeled streamflow based on historical observations of climate and modeled streamflow based on projected future climate from GCMs is also made for the design 7-day low streamflow. The percentage change in the magnitude of design low flow increases approximately linearly with return periods of up to 5000 years under CMIP 5 RCP 4.5 scenarios.

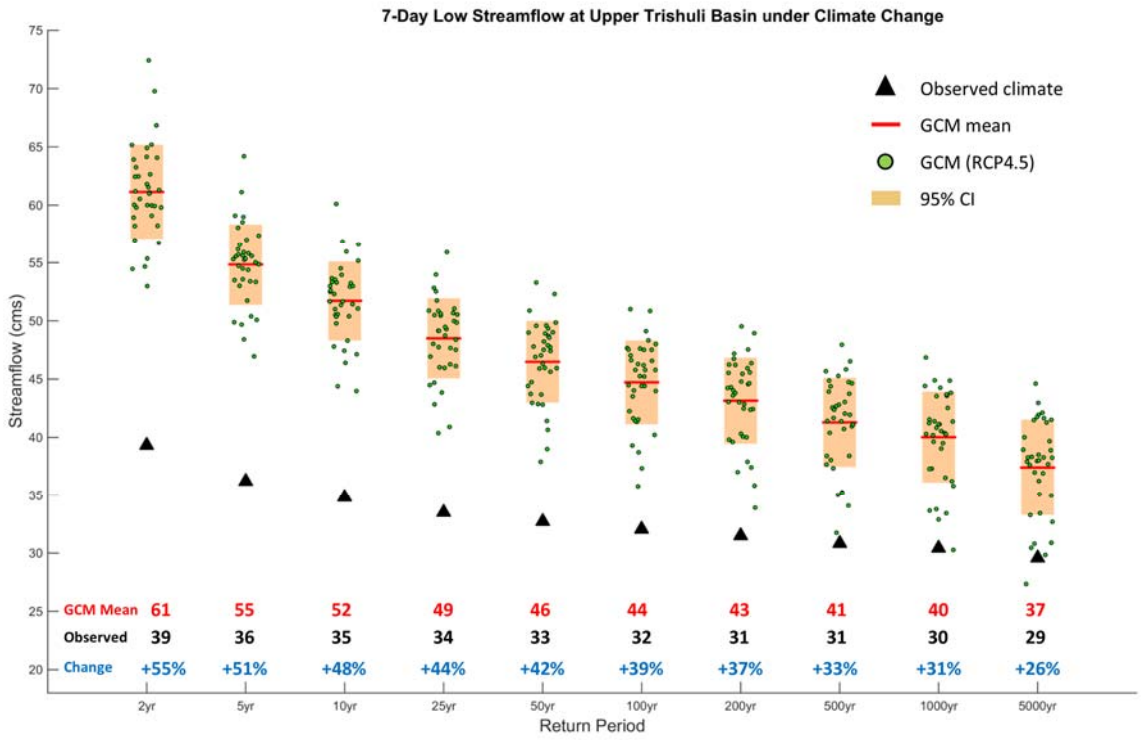


Figure 19 Frequency analysis with the Log-Pearson Type III for 7-day low streamflow at UT-1 basin under climate change.

These results, in combination with Figure 17, suggest that the level of concern associated with reductions in low season flow can be low.

3.2 Response of Hydropower Production

The hydropower response generally follows the streamflow response, as shown in Figure 20. With up to 2 degrees in warming, the high-value dry season electricity production is expected to increase from approximately 470 GWhr to approximately 550 GWhr. With 2 degrees of warming, total annual hydropower production increases from approximately 1515 GWhr to approximately 1640 GWhr, and with 3 degrees of warming the increase is to 1665 GWhr. The larger percent increase is in the dry season.

Care should be taken not to falsely associate colors in the 3 plots of Figure 20. Each color scheme is unique to the time period described, and relative to the respective mean.

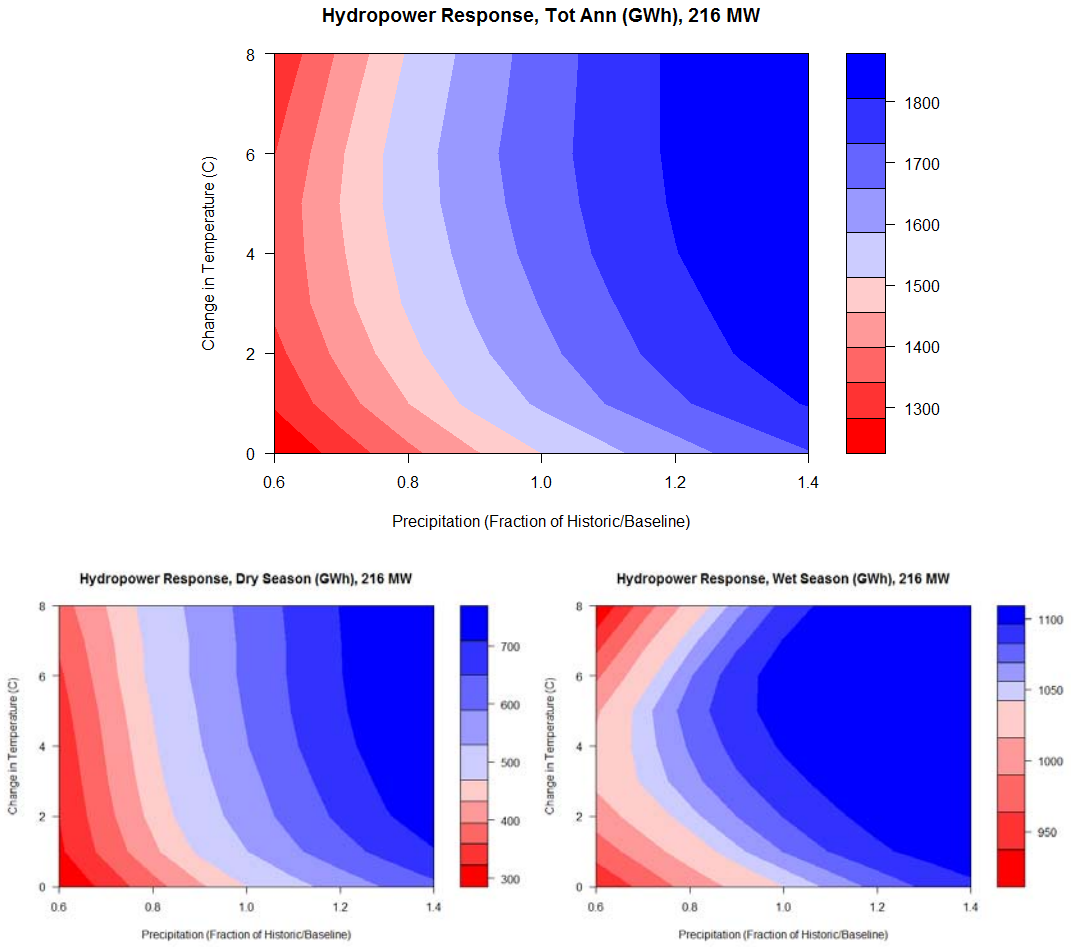


Figure 20 Hydropower generation climate response surface.

3.3 Response of Economic Performance

The range of possible economic performance under climate change is presented in Figure 21. Under baseline conditions (no change in precipitation or temperature), the NPV over the 30-year design lifetime of the project was estimated to be approximately $365M. Within the range of climate change explored, the NPV remained positive, increasing in "favorable" future climates to over $700M, and decreasing in "unfavorable" future climates to approximately $125M. More likely, with a 2 degree increase in temperature and a negligible change in mean annual precipitation, the increase in NPV would be to $475M. A 3 degree increase in temperature with negligible change in precipitation would result in an NPV of $500M.

The findings of Figure 21 are sensitive to assumptions regarding discount rate, capital/O&M cost, and electricity price, as summarized in Table 2. It is also assumed that all electricity produced is sold, meaning that we only model the supply-side of the energy markets. This assumption is contingent in large part on energy-trading agreements between India and Nepal, and should be approached with caution.

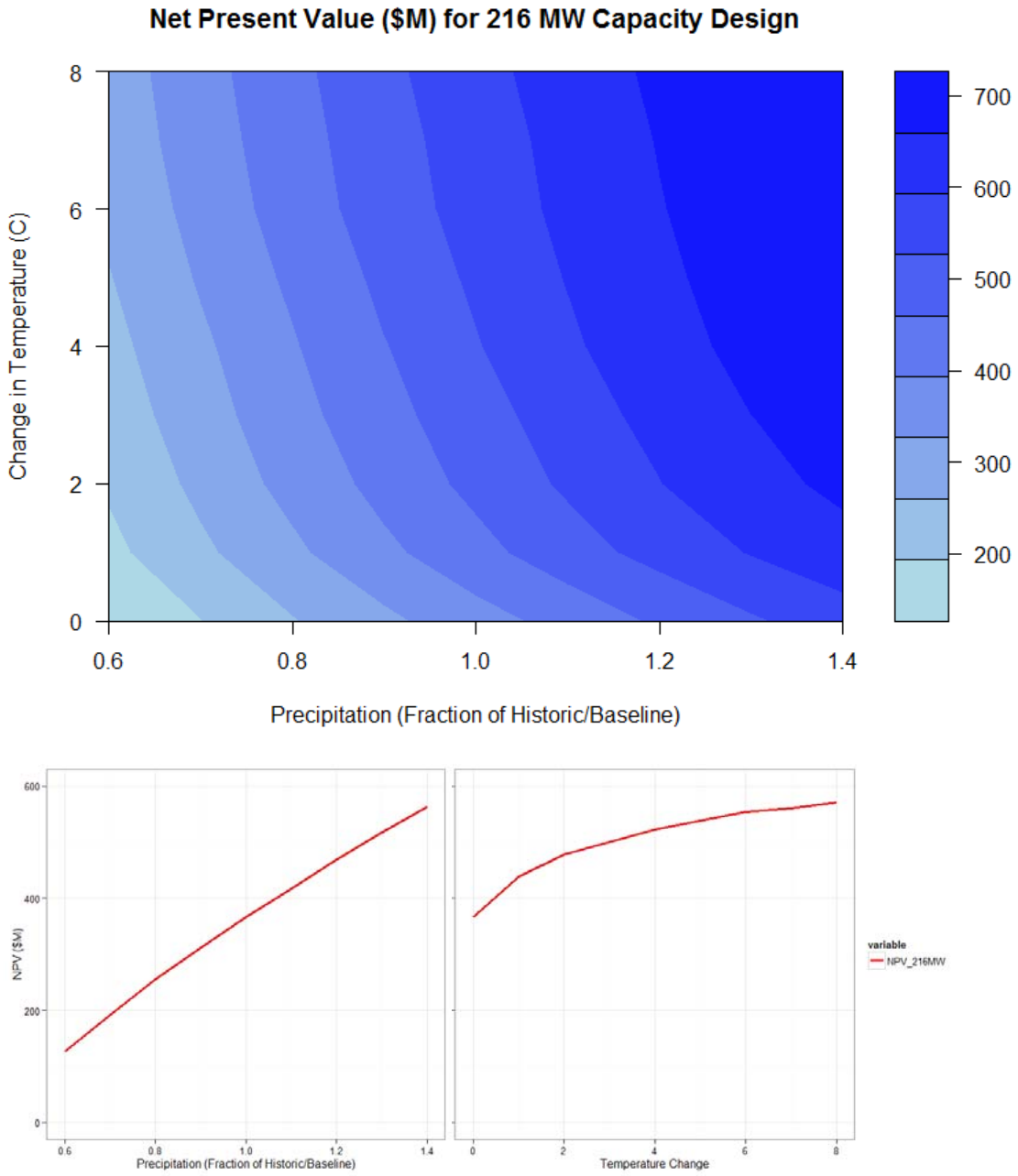


Figure 21 Range of possible economic performance of UT-1 hydropower plant under climate change.

3.4 Effect of Changes in Upstream Water Demand

One of the major concerns for a PROR dam is inflow changes due to upstream development. The changing volume and timing of upstream inflow caused by the upstream human development might affect the designed hydropower generation of the UT-1 project. In this section, we comment the effect of changing upstream water demand on streamflow.

The following figures show the current dominant land use/land cover (Figure 22a) and percentage of cropland inside the UT-1 basin (Figure 22b) according to FAO Global Land Cover SHARE database. Most of the crop lands are located downstream of the dam site and only 3.1% of the upstream land has crop activities. These figures indicate that under the current conditions, upstream water demand is not a major factor. Because domestic water use is relative small, no evidence of industrial water uses exist, and agricultural water uses is also understood to be limited based on the small percentage of cropland.

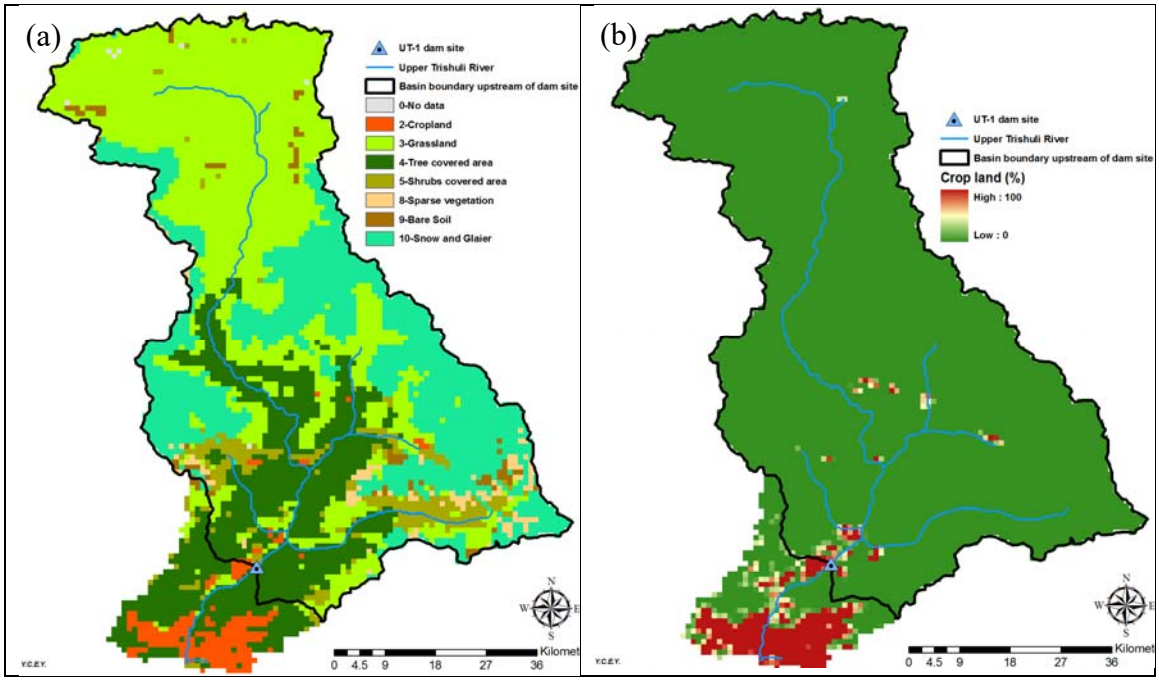


Figure 22 (a) Dominant land cover for the UT-1 basin; (b) Crop land percentage for the UT-1 project. Maps are created from FAO Global Land Cover SHARE database.

There is no evidence of any future industrial development upstream of the dam site. Due to the topography constraint, a dramatic population growth in the near future is unlikely. Therefore, no significant changes in industrial and domestic water uses are anticipated.

We evaluate potential agricultural water uses changes by comparing with other mountain agricultural developments plans in Nepal. High Value Agriculture Project in Hill and Mountain Areas (HVAP) is a joint project between Ministry of Agricultural Development and International Fund for Agricultural Development (IFAD) and focuses on the western districts of Nepal (e.g., Achham, Jumla, Salyan). The purpose of this project is to integrate the rural poor in high value agriculture and non-timber forestry products and the goal is to reduce poverty and vulnerability of people in the hill and mountain areas. Project components include: 1) making a marketing arrangement for producers and consumers; 2) providing service support for the market; and 3) providing technical support for the project management. Only a small part of the HVAP is to build infrastructure (road) to physically connect to a small number of more remote communities. No expansion of cropland has been proposed. We assume that if similar projects take place in the UT-1 basin, no

significant change will be made on the current cropland. Therefore, no significant future agricultural water uses changes is projected in the UT-1 basin. The details of HVAP can be found on the official website http://www.hvap.gov.np/index.php.

In sum, based on our analysis, the effect of changing upstream water demand on UT-1 project is negligible.

3.5 Possible Disease Effects

According to a 2005 World Health Organization (WHO) report: "The effect of irrigation and large dams on the burden of malaria on global and regional scale" quantified the risk of public health caused by water project development and operation. Following the same concept, we evaluated the effect of additional surface (inundation) area causes by the weir construction and further link that with additional risk of the burden of malaria. According to Table 1.6-1 of the "Hydrologic Analysis" of the UT-1 design documents, we plotted the water level-surface area rating curve under natural condition and after weir construction. We also calculated the difference of surface area between these two curves in Figure 23. The maximal additional surface area that cause by weir was calculated to be 4,439 m^2 (when water level is 1243 meters above mean sea level, masl).

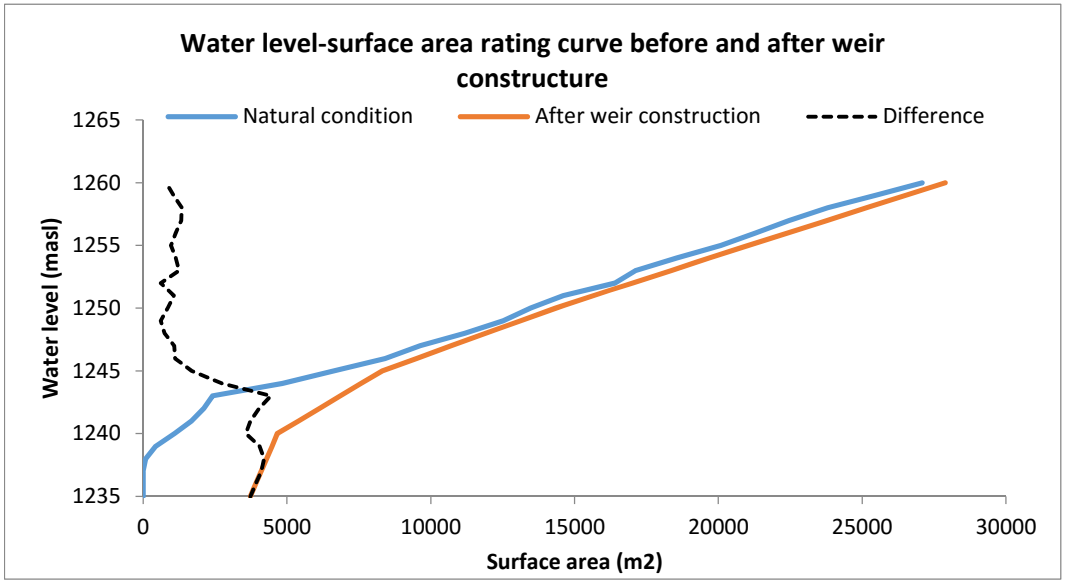


Figure 23 Rating curve for water level and surface area of the UT-1 project under current and after weir construction condition.

Following the WHO 2005 report, we estimated mosquitoes' flight range change due to the weir construction. Figure 24 shows how the estimation was made. In Figure 24, the green polygon is the original surface area under natural condition and the blue polygon is the additional surface area causes by the weir. In reality, this blue part has an irregular shape and is difficult to estimate the width of it without the original digital elevation map (DEM) data used by the design document. In this study, we followed the WHO 2005 report and used a rectangular shape as a proxy. The width of the weir is 30.85 m and under the extreme condition the longest length of the blue part is 143.9 m (4,439/30.85). According to Boyd

(1949), the typical fight range of mosquitoes is 2,000 m. So the additional surface area cause by the weir will only increase maximal 7% (143.9/2,000) of mosquitoes' flight range. Given the sparse population located in this range, we conclude the possible disease risk cause by the UT-1 project is low.

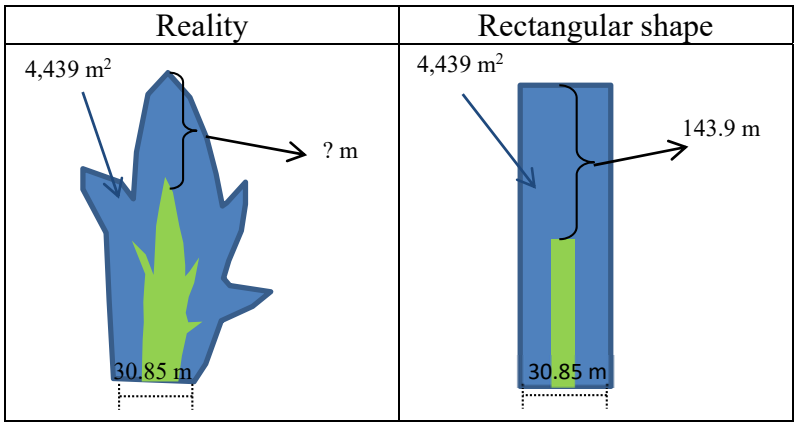


Figure 24 Estimation of area at risk of malaria near dam.

3.6 Structural Stability and Dam Break

A comprehensive analysis of dam structural stability and dam safety is beyond the scope of this climate change analysis, as the topic involves structural engineering, geology and seismology. In this study, we only evaluate the dam safety issue from the hydrological perspective by comparing designed capacity of weir and the peak flow under climate change impact.

According to the UT-1 dam design documents, the capacity of weir discharges is 3,563 m^3/s (corresponding to return period 5,000 years) and 3,276 m^3/s (corresponding to return period 2,000 years) when one gate malfunctions. We compare these two values with the frequency analysis presented in a previous section and use Figure 25 to explain the result. In Figure 25, the black triangle is the result from long-term historical streamflow data. The values are the same as Table 1.3.1-5 in the "Hydrologic Analysis" of the UT-1 project design document. Since we used two probability distributions, Gumbel and Log Pearson Type III in our frequency analysis under climate change, we have two changing percentage values for each return period. We used these two changing percentage values, multiplied them by the historical values based on the frequency analysis (black triangles) and plotted them as orange box in Figure 25. Two horizontal lines were added to represent design capacities for 3,563 m^3/s (red) and 3,276 m^3/s (purple).

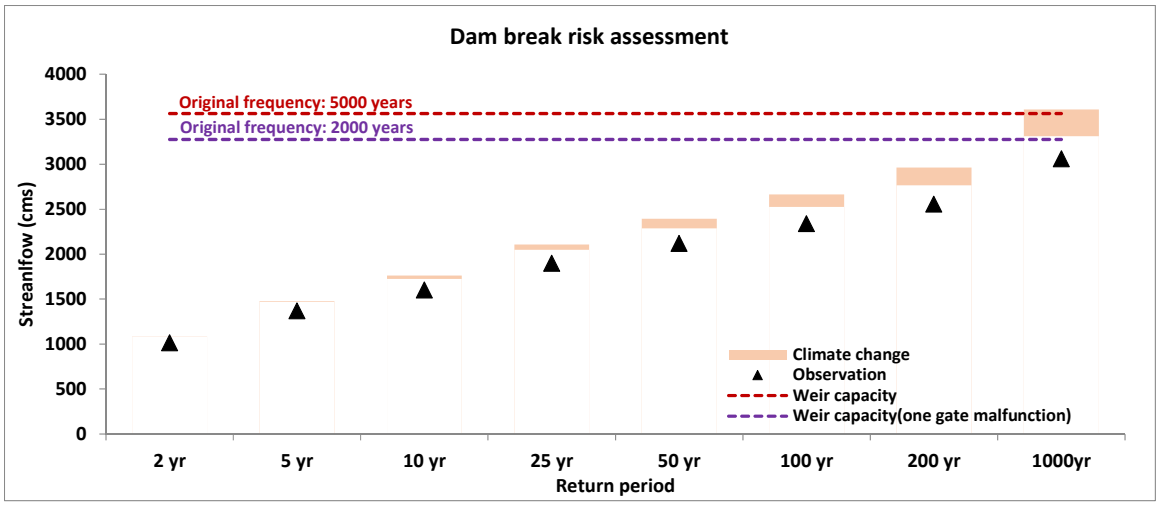


Figure 25 Compare weir designed capacity of UT-1 project with flood frequency under climate change impact.

The impact of climate change is expected to increase streamflow volume for a given return period or reduce return period for a given streamflow volume. For example, under the historical climate, 2,300 m^3/s is a 100-year flood. The same volume of streamflow becomes a 50-year flood under climate change impact. Therefore, climate change impact does post a threat on weir capacity design. However, the original design can be seen as "overcapacity" since it uses 5,000 and 2,000 year return period as design standard. This is addressed in Chapter 5.

4. Possible Adaptation to Address Climate Risks

The previous section discussed some of the vulnerabilities that were identified during the preliminary analysis. The next step in the analysis is the assessment of the risks associated with those vulnerabilities, and the consideration of possible adaptations to reduce risks. Risks are estimated by assigning probabilities to the conditions that cause vulnerabilities. For each of the risk scenarios defined above, a probability estimate is assigned to that scenario based on available information. Since the probabilities are necessarily subjective, the term "level of concern" is used to clarify the purpose of the probabilities. Level of concern is estimated based on three factors: 1) theoretical basis for the climate change (i.e. atmospheric science); 2) observations of the climate change (i.e. historical trend); and 3) modeling projections of the climate change (i.e., GCM results). The level of concern is higher when the three factors are in agreement regarding a particular change. An example is warming temperatures, where there is a clear theoretical basis for why temperatures are warming, the observed record shows temperatures increasing, and climate change projections indicate further increases. Probability estimates may also be applied to other uncertain factors if reasonable means of estimating them are available.

Table 3 summarizes the results of the preliminary risk assessment. In general, the risks of climate change to UT-1 can be described as low. The project is designed conservatively in terms of the expected flows needed for hydroelectricity generation. The sedimentation

basin, weir and spillway, which may be considered the most potentially vulnerable aspects of the design, have been designed conservatively. The climate stress test analysis revealed that low flows are largely insensitive to plausible changes in climate.

Table 3 Preliminary assessment of risks.

Risk	Cause of Concern	Level of Concern
Flood	• Climate change may cause extreme streamflow to increase in volume or frequency • Climate stress test indicates that climate warming could increase extreme design flows by about 20% • Spillway is designed for 5000 year flood which is quite conservative • Design based on Gumbel extreme value distribution; other distributions would yield a much higher flood magnitude for the 5000 year flood (e.g., log Pearson Type III) • Increasing weir/spillway capacity may be considered	Low
Sedimentation	• Climate change may increase sedimentation rates due to increases in the intensity of precipitation • Sedimentation rates are already high • Sedimentation basin has been designed quite conservatively • May consider operational approaches to managing sedimentation events	Low
Missed opportunity	• Failure to capitalize (regret) on potentially increasing flows by not increasing the capacity of the headworks and turbines	Not modeled at this stage
Reduced low flow	• Climate change may cause a decrease in streamflow during the low flow season • Low flow season streamflow is vital to energy production needs in Nepal • Climate stress test revealed that low flow season flows are largely insensitive to climate warming • Precipitation changes may cause increase in low season flows • No clear indication that low flows are a concern	Very Low
Structural stability and dam break	• To be determined	Low, based only on risk of increased precipitation-based flood
Disease	• To be determined	Low, based on mosquito analysis

The potential for climate change to effect high flows deserved close attention, and possible adaptation. Increasing precipitation and increasing intensity of precipitation are both generally consistent with the expectations for a warming climate. Both could contribute to

increases in flood flows and increases in sedimentation. Thus the adaptation analysis focused on addressing these possible concerns.

5. Proposed Adaptation Subsidy

The weir and spillway is currently designed for the 5000 year recurrence interval flood event. The spillway is designed to safely pass flows that exceed the capacity of the headworks and weir. This is a conservative design and exceeds the design capacity of the downstream structure. There is a great deal of uncertainty associated with estimating the level of a 5000 year event, since such events are very rare, an in fact, never yet experienced in the flow record. As a result, the flow level associated with such a design event is sensitive to the extreme value distribution (i.e., statistical model) used to estimate the event. The analysis of the hydrologic contractor showed a range of 3,428 cm^3/s to 5,411 m^3/s for the 5000 year event based on the choice of extreme value distribution. The selected design event was 3,563 m^3/s, which is the low end of the aforementioned range. The largest design flow value was based on the log Pearson Type III extreme value distribution, which is the distribution preferred by the US Army Corps of Engineers.

The sedimentation basin performs the role of reducing streamflow velocity such that suspended solids can settle to the bottom in the basin rather than in other locations which would reduce the capacity of the headworks or damage turbines. The sedimentation design is quite conservative and is likely to handle possible increased sedimentation due to climate change. Nonetheless, low cost adaptation may be considered to address the large degree of uncertainty associated with possible future climate changes.

Table 4 summarizes elements of the proposed design already accounting for climate change above and beyond "business as usual" safety factors. The primary functions of the climate-robust design elements are river diversion, design modifications to account for the increased likelihood of glacier lake outburst floods (GLOFs) in a warmer future, and an extra-capacity de-sanding basin to account for the risk of increased turbidity due to greater precipitation variability in the future. The total value of the climate-robust design elements is approximately $55M, and is eligible for blended finance under IFC regulations. Table 4 is preliminary, and represents no promises of the IFC at this stage.

Table 4 Blended finance for UT-1 investments in climate change robustness.

	Component	Units	Event	Cost with provision for climate change	Cost business as usual	Diff.	Remarks
1	River diversion works (The design flood proposed for the diversion scheme is the 2 year return period wet season event with a magnitude of 1,012 m3/s.)			18,900,000			
2	Design flood for weir 5,000 year (3,563 m3/sec) to withstand GLOF*		GLOF	21,300,000			
3	Dam foundation to cope with the 5,000 year flood to withstand GLOF		GLOF				
4	Large gates to release extreme discharges (10,000 year ?) and sediments; A gated concrete intake weir containing 3 spillway bays; 3 radial gates 11.0 m wide x 16.5 m high						1 extra gate supplied for safety factor
5	Addition of Gravel Trap, Tranquilizing basin & Undersluice						
6	Desanding basins (The concentration varies from a minimum of 35 mg/l in January to a maximum in July of 1798 mg/l.) **			14,300,000			
7	Intake designed to operate with the reservoir completely filled with sediments, meaning that even with a sediment load significantly larger than anticipated the intake should be able to cointinue to operate as designed						
8	An access is provided to facilitate heavy equipment access to the area of the intake for clean out during the low-flow period, in case of severe sediment loading ***						
9	Cost of hydraulic model tests to address climate change concerns			250,000	0		
10	Cost of hiring Cloudwater to conduct climate change analysis	LS	Both monsoon and low flows	150,000	0		
11	Real time sediment monitoring			150,000	0		
12	Early warning systems	LS					

13	Underground powerhouse avoiding the risks of a major GLOF flooding vs. Surface powerhouse			
14	Turbines coating			
15	Provide extra spillway capacity on the left bank			to be modeled and costed
16	Generation foregone due to flushing based on real time sediment monitoring	GWh	Monsoon sediments reaching above 5,000 ppm	

*In business as usual the option could have been 3,276 m^3/s (2,000 year frequency) m^3/s (2,000 year frequency)
**Basin length to exclude particles less than 0.2 mm from passing through the turbines
***The bridge over the weir which supports the spillway gantry crane and as a maintenance access for the weir has been designed as precast concrete box elements tied together transversally by post-tensioned tendons.

An optimization exercise was carried out by the designers to determine the size and the number of the flushing channel/culverts and the gradient of the flushing tunnel. The flushing plan adopted for the Project will be to close off one desander at a time leaving two units operating. It has been estimated that the loss of generation time will be 5% annually. The flushing cycles for the desander vary according to the month of the year. For January to April and November and December flushing will take place once per month for the remaining months the following frequencies have been estimated: May – 4 times; June- 9 times; July 19 times; August – 13 times; September – 8 times; October – 3 times.

6. Conclusions and Recommendations

This report has analyzed in depth the climate change related risks to the UT-1 hydropower project and concluded the associated risks to the structure and performance of the proposed UT-1 hydropower facility to be low, as summarized in Chapter 4. Conclusions are limited by the available data on historical climate in the basin and region, and in statements regarding likelihood, the conclusions are limited by the quality of the best available GCM projections. Economic performance projections are further subject to uncertainties in electricity markets, discount rates, O&M costs, and transmission infrastructure, among other things. Chapter 5 has presented climate-robust design modifications already incorporated into the UT-1 proposal. The design modifications presented in Chapter 5 address most of the concerns raised in Chapter 4, and as such are eligible for blended financing by the IFC.

Appendix: Cost Estimate for Items 1, 2 and 3 by Hydro Lab, Nepal

Item 1: Real Time Sediment Monitoring System
Item 2: Stream-flow Monitoring and Early Warning System
Item 3: Sediment guided operation system

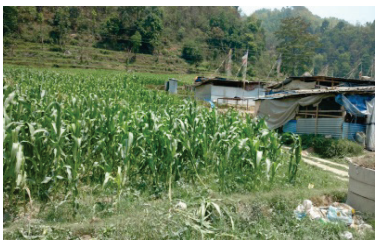
Appendix G
Stakeholder Engagement Plan and Community Grievance Redressal Mechanism









Stakeholder Engagement Plan and Grievance Redressal Mechanism

Upper Trishuli-1 Hydropower Project, Nepal

Draft Report

June 2018

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ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
AoI	Area of Influence
CDO	Chief District Officer
CLO	Community Liaison Officer
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESS	Environmental and Social Standards
FGD	focus group discussions
FPIC	Free Prior Informed Consent
GRM	Grievance Redressal Mechanism
IFC	International Finance Corporation
INGO	international nongovernmental organization
LALRP	Land Acquisition and Livelihoods Restoration Plan
LRP	Livelihood Restoration Plan
NGO	nongovernmental organization
NPR	Nepalese Rupee
NRA	National Reconstruction Authority
NWEDC	Nepal Water and Energy Development Company
PAF	Project Affected Family
PDA	Project Development Agreement
Project	Upper Trishuli-1 Hydro Power Project
PS	Performance Standard
SEP	Stakeholder Engagement Plan
SIMF	Social Impact Management Framework
VDC	Village Development Committee

WBG- World Bank Group

1 INTRODUCTION

This document presents the updated Stakeholder Engagement Plan (SEP) and Grievance Redressal Mechanism (GRM) for the proposed Upper Trishuli-1 Hydro Power Project (the Project), to be constructed by the Nepal Water and Energy Development Company (NWEDC). This document has been prepared as part of a larger Social Impact Management Framework (SIMF), with the aim of guiding the stakeholder consultation and grievance redressal processes across the life of the Project and during the implementation of the management plans formulated as part of the Environmental and Social Impact Assessment (ESIA) and SIMF.

The main purpose of this plan is to allow the stakeholder engagement to be undertaken in a systematic manner that will allow the various stakeholder groups to express their individual views and opinions, and the Project to appropriately respond to them. The plan is aimed at enabling active meaningful engagement with the stakeholder groups by identifying different mechanisms for the participation of stakeholder groups, especially vulnerable groups.

1.1 CONTEXT OF THE SEP AND GRM

The Project is being developed as a 216 megawatt green field run-of-the-river project located in the upper part of the Trishuli watershed, approximately 50 kilometres north of Kathmandu. The project area of influence [AoI] is located in the former Haku, Ramche, and Dhunche Village Development Committees (VDCs), Rasuwa District in the Central Development Region of Nepal, (the Project's AoI currently includes four out of the five Gaonpalikas). In March 2012, the International Finance Corporation (IFC) Infra-Ventures signed a Joint Development Agreement with Korea South-East Power Co. Ltd, Daelim Industrial Co., Ltd; Kyeryong Construction Industrial Co. Ltd.; and Jade Power Private Limited to develop the Project. The Project Development Agreement (PDA) with the Government of Nepal was signed on 29th December 2016.

As part of this Project and in keeping with the applicable reference framework, a number of environmental and social assessments were performed and management plans were developed. These plans included a SEP and a GRM that formed part of a Livelihood Restoration Plan (LRP) prepared in 2015. The community engagement undertaken as part of the LRP development, indicated that although the local people reportedly feel the Project is a positive and they are keen to work with the Project proponent, there were concerns voiced in regard to the pending compensation for structures, impacts of the Project on the forest cover, land availability, pollution, and social and cultural problems in the area.

Based on the SEP and GRM requirements, the Project initiated further stakeholder engagement activities. However, in April 2015, Nepal was struck by a severe earthquake that resulted in the suspension of the engagement activities, and focus shifted to relief and rehabilitation of the communities displaced by the earthquake. While the SEP focused primarily on the Project Affected Families (PAFs), the focus in the post-earthquake scenario shifted towards the local community in the Project area.

The 2015 earthquake also resulted in changes in the Project baseline. These changes included residences, asset ownership, livelihood profile, financial status of the Project, and stakeholder expectations from the Project. Due to these changes, the impact assessments, management plans, and 2015 LRP needed to be updated.

This SEP and GRM were prepared taking into account the changes caused by the earthquake, to provide a mechanism for engagement and grievance redressal for the duration of the Project life cycle.

1.2 AIMS AND OBJECTIVES OF THE SEP AND GRM

The IFC Stakeholder Engagement Handbook defines stakeholder engagement as "a means of describing a broader, more inclusive, and continuous process between a company and those potentially impacted that encompasses a range of activities and approaches and spans the entire life of a project." The specific objectives of the SEP are:

- Identification and analysis of the stakeholder groups and their profiles, interests, issues/impacts and concerns relevant to the Project;
- Identification of specific measures to allow meaningful engagement with the different stakeholder groups in a manner that is transparent and accessible and using culturally appropriate communication methods with a specific focus on vulnerable groups;
- Allow for a relationship to be built with the various stakeholders of the Project based on mutual respect and trust;
- Facilitate adequate and timely dissemination of information to the stakeholder groups in a culturally appropriate manner;
- Provide systems for prior disclosure/dissemination of information and consultation, including seeking inputs from affected persons, incorporation of inputs, as applicable, and providing feedback to affected persons/groups on whether and how the input has been incorporated;
- Providing mechanisms for feedback and dispute resolution; and
- Providing a mechanism for documentation of the activities undertaken and the reporting and monitoring of the same.

Grievance redressal is one of the most critical components of effective stakeholder engagement. The IFC Good Practice Note on Addressing Grievances from Project Affected Communities (2009) defines a grievance as "a concern or complaint raised by an individual or a group within communities affected by company operations. Both concerns and complaints can result from either real or perceived impacts of a company's operations, and may be filed in the same manner and handled with the same procedure." The purpose of a GRM is to provide a forum to the internal and external stakeholders to voice their concerns, queries and issues with the Project. Such a mechanism would provide the stakeholders with one Project personnel or one channel through which their queries will be channelled as well as ensure timely responses to each query. The specific objectives of the GRM are as follows:

- To allow stakeholders the opportunity to raise comments/concerns;
- To structure and manage the handling of comments, responses and grievances, and allow monitoring of the effectiveness of the mechanism; and
- To ensure that comments, responses, and grievances are handled in a fair and transparent manner, in line with the applicable reference framework.

1.3 PRINCIPLES OF STAKEHOLDER ENGAGEMENT AND GRIEVANCE REDRESSAL

The stakeholder engagement and grievance redressal process for the Project will be based on the following principles:

- **Transparency and fairness**: The process for grievance resolution shall be transparent, in harmony with the local culture, and in the appropriate language. It shall explicitly assure potential users that the mechanism will not impede their access to other judicial or administrative remedies.
- **Accessibility and cultural appropriateness:** Every member of the community or groups shall have access to the grievance procedure. Any individual or group that is directly or indirectly affected by the Project's and its contractors' activities, as well as those who may have an interest in the Project or the ability to influence its outcome, either positively or negatively, can raise a grievance. To allow all stakeholders to have access to the mechanism, the grievance redressal procedure will be made available in the local languages of Nepali and Tamang and any other language preferred by the community.
- **Meaningful Information**: As part of the engagement process, meaningful information shall be disclosed to the stakeholders to allow for active and informed engagement.
- **Openness and communication regularity:** There are multiple channels available for individuals and groups to choose their preferred method of lodging grievances.

- **Channels of communication** are kept open throughout the process of addressing each grievance, and up to 3 months after the situation has been resolved.
- **Written records:** All grievances are registered on a Grievance Form, as discussed in Section 8.2.2, and tracked through to resolution.
- **Dialogue and site visits:** All grievances are considered to warrant discussions with the complainant and a site visit, if required, to gain a first-hand understanding of the nature of the concern. The purpose of the visit is to verify the validity and severity of the grievance.
- **Timely resolution:** The Project aims to resolve all grievances within 3 weeks preferably.
- **Incorporation of feedback:** The feedback received to-date from the engagement and grievance redressal process shall be incorporated into the Project and program design, and the same shall be reported back to the stakeholder.

1.4 APPLICABILITY OF THE SEP-GRM

The SEP-GRM applies to the entire Upper Trishuli-1 Project, including any new acquisitions such as offices, camps, research and development, and associated facilities. This document is applicable to the entire life cycle of the Project with a specific focus on the implementation of the SIMF and other management plans. The SEP is a part of the larger SIMF and is to be considered as a living document, to be updated regularly based on the emerging needs and patterns for engagement with the various stakeholders.

1.5 STRUCTURE OF THE SEP AND GRM

The remaining sections of the SEP and GRM are structured as follows:

Section 2	Brief Project understanding
Section 3	The applicable reference framework governing the SEP and GRM
Section 4	Brief review of the engagement activities undertaken thus far by the Project
Section 5	Description of the key stakeholder groups and their relative influence and impact levels
Section 6	Proposed stakeholder engagement activities
Section 7	Description of the Project's information disclosure process
Section 8	GRM for the Project
Section 9	Implementation Roles and Responsibilities, process of documentation, monitoring, and reporting

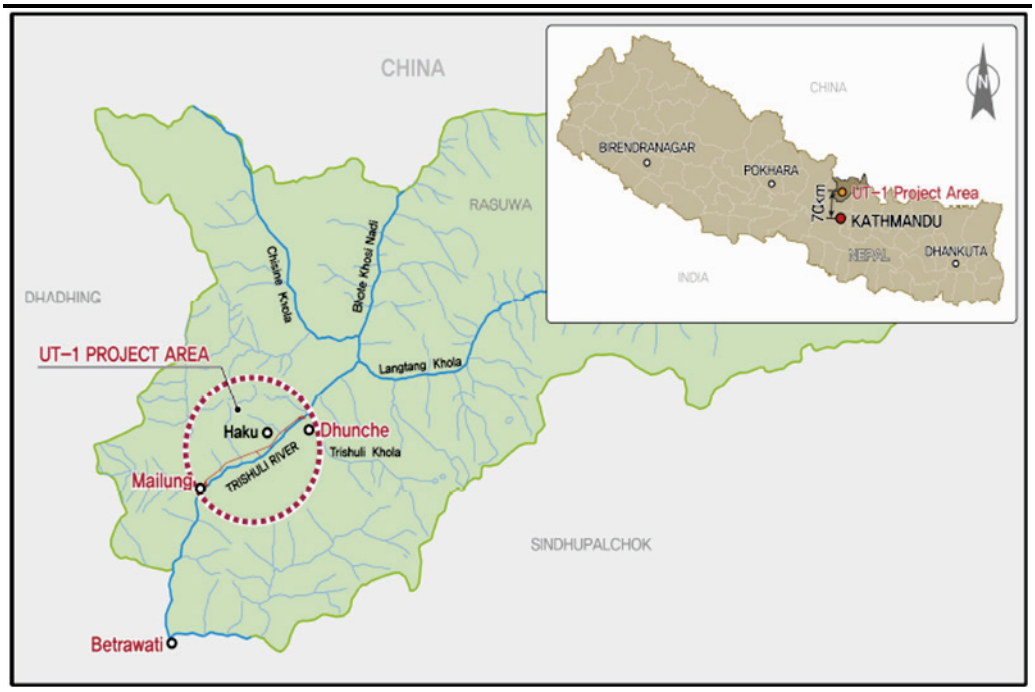
2 PROJECT UNDERSTANDING

This section provides a brief description of the Project, Project background, and the AoI. This information is important for the purpose of identifying the key stakeholders for the Project, since most of the stakeholder interactions are expected to be concentrated in the Project AoI.

2.1 PROJECT BACKGROUND

The Project is a 216 megawatt green field runoff- river hydropower facility to be located in the upper part of the Trishuli watershed, in the Rasuwa District in central Nepal, 50 kilometres northeast of Kathmandu, with the geographical coordinates longitude between 85°12′40″E and 85°18′03″E, and latitude between 28°04′27.50″N and 28°07′42″N (see ***Figure 2.1***).

Figure 2.1 Project Location



Source: Upper Trishuli-1 Detailed Project Report

2.2 AREA OF INFLUENCE OF THE PROJECT

The Project footprint is spread across three former VDCs: Haku, Dhunche, and Ramche. Land acquisition for the Project is from eight villages (Haku Besi, Sanu Haku, Thullu Haku, Gogone, Tiru, Thanku, Mailung, and Phoolbari) from the Haku VDC. A total of 107.79 hectares of land are required for the Project. LRP provides an understanding of the land take process till date for the Project.

The introduction of the new Nepalese Constitution in 2015 was accompanied by a change in the administrative structure of the country (see ***Figure 2.2***) in keeping with this, the following wards and *Gaunpalika/ Gaupalika* are now included in the Project footprint (Table 2.1). The figure shows the Project layout in reference to both the former administrative structure and the new administrative structure.

Table 2.1 Change in Administrative Structure for the Project's AoI

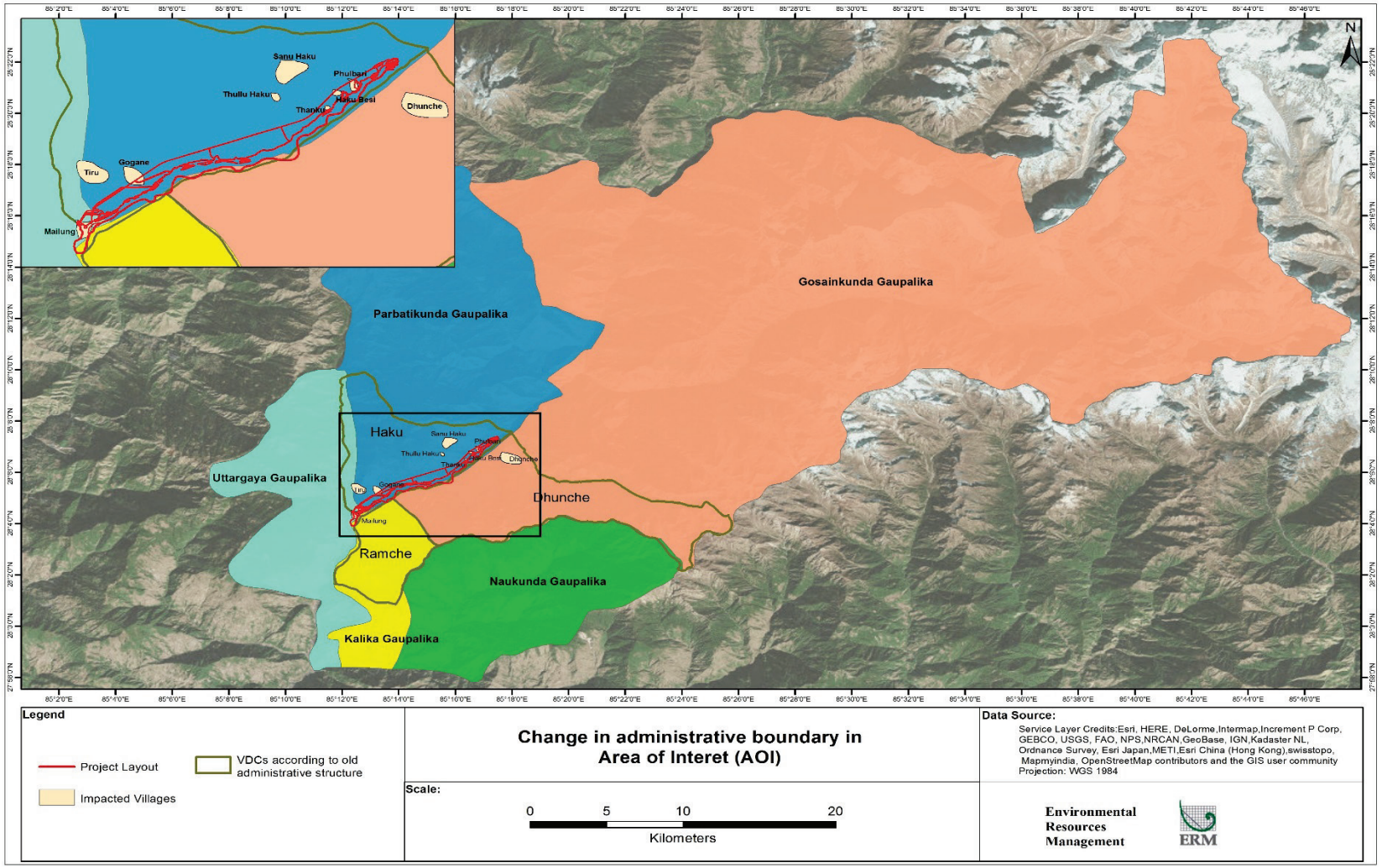
Impacted Village	Old Administrative Structure	New Administrative Structure
Haku Besi, Sanu Haku and Thullu Haku	Haku Ward number 3	Parvati Kunda Ward number 1 & 2
Gogone and Tiru	Haku Ward Number 8&9	Uttar Gaya Ward number 1
Mailung	Dadagaon Ward number 9	Uttar Gaya Ward number 1
Thanku	Haku Ward number 5	Parvati Kunda Ward number 1 & 2
Phoolbari	Haku Ward number 3	Parvati Kunda Ward number 1 & 2
No directly affected villages	Ramche	Kalika Ward Number 1
No directly affected villages	Dhunche	Gosaikunda Ward number 6

Source: NWEDC

Under the previous administrative structure, the Rasuwa district was comprised of 18 VDCs, each with nine wards. However, under the new administrative structure, there are five Gaunpalikas in the Rasuwa district. Thus, while the Project footprint was previously directly affecting 3 of the 18 VDCs, it is now affecting four of the five Gaunpalikas in the Rasuwa district. Furthermore, the reorganisation of the wards within the 18 VDCs has been done in such a manner that even if the wards fall under one VDC, they may not fall under a single Gaunpalika. This results in an increase in the population within the Gaunpalikas within the Project footprint.

The AoI for this SEP and GRM is comprised of the directly affected villages and VDCs, and areas of indirect Project impacts on ecosystem services, upon which there is livelihood dependence, and associated facilities that have a land impact. The AoI as determined by the ESIA covers the three former VDCs of Haku, Dhunche, and Ramche. Certain Project benefits will be at the district and Gaunpalika level (such as the Benefit Sharing Plans); however, they are outside the scope of this Plan. Please refer to the ESIA, LRP and the Indigenous People's Development Plan for a detailed description of the Project's AoI.

Figure 2.2 Project Layout against the Revised Administrative Structure



3 APPLICABLE REFERENCE FRAMEWORK

This section describes the requirements of the applicable reference framework for stakeholder engagement and grievance redressal, which include the following:

- Applicable national regulations;
- Applicable World Bank Group (WBG) Performance Standards (PSs);
- Asian Development Bank (ADB) Safeguards; and
- Asian Infrastructure Investment Bank's (AIIB) Environmental and Social Standards.

While this section discusses the specific requirements for public consultations and disclosure, details of the applicable reference framework for the Project are provided in the Land Acquisition and Livelihoods Restoration Plan (LALRP) for the Project.

3.1 APPLICABLE NATIONAL REGULATIONS

3.1.1 *Convention (No. 169) Concerning Indigenous and Tribal Peoples in Independent Countries*

Article 7 of the Convention provides rights to indigenous and tribal people to decide their own priorities for the development process. However, for the national development plans and programs, it mandates engagement with indigenous and tribal people during the formulation of the plans and programs.

3.1.2 *Operational Manual of Environmental Social Impact Assessment for Sub Projects Financed under the Additional Financing of the Power Development Project by the Nepal Electricity Authority*

This manual, formulated by the Nepal Electricity Authority, presents a summary of the processes, guidelines, and principles for the preparation of Environmental Impact Assessments (EIAs) for activities supported under the Nepal Power Development Project and the additional financing of the Nepal Power Development Project. In addition, the legislation has provisions for conducting EIAs for transmission and distribution lines.

While this manual is not directly applicable to the Project in question, it is being used as a guidance tool to understand the consultation and public disclosure requirements. This is important due to the fact that Nepal does not have any regulations outlining the consultation process for hydropower projects.

This manual highlights the importance of integrating the public consultation and information dissemination process across project, while identifying and accounting for vulnerable groups to ensure their participation in the process. The manual identifies public consultations and participation for the various stakeholder groups as a vital component in EIA studies, especially for hydropower projects, which according to World Bank Guidelines are categorised as Category A projects. The public participation process involves the following:

- Information dissemination, which informs stakeholders of project activities, potential impacts, and mitigation measures through the life of the project.
- Consultations, which allow the stakeholders to express their views on issues relating to the project. However, the project proponent is not required to take such views into account in the decision-making process.
- Participation, which requires shared involvement and responsibilities, and decision-making by agreed upon processes such as mediation and consensus building.

This manual requires a public hearing with the stakeholders at the local and district levels, to allow for the discussion of the EIA prepared for the project. As part of this public hearing, the project proponent is required to disclose all the information contained in the draft EIA report, while allowing for relevant comments and suggestions to be received and incorporated into the final EIA.

The manual requires the formulation of a stakeholder involvement plan before work on the EIA begins, and identifies numerous techniques to encourage stakeholder participation:

- Public hearings;
- Participation in advisory panels;
- Open house discussions;
- Interviews with stakeholder representatives;
- Questionnaires across a sample of local stakeholders; and
- Participatory appraisal techniques based on group inquiries and analysis.

The manual requires all consultations with PAFs to be documented. Furthermore, the manual requires the Resettlement Action Plan to include the following details:

- Identification of key stakeholders;
- Institutional mechanism for consultation and participation;
- Key issues raised during consultations;
- Follow-up steps after consultations;
- Proposed consultation process; and
- Information disclosure.

3.2 WBG PERFORMANCE STANDARDS

3.2.1 Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts

This PS recognizes stakeholder engagement as an ongoing process that involves the elements of stakeholder analysis and planning, disclosure of information, consultation and participation through the life of the project, a grievance mechanism, and ongoing reporting to the affected communities. For this, the PS requires the formulation of a Stakeholder Engagement Framework/Plan that will identify the relevant stakeholders and the engagement process. The engagement process for the project needs to include and allow for the participation of both directly impacted and indirectly impacted stakeholders and needs to be free of external manipulation and coercion.

The PS identifies relevant information to be disclosed during the engagement process throughout the life of the project:

- The purpose, nature, and scale of the project;
- The duration of the proposed project activities;
- Any risks and potential impacts on the community and the relevant mitigation measures;
- The proposed stakeholder engagement process;
- Grievance mechanism.

3.2.2 Performance Standard 5: Land Acquisition and Involuntary Resettlement

This PS requires the project to engage with the affected communities, including disclosing relevant information and ensuring participation of stakeholders through the various stages of project life, including planning, implementation, monitoring, and evaluation of compensation, livelihood restoration activities, and resettlement. It also requires the consultation process to ensure the participation of women, and the recording of their perspectives, and the protection of their interests in the planning of the project and resettlement activities.

3.2.3 Performance Standard 7: Indigenous People

This PS identifies the need to include Indigenous People in the engagement process in a culturally appropriate manner, in keeping with the requirements of PS 1.

3.3 ASIAN DEVELOPMENT BANK'S POLICIES

3.3.1 Public Communications Policy (2011)

ADB's *Public Communications Policy (2011)* sets out disclosure requirements for various ADB activities, including Safeguard Requirements. Safeguard Requirement 2: Involuntary Resettlement (Appendix 2 of the Safeguard Policy Statement) and Safeguard Requirement 3: Indigenous Peoples (Appendix 3 of the Safeguard Policy Statement), set out the need for meaningful consultation and information disclosure during project preparation and operation to the affected population and other key stakeholders. Key requirements include:

- Information disclosure: The borrower/client will submit the following documents to ADB for disclosure on ADB's website as per the applicability with respect to the Project:
  - Draft EIA including draft EMP;
  - Final EIA/ Initial Environmental Examination;
  - Updated EIA/Initial Environmental Examination and corrective active plan;
  - Environmental Monitoring Reports;
  - Resettlement Plan; and
  - Indigenous Peoples Plan.
- Information disclosure to affected people or stakeholders: The borrower/client will provide relevant environmental information in a timely manner, in an accessible place, and in a form and language(s) understandable to affected people and other stakeholders. For uneducated people, other suitable communication methods will be used.
- Consultation and participation: The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.
- Timing and frequency for consultation and participation: Meaningful consultation begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle.

3.4 ASIAN INFRASTRUCTURE INVESTMENT BANK'S ENVIRONMENTAL AND SOCIAL STANDARDS

The AIIB's Environmental and Social Framework aims to achieve environmentally and socially sustainable project outcomes by integrating good international practice in to all phases of a project, from the decision

making to the preparation and implementation. Included in its framework[1] are:

- An Environmental and Social Policy, which sets forth mandatory environmental and social requirements for each Project.
- Environmental and Social Standards (ESSs), which set out more detailed mandatory environmental and social requirements relating to the following:
  - ESS 1: Environmental and Social Assessment and Management;
  - ESS 2: Involuntary Resettlement; and
  - ESS 3: Indigenous Peoples.
- An Environmental and Social Exclusion List (as an appendix to the Environmental and Social Policy) that provides an exclusion list of activities or items that will not be funded by the AIIB.

Together, the AIIB's Policy and Standards comprise an environmental and social management approach that is designed to:

- Support decision-making by AIIB;
- Provide a robust structure for managing operational and reputational risks of AIIB and its shareholders in relation to environmental and social risks and impacts in Projects;
- Provide for environmental and social screening and categorization of Projects;
- Analyse potential environmental and social risks and impacts of projects;
- Identify actions to avoid, minimise, mitigate, offset, or compensate for environmental and social impacts of projects;
- Support integration of environmental and social management measures into projects;
- Specify environmental and social management provisions to be included in agreements governing projects;
- Provide a mechanism for public consultation and disclosure of information on environmental and social risks and impacts of projects;
- Provide for monitoring and supervision of environmental and social management measures under projects; and
- Facilitate development and dissemination of lessons learned from projects to improve environmental and social management practices.

[1] AIIB's Environmental and Social Framework: https://www.aiib.org/en/policies-strategies/framework-agreements/environmental-social-framework.html

4 REVIEW OF ENGAGEMENT ACTIVITIES UNDERTAKEN SO FAR

This section describes the engagement activities undertaken so far as part of the Project, during the land procurement process, the environmental and social assessment process, and as part of the earthquake relief work. Stakeholders for this SEP and GRM were identified based on this prior engagement. Engagement activities undertaken to-date were critical for identifying stakeholders and formulating the SEP for the remaining life of the Project.

4.1 CONSULTATIONS AS PART OF LAND TAKE PROCESS

The land identification and survey for the Project's powerhouse was undertaken in 2009-2010. The survey was followed by public meetings in Mailung and Gogone and meetings at Haku Besi in September and October 2012.

A few of the meetings were conducted at an individual household level. However, to complete the required number of meetings, most were conducted at the VDC level. As part of these meetings, the mutually acceptable rates for land compensation were identified.

These meetings, undertaken with land owners and other community representatives, provided Project information, the Project land requirements (including the community forest land), and the proposed entitlements in lieu of the same.

These meetings were followed by a public hearing, held in March 2013, after the completion of the pre-earthquake EIA. The purpose of the public hearing was to provide a more detailed Project understanding and finalize the compensation amount for the land purchase. According to the information made available during the consultations, the land owners had initially demanded a compensation rate of Nepalese Rupees (NPR) 10 lakh per ropani, which was subsequently negotiated to NPR 5 lakh per ropani.

There were certain cases where there were issues pertaining to clarity on land ownership. For issues pertaining land ownership, the Project provided the details to the District Administration Office for resolution. Their intervention facilitated the establishment of land ownership and enabled rightful compensation to the appropriate land owners after ratification of the rates through the Compensation Fixation Committee. The Project's land take (tenancy rights transfer) was undertaken on the basis of negotiated settlements with the tenancy right holders.

The first negotiation for private land rates took place in Mailung. Per the records made available, two formal meetings were conducted over Guthi land. NWEDC representatives and Haku Besi villagers (Ward nos. 7 & 3) met on 19

January 2013 to agree on rates and terms of transfer of the tenancy rights. Subsequently, a meeting was held at the NWEDC head office in Nakshal, Kathmandu. Guthi land tenants of Haku Besi and the NWEDC attended the meeting (16 villagers were present).

Subsequent to the meetings and the agreed rates, the monetised value of the tenancy rights was transferred to the accounts of the former tenants.

4.2 ENGAGEMENT UNDERTAKEN AS PART OF THE ESIA PROCESS

The key engagement activities undertaken as part of the impact assessment process pertain to public meetings, consultations, and surveys as discussed below:

- **Public Meetings, 2012:** In September and October, public meetings with various local stakeholders (including land owners and community representatives), were held in Mailung, Haku Besi, and Gogone. As part of the meetings, information regarding the Project was disclosed, including the capacity of the Project, the location of key facilities, and the land requirements, including community forest land, and potential benefits to the community in terms of compensation, employment, and training. The compensation rates for the land to be procured were also discussed.
- **Public Meetings, 2013:** Consultations and negotiations with land owners were carried out in February once the measurements of private land required were complete. A public hearing was held in March after the completion of the EIA study to provide a current description of the Project and to finalize the compensation amounts for the land purchase. Reportedly, during the public hearing, the community land owners were promised jobs, shares in the Project, training, as well as community benefits, such as development of a road and a school for the community. Land owners had earlier demanded a compensation rate of NPR 10 lakh per ropani; however this was negotiated down to NPR 5 lakh per ropani. As part of the meeting, the final compensation package was agreed upon with the community and documented with signed agreements. Apart from these consultations, meetings were also undertaken with the District Administration Office, Forest Department, and the Survey Department to finalize the compensation rates and the land procurement process.
- **Supplemental ESIA, 2014:** In addition to the public meetings, the Project also engaged with the community as part of the Supplemental ESIA process through consultations and household surveys of the land owners and the local community. The purpose of these consultations and surveys was to develop a socioeconomic baseline of the Project area, to predict potential impacts on the community due to Project activities, and to document the community's perception of the Project and its activities.

4.3 ENGAGEMENTS UNDERTAKEN DURING THE LRP FORMATION PROCESS - 2015

In addition to the consultations undertaken during the EIA and Cumulative ESIA process, consultations were also undertaken as part of the LRP process. The LRP involved consultations with the key stakeholder groups identified through the engagements carried out during the land procurement and impact assessment processes.

Figure 4.1 Engagement Undertaken as Part of the LRP Process

Source: ERM site visit, 2015

The purpose of these consultations was to develop an understanding of:

- The local stakeholder's perception of the Project and its activities;
- The impacts of the Project on the community, especially in terms of the impacts of land take;
- The adequacy and utilization of the compensation; and
- The possible livelihood restoration activities that can be introduced.

Table 4.1 provides a list of the consultations undertaken and their purpose.

Table 4.1 Stakeholder Consultations Undertaken Prior to the Earthquake

S. No	Stakeholder Group	Village/ VDC	Date	Number of Participants	Purpose
1	Community Forestry User Group	Mailung	18-11-2014	2	Understand the working of the CFUGS, the impact of the Project on the Guthi land, and the compensation paid
2	Jan Sarokar Samiti	Mailung	11-01-2015	2	Develop an understanding of the Jan Sarokar Samiti for the Project

S. No	Stakeholder Group	Village/ VDC	Date	Number of Participants	Purpose
3	Community Forestry User Group	Haku Besi	13-1-2015	22	Develop an understanding of the working of the CFUGS, the impact of the Project on the Guthi land, and the compensation paid
4	Tamangs	Haku Besi	12-01-2015	18	Understand the socioeconomic profile of the indigenous group, their relationship with other communities, the impacts, and expectations from the Project
5	Women	Haku Besi	13-01-2015	11	Understand the socioeconomic status of women, their understanding and expectations of the Project, and its potential impacts
6	Tamangs	Haku Besi	13-01-2015	4	Understand the socioeconomic profile of the indigenous group, their relationship with other communities, the impacts, and expectations from the Project
7	Youth	Haku Besi	14-01-2015	16	Understand the perception of the stakeholder group in regards to the Project and their expectations and the changing socioeconomic profile of the villages
8	Women	Mailung	10-02-2015	3	Understand the socioeconomic status of women, their understanding and expectations of the Project, and its potential impacts
9	Women	Mailung	11-02-2015	2	Understand the socioeconomic status of women, their understanding and expectations of the Project, and its potential impacts
10	Forest Department	Mailung	12-02-2015	1	Understand the community forest diversion related permission, on ground implementation, and other community forest related issues
11	Fishing Group	Karakchapul	12-02-2015	3	Understand the nature of the fishing activities in the area and the potential impacts of the Project and the possible mitigation/compensation measures that can be put in place
12	Community Forest User Group	Mailung	12-02-2015	1	Understand the working of the CFUGS, the impact of the Project on the Guthi land, and the compensation paid

S. No	Stakeholder Group	Village/ VDC	Date	Number of Participants	Purpose
13	Assistant Chief District Officer	Dhunche	12-02-2015	1	Understand the land acquisition process in the district and the role of the government, and the policy towards the hydropower projects
14	Senior Agriculture Development Officer	Dhunche	12-02-2015	3	Understand agricultural activities in the district, the government programs and schemes being implemented, and the identification of potential programs/activities that can be undertaken in collaboration with the project proponents
15	Mapi Department	Dhunche	13-02-2015	1	Understand the land survey process for the private purchase
16	Malpot Department	Dhunche	13-02-2015	1	Understand the role of the department in the land survey and transaction

4.4 APPOINTMENT OF COMMUNITY LIAISON OFFICER

The SEP-GRM prepared in 2015 suggested hiring Community Liaison Officers (CLOs) to carry out the engagement activities with the PAFs. The Project hired two CLOs in 2015, which are stationed at Dhunche, one of which is a member of a PAF. These CLOs serve as the local point of contact between the Project and the PAFs and play an important role in the implementation of the stakeholder engagement process and the LALRP.

4.5 ENGAGEMENT UNDERTAKEN BY NWEDC WITH PAFS

As described in Section 1.1, Nepal was struck by a 7.8 to 8.1 magnitude earthquake (known as the Gorkha Earthquake) on 25 April 2015. The Rasuwa District, where the Project is located, was one of the worst affected areas. The earthquake damaged more than 80 percent of the houses in the Project footprint area (three VDCs accounting for about 500 households), resulting in more than 200 deaths in the area (43 at the Project site). The access road to the Project site was also damaged.

As a stakeholder in the region, the Project proactively engaged with the local community to provide relief and rehabilitation support to the earthquake-affected communities. As part of this engagement exercise, and in partnership with the local government and community-based organizations, the Project undertook immediate interventions post-earthquake and long-term interventions in the form of relief activities. NWEDC's immediate interventions included providing evacuation support and relief to the stranded local community, as well as:

- Aid in search and rescue operations in Mailung, Gogone, Tiru, and Haku VDCs, through which they rescued approximately 67 injured locals via helicopters;
- Immediate relief in the form of food, tarpaulin sheets, blankets, toilet pans, and utensils;
- Distribution of Corrugated Galvanised Iron (CGI) Sheets (1555.73 tonnes) and bamboo (eight per family) for the construction of temporary shelters and toilets;
- Distribution of rice and cooking oil (a total of approximately 37.7 tonnes of rice and 1,452 litres of cooking oil);
- Medical health camps and medicine support;
- Distribution of warm clothes to school children in the Haku VDC;
- Drinking water, water tanks, and pipes; and
- Contribution of $50,000 USD as support for relief and rehabilitation of quake victims to the Nepali Ambassador in Seoul by Korea South East Power Co. Ltd.

This relief support was focused on the villages of Mailung, Gogone, and Tiru, which were more severely impacted. Relief support priority was given to the elderly, disabled, and injured people. As part of these relief activities, no differentiation was made between the Project-affected households and the local community in the VDCs.

4.6 ENGAGEMENT UNDERTAKEN AS PART OF THE GAP ASSESSMENT PROCESS - 2016

In 2016, ERM was recruited to undertake an Environmental and Social (E&S) gap analysis and status assessment of the Project and the AoI, in the post-earthquake scenario. One of the key activities undertaken as part of this assessment were consultations with internal and external stakeholders (see Table 4.2).

Table 4.2 Gap Assessment Stakeholder Consultations Undertaken Post-Earthquake

S. No	Stakeholder Group	Location	Date	Key Issues
1.	NWEDC	Kathmandu	3 and 4 April 2016	• Additional studies being undertaken by NWEDC post-earthquake • Possible Project design changes resultant from the earthquake and otherwise • Status of Environmental and Social Management System for the Project, existing proposed organisational structure for implementation of the Environmental and Social Management Plan and Health and Safety (HSE) plan for the Project • Additional baseline studies being presently undertaken; • Status and understanding of the various relief activities being undertaken by the Project in IDP camps
2.	Local Community	Mailung	5 April 2016	• Understanding of the impacts from the earthquake • Status and understanding of the various relief activities being undertaken by the Project, nongovernmental organizations (NGOs), and government in IDP camps • Change in socioeconomic baseline in the area post-earthquake, in terms of social structure, livelihoods, and access to infrastructure and services • Key concerns of the local community in the post-earthquake scenario • Key expectations of the community from the Project and the government
3.	Local Community, in IDP Camp,	Naubise	5 April 2016	
4.	Local Community, in IDP Camp	Bogetitar	6 April 2016	
5.	Land Owners in IDP Camps	Across IDP camps	6 April 2016	
6.	Local Community, in IDP Camp	Farm Camp	7 April 2016	
7.	Local Community, in IDP Camp	Kebutol	7 April 2016	
8.	Local Community, in IDP Camp	Pradhikaran	7 April 2016	
9.	Saman (Design Engineers)	Dhunche	6 April 2016	• Understanding of the proposed design changes in keeping with the health and safety, and environmental, and social concerns, as well as from a risk perspective
10.	Agriculture Department	Dhunche	7 April 2016	• Status and understanding of the relief work and support being provided by the department to the affected communities • Discussion on the possibility of involving the department in the implementation of the mitigation measures to be identified as part of the gap assessment

S. No	Stakeholder Group	Location	Date	Key Issues
11.	Assistant Chief District Officer	Dhunche	7 April 2016	• A discussion on the relief work being undertaken in the district • A discussion on the possibility of the affected communities returning to their villages, in keeping with the health and safety concerns • An understanding of the government's position and plans on the resettlement of the affected communities and the possible way forward
12.	Forest Department	Dhunche	7 April 2016	• The impact of the earthquake on the forest area, especially in terms of landslides • The impact from the earthquake in the Project area • The impact on biodiversity within the national park post the earthquake
13.	Forest Ranger, Lantang National Park	Dhunche	8 April 2016	• The impact of the earthquake on the forest habitat • Impact on biodiversity in the forest area post the earthquake • The measures to be taken by the department in view of the dewatering of a stretch of the river due to the Project
14.	NGO, Samaritan Trust	Dhunche	7 April 2016	• Status of the various relief activities being undertaken by the NGOs and government in IDP camps • Change in socioeconomic baseline in the area post the earthquake, in terms of social structure, livelihoods and access to infrastructure and services • Key concerns of the local community in the post-earthquake scenario • Key expectations of the community from the Project and the government • Future activities planned by NGOs in the IDP camps • Discussion on the possibility of the Project partnering with the NGOs in the implementation of the mitigation measures to be identified as part of the gap assessment
15.	NGO Manekor	Dhunche	8 April 2016	
16.	NGO Karuna	Dhunche	8 April 2016	
17.	NGO Lali Guras Samudayak Development Chamber	Dhunche	8 April 2016	
18.	NGO Parivartan	Dhunche	8 April 2016	

4.7 ENGAGEMENT UNDERTAKEN AS PART OF THE LALRP FORMULATION IN 2017

As part of the LALRP formulation process in 2017, focus group discussions (FGDs) and key informant interviews were undertaken with certain key stakeholder groups. These discussions and interviews were aimed at supplementing and triangulating the information from the PAF survey and collecting additional qualitative data on certain key areas, such as NGO activity in the area, livelihood restoration mechanisms, etc.

Figure 4.2 ***Stakeholder Engagement Activities Undertaken as Part of LALRP***

Source: ERM site visit, 2017

The following stakeholder groups were covered as part of the discussions and interviews.

Table 4.3 ***Stakeholder Engagement as part of the LALRP Process***

S. No	Stakeholder Group	Group Representatives	Date	Summary of Consultations Undertaken
1.	NGOs active in the Project area	Manekor	12 April 2017	Discussion on the activities of the organizations in the post-earthquake scenario, and the key learnings/take-aways
2.		LaCCos	12 April 2017	
3.		Lumanti	11 May 2017	
4.	Government Departments	National Reconstruction Authority (NRA)	13 April 2017	Discussion on the role and purpose of the NRA, its key objectives, way forward, and challenges being faced
5.		Ministry of Federal Affairs and Local Development	5 May 2017	Discussion on the process of grant disbursal for house reconstruction and the role of the ministry in the same
6.		Department of Urban Development & Building Construction	5 May 2017	Discussion on the overall reconstruction process and the designs approved by the government

S. No	Stakeholder Group	Group Representatives	Date	Summary of Consultations Undertaken
7.		Land and Revenue Department	5 May 2017	Discussion on the role and key objectives of the agencies and the possibility of associating with them for the LALRP process
8.		Veterinary Department	5 May 2017	
9.		Chief District Officer	12 April 2017	
10.		Cottage Industry Department	5 May 2017	
11.	Local Community/ PAFs	Women group from Haku VDC	5 May 2017	Discussion with the various stakeholder groups on the following aspects: • The impacts from the earthquake • Present livelihood profile • Role of the Project in earthquake relief • Present perception towards the Project • Present expectations from the Project in terms of LALRP activities
12.		Women Group from Haku VDC	5 May 2017	
13.		Tamang Women Group from Satbise	1 May 2017	
14.		Mixed group in Nuabise	8 May 2017	
15.		Mixed group in Bogetitar	7 May 2017	
16.		Mixed Youth Group	29 April 2017	
17.		Mixed Group from Farm Camp	12 April 2017	
18.		Women Shop Owner in Nuabise	8 May 2017	
19.		Women Shop Owner in Nuabise	8 May 2017	
20.		Mixed Group in Khalde	13 April 2017	
21.		Key Informant Interview, local Politician in Nuabise	13 April 2017	
22.		Key Informant Interview, women returned after Foreign Employment	2 May 2017	
23.		Men Group in Mailung	14 April 2017	
24.		Men Group from Haku VDC	6 May 2017	

4.7.1 Key Feedback Received During Stakeholder Consultations

Based on these consultations undertaken for the LALRP, the following are some of the key feedback or areas of concern:

- Access to Relief Support
  - One of the key feedbacks from the local community residing in IDP camps was the difference in access to relief support across the camps. It was reported that due to interventions of local political leaders, IDP camps such as Nuabise and Bogetitar received most of the relief support from numerous NGOs/international NGOs (INGOs). However, camps such as Satbise, with no strong political leader, did not receive any relief support from any NGO/INGO.

Another reason Satbise did not receive relief support was that while the residents of the IDP camps are from Rasuwa district, the camp is located in Nuwakot district. As there was a demarcation of NGOs/INGOs according to districts, Satbise did not receive support from NGOs operating in Rasuwa, which had the maximum concentration of NGOs. As a result, residents of the Nuabise and Bogetitar camps have received multiple trainings/relief support, while the residents of Satbise did not receive any.

- Issues related to Housing
  - Local community representatives reported various issues associated with residing in IDP camps and the uncertainty associated with their residence. These issues included lack of space, health and sanitation issues, as well as the inability to establish a stable of source of livelihood. According to community representatives, many households have been unable to establish a stable of income or initiate a business activity (such as livestock farming or setting up a small shop) due to the lack of space and uncertainty of the duration of stay in IDP camps.
  - The community is mostly concerned about the housing issue and is uncertain of next steps. Although some of the community leaders are aware of the current developments, they have an expectation that the company will also do something about housing issue.
- Key Learnings from Trainings Received
  - Another important feedback from the community was the reason for the failure of poultry farming for most households. According to the information made available, a number of households were provided with a basic poultry farming training and 200 chicks for starting their own farm. However, most of the households did not have an adequate understanding of the kind of diseases prevalent in poultry and the process of vaccination. As a result of this, most of the chicks died within the first few months. Very few households who had prior knowledge and experience were able to sustain their holdings. Furthermore, poultry farming requires a consistent supply of electricity, which is not always available in the IDP camps and villages. This also makes sustaining poultry farms in areas of residence difficult. According to the discussion with the women groups, most of the trainings provided to women were geared towards household skills, such as sewing and tailoring, vegetable gardening, etc., and not livelihood generation. Furthermore, while some women received trainings such as making Pangi[2] no market linkage was provided as part of the training. This resulted in most of the women, only using the skills

[2] Pangi is a traditional woolen apron worn by Tamang women. This apron is also a symbol of the women's marital status.

obtained from the training sporadically, and for mostly for meeting household needs.

- According to the discussions with certain PAFs and youth representatives, the NGOs/INGOs provided similar trainings in the IDP camps, with a focus on skills such as masonry. This has reportedly resulted in a difference in the demand and supply of masonry jobs. Furthermore, over the last few months, there has been a reduction in the number of masonry or construction labour-related jobs available due to completion of the post-earthquake reconstruction activities. Also, the masonry training did not include working with cement and concrete, only with local material, which has limited their opportunity in urban areas.
- Another important feedback provided by the community was that many of the local community residents took trainings without fully understanding the skill and its potential. The primary aim immediately post-earthquake was to get as much relief support as possible. However, this resulted in many members of the community, especially women and youth, in taking trainings in which they had no interest in and subsequently not using the skill gained.

- Adequacy of compensation provided:
  - a number of the land owners who sold their land to the project, expressed dissatisfaction for the compensation provided for the land and other assets provided by the project.
  - This was reported to be primarily resultant from the large number of claimants/dependents upon the reportedly non-payment of compensation for certain other assets impacted.
  - It was understood that, in a number of cases, while the land was registered under a single individual's name, the families who were dependent upon the land resided in separate households. This was primarily the case in situations where the land was in the name of one individual, whose children and/or grand children had established separate households after marriage, but the official partition of the land had not been undertaken.
  - Furthermore, in cases where the number of dependents was high, after the division of the compensation, the amount per head was not enough for the individuals to allow for the restoration of the livelihoods in terms of purchase of alternative land or establishing a business.
  - Also, the land owners had earlier asked for NPR 10 lakh per ropani as the compensation amount for the land take. However, this was negotiated to NPR 5 lakh per ropani by the project.
  - The land owners also preferred the land to be leased by the project, as it would have provided a regular source of income. However,

due to the nature of project land requirement, the same was not feasible;

- Also, compensation for the trees and certain structures was not provided by the project.

- **Impact on access to natural resources:** according to the consultations undertaken, it is understood that the project has resulted or will result in loss of access to natural resources such as forest resources and fishing resources. The community was of the opinion that the project activities resulted in the loss of more trees than had been marked as part of the lease agreement. This is reported to primarily be resultant from the debris from the road construction activities falling downslope, onto land that is not part of the lease agreement or purchased from the land owners, and by the migrant labour accessing the forest for firewood.
- Issues in Project Implementation
  - The PAFs have a concern that the current Sarokar samiti for the Project does not have adequate representation of the people from Haku. While all the PAFs (land sellers or tenants on Guthi land) reside in the Haku VDC and in other IDP camps, they do not participate in the meetings of Sarokar samiti. While they have lost the land, there is no preferential treatment for PAFs in getting the benefits in the Project.
  - During the consultations undertaken, the community representatives informed ERM that during the negotiations for the land procurement, the project had promised employment for one member from each impacted family in the project. However, the members of the community are yet to get employment in the project. The community also expressed unhappiness over the fact that contractual work for the access road was awarded to outside contractors instead of the local community.
  - Some of the PAFs also had concerns regarding delays in the payment in the access road construction. It was mentioned that half of it was paid with NWEDC intervention, but a part of it is still pending. It was highlighted as a major concern that it will become a critical issue in the future, as the daily wage is one of the key sources of income for the family. Without a 7-day or 15-day payment cycle, it will become difficult for the PAFs to become engaged in the construction work.
  - PAFs mostly responded that they do not see a major challenge with the influx of workers since there has been a good relationship with them in the past. They feel that the labourers will buy from the locals; however they are concerned that wage rates will be reduced because of the influx of the workers from outside.

4.7.2 NGO/CSO Feedback/Perception for the project

In addition to the above mentioned feedback, received as part of the LRP process, The Lawyer's Association for Human Rights of Nepalese Indigenous Peoples has undertaken a study on the project and provided certain feedback on the project activities and impacts. This study is primarily based on the studies/ reports prepared for the project prior to 2015, and information made available by the local community during consultations undertaken by the organization's representatives. The following bullet points summarize the key observations made in the report:

- Engagement and Representation
  - The engagement activities undertaken as part of the regulatory impact assessment and supplementary ESIA process have primarily been in Nepali language, while most local community speaks Tamang;
  - The project has not undertaken adequate information disclosure for the project, to allow the community to understand the project activities and potential impacts. Also, no FPIC process has been undertaken for the project;
  - The engagement activities undertaken for the project thus far (prior to 2015) did not allow for adequate participation of women or vulnerable Indigenous People PAFs;
  - While coordination committees have been formed by the local community, the concerns raised by these have not been adequately addressed by the project. Furthermore, there are reports of the committees being politicized and dominated by certain groups, which did not allow for the voices of the vulnerable groups to be adequately heard;
- Land Acquisition, Impact and Compensation Process
  - There are reports of compensation not being paid by the project for impact on structures and standing crops/ trees/medicinal plants. Also, as part of the land take process, the PAFs were reported to not have been made aware of their rights and entitlements. This did not allow them to properly negotiate for their rights;
  - PAFs were provided assurances of receiving employment and houses by the project, however, these were not met;
  - No Land Acquisition and Livelihood Restoration Plan was formulated for the project. The project also did not provide any financial literacy training to the PAFs, to allow them to better manage the compensation amount received

- The assessments reports for the project thus far (prior to 2015) did not identify the number of PAFs to be impacted by loss of community forests or due to project activities in the Gumchet settlement;
- The assessments reports for the project thus far (prior to 2015) did not identify any compensation or mitigation measures for the project's impacts on natural resources, in terms of use of river for various purposes such as drinking, cattle grazing, bathing, washing, water mills, irrigation, fishing, recreation, cremation (Dalits);

- Earthquake Impacts and Relief Support
  - The PAFs are reportedly of the opinion that the impacts of the earthquake on the Project AoI were enhanced due to the project activities;
  - No follow up studies post-earthquake were undertaken by the project to assess damages or impacts and earthquake resilience;
  - While the project provided relief support of reportedly $400,000, the same was used without consulting with the PAFs. As a result, the money was used to buy provisions, instead of alternative land. It is reported that many PAFs refused to accept this support from the project.

The project aims to address most of these concerns/observations raised by the organization through the Summary ESIA and SIMF formulated for the project and the Free Prior Informed Consent (FPIC) process to be undertaken.

4.8 COMMUNITY PERCEPTION AND FEEDBACK

Project engagement with the local community and external stakeholders has been characterised by regular communication and interaction with the relevant stakeholders. Through this engagement, the Project has attempted to ensure timely dissemination of relevant information to the stakeholders in terms of Project activities, potential impacts from the same and the mitigation measures proposed.

Wherever relevant, feedback and input has also been sought from the community in terms of their expectations and concerns, especially so in terms of the land take process and entitlements identified as part of the livelihood restoration process. This engagement has been undertaken in a keeping with the formal legal process through public hearings, as well as through consultations as part of the environmental and social assessment process since the Project inception. To the extent possible, this feedback and other input has been incorporated into the management plans and Project activities.

According to the information available, while the community and other stakeholders may have some concerns regarding the Project, the overall perception is positive. The community views the Project as a source of local development in the area, primarily through the construction of the access road and employment opportunity generation. The community is aware of the benefit-sharing requirements of the legal framework and is aware of other projects where the impacted districts and VDCs have been given access to benefits in the form of electrification, jobs, royalties, and shares. These relations were further strengthened by the earthquake relief and reconstruction efforts and linked social engagement efforts by the Project.

This understanding of the engagement activities already undertaken by the Project, the key feedback and concerns of the local community towards the Project has informed the following stakeholder identification and analysis process.

5 STAKEHOLDER IDENTIFICATION AND ANALYSIS

This section provides an analysis of the stakeholders identified for the Project based on the land procurement, impact assessment, and LRP process. The stakeholder analysis for this SEP identifies the individuals or groups that are likely to be impacted by Project activities and groups them based on the significance of the impact/influence. This information is then used to formulate the SEP and assess the manner in which the interests of the stakeholders shall be addressed during the Project life cycle.

5.1 STAKEHOLDER IDENTIFICATION AND CATEGORIZATION

A stakeholder is "a person, group, or organization that has a direct or indirect stake in a Project/organization because it can affect or be affected by the Project/organization's actions, objectives, and policies". Stakeholders who are likely to be directly impacted or have a direct impact on the Project activities are known as **Primary Stakeholders**, while those who are likely to have an indirect impact or are to be indirectly impacted are known as **Secondary Stakeholders**.

Table 5.1 Stakeholder Group Categorisation

Stakeholder Group	Primary Stakeholders	Secondary Stakeholders
Community	• Project Affected Families and People • Vulnerable Groups • Local Community in AoI	• Local Community Leaders
Institutional Stakeholders	• SIMF Implementation Partners and NGOs	• Project Financing Agencies • Gaon Palika/VDC Institutions • Jan Sarokar Samiti
Government Bodies	• Regulatory Authorities	• District Administration • Government Bodies working on Community Development Activities
Other Groups	• Engineering, procurement, and construction contractors and sub-contractors	• Local Political Groups • Media • NGOs/CSOs active in the area

5.2 STAKEHOLDER MAPPING

Stakeholder mapping is a process of examining the relative influence that different individuals and groups have over a Project as well as the influence of the Project over them. The purpose of a stakeholder mapping is to:

- Identify each stakeholder group;
- Study their profile and the nature of the stakes;

- Understand each group's specific issues, concerns as well as expectations from the Project
- Gauge their influence on the Project;

The significance of a stakeholder group is categorised considering the magnitude of impact of the Project on the stakeholder or degree of influence (power, proximity) of a stakeholder group on the Project functioning. The significance of the stakeholder group importance for the Project and the requirement for engaging with them is identified as an interaction of the impact and influence. The matrix for significance is as depicted in the table below.

Table 5.2 Stakeholder Significance and Engagement Requirement

		Influence of/by Stakeholder on Project		
		Low	**Medium**	**High**
Magnitude of Impact of Project	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Urgent
	Large	Moderate	Urgent	Urgent

Table 5.3 provides a brief profile of the various stakeholders identified, along with their key concerns in terms of the Project activities and their level of significance.

Table 5.3 Stakeholder Mapping

Stakeholder Group	Profile of the Stakeholder Group	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations and Concerns	Magnitude of Impact/ Influence	Stakeholder Significance
Primary Stakeholders						
Project Affected Families	• This stakeholder group comprises of the 142 PAFs identified as the households who are directly or indirectly impacted by the project land take process. • These 142 PAFs are comprised of 604 individuals, known as Project Affected People. • These PAFs are comprised of households from the villages of Gogone, Tiru, Mailung, Haku Besi, Thanku and Phoolbari in the Haku VDC.	• This stakeholder group constitutes the most important stakeholder group as they have lost land to the Project, which was the primary source of their livelihood. • The Project had compensated the PAFs with a rate of NPR 5 lakhs per ropani, but the sub-divisions in the family and earthquake has nullified the compensation amount received by some families. • The Project can impact the PAFs by training them on the right skills and connecting them to livelihood opportunities / income generating activities in keeping with the various management plans formulated as part of the SIMF for the Project	• This stakeholder group shall play a critical role in the formation of public opinion towards the Project and allowing for the smooth functioning of the Project. • This stakeholder group may be used as local resources as construction labourers, masons, drivers, etc. during the construction phase of the Project. • Members of these stakeholder groups can provide services/ goods required for the construction of the Project like truck services, petty contractors, suppliers of construction materials, etc. • Using local resources/ services will also help the Project to fulfil the requirements stated in the PDA.	The members of the PAFs have high expectations from the Project in terms of opportunities for livelihood generation and community development. Some of the key expectations include: • Timely disclosure of information regarding the Project in terms of details and timelines of implementation of plans formulated; • Clarity on initiation of construction activities and on employment (permanent or contractual) opportunities with the Project; • Timely payment for any work which includes labour involvement; • Support in terms of market linkages for existing skill set and livelihood enhancement measures, as a part of the SIMF; • Support in establishing business enterprises and their linkage with the Project for sale of goods/ services; • Benefit sharing as per the PDA in terms of skill and employment, rural electrification, equity shares, infrastructural development; and • Access to the GRM established for the Project.	Impact of Project on Stakeholder: Large Influence of Stakeholder on Project: Medium	Urgent
Vulnerable Groups	This stakeholder group comprises of those PAFs who may be disproportionately impacted by the Project due to their socio-cultural and economic status. It shall be noted that there is a certain level of vulnerability associated with all the PAFs, due to their pre-earthquake socio-economic status and the impacts of the earthquake on shelter and livelihoods. However, within this larger group, there are those who are disproportionately impacted. This group is comprised of the following: • Those without any potential source of income • Those without any productive agricultural land • Physically or mentally disabled • Elderly couples/ single member households without support • Single women headed households	• The Project can positively impact this group by assigning priority to them for employment opportunities with the Project and during LRP implementation. • It is expected that any intervention by the Project which is focused on them will result in an significant improvement in the living standards of this stakeholder group due to their present status	• This stakeholder group cannot exert much influence on the Project, owing to its socioeconomic status	• Apart from the expectations and concerns identified for the impacted PAFs, this stakeholder group's primary expectation pertains to preferential treatment in the implementation of SIMF. • This preferential treatment may involve priority in suitable employment opportunities, skill based trainings followed by employment with Project (if unskilled or not appropriately skilled), provision of cash based support, wherever applicable, etc.	Impact of Project on Stakeholder: Large Influence of Stakeholder on Project: Low	Moderate
Local Community in AoI	• This stakeholder group is comprised of the local population in the three VDCs touched by the Project boundaries, which is not expected to be directly impacted by the Project activities but may be impacted indirectly. • The three VDCs are characterised by a total population of 1,646 households and 7,181 individuals.	• This stakeholder group has been impacted by the Project in terms of the loss of common property resources and natural resources due to land take by the Project and by the development of the Project in the area. • This stakeholder group may benefit during the construction phase of the Project, where they can get better business opportunities on account of influx of population (contractors and labourers); hence greater demand for their products/ services. • This stakeholder group is expected to benefit from the implementation of the benefit sharing provisions of the SIMF. • The stakeholder group may be adversely impacted by the Project in terms of community health and safety impacts of Project activities.	• This stakeholder group shall play a critical role in the formation of public opinion towards the Project and allowing for the smooth functioning of the Project. • This stakeholder group may be used as local resources as construction labourers, masons, drivers, etc. during the construction phase of the Project. • Members of these stakeholder groups can provide services/ goods required for the construction of the Project like truck services, petty contractors, suppliers of construction materials, etc. • Using local resources/ services will also help the Project to fulfil the requirements stated in the PDA.	The key expectations of the stakeholder group from the Project include: • Completion of Project activities keeping in mind community health and safety. • Adequate and timely communication of Project information, in terms of timelines of key activities and their potential impacts. • Access to the GRM established for the Project. • Benefit sharing as per the PDA in terms of skill and employment, rural electrification, equity shares, infrastructural development. • Access to community development benefits, in keeping with the requirements of the applicable reference framework.	Impact of Project on Stakeholder: Large Influence of Stakeholder on Project: Medium	Urgent

Stakeholder Group	Profile of the Stakeholder Group	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations and Concerns	Magnitude of Impact/ Influence	Stakeholder Significance
SIMF Implementation Partners and NGOs	• This stakeholder group is comprised of the NGOs and third-party livelihood restoration experts who will be engaged for implementing the plans formulated as part of the SIMF for the Project. • This implementation partner will collaborate with other NGOs, which would be assisting with the various entitlements identified in the LALRP.	• The project will provide sustained business opportunity to this group for a long period. • Timely provision of information and resources by the project is critical for performance of this stakeholder group. • Adequate planning and budget allocation will be imperative for the smooth implementation of the plans formulated, which in turn may have an impact on the community's perception of the NGO.	• This stakeholder group is critical for the smooth functioning and timely implementation of the management plans formulated. • The manner of functioning of this group on ground will influence the opinions of the local stakeholders about the project.	The key expectations of the stakeholder group from the project pertain to: • Timely and complete provisioning of information pertaining to the LALRP, its objectives, components and implementation process. • Timely provision of financial resources and support from NWEDC for the implementation of the management plans. • Timely provision of information and update on the commencement of the construction activities and the implications on the management plan implementation.	Impact of Project on Stakeholder: Medium Influence of Stakeholder on Project: High	Urgent
Regulatory Authorities	• This group is comprised of the regulatory authorities at the district and national level that are responsible for various permits and licenses pertaining to the project.	• The impact of the Project on this stakeholder group will be negligible as it is one of the projects being implemented in the district and the country.	• This stakeholder group is high in priority as this group provides the permits and licenses essential for the functioning of the project. • This stakeholder group can result in Project shut down or stoppage for a few days and/ or penalties and fines being levied on the Project.	• The main expectation of the Regulatory Authorities from the Project Proponents is abidance to all applicable guidelines, policies and laws.	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Moderate
EPC Contractors and other sub-contractors	• This stakeholder group comprises of the contractors involved in the project. • The main EPC contractor for the project is Daelim Kyeryong Industrial Co Ltd. • There are 7 main packages of contract being awarded • The EPC contractors will in turn sub contract parts of the scope of work to local, national and international sub-contractors	• The project provides a sustained business opportunity to this group in the area • The project will thus provide an entry point into the district to the EPC contractors	• This stakeholder group is critical for the smooth functioning and timely implementation of the project; • This group may also play an important role in the formation of public opinion towards the project. • This group will be a stakeholder in the implementation of the benefit sharing plans formulated for the project.	• Clear communication in terms of tasks, roles and responsibilities and timelines for the project; • Undertaking project activities in keeping with the contractual agreements and applicable regulations in place; • Timely payment of dues; and • Adequate provision for the health and safety of the personnel on the project.	Impact of Project on Stakeholder: Medium Influence of Stakeholder on Project: High	Urgent
Secondary Stakeholders						
Local Community Leaders	• This stakeholder group is comprised of those individuals in the community who hold traditional or rational power.	• The impacts of the project on this stakeholder group will be similar and comparable to that on the local community in the AoI.	• This group thus has the ability to influence the perception of the community in regards to the project and its activities.	The main expectations and concerns of this stakeholder group from the project are as follows: • Completion of project activities keeping in mind community health and safety; • Adequate communication of project information, in terms of timelines of key activities and their potential impacts; and • Access to the GRM established for the project.	Impact of Project on Stakeholder: Large Influence of Stakeholder on Project: Medium	Urgent
Project Financing Agencies	• This stakeholder group is comprised of the financing agencies who are exploring an investment opportunity in the project. • Together with the IFC, this project is likely to be eventually considered for financing by a group of financial institutions consisting of ADB, the Dutch Development Bank, the Export-Import Bank of Korea, the German Investment Corporation, Korean Development Bank, Proparco, and other lenders to be designated, as well as potential Guarantees from World Bank and MIGA.	• The influence of the project on the stakeholder group will primarily pertain to the impact the project's performance will have on the agency's public opinion in the local area, country and international arena.	• This stakeholder group's influence on the project will primarily pertain to the determination of the project's financial feasibility. • In addition to the national rules and regulations, the project is required to comply with the internal standards of these financial institutions.	The main expectations and concerns of this stakeholder group from the project are as follows: • Timely completion of the project activities; and • Ensuring that the project is in compliance to the applicable reference framework, especially in terms of health and safety, environmental management, vulnerable groups; including women and Indigenous population and disclosure of information.	Impact of Project on Stakeholder: Large Influence of Stakeholder on Project: High	Urgent
District Administration	• This stakeholder group is comprised of the government departments at district level, including land and revenue, forest department, ,horticulture, veterinary care, cottage industry, animal husbandry etc.	• The influence of the project on the stakeholders pertains to the role the project will play in the support provided in the livelihood restoration of earthquake affected population in the area and in the district in general.	• This stakeholder group will be critical for obtaining any clearances and permits required at the district level. • This group will play a key role in the overall implementation of the project, especially in the planning and implementation of the management plans formulated, in the form of assistance for skill trainings, income generating activities, etc.	The key expectations of the stakeholder group from the project is as follows: • Project's compliance to the regulatory requirements; • Timely disclosure of information and provisioning of updates throughout the life of the project.	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Moderate
Gaunpalika/VDC Institutions	• This stakeholder group is comprised of institutions such as health and education at the VDC level, which	• The project will bring developmental gains and employment opportunities in the area.	• This stakeholder's influence on the project will pertain to their role in the	The key expectations of the stakeholder group from the project include:	Impact of Project on	Minor

Stakeholder Group	Profile of the Stakeholder Group	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations and Concerns	Magnitude of Impact/ Influence	Stakeholder Significance
	is in the process of transition of to Gaunpalika level, as per the new administrative structure of Nepal.	• The project is also expected to play a critical role in the development of these institution capacities through its CSR activities and the implementation of the management plans formulated.	implementation of the CSR activities identified and the management plans formulated.	• Timely disclosure of information pertaining to the project; • Involvement in the formulation and implementation of the community development activities for the project; and • Protection of the environment and the safety of the local community.	Stakeholder: Medium Influence of Stakeholder on Project: Low	
Jan Sarokar Samitis	• The Jan Sarokar Samiti is a committee especially formed for the project with representation of three affected VDCs, namely Dhunche, Haku, and Ramche during the initiation of land take process. • The role of the committee has been limited after the finalisation of the land take process.	• The impact of the project on the stakeholder group primarily pertains to the stakeholder group being formed for the sole purpose of facilitating the negotiation process for the land take of the project.	• The impact of project on this stakeholder group is limited as the primary purpose of its formation has been completed. • The stakeholder group will play a role in any future land take for the project in the area. • This committee can also play a greater role if it is involved in the implementation of the management plans formulated.	The key expectations of the stakeholder group from the project include: • Timely disclosure of information pertaining to the project; and • Involvement in the formulation and implementation of the community development activities for the project.	Impact of Project on Stakeholder: Medium Influence of Stakeholder on Project: Medium	Moderate
Government Bodies working on Community Development Activities	• This stakeholder group includes those government bodies which are involved in undertaking community development activities such as the NRA, the cottage industry department, horticulture department, veterinary department, etc.	• The impact of the project on this stakeholder group is expected to primarily pertain to the role the project will play in implementing community development activities in the area.	• This stakeholder group, especially the NRA, will have an impact on the local community in the project area, the PAFs and subsequently on the functioning of project and implementation of the LALRP. • This stakeholder group may also be involved in the implementation of the community development plans.	The key expectations of the stakeholder group from the project include: • Timely disclosure of information pertaining to the project; and • Involvement in the formulation and implementation of the community development activities for the project.	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: Medium	Minor
Local Political Groups	• This stakeholder group is comprised of the political parties and local politicians active in the region.	• The impact of the project on the group is expected to be limited to that on the local community as a whole.	These groups are very active in the area and are looked up to by the earthquake affected people and other people at large. • This stakeholder group may play an important role in the polarisation of public opinion towards a project.	• Undertaking project activities in keeping with the applicable regulations in place; • Adequate livelihood restoration and support for their respective groups/ settlements; • Assistance in resettlement of the displaced community presently living in IDP camps; and • Timely implementation of the management plans.	Impact of Project on Stakeholder: Medium Influence of Stakeholder on Project: Medium	Medium
Media	• This stakeholder group is comprised of the regional and national press (both print and audio-visual). This stakeholder group can play an extremely important role in the generation of awareness and public opinion towards the project.	• The influence of the project on the stakeholder is likely to be extremely limited due to the nature of the project activities	• The influence of the stakeholder group on the project is likely to pertain to the opinion formation amongst the local, national and potentially international stakeholders towards the project.	• Provisioning of adequate community development measures by the project; • Compliance to the regulatory requirements applicable to the project; • Timely disclosure of information pertaining to the project; and • Ensuring safety of the local community, workers and the environment.	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Medium
NGOs/CSOs operating in the area	• This stakeholder group is comprised of regional, national and international Non-Governmental Organizations (NGOs) and civil Society Organizations (CSOs) operating in the sphere of human rights, advocacy indigenous people's development and community development. Some of the key NGOs/CSOs identified include LACCOS, Manekor and LAHURN	• The influence of the project on the stakeholder is likely to be extremely limited due to the nature of the project activities	• The influence of the stakeholder group on the project is likely to pertain to the opinion formation amongst the local, national and potentially international stakeholders towards the project.	• Provisioning of adequate community development measures by the project; • Compliance to the regulatory requirements and international best practices applicable to the project; • Timely disclosure of information pertaining to the project; and • Ensuring safety of the local community, workers and the environment.	Impact of Project on Stakeholder: Small Influence of Stakeholder on Project: High	Medium

6 PROPOSED STAKEHOLDER ENGAGEMENT ACTIVITIES

6.1 PROPOSED ENGAGEMENT ACTIVITIES

In keeping with the applicable reference framework and the expectations of the stakeholders, the project will undertake regular engagement with the key stakeholder groups identified; through the life of the project.

The primary purpose of the ongoing engagement will be to allow for the stakeholders to participate in the decision making process for the project. In keeping with this, one of the key engagement mechanisms identified for the project is the FPIC process to be undertaken for the project and the grievance redressal mechanism (GRM) put in place for the project.

Based on the previous engagement activities and the profile of the stakeholders thus developed, certain engagement activities have been identified for the project going forward, as shown in ***Table 6.1***. The primary objective of these engagement activities is to allow for the stakeholders to interact with the project and contribute towards the project planning and in an effective and culturally appropriate manner. While the table below and following sub-section identifies the key proposed engagement activities, in keeping with the present understanding, it is acknowledged that the engagement plan is a live document. These engagement activities proposed; their frequency; location and modus operandi will be updated as required, based on the monitoring process and feedback of the stakeholders; through the life of the project. Furthermore, the following table and engagement plan will not limit the project from interacting with the stakeholders when required.

Table 6.1 Proposed Stakeholder Engagement Activities

Purpose of consultation	Stakeholder Groups	Method of Engagement	Frequency of Engagement	Proposed Location of Engagement
Construction Phase				
Information disclosure	• Project Affected Families and People • Local Community in AoI • Vulnerable Groups • Local Community Leaders • NGOs/CSOs	Disclosure of SIMF and other plans put in place for the project	At the time of formulation and finalisation of plans and as part of FPIC	At VDC/ Gaon Palika Offices or in locations identified in consultation with the stakeholders
	• Gaon Palika/ VDC Institutions • Project Affected Families and People • Local Community in AoI • Vulnerable Groups • Local Community Leaders	Provisioning of reports and updates in local language in keeping with reporting requirements of SIMF	In keeping with the reporting timelines identified as part of the SIMF	
	• Media • NGOs/CSOs	Broadcast of information in newspapers, on radio and local television	As and when required	Nuwakot and Rasuwa District
	• District Administration • Project Financing Agencies • Gaon Palika/ VDC Institutions • Regulatory Authorities	Reporting requirements in keeping with regulatory framework	At least annually or as and when required	In keeping with the regulatory procedures
	• Project Affected Families and People • Local Community in AoI • Vulnerable Groups • Local Community Leaders	Public meetings (through the construction phase, post FPIC)	At least annually or as and when required	At VDC/ Gaon Palika Offices or in locations identified in consultation with the stakeholders
	• Jan Sarokar Samiti • Local Political Groups	Meetings with Officials	as and when required	At Samiti/Party offices
	• EPC Contractors and Sub-contractors	Disclosure of Labour Influx Management Plan and SIMF Plans	At the time of formulation and finalization of plans and followed by subsequent refreshers	At project site
		Regular Meetings/ Tool Box talks	At least weekly	At project site

Purpose of consultation	Stakeholder Groups	Method of Engagement	Frequency of Engagement	Proposed Location of Engagement
Monitoring of implementation of the SIMF Plans	• Project Affected Families and People • Local Community in AoI • Vulnerable Groups • Local Community Leaders	Focus Group Discussions	At least six monthly; through the construction phase	At VDC/ Gaon Palika Offices/community centres or in locations identified in consultation with the stakeholders
		Interviews with key informants	At least six monthly; through the construction phase	
		Questionnaires	At least annually through the construction phase	
		As part of the GRM process	Regularly through the construction phase	In keeping with GRM provisions
	• SIMF Implementation Partners and NGOs	Regular Meetings	At least monthly through the SIMF implementation	At project site
	• Jan Sarokar Samiti • NGOs/CSOs	Meetings with Samiti Members	as and when required	Samiti Office
Monitoring of the project activities and	• Project Affected Families and People • Local Community in AoI • Vulnerable Groups • Local Community Leaders • NGOs/CSOs	Open public meetings	Annually	At VDC/ Gaon Palika Offices/community centres or in locations identified in consultation with the stakeholders
		Focus Group Discussions	At least annually through the construction phase	
		As part of the GRM process	As and when required through the construction phase	In keeping with GRM provisions
Project Status Update	• District Administration • Regulatory Authorities	Meetings with Officials	as and when required through the construction phase	Administration Offices
regular ongoing engagement	• Project Affected Families and People • Local Community in AoI • Vulnerable Groups • Local Community Leaders •	Open Public Meetings	At least bi annually	At VDC/ Gaon Palika Offices/community centres or in locations identified in consultation with the stakeholders
		Focus Group Discussions	At least every 2 months	
		As part of the GRM Process	As and when required through the construction phase	In keeping with GRM provisions

Purpose of consultation	Stakeholder Groups	Method of Engagement	Frequency of Engagement	Proposed Location of Engagement
Operations & Closure Phase				
Information disclosure	• Gaon Palika/ VDC Institutions • Project Affected Families and People • Local Community in AoI • Vulnerable Groups • Local Community Leaders	Provisioning of reports and updates in local language in keeping with reporting requirements of SIMF	In keeping with the reporting timelines identified as part of the SIMF	At VDC/ Gaon Palika Offices or in locations identified in consultation with the stakeholders
	• Media • NGOs/CSOs	Broadcast of information in newspapers, on radio and local television	As and when required through the operation and closure phase	Nuwakot and Rasuwa District
	• District Administration • Project Financing Agencies • Gaon Palika/ VDC Institutions • Regulatory Authorities	Reporting requirements in keeping with regulatory framework	At least annually or as and when required through the operation and closure phase	In keeping with the regulatory procedures
	• Project Affected Families and People • Local Community in AoI • Vulnerable Groups • Local Community Leaders	Public meetings	At least annually or as and when required through the operation and closure phase	At VDC/ Gaon Palika Offices or in locations identified in consultation with the stakeholders
	• Jan Sarokar Samiti • Local Political Groups	Meetings with Officials	As and when required	At Samiti/Party offices
	• EPC Contractors and Sub Contractors	Regular Meetings/ Tool Box talks	At least monthly	At project site
Monitoring of the project activities and regular engagement	• Project Affected Families and People • Local Community in AoI Vulnerable Groups • Vulnerable Groups • Local Community Leaders • NGOs/CSOs	Open public meetings	Annually through the operation and closure phase	At VDC/ Gaon Palika Offices/community centres or in locations identified in consultation with the stakeholders
		Focus Group Discussions	At least annually through the operation and closure phase	
		As part of the GRM process	As and when required through the operation and closure phase	In keeping with GRM provisions
	• EPC Contractors and Sub Contractors	As part of the GRM process	As and when required	In keeping with GRM provisions
Project Status Update	• District Administration • Regulatory Authorities	Meetings with Officials	As and when required through the operation and closure phase	Administration Offices

Purpose of consultation	Stakeholder Groups	Method of Engagement	Frequency of Engagement	Proposed Location of Engagement
Monitoring of implementation of the SIMF Plans	• Project Affected Families and People • Local Community in AoI • Vulnerable Groups • Local Community Leaders	Focus Group Discussions	At least six monthly through the operation and closure phase	At VDC/ Gaon Palika Offices/community centres or in locations identified in consultation with the stakeholders
		Interviews with key informants	At least six monthly through the operation and closure phase	
		Questionnaires	At least annually through the operation and closure phase	
		As part of the GRM process	Regularly through the operation and closure phase	In keeping with GRM provisions
	• SIMF Implementation Partners and NGOs	Regular Meetings	At least monthly through the operation and closure phase	At project site
	• Jan Sarokar Samiti	Meetings with Samiti Members	As and when required through the operation and closure phase	Samiti Office

6.2 METHODS OF ENGAGEMENT

The methods of engagement incorporate individual profiles, concerns, and expectations of the groups. The need for different modes of engagement is primarily because the utilization of a common modus operandi for all the stakeholders and that too for the whole project duration may result in the failure of the engagement process to achieving its goals. The following methods have been identified for the purpose of this project:

- **Focus Group Discussions:** An FGD refers to a discussion carried out amongst a group of people (6 to 8) from a similar background/profile on a specific topic while being guided by a moderator. The primary purpose of such discussions is to gather insight into the thought process of the group in regards to a particular issue. Apart from FGDs, general discussions with either the community or individual representatives are also part of the engagement process. This method allows for the collective opinion of these groups to be captured and assessed. This method of consultation is imperative for the vulnerable groups because consultations with the entire community run the risk of the dominant group's views predominating. These discussions can be undertaken either at the villages of residence, the common VDCs/Gaon Palikas, the Project site office, or any other location agreed upon with the stakeholders. If a location apart from the villages of residence is chosen, care shall be taken to ensure the comfort of the stakeholders (e.g. provide food) and the discussions shall be timed to allow the representatives to reach their residences before dark.
- **Semi-structured and Structured Interviews and Questionnaires:** In semi-structured interviews and questionnaires, a pre-determined set of open questions or check points are used to gather information pertaining to specific themes or issues. Similar to the FGDs, these interviews can be undertaken either at the villages of residence of the stakeholders, the common VDCs, the project site office, or any other location agreed upon with the representatives.
- **Open Public Meetings:** These meetings and consultations not only form a part of certain regulatory requirements (such as public hearing) but also serve as useful tools for gathering information from larger groups. These meetings and consultations typically involve a notification (to publicise the matter to be consoled upon) and a consultation (a two way flow of information).
- **Information Disclosure:** This process is not only part of certain regulatory requirements but also a requirement of the partners in the project. The process of information disclosure can be undertaken in two manners, either voluntary disclosure or disclosure as part of the regulatory requirements. One of the key components of the disclosure process for the project will be the FPIC process as discussed in the IPP. However, in keeping with the applicable reference framework, the FPIC process is to be undertaken with the indigenous people of the 9 villages directly impacted by the project. A detailed information disclosure plan is provided in the following section.

7 DISCLOSURE AND PARTICIPATION PLAN

Information disclosure is an important activity not just as a form of engagement but for also enabling the other engagement activities to be undertaken in an informed and participatory manner. This section outlines the process to be followed for the disclosure and participation as part of the LRP implementation.

7.1 DISCLOSURE MECHANISM

The process of information disclosure can be undertaken in two manners, either voluntary disclosure or disclosure as part of the regulatory requirements (EIA requirements, public hearing). While regulatory disclosure involves the provisioning of information as required by the authorities and agencies involved in the project, voluntary disclosure refers to the process of disclosing information to the various stakeholders in a voluntary manner.

This disclosure not only allows for trust to be built amongst the stakeholders through the sharing of information but also allow for more constructive participation in the other processes of consultation and resolution of grievances due to availability of accurate and timely information.

One of the most critical components of the disclosure process is the disclosure of the SIMF plans and provisions of the ESIA for the project, and receiving feedback from the stakeholders on the same. In keeping with the applicable reference framework, the project also has to establish Free Prior Informed Consent (FPIC) from the Indigenous People's population in keeping with the requirements of IFC PS 7. The PAFs and the local community in the Project AoI is predominantly IPs population belonging to Tamang, Gurung and Newar. Hence, the process of disclosure will be undertaken in keeping with the requirements of IFC PS 7. The IPP for the project provides the detailed understanding of the applicability of the FPIC and the process to be followed for the same. The following sections provide an understanding of the information disclosure process to be followed for the project in general.

7.1.1 *Key Aspects to be covered in Disclosure*

As part of the information disclosure process, critical project information will be shared and feedback will be sought from the stakeholders on the same, including:

- The key project impacts identified;
- The details of the SIMF Plans formulated and the entitlements within the same including the Gender Action Plan, Stakeholder Engagement plan and Grievance Redressal Mechanism;

- The summary of the ESIA update and the key impacts and mitigation measures identified in the same including the provisions of the management plans developed as part of the ESMMP, including the labour influx management plan;
- The basis of the establishment of entitlements and the entitled groups identified;
- The implementation mechanism and schedule for the SIMF initiatives;
- The details of the compensation already paid to the community;
- The details of the additional compensation to be paid and the budget for the SIMF implementation;
- The monitoring process to be put in place for the SIMF plans; and
- The participation of the local stakeholders in the implementation and monitoring process of the SIMF Plans and other mitigation measures identified.

As part of the information disclosure, an attempt shall be made to disclose all relevant information (such as plans pertaining to the community development, local employment opportunities) to the target stakeholders as early as possible, so as to allow for trust to be built in the relations.

At the least the next steps in the plans of the project would be explained, with a clarification on which project/SIMF elements are fixed and which can be subject to change or be improved upon on the basis of the consultations and stakeholder inputs shall be disclosed.

7.1.2 Process for Disclosure of Information

The process of disclosure involves the provisioning of information in a timely and accessible manner to the various stakeholders in a project including PAFs, local community, NGOs/CSOs identified. For this purpose the key means of disclosing the information and allowing for a process of feedback and participation has been identified as making non-technical summaries of the SIMF plans and the reports formulated as part of Task 1 and 3 of the project and their monitoring reports, available in the form of pamphlets and reports at key locations and group meetings and discussions. The copies of the non-technical summaries identified will be made available in the local language at locations suitable to the community, such as at the CDO office, the Jan Sarokar Samiti office, at the VDC/IDP Camp level etc.

This information disclosure shall be undertaken in the local Nepali or Tamang Language. While most of the stakeholders are comfortable in interacting in the national language Nepali, certain groups of the Tamang community, such as those in the villages Tiru and Gogone, only speak the Tamang language. Furthermore, the literacy level amongst the community is generally low, with formal education only gaining importance with the present generation. In

keeping with these aspects, it is essential to ensure that any disclosure undertaken is done in a manner that allows maximum stakeholders to comprehend the information being shared and participate in the feedback process.

Some of the disclosure related activities proposed for the future are as follows:

- The meetings and discussions can be undertaken for the local community in the villages in and surrounding the project area and will be held at various levels, such as the district headquarters, VDCs, wards and IDP Camps as well. The venue and timings of the meetings and discussions will be finalized in consultation with the stakeholder groups
- In addition to these meetings being undertaken across the local community as a whole, specific meetings will be undertaken across critical stakeholder groups such as the vulnerable groups and PAFs. Through these meetings an attempt will be made to allow these groups to give their unique viewpoints and feedbacks for the project while ensuring that these groups are involved in the implementation, review and monitoring of the SIMF.
- The proceedings of these meetings and discussions will be properly documented, as minutes and in photographs and copies of the same will be shared with the stakeholders for their keeping.
- As a part of the disclosure, the stakeholder reports or the key public consultation findings or the grievance related records can also be made available on the NWEDC website and on a public notice board outside NWEDC office;

This method has been identified as the most suitable approach for information disclosure keeping in mind the literacy levels in the area. In order to ensure that the opinions of the sections of the community who don't have access to the reports are also taken into account, public consultations are recommended. These public consultations can be done on an annual basis or as and when the urgency of the situation warrants having such public consultations.

Also while undertaking the process of disclosure it is important that the project makes an attempt to refrain from creating false expectations. Also, when possible, an attempt shall be made to disclose actual numbers, even estimates, wherever available.

The process of disclosure is presently ongoing, with meetings and consultations being undertaken with the local community and institutional stakeholders & NGOs/CSOs such as NEFIN and LAHURN. The SEP will be updated with the results of the disclosure process once completed.

8 GRIEVANCE REDRESSAL MECHANISM

Grievance redressal is another critical component of effective stakeholder engagement. The purpose of GRM is to provide a forum to the internal and external stakeholders to voice their concerns, queries and issues with the project. Such a mechanism would provide the stakeholders with one project personnel or one channel through which their queries will be channelled and will ensure timely responses to each query. This will allow for trust to be built amongst the stakeholders and prevent the culmination of small issues into major community unrest. The GRM will be accessible and understandable for all stakeholders in the project and for the entire project life. The GRM will be communicated to all relevant stakeholders and will also be applicable for any contractor that will occupy and/or use land during the construction and operations phase.

WBG standards require Grievance Mechanisms to provide a structured way of receiving and resolving grievances. Complaints shall be addressed promptly using an understandable and transparent process that is culturally appropriate and readily acceptable to all segments of affected communities, and is at no cost and without retribution. The mechanism shall be appropriate to the scale of impacts and risks presented by a project and beneficial for both the company and stakeholders. The mechanism must not impede access to other judicial or administrative remedies.

This section contains the following:

- Grievance definition and categories and GRM principles;
- Some of the key emerging grievances based on consultations with NWEDC and community ; and
- The process of receiving, documenting, addressing and closing grievances.

8.1 GRIEVANCE DEFINITION AND CATEGORIES

As stated earlier, a grievance is a concern or complaint raised by an individual or a group within communities affected by company operations. Both concerns and complaints can result from either real or perceived impacts of a company's operations, and may be filed in the same manner and handled with the same procedure. Grievances may take the form of specific complaints for actual damages or injury, general concerns about project activities, incidents and impacts or perceived impacts. Based on the understanding of the project area and the stakeholders, an indicative list of the types of grievances have been identified for the project, as can be seen below:

- Internal Grievances: Grievances from Employees (including both direct and indirect employees, including local workers and migrant workers through contractors):

- Complaints pertaining to amount of wage, salary, other remuneration or benefits as per Company's Human Resource policy;
- Timely disbursement of remuneration;
- Gender discrimination;
- Issues related to workers organization.
- Labour Accommodation
- Health and Safety issues
- Extended working hours

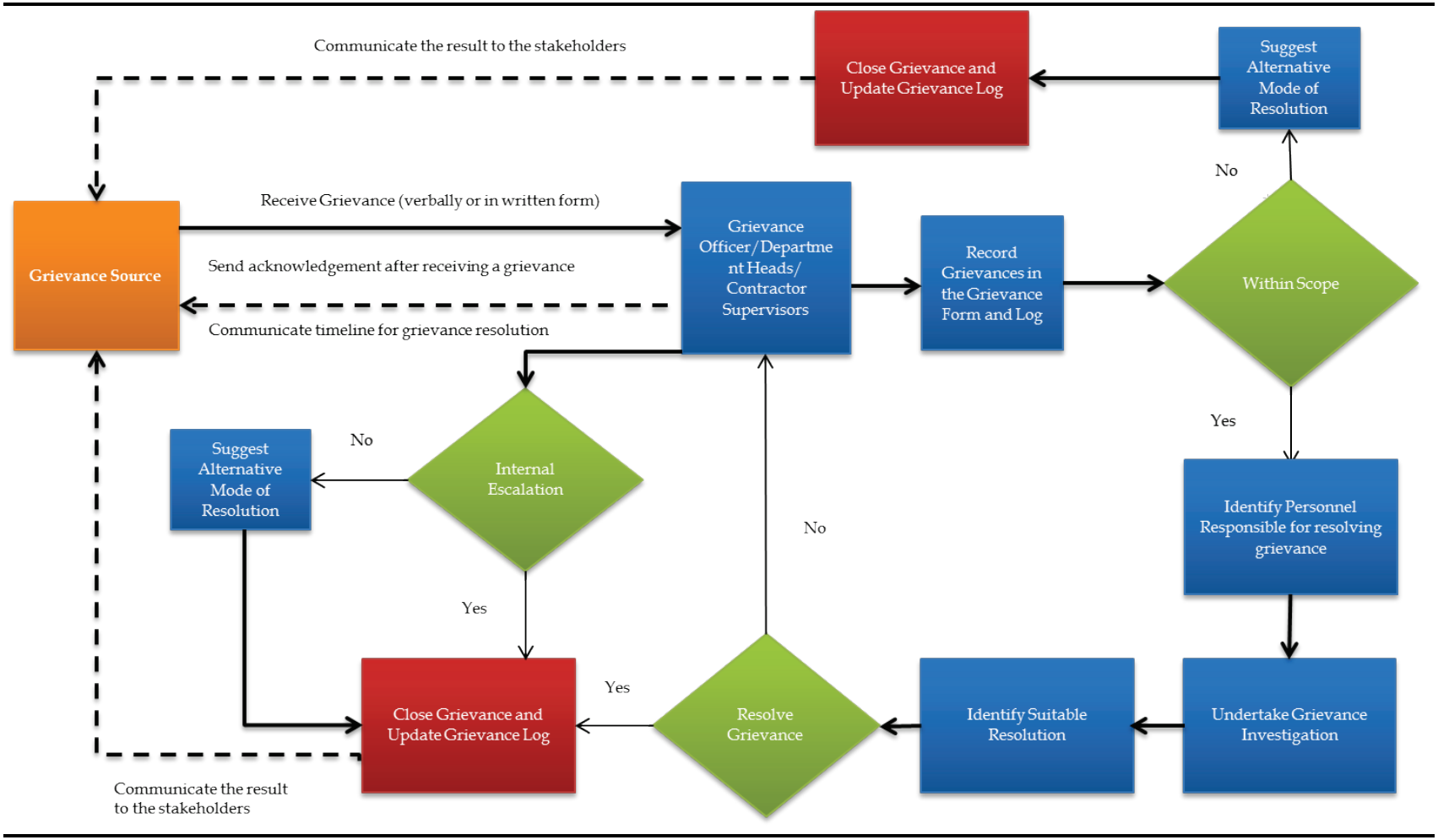
- External Grievances
  - Entitlements identified as part of the SIMF and the implementation of the same;
  - damage of trees and property;
  - further losses to community forest;
  - issues related to transportation and traffic;
  - increase in environment pollution;
  - impact on community health;
  - disturbances to locals due to influx of migrant workers in the area;
  - Issues arising out of sharing of employment and business opportunity;
  - Concerns over the impact on local cultures and customs; and

The list of grievances is indicative and not exhaustive and will be regularly updated as and when the new one arises. Thus, this list does not restrict the stakeholders from communicating any grievances related to the project, even if the grievance is not mentioned above.

8.2 INTERNAL GRIEVANCE MECHANISM

The process to be followed for the redressal of the internal stakeholder grievances is summarized below.

Figure 8.1 Schematic Representation of the Internal Grievance Redressal Process



8.2.1 Publicizing and Disclosure of the GRM

The GRM will be disclosed to the stakeholders through written and verbal communication. The mediums to be used for this purpose are staff meetings, written communication and one-to-one meetings. Each worker and employee shall be made aware of the GRM in place at the time of joining, as part of the induction process.

8.2.2 Receiving and Recording Grievances

As part of the GRM, the grievances from the stakeholders or their representatives may be communicated verbally (in person to the respective supervisor or over a telephonic conversation) or in written form (in the form given below). All grievances communicated in any of these mediums shall be recognized and recorded by the supervisor as and when it is expressed.

Figure 8.2 Grievance Recording Form

GRIEVANCE REGISTRATION	
Case No.:	**Date :**
Name :	
Department/ Contractor Name	
Phone no.	
Details of grievance:	
Name of person recording grievances (if applicable):	
Designation of recording person (if applicable):	
Proposed date of response to grievance:	
Signature of recording person (if applicable)	**Signature of complainant**
GRIEVANCE REDRESSAL RESPONSE	
Date of redresses:	
Decision of GO (give full details):	

The project will also put in place suggestion/ complaint boxes at strategic locations across the facility. These suggestion/complaint boxes will be opened at least every week. The employees and workers may drop their grievances in

these boxes as well in keeping with the format attached. In case of any worker or employee needs to file an anonymous complaint, s/he shall be allowed to do so by not filling the Name, department, signature and contact information. The workers will be informed that grievances will be kept confidential, and they shall not fear reprisals etc. from lodging grievances.

8.2.3 Maintaining a Grievance Register

Each grievance thus received, shall be recorded in a grievance register. The format for the grievance register shall be as follows.

S. No	Date	Grievance Number	Name of Grievant	Department	Medium of Communication	Details of Grievance	Concerned Department	Name of Recording Person	Present Status	Remarks
1										
2										
3										
4										

This grievance register shall be updated at each stage of the grievance redressal. Once the grievance is recorded in the register, a preliminary analysis shall be undertaken by the grievance officer (preferably HR representative) to ensure that the grievance is within the scope of the GRM.

8.2.4 Acknowledgement of Grievance

Once the grievance is received, a grievance number shall be allocated and communicated to the grievant. This communication shall also serve as an acknowledgement of the grievance. In case the grievance is assessed to be out of the scope of the GRM, a communication towards the same shall be made to the grievant, and an alternative mode of redressal shall be suggested. As part of this acknowledgement a tentative timeline for the redressal of the grievances shall be identified, in keeping with the process below. This acknowledgement shall be provided on the same day as the grievance is received.

8.2.5 Resolution and Closure

Allocation of Responsibility

Once the grievance is received and recorded, based on the subject and issue, the Grievance Officer shall identify the department, contractor or personnel responsible for resolving the grievance.

Grievance Investigation

The Grievance Officer and concerned department shall then undertake an enquiry into the facts and figures relating to the grievance. This shall be aimed at establishing and analysing the cause of the grievance and subsequently identifying suitable mitigation measures for the same. The analysis of the

cause will involve studying various aspects of the grievance such as the employees past history, frequency of the occurrence, management practices, etc.

As part of this investigation, the grievance officer may also undertake confidential discussions with the concerned parties to develop a more detailed understanding of the issue at hand. The site investigation shall be completed in no more than 10 working days of receiving the grievance.

Resolution, Escalation and Closure

Based on the understanding thus developed, the grievance officer, in consultation with the concerned departments, shall identify a suitable resolution to the issue. This resolution shall be accordingly communicated to the grievant within 10 working days of completing the site investigation.

In case the issue is beyond the purview of the grievance officer, it shall be escalated to the department head or Owner's Engineer (as appropriate). A communication regarding the same shall be provided to the grievant. The department head or CSE/OE shall in turn endeavour to resolve the grievance within 10 working days of the escalation.

In case the grievance remains unsettled, Department head or CSE/OE will forward the case to the PMO at Kathmandu for the settlement. The Unit Head shall endeavour to resolve the grievance within 10 working days.

If however the PMO is not able to identify an adequate resolution for the grievance, then an adequate response shall be given to the grievant along with a suggested alternative resolution to the grievance.

If at any stage, the grievant is not satisfied with the solution, s/he may choose to ask for an escalation of the grievance to the next level. If at the close of the grievance the grievant is dissatisfied with the resolution, they may appeal the resolution provided and resubmit their grievances. This shall be acceptable up to 3 times, post which the grievant may resort to legal measures if still dissatisfied.

8.2.6 Update of Records

The records of the grievance register shall be updated every working week with the present status of the grievance. Once the grievance is resolved, and the same has been communicated to the grievant, the grievance shall be closed in the grievance register. The grievance register shall also provide an understanding of the manner in which the grievance was resolved. These instances shall then serve as references for any future grievances of similar nature. In case of anonymous complaints, a summary of the grievance and resolution shall be posted on the notice boards and other relevant public places.

8.3 EXTERNAL GRIEVANCE MECHANISM

The process to be followed for the redressal of the external stakeholder grievances is summarized below.

8.3.1 Publicizing and Disclosure of the GRM

The GRM will be disclosed to the stakeholders through written and verbal communication. The mediums to be used for this purpose are public meetings, group discussions, announcements in radios and other communication channels, display of GRM provisions in Gaon Palika offices, District offices and other key locations and provisioning of the GRM in the manner outlined in the previous section. The GRM disclosure will be done along with the disclosure of other management plans. Once a disclosure is done, as part of the annual open public meetings to be undertaken with stakeholders, the project will provide a refresher of the provisions of the GRM and the manner in which grievances can be communicated.

8.3.2 Receiving and Recording Grievances

As part of the GRM, the grievances from the stakeholder or their representatives may be communicated verbally (in person or over a telephonic conversation) or in written form (in the format given below) to the project representatives or to the GO directly. If the grievance is received directly by the GO or other project representatives, it will be recorded directly into the Grievance Form as soon as the personnel return to site. A sample grievance form is as follows.

Figure 8.3 *External Stakeholder Grievance Redressal Mechanism Schematic Representation*

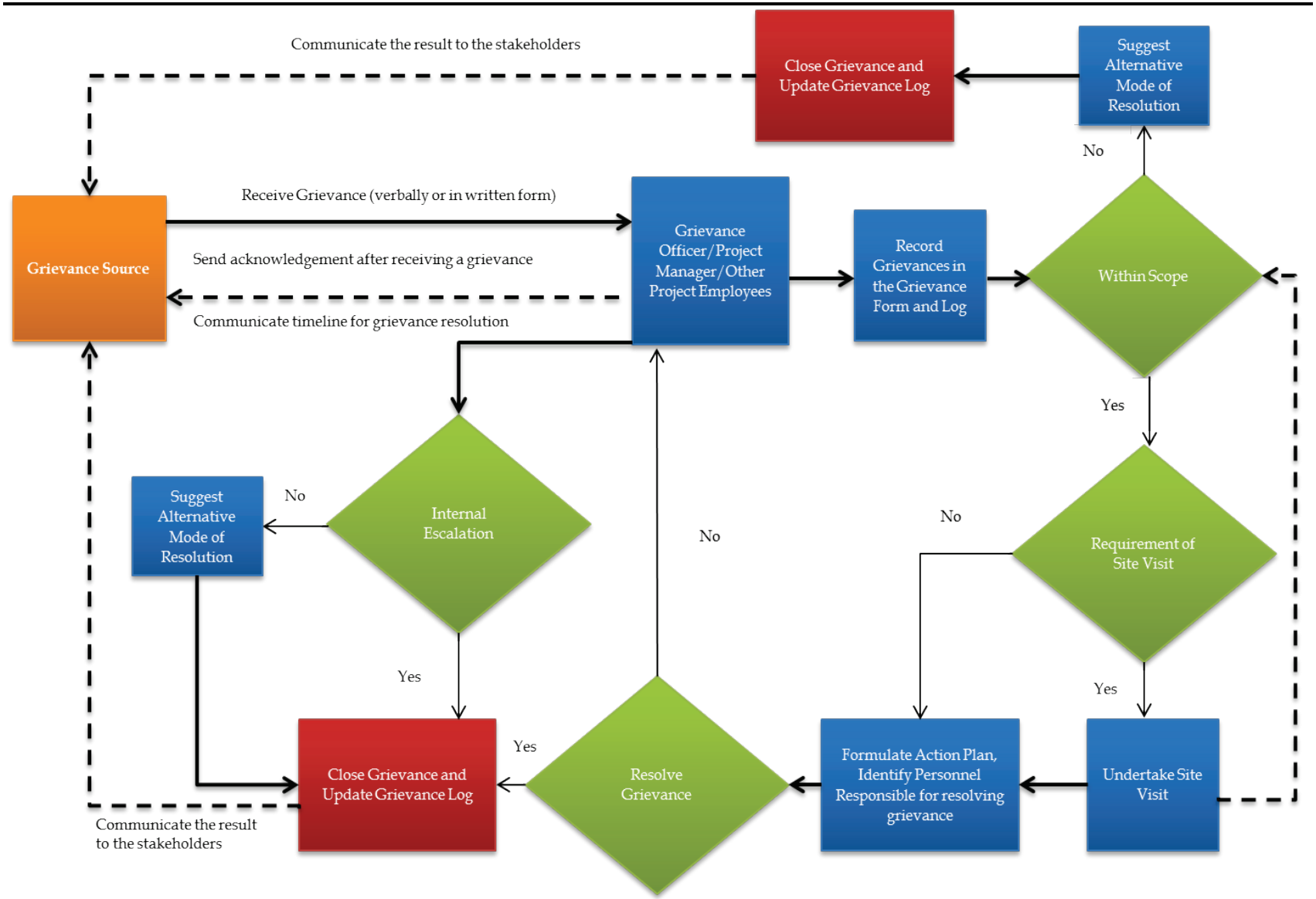


Figure 8.4 Grievance Recording Form

GRIEVANCE REGISTRATION		
Case No.:	**Date :**	
Name :		
VDC/IDP Camp:	**Tole/ Ward:**	
Phone no.		
Details of grievance:		
Name of person recording grievances:		
Designation of recording person:		
Proposed date of response to grievance:		
Signature of recording person	**Signature of complainant**	
GRIEVANCE REDRESSAL RESPONSE		
Date of redresses:		
Decision of GO (give full details):		
Claimant accepts the outcome:	**Accepted**	**Not accepted**
Signature of claimant :		
Signature of GO:		
Note: **Please note, if at any time the grievant is unsatisfied with the resolution of the grievance, they may choose to ask for an escalation to the next level or may resort to legal redress.**		

All project staff will be informed that they must pass all grievances, communications to the Grievance Officer (discussed in the following section) on site as soon as possible after they are received. Details of the person lodging the grievance shall be noted and passed along with the grievance. While receiving the grievance, the option of escalating the grievance or resorting to legal redress in case of dissatisfaction shall be clearly communicated to the grievant along with the case number. The Grievance Officer in turn will communicate all grievances to the Social Manager for the project.

For assisting the communication of grievances, a register will be maintained at the project office and camp, at which any individual/group can come have their complaint registered. Village leaders and government departments will

also be advised to pass any complaints they receive to the site level community liaison officers.

In case of any anonymous complaints, the same may be registered by not entering their personal details in the register. Also, the community, in internal consultation, may appoint a literate individual within the village to assist the illiterate population in communicating their grievances.

8.3.3 Maintaining a Grievance Register

Each grievance thus received, shall be recorded in a grievance register. The format for the grievance register shall be as follows.

S. No	Date	Grievance number	Name of Grievant	VDC/Gaon Palika	Ward/Tole	Details of Grievance	Concerned Department	Name of Recording Person	Present Status	Remarks
1.										
2.										
3.										

This grievance register shall be updated at each stage of the grievance redressal. Once the grievance is recorded in the register, a preliminary analysis shall be undertaken by the social manager to ensure that the grievance is within the scope of the GRM.

8.3.4 Acknowledgment of Grievance

Upon the completion of the recording of the grievance, the stakeholder will be provided with an acknowledgment of the receipt, along with a summary of the grievance.

Box 8.1 Acknowledgement Receipt for Claimant

This receipt is acknowledgement of grievance registration by_____ _____, resident of village _____ on date _____. His case number is _____ and the date for response is _____.

Full name & signature of recording person

In case the grievance is assessed to be out of the scope of the GRM, a communication towards the same shall be made to the grievant, and an alternative mode of redressal shall be suggested.

8.3.5 Site Inspection and Resolution

For the purpose of verifying and resolving the grievances received, site inspection may not be required in all the cases. Depending upon the sensitivity of the issue, requirement of a site inspection will be identified.

A site inspection will be undertaken by the site level community liaison officers or the project member assigned by the Social Manager. The purpose of the site inspection will be to check the validity and severity of the grievance. For this purpose, the personnel may also undertake discussions with the concerned external stakeholder. The inspection will be undertaken within ten days of receiving the grievance. The assigned individual will then work with other relevant members of the Project team to investigate the problem and identify measures to resolve the grievance as appropriate. The personnel to be involved in the grievance resolution shall be dependent upon the nature of the grievance, as discussed in the table below.

Table 8.1 Classification and Categorisation of External Grievances

S. No.	Nature of Grievance	Categorisation
1.	Compensation	Social manager, Environmental and Social Manager
2.	SIMF implementation related	
3.	Compensation on account of damage to community forest etc.	Project Management and EPC contractor, Social Manager, Environmental and Social Manager
4.	Environmental impact, Community health, culture and customs etc.	Project Management and EPC contractor, Social manager, Environmental and Social Manager
5.	Migrant worker related issues	EPC contractor, Social manager, Environmental and Social Manager

8.3.6 Resolution, Escalation, and Closure

Based on the understanding thus developed, the social manager, in consultation with the concerned departments, shall identify a suitable resolution to the issue. This could involve provision of information to clarify the situation, undertaking measures to remedy actual problems or compensate for any damage that has been caused either by financial compensation or compensation in-kind, and introduction of mitigation measures to prevent recurrence of the problem in the future. This resolution shall be accordingly communicated to the grievant within 10 working days of completing the site investigation.

In case the issue is beyond the purview of the social manager, it shall be escalated to the ESST or ESMC Head (as appropriate). A communication regarding the same shall be provided to the grievant. The ESST or ESMC head shall in turn endeavour to resolve the grievance within 10 working days of the escalation.

In case the grievance remains unsettled, ESST or ESMC Head will forward the case to the NWEDC Corporate Team for the settlement. The Corporate Team shall endeavour to resolve the grievance within 10 working days.

If however the Corporate Team is not able to identify an adequate resolution for the grievance, then an adequate response shall be given to the grievant along with a suggested alternative resolution to the grievance.

If at any stage, the grievant is not satisfied with the solution, s/he may choose to ask for an escalation of the grievance to the next level. Where a grievance is found to be not a real problem a clear explanation will be provided to the complainant. If at the close of the grievance the grievant is dissatisfied with the resolution, they may appeal the resolution provided and resubmit their grievances. This shall be acceptable up to 3 times, post which the grievant may resort to legal measures if still dissatisfied.

8.3.7 Update of Records

The records of the grievance register shall be updated every working week with the present status of the grievance. Once the grievance is resolved, and the same has been communicated to the grievant, the grievance shall be closed in the grievance register. The grievance register shall also provide an understanding of the manner in which the grievance was resolved. These instances shall then serve as references for any future grievances of similar nature. However, the project will ensure that all grievances communicated will be maintained in a confidential manner.

For the purpose of ensuring the proper and effective implementation of the SEP and GRM, the project will ensure that this engagement process is given as much importance as the other project activities and ensure the availability of the required resources. The following sub sections discuss both these resource requirements, manpower and financial in detail.

9.1 MANPOWER

In order to ensure the proper maintenance and functioning of the SEP and GRM, the project will make available human resources as required in the form of internal resources within the project as well as external resources such as NGOs or other third parties.

9.1.1 Internal Resources

The project will identify specific project personnel who are to manage the stakeholder engagement and grievance redressal process through the life of the project. These personnel will be part of the Environmental and Social Management Cell for the project. The following figure provides an understanding of the proposed structure of the ESMC.

Figure 9.1 Organization Structure of the ESMC

While the project has already employed 2 site level community liaison officers, one of whom shall serve as the Grievance Officer for the project. One of these liaison officers is a Tamang PAF for the project. In addition to this, the project will also identify any additional personnel, especially women, which may be required for the effective implementation of the SEP and GRM. In case the existent resources at the project appear to be insufficient to meet the needs for the implementation of the SEP and GRM as outlined in the previous sections, the employment off personnel specifically for the purpose of the stakeholder engagement through the life of the project will be undertaken.

Furthermore, due to the fact that a number of contractors and external parties will be involved in the project at various stages of its development, it will be ensured that the contractors/third parties abide by the principles established as part of the SEP and GRM. Wherever possible, relevant conditions will be inserted into the contracts, including right to investigate reported incidents and penalties for non-compliance. Also it will be ensured that vetted and agreed Codes of Conduct are developed and shared with the relevant contractor employees.

Role and Responsibilities of the Social Manager and Site Level Community Liaison Officers

The Social Manager and Site Level community liaison officers will be responsible for the implementation of the SEP for the project and will report to the ESMC Head. These personnel will be responsible for ensuring the implementation of the SEP, including information disclosure and the documenting of the activities undertaken.

Role and Responsibilities of the Grievance Officer

A Grievance Officer will be appointed and will be responsible for coordinating day to day functioning and implementation of the GRM. The Grievance officer will report to the Environmental and Social Manager and Social Manager on a regular basis, as discussed subsequently.

9.1.2 External Resources

In case the internal resources at the project appear to be insufficient, the project will also consider engaging a reputed third party in the form of the organization familiar with the region and are acceptable to the community. The NGO would then not only serve as a link between the company and the community but as a third party in the implementation of the SEP and GRM. In addition to this, the project will also explore the potential of involving the local community, especially women, in the monitoring process of the SEP and GRM implementation.

9.2 TRAINING REQUIREMENTS

The project will, from time to time assess the adequacy and capacity of the ESMC team members in terms of their understanding of the SEP and GRM put in place for the project and the principles governing the same. Provisions for refresher trainings will be put in place.

9.3 FINANCIAL RESOURCES

The project will ensure that the budget formulated for the purpose of the stakeholder engagement process and grievance redressal is sufficient to meet the expenses of the same. In case of grievances requiring monetary compensation, the amount for the same will be provided through the dedicated escrow account set up for the project.

9.4 DOCUMENTATION, MONITORING AND REPORTING PROCESS

As has been discussed in the previous sections, the review and appraisal process in any project is an extremely important component for the smooth functioning and the avoidance of major risks within a project. This importance of the review process lies in the fact that it allows for the corrections of any oversight which may have been made during the initial stages of a project through mid-course corrections. This also serves as an important quality assurance mechanism.

The review process becomes all the more important when it is kept in mind that the SEP is a 'live document' or in other words a document which needs to be revised in a timely manner so as to make it comprehensive for any given period of time. This is so because of the fact that due to the life span of the project, it is difficult to properly identify and understand each stakeholder in the beginning of the project. The SEP thus requires regular reviews keeping in mind attributes such as the stakeholders, the engagement process for each stakeholder and the reporting time period for each.

9.5 DOCUMENTATION OF THE SEP-GRM IMPLEMENTATION

All stakeholder engagement activities as mentioned in the previous sections will be documented, in a standard engagement activities format, as can be seen below.

Table 9.1 Format for Recording Engagement Activities

Date	Location	Stakeholder Group	Form of Engagement	Purpose of Engagement	Key findings/ conclusion	Reference to MoMs	Remarks

In addition to this format, the key points of each engagement activities will be documented in the form of Minutes of Meetings (MoMs), which will be signed by the attendees of the activities. These MoMs will be referred to in the documentation format, as can be seen above. To the extent possible, photographic evidence will be maintained of the engagement activities undertaken. For the purpose of documenting the grievances received, the format as given in the

9.6 MONITORING OF THE SEP-GRM IMPLEMENTATION

It is important to monitor stakeholder engagement to ensure that the consultation and disclosure efforts are effective, and in particular that the key stakeholders such as local communities have been meaningfully consulted through the process. The monitoring of the SEP implementation will be undertaken on a quarterly basis by the ESMC. Monitoring will include:

- Auditing the implementation of the SEP;
- Monitoring the formal and informal consultation activities conducted with the stakeholder groups;
- Monitoring the effectiveness of the engagement processes in managing impacts and expectations by:
  - Tracking feedback received from engagement activities
  - Recording and tracking commitments made to communities; and
  - Assessing the efficacy of the engagement activities in terms of the desired outcomes and the participation of the stakeholder groups
- Tracking of grievances received and their resolution status
  - Number of grievances received
  - Nature of grievances received
  - Proportion of grievances closed in satisfaction to the grievant
  - Proportion of grievances closed within 10 days of receiving the grievances
  - Proportion of grievances escalated due to non-resolution internally
  - Proportion of grievances escalated by grievants

The Social Manager will also undertake quarterly reporting to the ESMC which would allow for the ESMC to adequately monitor the implementation of the SEP, as is discussed in the following section.

9.7 REPORTING OF THE SEP-GRM

The initial years of Project construction and SIMF implementation will witness lot of flux in the profile of stakeholders identified and subsequently the nature of their stakes may change. Additionally, the concerns and grievances of the PAFs and other stakeholder may also be more on account of uncertain location of the PAFs, SIMF implementation, and other construction related issues. Thus, the performance of the SEP-GRM will be reviewed on a bi-annual basis during the initial years of SEP implementation. For the purpose of review, the quarterly reports will be considered for analysis and discussion. On the basis of these reports, a Stakeholder Engagement and Grievance Redressal Report will be prepared and disclosed biannually and annually, including a summary of issues raised by stakeholders, numbers and subjects of grievances, a summary of key actions taken to address the concerns, analysis of trends and plans for engagement in the next time period.

Appendix H Indigenous People's Plan










Social Impact Management Framework Update

Indigenous People's Plan: *Upper Trishuli-1 Hydropower Project, Nepal*

Draft Report

June 2018

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CONTENTS

1 INTRODUCTION

1.1 BACKGROUND

The proposed Upper Trishuli-1 (UT-1) Hydropower Project (216MW) is on River Trishuli within Rasuwa District of Central Development Region of Nepal. Nepal Water and Energy Development Company Limited (NWEDC) is developing the project and is considering financial support from a consortium of lenders including International Finance Corporation (IFC), Asian Development Bank (ADB), Asian Infrastructure Investment Bank (AIIB), European Investment Bank, the Export–Import Bank of Korea, the German Investment Corporation (DEG), Korean Development Bank, Proparco, CDC, as well as with potential guarantee from World Bank (WB) and Multilateral Investment Guarantee Agency (MIGA).

The Environment Impact Assessment (EIA) as required under the laws of Government of Nepal (GoN) was carried out for the project and was approved in February 2013. With the involvement of international lenders, this environment and social impact assessment process carried out earlier was strengthened with supplementary studies and formulating complementary environment and social action plans in February 2015. In April 2015, Nepal suffered a large earthquake with epicentre within 100km radius of the proposed UT-1 project site. The earthquake brought death, destruction and disruption in social life and livelihood practices. Though post-earthquake relief and reconstruction efforts addressed immediate humanitarian concerns, the normalcy of life and livelihood practices not achieved yet. This special circumstance has greatly complicated the process of planning to mitigate and manage impacts attributable to UT-1 project.

The lenders selected the international sustainability-consulting firm Environmental Resources Management (ERM) to consolidate all prior impact assessments and supplemental and complementary studies into a single Updated Non-Technical ESIA Report (Updated ESIA), along with an updated Environmental and Social Management System (ESMS) and Environmental and Social Management and Monitoring Plans (ESMMP), including a Social Management Framework. This report is part of this Social Management Framework and address specific requirements of Indigenous Peoples as project-affected persons (PAPs).

The social impacts of UT-1 on the local population is addressed through a number of management plans:

- Occupational Health and Safety Management Plan for workers;
- Workers Accommodation Management Plan;
- Land Acquisition and Livelihood Restoration Plan;
- Labour Influx Management Plan;
- Cultural Heritage Management Plan;

- Stakeholder Engagement and Grievance Redress Plan; and
- Indigenous Peoples Plan (this report).

In addition to these social management plans, as per provisions under Project Development Agreement (PDA) signed between NWEDC and GoN, NWEDC will develop and implement following plans in consultation with GoN.

- Local Benefit Sharing Plan;
- Disaster Management Plan;
- Employment and Skill Training Plan; and
- Industrial Benefit Sharing Plan.

The PDA describes broad obligations of NWEDC towards these plans on the basis of which these detailed plans are developed by NWEDC in close collaboration with GoN.

This report examines the impact of the proposed project on Indigenous Peoples including their livelihood, culture and rights as members of Indigenous Peoples community. This Draft IPP along with other Draft documents (ESIA-ESMP, SIMP) shall be disclosed and will be used to facilitate consultation with affected IPs households/ communities for soliciting their comments and feedback for designing of adequate and acceptable mitigation measures.

1.2 OBJECTIVES AND SCOPE OF THE IPP

This document records the efforts of NWEDC for minimizing and/ or mitigating the adverse impacts from the project on the Indigenous Population in the Project Area of Influence (AoI). Where avoidance was not possible, NWEDC has planned mitigation measures, and this document provides a synopsis of that. The Draft IPP also identifies potential measures to enhance the positive impacts and opportunities from the project for the local Indigenous Peoples. The specific objectives of this Draft IPP are as follows:

- To identify impacts that are likely to affect Indigenous Peoples as a collective and whether they would affect them differently;
- To share relevant information on various impacts and mitigation measures/ opportunities for project benefits with affected IPs communities and their representatives.
- To seek their suggestions for making the proposed mitigation measures and various action plans more effective, appropriate and acceptable to them;
- To identify opportunities and actions to enhance positive impacts of the project on Indigenous People, e.g. by means of capacity building, agricultural support/extension, skills enhancement, preferential employment (if feasible), improved service delivery where feasible, and other targeted CSR initiatives; and

- Finally, to develop a mutually acceptable memorandum of understanding between the project proponent and affected IPs and seek support and consent for the project through an FPIC process.

1.3 APPLICABLE REFERENCE FRAMEWORK

This Draft IPP is prepared to meet the requirements of the IFC PS 7: Indigenous People and the ADB SPS 2009. The following table provides key provisions in these two applicable reference framework.

Table 1-1 Applicable Reference Framework Requirements for IPDP and FPIC

Applicable Reference Framework	Requirements for IPDP	Requirements for FPIC
IFC PS 1: Assessment and Management of Environmental and Social Risks and Impacts	The part of PS-1 dealing with Management Program envisage Indigenous Peoples Plan (IPP) as a thematic plan and should be developed by qualified experts with substantive experience.	For projects with adverse impacts to Indigenous Peoples, the client is required to engage them in a process of ICP and in certain circumstances; the client is required to obtain their Free, Prior, and Informed Consent (FPIC).
IFC PS 7: Indigenous People	• If adverse impacts are unavoidable The project should prepare an Indigenous Peoples Plan (IPP) outlining the actions to minimize and/or compensate for adverse impacts in a culturally appropriate manner • a free-standing IPP may be prepared, or it may be a component of a broader community development plan • The plan should detail actions to minimize and/or compensate for adverse social and economic impacts, and identify opportunities and actions to enhance positive impacts of the project on the Indigenous Peoples. • Where appropriate, the plan may also include measures to promote conservation and sustainable management of the natural resources on which the Indigenous Peoples depend • The plan should include a clear statement of roles and responsibilities, funding and resource inputs, a time-bound schedule of activities, and a budget. • The IPP shall be regular monitored and should be flexible to allow for it to be adapted as needed if circumstances change,	One of the objectives of the PS is to ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the following circumstances are present • Impacts on Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use • Relocation of Indigenous Peoples from Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use • Significant Impacts on Critical Cultural Heritage
ADB SPS Safeguard Requirements 3: Indigenous People	• If the proposed project will have impacts, positive and/or negative, on Indigenous Peoples, the borrower/client will prepare an IPP in the context of the impact assessment and through meaningful consultation with the affected Indigenous Peoples communities. • The IPP will set out the measures whereby the borrower/client will ensure that: o that affected Indigenous Peoples receive culturally appropriate social and economic benefits; and	• The borrower/client will undertake meaningful consultation with affected Indigenous Peoples to ensure their informed participation in o designing, implementing, and monitoring measures to avoid adverse impacts on them or, when avoidance is not possible, to minimize, mitigate, and compensate for such effects; and o tailoring project benefits that accrue to them in a culturally appropriate manner.

Applicable Reference Framework	Requirements for IPDP	Requirements for FPIC
	○ That when potential adverse impacts on Indigenous Peoples are identified, these will be avoided to the maximum extent possible. • Where this avoidance is proven to be impossible, based on meaningful consultation with indigenous communities, the IPP will outline measures to minimize, mitigate, and compensate for the adverse impacts. • The level of detail and comprehensiveness of IPPs will vary depending on the specific project and the nature of impacts to be addressed. The borrower/client will integrate the elements of the IPP into the project's design	• To carry out meaningful consultation with affected Indigenous Peoples, the borrower/ client will establish a context-specific strategy for inclusive and participatory consultation, including approaches of identifying appropriate Indigenous Peoples representatives, and consultation methods appropriate to the social and cultural values of the affected Indigenous Peoples communities. • The borrower/client will pay special attention to the concerns of indigenous women and youth. • The consultation process and its results will be documented and reflected in the Indigenous Peoples plan (IPP). • the project will seek consent from the affected Indigenous Peoples communities in case the project is likely to result in the following impacts; ○ commercial development of the cultural resources and knowledge of Indigenous Peoples; ○ physical displacement from traditional or customary lands; and ○ commercial development of natural resources within customary lands under use that that would impact the livelihoods or the cultural, ceremonial, or spiritual uses that define the identity and community of Indigenous Peoples.

1.4 *INDIGENOUS PEOPLES/ INDIGENOUS NATIONALITIES IN NEPAL*

The process of recognition of the rights of Indigenous Peoples in Nepal is progressive. Until 1990 Indigenous Peoples separate identities and concerns were largely ignored. This position changed with the political change[1] in 1990 and gradually representatives from Indigenous Peoples, scholars and academic groups highlighted the socio-economic discrepancies between dominant groups and indigenous people and demanded special attention to them. The Self-Governance Act 1998 for the first time recognized that Indigenous Peoples are excluded from the governance process and they need to be brought into national mainstream. The Act made provisions for their representation in Village, Municipal and District Development Councils. It is believed that this law became the basis of the passing of a more specific law that defined and identified Indigenous Peoples.

In 2002, National Foundation for Development of Indigenous Nationalities Act (NFDIN-2002) defined 'Adibasi Janajati' as a group or community with its own other tongue and traditional customary practices, distinct cultural identity, social structure and oral or written history. A comparative analysis of this definition vis-à-vis the definition of the Indigenous Peoples (IPs) as per ILO Convention No 169 and United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)[2] by several IP activists, scholars and representatives points to two issues of departure. First, NFDIN 2002 does not recognize the 'self-identification' of Indigenous Peoples. It has identified 59 *Adibasi Janajatis* and set a process of constituting a committee which will decide on such claims. Second, the existence of traditional political institutions is not a parameter for recognition of the Indigenous Peoples.

Thus, NFDIN 2002 laid the foundation for identification of IPs in Nepal. The Adibasi Janajati is translated as 'Indigenous Nationalities' in Nepal contrary to the more popular term 'Indigenous People'. This to several scholars and authors is indicative of the political aspirations and territoriality which is an integral part of the Indigenous Peoples movement in Nepal since 1990s.
The strength of the Indigenous Peoples movement in Nepal was so strong that Nepal was the first country in Asia and second in Asia-Pacific to ratify ILO Convention No 169. Nepal ratified the ILO C-169 on September 2007 and also voted in favour of UNDRIP in UN General Assembly. The twenty points agreement between Indigenous Peoples and Nepal Government in 2007 which kick-started the on-going political process includes inclusion of the IPs in the process of restructuring the State and formation of Nepal's new Constitution.

[1] In 1990 Nepal made transition from an absolute monarchy to constitutional democracy after a popular Jan Andolan supported by multiple political parties.

(1) [2] The convention No. 169 in its article 7 provides right to the indigenous and tribal people to decide their own priorities for the process of development. Article 12, 13, 14 and 15 safeguards rights of the indigenous people in the land and natural resources in territories traditionally occupied by them.

(2) The UNDRIP adopted in 2007 sets out the individual and collective rights of indigenous peoples, as well as their rights to culture, identity, language, employment, health, education and other issues . The goal of the Declaration is to encourage countries to work alongside indigenous peoples to solve global issues like development, multicultural democracy and decentralization.

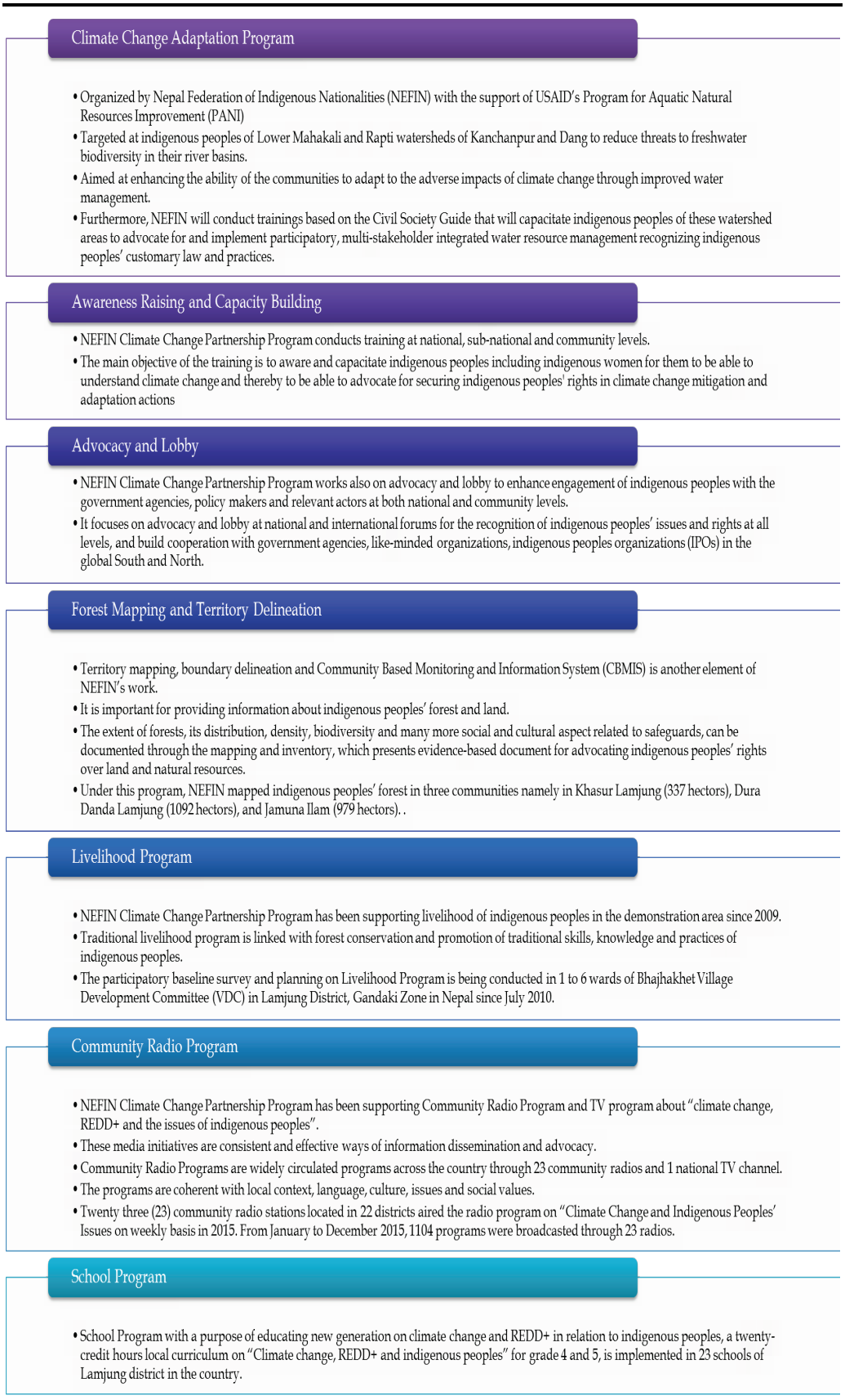
As a consequence, several Indigenous Peoples Organizations participated in the election to the Constituent Assembly and have been contributing to the finalization of the Constitution.

The Constitution, guarantees the right to social justice and participation in the state structure on the basis of the principle of social inclusion. Art 63.4.3(a) provides proportional representation of indigenous people in the Constituent Assembly. There is an intense debate in the Constituent Assembly on recognizing autonomous states (11 states and sub-states) territorial claims of different ethnic groups within the federal democratic structure of Nepal.

The NFDIN 2002 not only identifies 59 Adibasi Janajatis, it also divides them into four geographic regions. The mountain region or Himalaya has 17, Hills have 24, Inner Terai has 7 and Terai has 12 Indigenous People groups. The Nepal Federation of Indigenous Nationalities (NEFIN), which is a non-profit organization representing indigenous peoples issues, makes a classification based on their social-economic status and vulnerabilities. The five categories are: endangered groups, highly marginalised groups, marginalized groups, disadvantaged groups and advanced groups.

The Nepal Federation of Indigenous Nationalities (NEFIN) undertakes a number of development programs for Indigenous people across the country. While the programs are not specific to any group or region, it is understood that they can be availed by any member of the IP population. The overview of the programs offered to IPs is provided in Figure 1.1. Although these programs are not implemented in project area, yet it provides range of Government Initiatives for the IPs in project area as well.

Figure 1.1 Developmental Programs for Indigenous Population in Nepal



Source: NEFIN website

1.5 SCREENING OF CLIENT'S OBLIGATIONS UNDER PS-7

The IFC PS-7 clause-14 states 'if client proposes to locate a project on lands traditionally owned by or under the customary use of Indigenous Peoples and adverse impacts can be expected, client will take steps to protect the rights of the indigenous people.' The screening of the client's obligations vis-à-vis provisions of PS-7 is presented in table below.

Table 1-2 Screening of the client's obligations vis-à-vis provisions of PS-7

Provisions	Status
Document efforts to avoid and otherwise minimize the area of land proposed for the project;	Client has minimized the land required for the project and avoided un-necessary acquisition of land for the project. The details are discussed in the land requirement and alternative analysis sections of this report.
Document efforts to avoid and otherwise minimize impacts on natural resources and natural areas of importance to Indigenous People	The requirement of the community forest land is minimized and the land will be used during construction phase only.
Identify and review all property interests and traditional resource uses prior to purchasing or leasing land;	The ESIA and LALRP processes have been undertaken to review property interests and traditional resource use as part of the planning process of the project.
Assess and document the Affected Communities of Indigenous Peoples' resource use without prejudicing any Indigenous Peoples' land claim. The assessment of land and natural resource use should be gender inclusive and specifically consider women's role in the management and use of these resources;	The assessment of the affected communities of IP and their resource use is conducted as part of this study and needs to be read in conjunction with the LALRP.
Rights under national law, including any national law recognizing customary use rights;	The legal requirements under the national law were screened. The Forest Act 2044, Forest Rules 2051 and Availing Forest Land for Other Purpose Procedure 2063 were referred. There is a provision of holding a general assembly of the concerned Community Forest Users Groups (CFUG) to seek their consent by the DFO prior to recommendation to the council of ministers to approve the use of forest land for non-forest use. Though Nepal has ratified ILO C-169 and UNDRIP, no specific process has been established for free prior informed consent (FPIC) process in the country.
Offer Affected Communities of Indigenous Peoples compensation and due process in the case of commercial development of their land and natural resources, together with culturally appropriate sustainable development opportunities.	There is no law which recognizes the customary use rights over other natural resources such as landscape and water. However, the hydropower development policy of Nepal recognizes that the hydropower development to act as a stimulus to bring long term sustainable benefits to Nepal in general and local community in particular. Therefore, it makes provisions of Local Benefit Sharing Plan, Industrial Benefits Plan and Employment and Skill Training Plan as part of the responsibility of NWEDC.

In keeping with the impacts identified, certain mitigation measures have been identified. These mitigation measures are applicable on all the PAFs/ land owners impacted by the project activities, and are not specific to the IP population. In addition to this, certain key measures have been identified for the IP population to allow for the minimization of adverse impacts and maximization of opportunities created by the project. The following sub sections provide an understanding of the key mitigation measures put in place, including the requirement for an FPIC process.

1.6 SCREENING FOR FPIC REQUIREMENT

IFC PS-7 in clause 14 deals with the circumstances in which free, prior and informed consent process has to be conducted. The conditions which trigger the FPIC for this project are summarized in Table below.

Table 1-3 Special Circumstances requiring FPIC and its relevance

Criteria	Relevance	Compliance Status
Impacts on lands and natural resources subject to traditional ownership or under customary use	The community forest land to be used for the project is part of the collectively owned natural resources by local Indigenous Peoples. The changes in the river condition due to project will also potentially impact customary use of the river and fish population in it.	The DFO is reported to have carried out the consultation with CFUGs and obtained consent holding General Assembly of these three concerned CFUGs as per Forest Rules 1995. As the process documentation is not available, the adequacy of the process could not be judged.
Relocation of IPs from lands and Natural Resources subject to traditional ownership or under customary use.	Project involves acquisition of 36 structures including 27 residential structures, 8 cowsheds, and 1 water mill. The residential structures included 14 primary residences, 5 secondary residences (only used seasonally) and 8 partially constructed houses. Out of the 14 primary residences 7 were prior to earthquake and 7 are post-earthquake. They impact 12 families.	It should be noted that earthquake had damaged all structures and all families moved to IDP camps.
Critical Cultural Heritage	The river, streams and landscape affected by project activities were not found to be assigned cultural and spiritual value by local IPs communities. Hence, no critical cultural heritage is located in project impact area.	
Commercial use of Traditional Knowledge and Knowhow of IPs	Not Relevant	

As the project impacts the lands and natural resources subject to traditional ownership/under customary use of IPs as well as relocation of few IP PAFs, the requirement of free prior and informed consent for the project is triggered.

2 DESCRIPTION OF PROJECT

2.1 PROJECT LOCATION

The Project is located in a remote area in the upper portion of the Trishuli River Basin, just downstream of the confluence of the Langtang Khola and the Bhote Khosi River. The Langtang National Park forms the eastern boundary of most of the Project area. There are six existing operating hydropower projects and seven projects under construction within the Upper Trishuli River Basin. In addition, the Upper Trishuli-2 Project is proposed, but not yet under construction, and would be located approximately 0.5 kilometre upstream from the UT-1 dam. Two of the existing and two of the under-construction hydropower projects on the main stem of the Trishuli River downstream of the Project (the nearest, UT-3A Hydropower Project, is approximately 1.5 kilometres away).

2.2 PROJECT FACILITIES

The Project consists of a 100.9-metre-wide diversion dam in a narrow gorge located on the Trishuli River 275 metres downstream of the confluence of the Langtang Khola with the Bhote Khosi River (Figure 2-1). The diversion dam creates a small 2.1-hectare (ha) impoundment and diverts up to 76 cubic metres per second (m^3/s) of water through a powerhouse with a 216-megawatt (MW) capacity, returning the water to the Trishuli River approximately 10.7 kilometres downstream of the dam.

Table 2-1 Overview of Upper Trishuli-1 project facilities

Project Facility	Description
Dam	100.9 m long x 30.85 m wide x 29.5 m high concrete gravity dam
Spillway Gates	Three 11.0 m wide x 16.5 m high spillway gates capable of passing 200 year storm (2,555 m^3/s)
Reservoir	2.1 ha impoundment at normal operating elevation (1255.0 m)
Intake Structure	Horizontal bell-mouth type intake with two 3.25 m wide x 6.5 m high roller gates on right side near spillway at intake elevation of 1247.0 m
Desander	Underground horizontal flushing type desander with 3 chambers each 115.0 m long, 10.0 m wide, and 23.93 m high designed to remove particle sizes of 0.2 mm or larger, with three sediment flushing channel connecting into a 3.4 m wide x 1.7 m high flushing tunnel
Headrace Tunnel	6.5 m diameter x 9.7 km long low pressure tunnel
Surge Tank	8.5 m diameter x 38 m high tank to manage pressure changes in headrace tunnel
Vertical Pressure Tunnel	6.5 m diameter x 292 m long concrete lined high pressure tunnel
Horizontal Pressure Tunnel	6.5 m diameter x 40 m long concrete lined high pressure tunnel
Penstock	110.7 m long x 1.6 m to 6.5 m diameter concrete (upper section) and steel (lower section) high pressure pipe
Powerhouse	Underground 3 vertical axis Francis turbine generating units each with 72 MW of capacity accessed by a tunnel

Project Facility	Description
Tailrace Tunnel	Three 6.5 m diameter x 55.0 m long concrete lined pipes combining into one 6.5 m diameter x 178 m long concrete tunnel
Tailrace Outlet	6.5 m diameter x 38.15 m long outlet at elevation 910.0 m
Transformer Cavern	Main transformer and 220 kV gas insulated switchgear
Cable Tunnel	381.5 m long
Take-off Yard	Underground facility that will house transformers, disconnecting switches, circuit breakers, current transformers, voltage transformers, bus bars, and other necessary protection equipment
Administrative Complex	Administration, Main Control, Generator, Worker Accommodation, and Security buildings

Source: DKJV 2017

ha = hectare; km = kilometre; kV = kilovolt; m = metre; mm = millimetre; m^3/s = cubic metres per second; mm = millimetres; MW = megawatt

2.3 *ANCILLARY PROJECT FACILITIES*

2.3.1 *Access Roads*

Vehicular access to the Project is from the public Betrawoti-Mailung-Syabrubesi Road (i.e. the road to China), via a public spur road, which was constructed by the nearby Mailung Hydropower Project, but is managed by the Mailung Rural Municipality. Nepal Water and Energy Development Company Limited (NWEDC) constructed a private bridge over Mailung Khola from the spur road to access their former construction camp and powerhouse site, but it was destroyed by the earthquake. NWEDC proposes a new access to the powerhouse site, downstream of the former bridge, which includes a new 39.6 m long by 4.3 m wide Bailey Bridge (a type of portable, pre-fabricated, truss bridge) across Mailung Khola. As part of the Project, NWEDC will construct an 11.84-kilometre-long/5.5-metre-wide private road from the Mailung Khola Bridge to the UT-1 dam site.

The Project will also take advantage of the newly constructed "Army Road," which follows along the east bank of the Trishuli River and ultimately extends to China. There will be two points of access to the Project from the Army Road:

- Near the powerhouse – a short access road and temporary 51.8 m long by 4.3 m wide Bailey Bridge across the Trishuli River to access the Army Road as well as the Mailung Worker Camp; and
- Near the dam site and Haku Besi – a short access road and temporary 39.6 m long by 4.3 m wide Bailey Bridge across the Trishuli River that connects the Army Road with the NWEDC Access Road.

2.3.2 *Transmission Line*

The Project will require construction of a 1184.5-metre-long single circuit 220 kV transmission line within a 30-metre-wide right-of-way. The transmission line will require the construction of five new 35-metre-high steel lattice towers from its take-off yard to the Tower AP-28 of Nepal Electricity Authority's

(NEA) proposed Chilime-Trishuli 220-kilovolt double circuit transmission line. The transmission line will have a minimum ground clearance of 11 metres.

In accordance with Nepalese regulations, NWEDC will permanently acquire the land for the five towers (with each tower having a 13 metre by 13-metre concrete pad) and will lease the remaining right-of-way land from the government. The take-off yard will be built within the powerhouse boundary on land already procured by the Project. Project Design Changes since Supplemental Environmental and Social Impact Assessment

2.4 *PROJECT DESIGN CHANGES DUE TO EARTHQUAKE IN APRIL 2015*

NWEDC had initiated construction prior to the April 2015 earthquake. It had constructed a bridge over the Mailung Khola, a worker camp at the Mailung School (adjacent to the powerhouse) to facilitate this construction of Access Road. Approximately 5.1 kilometres out of 11.2km of the access road connecting to the dam site was completed at the time of earthquake. As a result of the earthquake, the bridge was damaged, the worker camp destroyed, and portions of the access road were impacted by landslides.

As a result, NWEDC will construct a new bridge over Mailung Khola downstream of the damaged bridge, relocate the worker camp for safety reasons to the east side of the Trishuli River, and is in the process of removing the landslide debris covering portions of the access road. In addition, the Project design has been modified to take into account better defined seismic hazards (e.g. the Lender's Engineer specified a Maximum Credible Earthquake of 0.83 g [acceleration of gravity] for a 3,000-year recurrence period based on a Deterministic Seismic Hazard Analysis), changes in landscape conditions (e.g. landslides), and to optimise engineering aspects of the dam. The dam design has also been upgraded to withstand a 10,000-year flood event with a combination of spillway gates and an emergency spillway overflow, as well as revised to accommodate a fish ladder. These Project design changes are summarized in Table below.

Table 2-2 Project design changes due to earthquake in 2015

Project Feature	Original Design	Revised Design	Reason for Change
Dam	Spread concrete foundation Design discharge – 3,563 m^3/s at 5,000 year frequency	Floating foundation Design discharge – 3780 m^3/s at 10,000 year frequency Fish ladder included	Updated seismic design and to include a fish ladder
Intake	Spread concrete foundation Gravel trap at front of intake	Bored cast in-place pile Bed load sluice, settling basin and gravel trap	Updated seismic design To prevent sediment inflow
Powerhouse	Outdoor transformer	Transformer set in cavern	Updated seismic design

Project Feature	Original Design	Revised Design	Reason for Change
Take-off yard	Location – Station 0+800 Access Tunnel – 353 m Cable Tunnel – 183 m Penstock work adit – 196 m D/T Shaft work adit – 83 m	Location – Station 0+80 Access Tunnel – 377 m Cable Tunnel – 381.5 m Penstock work adit – 280 m D/T Shaft work adit – 150 m	Avoid landslide area
Access Roads	19 km	Revised alignment, reduced road length to 11.8 km by replacing some access roads with tunnels	Avoid landslide areas
Surge tank access	2,750 m access road with 18 m air vent tunnel	1,740 m air vent/access tunnel (no access road)	Avoid landslide area
Work adit-4	342 m tunnel	1,140 m tunnel	Avoid landslide area
Powerhouse Worker Camp	Powerhouse Worker Camp on west side of river near Mailung Khola	Powerhouse Worker Camp relocated to east bank of Trishuli River	Avoid landslide area

Source: UT-1 HEP Detail Design Report, DKJV, 2017

km = kilometre; m = metre; m^3/s = cubic metre per second

2.5 *PROJECT CONSTRUCTION AND TEMPORARY WORKS*

Project construction is expected to take approximately 60 months to complete and will include establishment of temporary worker camps, infrastructure, river diversion works, quarries, and spoil disposal areas, which are described below.

2.5.1 *Project Workforce*

Project construction is expected to employ approximately 1,090 skilled, semi-skilled, and unskilled workers over the 60-month construction period. Approximately 10 to 15 percent of the workforce will be recruited locally, with the remainder from elsewhere in Nepal or expatriates.

2.5.2 *Temporary Worker Camps*

The Project will require four worker camps, each including accommodations, mess hall, medical clinic, recreation facilities, parking areas, and various offices, workshops, warehouses, storage areas, waste management facilities, and infrastructure. An overview of the proposed workers accommodation is provided in table below.

Table 2-3 Overview of the proposed temporary workers camps during construction phase

Worker Camp	Location	Capacity	Timing
Fulbari	Near dam site	Not yet determined	2019 - 2023
Thangu	Near Adit #1	400 workers	2020 - 2023
Bajet Phat	Near Adit #2	380 workers	2019 - 2022
Mailung	Near powerhouse and take off yard	500 workers	2018 - 2023

2.5.3 Construction Yards and Infrastructure

The construction phase will also involve setting up construction yards with facilities such as batch plants, stone crushers, and storage yards for construction materials and equipment.

- Batch Plants – three Batch Plants are proposed for making concrete, one in the Fulbari area near the dam site, one in the Tumda Dagar area near Adit #3, and one in the Mailung area near the powerhouse and take off yard;
- Crushing Plant – one Crushing Plant in the Tumda Dagar area near Adit #3;
- Construction and Equipment Yards – several construction and equipment storage yards near the worker camps

All of these facilities are located on the west side of the Trishuli River across from Langtang National Park with the exception of the Mailung Worker Camp, which is located on the east side of the Trishuli River within the Langtang National Park buffer area.

The Mailung Worker Camp was relocated to the east side of the river for worker health and safety reasons as the original worker camp, which was located on the west bank of the river, was severely damaged during the 2015 earthquake resulting in the death and injury of many construction workers. This facility will be located on 4.16 ha of land, of which approximately 2.80 ha are located within the Langtang National Park buffer zone and will be leased for 7 years from the Park, and 1.36 ha,which will be leased from a private landowner. This selected site was the only site with suitable topography and safe from earthquake-induced landslides in reasonable proximity to the powerhouse. NWEDC, with the consent of the Langtang National Park and the Buffer Zone Committee of Ramche, submitted an Updated Environmental Management Plan addressing potential impacts associated with this revised worker camp location, which was approved by the Nepal Ministry of Population and Environment on 31 December 2017 (NWEDC 2017). After construction is complete and/or the lease expires, NWEDC will return the 2.80 ha to the Langtang National Park.

Project construction will require sources of power, water, wastewater treatment, and fuel storage as summarized in Table 2-4.

Table 2-4 Overview of supporting infrastructure during construction phase

Requirement	Infrastructure	Capacity	Comments
Power	Diesel generation sets	5 MW	Facilities at each worker camp and construction yard.
Water	Water treatment plant and storage tanks	189,500 litres per day	Water source – groundwater. Facilities at each worker camp.

Wastewater	Wastewater treatment plant	175,500 litres per day	Facilities at each worker camp. Discharge to Trishuli River
Fuel Storage	Diesel	2,000,000 litres	Facilities at each worker camp. Aboveground tank with secondary containment

MW = megawatt

2.5.4 *River Diversion Works*

River diversion works are required to safely divert the river flow during construction so that it will not damage construction activities. The diversion works are divided into upstream and downstream cofferdams to cut off the river flow and direct it to a diversion tunnel to bypass construction activities. This design was selected taking into consideration the narrow river width, hydrologic conditions, cost, and worker safety.

2.5.5 *Quarry Sites*

The Project will require approximately 120,000 cubic metres of aggregate material for impervious core material, coarse and fine aggregates, riprap stone, and boulders, and approximately 60,000 cubic metres of sand. These materials will primarily be obtained from four quarry sites, all located on west side of the Trishuli River in the Project area, although some of the material will be sourced from Project tunnelling and excavation. These quarry sites have been selected based on test pits, laboratory analysis, an assessment of the volume and quality of aggregate available to meet overall Project demand, and avoid Langtang National Park. Excavation of material from the quarries, as well as excavation of the underground Project facilities (e.g. powerhouse, tunnels, and transformer cavern) will require blasting. The estimated amount of explosives to be used is 7,800 tons.

Table 2-5 List of quarry sites

Quarry Site #	Location	Permanent Land Area (ha)	Temporary Land Area (ha)	Total Land Area (ha)
1	Downstream of dam	0	1.27	1.27
2	Thangu area (near Haku Besi)	0	0.77	0.77
3	Tumda Dagar area (near	0	1.30	1.30
4	Near take-off yard	0	6.27	6.27
	Total	0	9.62	9.62

ha = hectare

2.5.6 *Excavation and Spoil Disposal Areas*

The Project originally required the excavation of approximately 2.7 million cubic meters of material, the reuse and/or replacement of approximately 0.3 million cubic meters, and ultimately the disposal of approximately 2.4 million cubic meters. As a result of the earthquake, there will be an increase in access

tunnel excavation as the surge tank access road has been converted to a tunnel, but NWEDC indicates that this increase in tunnel excavation is offset by a reduction in access road excavation, with no appreciable change in total excavation volumes. There is approximately 14,000 cubic metres of landslide debris covering some segment of the already constructed access road that will require removal.

NWEDC proposes 9 spoil disposal areas and summarized in Table 2-6. Please note that none of the spoil disposal areas is located in Langtang National Park. NWEDC indicates that these 9 proposed spoil disposal areas have sufficient capacity to accommodate the slight increase (<1 percent) in total excavation volume resulting from the removal of landslide debris.

Table 2-6 List of spoil disposal areas

Spoil Disposal Areas (DA)	Location	Spoil Capacity (m^3)	Size (ha)
DA-1	Mailung	190,919	1.09
DA-2	Mailung	278,047	1.65
DA-3	Mungtabar	99,478	2.09
DA-4	Dharnatar & Tungabagar	862,674	5.38
DA-5	Bugetphat	291,565	2.59
DA-6	Bugetphat	418,369	2.22
DA-7	Thangu	358,860	1.79
DA-8	Fulbari	52,780	0.26
DA-9	Fulbari	95,600	0.48
Total		2,648,652	17.56

2.6 PROJECT OPERATIONS

This section briefly describes Project operations, including facilities, workforce requirements, operational mode, sediment management, and power generation.

2.6.1 Operational Facilities and Workforce

The Project will be operated from an Operations Centre, which will include several buildings (Administration, Main Control, Generator, and Security) located near the take-off yard at the Powerhouse Site and employ approximately 72 workers. Because of its remote location, accommodations for all operational staff will be provided at the Project site.

2.6.2 Infrastructure

Infrastructure to support the operations workforce is summarized in Table 2-7.

Table 2-7 Operation phase infrastructure summary

Requirement	Infrastructure	Capacity	Comments
Power	UT-1 Project	11.2 GWH	Transformer to transform generation voltage to transmission voltage

Water	On-site water treatment plant	8,640 litres per day	Water source – local springs near Operations Centre
Wastewater	On-site wastewater treatment plant – package plant or community septic system	6,912 litres per day	Discharge point- Trishuli River near Operations Centre
Fuel Storage	Diesel	12,000 litre	Aboveground tank with secondary containment

2.6.3 Water Management and Operational Regime

The Project is designed to operate continuously as a run-of-river facility, diverting up to 76 m^3/s of water from a small reservoir created by the dam. The diverted water will be transported via tunnels to an underground power station. The Project discharges the water back to the Trishuli River downstream of the dam, creating a 10.7-kilometre-long diversion reach. Flows in excess of 76 m^3/s will spill over the dam into the diversion reach.

2.6.4 Sediment Management

The Project design includes a de-sander to trap sediments with a particle size as small as 0.2 millimetres so as to protect the turbines, which can be damaged by exposure to large sediment particles, and help maintain the Trishuli River's natural sediment balance. The sediment deposited in the three flushing channel will be periodically flushed out with flows of 6.0 m^3/s per channel over a 3 hour period about 5.5 days per year. The sediment will be discharged to the diversion reach a short distance downstream of the dam.

2.6.5 Power Generation

The Project has a capacity of 216 MW and based on historic river flow records, is predicted to generate about 1,440 gigawatt hours per year, as summarized in Table 2-8.

Table 2-8 Overview of power generation capacity of UT-1

Project Component	Description
Installed Capacity	216 MW
Turbines	Three vertical Francis turbines of 72 MW capacity each
Net head	327 m (for 3 units generation)
Design Discharge	Q_{50} – 76 m^3/s
Maximum Diversion Flow	76 m^3/s
Average Annual Energy	1533.1 GWH

GWH = gigawatt hour; m = metre; m3/s = cubic metres per second; MW = megawatt

3 BASELINE INFORMATION OF INDIGENOUS PEOPLE IN THE PROJECT AREA OF INFLUENCE

3.1 AREA OF INFLUENCE

The Environmental AoI is extended upstream approximately 2 kilometres, and downstream approximately 2 kilometres to where the Upper Trishuli-3A Hydropower Project is partially constructed. The Project is located in a steep canyon, so the extent of Project nuisance impacts (e.g. noise, fugitive dust, air emissions) is very limited, but we have assumed the AoI extends approximately two kilometres laterally from the Trishuli River.

The land take for the Project is from nine villages in the Haku VDC: Haku Besi, Sano Haku, Thulo Haku, Gogone, Tiru, Thanku, Mailung, Ghumchet, and Phoolbari). The introduction of a new Constitution in 2015 and accompanying change in the administrative structure of Nepal the administrative boundaries of the project area also have changed. The wards and Gaunpalikas within which the project foot print lies are listed below in Table 1.2.

Table 3-1 List of Impacted Villages and Administrative Units for Project AoI

Impacted Village Names	Total Population	Old Administrative Structure (Village Development Council)	New Administrative Structure (Gaon Palika & Nagar Palika)
Haku Besi	260	Haku Ward number 3	Parvati Kunda Ward number 1 & 2
Gogone and Tiru	168	Haku Ward Number 8&9	Uttargaya Ward number 1
Mailung	7	DadaGaun Ward number 9	Uttargaya Ward number 1
Thanku	NA	Haku Ward number 5	Parvati Kunda Ward number 1 & 2
Phoolbari	NA	Haku Ward number 3	Parvati Kunda Ward number 1 & 2
No directly affected villages		Ramche	Kalika Ward Number 1
No directly affected villages		Dhunche	Gosaikunda Ward number 6
Gumchet	NA	Ramche	Kalika Ward Number 1

Source: NWEDC

Thus, while earlier, the project was touching 3 of the 18 VDCs in the district, it is now touching 4 of the 5 *Gaunpalikas* in the Rasuwa District. Under the former structure, the Project was directly affecting 3 of the 18 VDCs in the district (i.e. Dhunche, Ramche and Haku); however, now it is affecting four of the five Gaunpalikas (GP) in the Rasuwa District. These four Gaupalikas are: Parbatikunda, Uttargaya, Kalika and Gosainkunda. We presume GoN will extend the Project Benefit Sharing Plan to these GPs which are directly and indirectly impacted by the Project. The number of households living in the three affected VDCs as per 2011 National Population and Housing Census of Nepal is provided in Table 3-2 below.

Table 3-2 The number of households in Project Affected Area as per 2011 Census

VDC Name	*Total House-holds*	*Ward Number*								
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Haku	443	35	59	58	36	44	24	41	91	55
Dhunche	714	43	25	23	36	257	20	29	272	9
Ramche	489	12	44	78	71	55	49	32	82	66
Total	1646									

Source: National Population and Housing Census 2011

Figure 3.1 Socio-economic Area of Influence

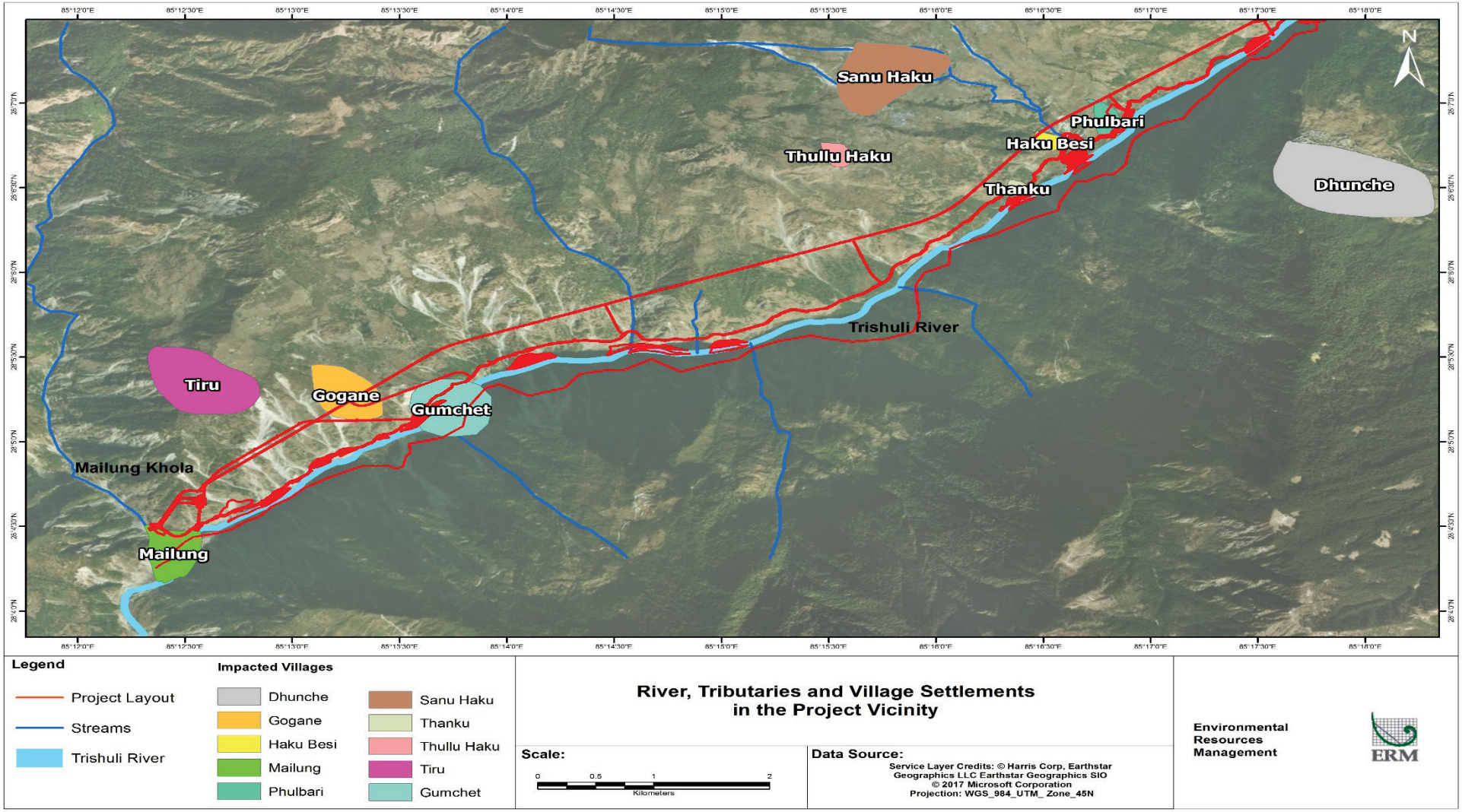
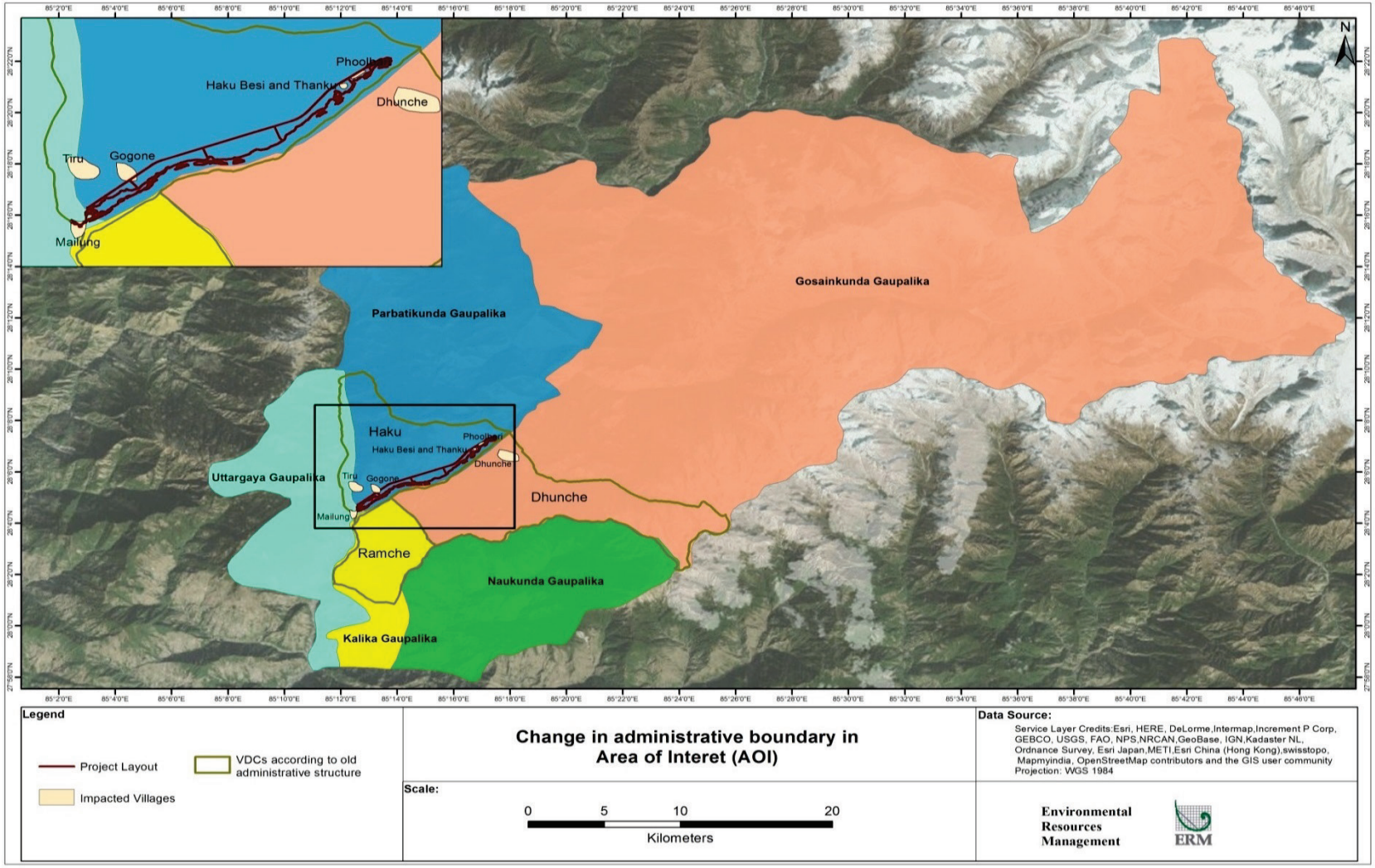


Figure 3.2 Project Layout against the Revised Administrative Structure



3.2 ETHNOGRAPHIC PROFILE OF IPS COMMUNITIES

The ethnic groups in AoI of the project are Tamangs, Gurungs, and Newars. The two most numerous Indigenous Peoples communities are Tamangs and Gurungs.

3.2.1 Tamang

Tamang comprise of the majority of the population (93.6% in the project area).. The project area is dominated by Tamangs though a sprinkling of other ethnic groups such as Gurung and Dalits are also reported. It is significant to note that the project affected families are comprised primarily of Tamangs (89% of the PAFs), as has been discussed in the socio-economic baseline for the project area presented in the LALRP plan.

Table 3.3 Ethnic Composition in Project Footprint VDCs

VDC	Tamang	Brahman	Chhetri	Gurung	Magar	Newar	Tharu	Dalit	Other	Total
Dhunche	2.64	0.59	0.22	0.77	0.10	0.33	0.01	0.24	0.41	5.311
Haku	5.32	0.02	0.00	0.19	0.00	0.03	0.00	0.13	0.02	5.712
Ramche	4.73	0.04	0.03	0.00	0.00	0.00	0.03	0.05	0.03	4.908

Source: VDC Profile, 2006

Demographically, Tamangs constitute 5.8% of the total population of Nepal (as per the 2011 Census data) and is the fifth most numerous ethnic group. They are located around the Kathmandu Valley and their ancestral territory encompasses Sinduli, Kabhre, Sindupalchok, Rasuwa, Nuwakot, Dhading and Makawanpur Districts. They refer to their ancestral territory as *Tamsaling*. It is significant to note that Rasuwa district is comprised of Tamangs and Gurungs. Tamangs are identified as one of the 24 hill tribes as per NEFIN 2002 list and belong to marginalised group as per NEFIN's classification.

The demographic profile of Tamang population in comparison with the total population of Nepal is presented in ***Table 3-3.***

Table 3-4 Demographic profile of Tamang population vis-a-vis total population of Nepal

Attribute	Tamang Population	Nepal Population
Average Population Growth	1.83%	1.35%
Sex Ratio	94 females per 100 males	94 females per 100 males
Average HH Size	4.6	4.9
Literacy	62.7%	66%
Absentee Population	6.9%	7.3%
% of population above 5 years who are attending School / College	65.2%	66.4%
% of population with access to improved source of Drinking Water	79.7%	85.4%
% of population with access to Toilet facility	58.8%	61.2%
% of population with access to clean cooking energy	22.4%	23.5%

Attribute	Tamang Population	Nepal Population
% of population with access to Electricity	70.4%	67.3%
Economically Active Population (Above 10 years)	61.6%	54.8%
Employed Population (Above 10 years)	55.9%	48.8%

Source: Census 2011 data

As depicted in ***Table 1-4*** above, the average growth of the Tamang population from 2001 to 2011 has been 1.84%, whereas the total population of Nepal has grown at 1.35% during this period. The average household size of the Tamang population is 4.6 while that of the rest of the Nepali population has been 4.9. The literacy rate of the Tamang population is 62.7%% which is comparable to the literacy rate of the Nepal's total population at 66%. Similarly, nearly 65% of Tamang population is attending schools and colleges and is comparable to the 66.4% of Nepali population attending schools/ colleges. This is understood to be resultant from the Tamang population residing in remote locations with limited access to educational infrastructure.

In terms of access to physical infrastructure, the Tamang population is understood to be comparable to the rest of the population in terms of access to electricity, clean cooking energy, clean drinking water and toilets, as the total population of Nepal.

In terms of economically active population and employed population, the proportion in the Tamang population (61.6% and 60% respectively) is higher when compared to Nepal's total population (55% and 49% respectively).

While a detailed socio-economic profile of the community in the AoI is provided in the ESIA and LALRP, an overview of the socio-cultural profile of Tamang population in the AoI is provided in Figure 1.4 below.

Figure 3.3 Socio-Economic Profile of the Tamang Community in the AoI

Tamang Group Socio-Economic Profile

Language

Tamangs have their own language though there are several dialects within it. There has been a strong promotional activity of their language and culture through radio and mass-media. There is a strong trend of its revival and evolution of a common Tamang Language. amang Language is recognised by Nepal Government and its been introduced at selected schools on a

Tradition, Culture and Beliefs

The Tamang people a mixed religion of animism and Tibetan buddhism. Tibetan buddhism has also integrated and legtimized age-old tradition of indigenous healing practices and the use of medicinal plants. Knowledgeable people in the communities are known as lamas and have responsibilities in curing illnesses; believed to be the result of physiological as well supernatural disordersThe Tamang culture is characterized by various traditional social institutions such as Nangkhor, Gedung, Chokpa and Ghyang. Tamang communities are organized, maintained and regulated through these social institutions. They mostly celebrate the nationally known festivities along with other ethnic groups. However, there is a revival of a few rituals and festivals in recent years. People of the project area live together with supernatural elements such as spiritual beings, sacred places, feared places, altars, evils, etc. Therefore, they perform Puija to pay respect to the mother earth while opening a new road, building a new house, or ploughing a field before sowing, felling trees, performing marriage ceremony, going for hunting, eating new fruits, etc. This ritual involves offering water, incense, grains, liquor, and prayers. They believe that human activities disturb the spirits of souls, and therefore some sort of compensation is required. Likewise, they also pay tribute to the mountains, water and their ancestral land.

Traditional Socio-Political Institutions

The traditional socio-political institutions are partially effective. Choho was recognized as a local leader who served voluntarily. He was selected by community members and was accepted as a leader at the clan level. He played multiple role in the community including administration, judicial and spiritual leader. The new socio -political structure is fast replacing the traditional leadership structure.

Traditional Dress

The traditional dress is worn only by few and has nearly disappeared. Women dress in their traditional attire on festive occasions.

Customary Laws

Customary laws are fully effective in the community and have a strong presence in tvillage life.

Social Structure

Tamang community is a ranked society which is organized into several clan groups.

Ethno-History and Mythology

The ethnic history of the community is mostly preserved in Oral Traditions. The myths are influenced by Buddhism

Livelihood Profile

The traditional occupations of the Tamang in the project area have been livestock herding and growing maize and potato (subsistence economy). More than 40% of the population in the AoI reported to be engaged in agriculture in the pre-earthquake scenario Forests are a key part of the Tamangs livelihood and lifestyle since they are sources of fuel, fodder and pasture, and also sacred places hosting nature spirits and deities. However, post earthquake, the dependence on agriculture and natural resources has reduced due to loss of access and damage to agricultural land and forest resources . There is now an increase in the dependence upon wage labour in construction sites and stone breaking.

According to the discussions with the locals, in the post-earthquake scenario, the livelihood profile of the community is characterised by a larger variation and uncertainty associated with income sources. Most of the locals involved in labour work, reported to be gainfully engaged for approx. 8-15 days in a month. This has also resulted in the PAFs diversifying their livelihood sources, with income from labour work, being supplemented by livestock/ poultry farming, agriculture, weaving, basket making and sale of homemade alcohol. Also, while in the pre-earthquake scenario, most women were engaged in agricultural or livestock farming activities, presently a larger number of women are reported to be engaged in income generating activities, primarily stone breaking. This is understood to be resultant from the fact the loss of agricultural land and livestock holding. Another shift in the post-earthquake scenario has been the increased burden on the younger population. This has resulted from the older generations (50 years and above) losing access to agricultural land and livestock holding and to not having any other skill training or physical fitness to undertake wage labour. While in the pre-earthquake scenario, the elderly population could sustain themselves, by sustenance agriculture or taking care of the family's livestock holding, they are now forced to depend upon the younger generation for support

Literacy Rate and Education

The Tamang population in the AoI reported a literacy rate of 69.6%, which is the second lowest literacy rate in the AoI. The Male literacy rate is 78.4% while the female literacy rate is 59.9%. More than 50% of the Literate Population is educated till primary level

Indigenous Skills/ Knowledge

Kwan Raba- cloth making

Chhaige- baskets and rope making

Syosyo Shengba – handmade paper making

Sing Thaba- Wooden craft

Thangka- cultural paintings

Marcha- herbal yeast making

Bamboo products

Voltu- bread cooked in water

Baavar- a kind of bread cooked in oil or ghee

Common Cultural Practices

Tattooing: making pictures by piercing in skin known as tattooing, which normally takes place in the event of starting a good work.

Lama Pathi- a mode of payment to the Lama who performs different spiritual activities to save the community from the natural calamities.

Tamang Taboos: activities prohibited by Tamang culture are called Taboos. For instance Tamang restrict certain species of timber for construction, they area; Angeri, Longbede, Langpar, Banjh, Khashru. Similarly, Ainjeru and Bilaune are not used as firewood.

Liquor Production: Liquor (both fermented and distilled) making is one of the most essential chores of Tamang women. It is not only essential for their daily consumption but also is mot to perform their rituals.

Ancestral Territory

Majority of Tamangs still inhabit in their claimed ancestral territory.

Status of Tangible Cultural Heritage

Their tangible cultural heritage sites are partially safe. The community has a strong commitment to their preservation.

3.2.2 Gurung

The etymology of their name suggests that the it is derived from the Tibetan word 'Grong' which means farmers. Gurungs call themselves as 'Tamu' which means horsemen in Tibetan language. Gurungs live along with other ethnic groups in the middle hills and valleys along the southern slope of the Annapurna Himalaya in the mid-western Nepal. It is believed their living territories extend from Gorkha in the east through Lamjund and Kaski to Svangia District. According to 2011 Census, the total population of Gurung in Nepal is 5,22,641.

Gurungs use Tamukwyi, their mother tongue while communicating with each other and use Nepalese to communicate with other ethnic groups. Tamukwyi is classified as a Tibeto-Burman language. According to 2011 Census as many as 325,622 of the total Gurung population still speak Tamukwyi. Besides Nepal, Tamukwyi language is spoken in India, Bhutan, Manmar and other countries such as UK, Singapur where Gurung have been employed.

The Gurungs wear colourful dress. The traditional dress of Gurungs include a short shirt tied across the front and a short skirt of several yards of white cotton material wrapped around the waist. The Gurung women wear a cotton or velveteen blouse tied at the front and a sari of printed material usually a dark reddish colour. Their ornaments include gold and coral necklaces, gold earrings and nose rings and bangles. The Gurungs are fomous for their dance tradition. They perform Sorathi, Ghado, Ghatu and other forms of traditional dance. The dancing season generally starts on Shri Panchami day (in January or February) till the day of Chandi purnima (some day in May or April).

The social structure of the Gurung includes 'char jat' which is divided further into several clans. The Char Jat categories are: 1) Ghale, "King; 2) Ghodane, "Minister"; 3) Lama, "Priest"; and 4) lamichane, "Councillor". The Char Jat as a whole is endogamous, while each of the four categories is exogamous.

Gurungs in Rasuwa District mostly practice agriculture and animal husbandry and many families have the tradition of serving in army or police force. They grow rice, maize, wheat, millet and potatoes in their farmland. Along with farming, they also practice sheep breeding for meat and wool. However, a major part of the family income comes from the salary or pensions of the members who served in army or police forces.

4 INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

Since the project inception, NWEDC has engaged with local communities in a process that recognised their human rights, dignity, aspirations, culture, and natural resource-based livelihoods. This section provides an overview of the engagement process undertaken by NWEDC.

4.1 BRIEF OVERVIEW OF PREVIOUS CONSULTATIONS

The project preparation or pre-construction activities started since 2010 and there is record of engagement with local community at least since 2012. An overview of these consultation process with local community is provided in this section.

4.1.1 Consultations with Affected Households in Planning and Land Acquisition Process

The affected community has been consulted since 2009-2010, when the project was conceptualised. The initial consultations were held with households for procuring their land through a negotiated settlement. During the land acquisition process, meetings were conducted with the land sellers both at household level and ward level (in Mailung, Gogone and Haku Besi). The purpose of these meetings was to provide the land owners, PAFs and other community representatives with information pertaining to the project, the land requirement for the project and the proposed entitlements/compensation in lieu for the same.

These meetings were followed by a public hearing, held in March 2013, post the completion of the EIA. The purpose of the public hearing was to provide a more detailed project understanding and finalize the compensation amount for the land purchase. As per the records made available, two formal meetings were conducted in case of Guthi land. NWEDC representatives and local villagers of Haku Besi (Ward no 7 & 3) met on 19th January 2013 to agree over the rates and terms of transfer of the tenancy rights. Subsequently a meeting was held at NWEDC head office, Nakshal, Kathmandu between Guthi Land tenants of Hakubesi and NWEDC, in which 16 villagers were present.

The sale and lease deeds signed by respective land owners are indicative of consent part of the land owners (majority of which are Tamang population); however, the disclosure and consultation process followed in land acquisition stages are not documented.

The consultation with Community Forest Users Groups on leasing the communally held land and land-based resources was led by DFO following due process of law under Forest Rules 1995. There were 422 member

households in affected CFUGs, out of which 90% were Tamang, 8% were Gurung and 1% was Newar and the remaining 1% was Dalit.

4.1.2 Consultations with affected Households during EIA Study

Consultations were held with local communities which comprised of Tamangs and Gurungs at various stages of the EIA and ESIA. The purpose of these consultations was to develop an understanding of their perception of the project and its activities, the perceived impacts of the project on them. The key engagement activities undertaken as part of the impact assessment process included public meetings and consultations and surveys as discussed below:

Public Meeting, 2012: In the months of September and October, public meetings were held in the villages Mailung, Haku Besi and Gogone respectively, with various local stakeholders including the land owners, PAFs and community representatives. As part of these meetings information regarding the project was disclosed, including the capacity of the project, the location of the key facilities, and the land requirement for the project including the requirement for community forest land and the potential benefits to the community in terms of compensation, employment and training. As part of this meeting, the compensation rates for the land to be procured were also discussed.

Public Meeting, 2013: In continuation of the public meetings, post the measurement of private land, consultations and meetings were undertaken in February 2013 with the land owners, for the purpose of negotiations for the land purchase. Following this, after the completion of the EIA study, a public hearing was held in March 2013. The purpose of this public hearing was to provide an understanding of the project and to finalize the compensation amount for the land purchase. It is reported that as part of the public hearing, the land owners were promised jobs, shares in the project, training as well as community benefits, such as development of road and a school for the community. It is reported that the land owners had earlier demanded a compensation rate of NPR 10 lakh per ropani, however this was negotiated down to NPR 5 lakh per ropani. As part of the meeting, the final compensation package was agreed upon with the community and their signatures were taken as agreements. Apart from these consultations, meetings were also undertaken with the DAO office, Forest Department and Survey department to finalize the compensation rates and the land procurement process.

4.1.3 Consultations with Affected Households during LRP Preparation in 2015

In addition to the consultations undertaken during the EIA process, further consultations were undertaken as part of the LRP preparation process in 2014-15. The purpose of these consultations was to develop an understanding of the impacts of land take, the adequacy of the compensation provided and the utilization of the same and possible livelihood restoration activities that can be

introduced. The following table provides a list of consultations undertaken and the purpose of the same.

Table 4-1 List of Stakeholder Consultations undertaken in 2015

S. No	Stakeholder Group	Village/ VDC	Date	Number of Participants	Purpose
1	Community Forestry User Group	Mailung	18-11-2014	2	To develop an understanding of the working of the working of the CFUGS, the impact of the project on the gutthi land and the compensation paid for the same
2	Jan Sarokar Samiti	Mailung	11-01-2015	2	To develop an understanding of the JanSarokar Samiti for the project
3	Community Forestry User Group	Haku Besi	13-1-2015	22	To develop an understanding of the working of the working of the CFUGS, the impact of the project on the gutthi land and the compensation paid for the same
4	Tamangs	Haku Besi	12-01-2015	18	To develop an understanding of the socio-economic profile of the indigenous group, there relationship with the other communities, the impacts from the project and the expectations from the project
5	Women	Haku Besi	13-01-2015	11	To develop an understanding of the socio-economic status of women, their understanding of the project and its potential impacts and their expectations from the project
6	Tamangs	Haku Besi	13-01-2015	4	To develop an understanding of the socio-economic profile of the indigenous group, there relationship with the other communities, the impacts from the project and the expectations from the project
7	Youth	Haku Besi	14-01-2015	16	To develop an understanding of the perception of the stakeholder group in regards to the project, the changing socio-economic profile of the villages and the expectations from the project
8	Women	Mailung	10-02-2015	3	To develop an understanding of the socio-economic status of women, their understanding of the project and its potential impacts and their expectations from the project
9	Women	Mailung	11-02-2015	2	To develop an understanding of the socio-economic status of women, their understanding of the project and its potential impacts

S. No	Stakeholder Group	Village/ VDC	Date	Number of Participants	Purpose
					and their expectations from the project
11	Fishing Group	Karakchapul	12-02-2015	3	To develop an understanding of the nature of the fishing activities in the area and the potential impacts of the project on the same and the possible mitigation/compensation measures that can be put in place
12	Community Forest User Group	Mailung	12-02-2015	1	To develop an understanding of the working of the working of the CFUGS, the impact of the project on the gutthi land and the compensation paid for the same

4.1.4 Consultations undertaken as part of Post-Earthquake Assessment in 2016

In 2016, ERM was contracted to undertake an E&S gap analysis and status assessment of the project and the AoI, in the post-earthquake scenario. One of the key activities undertaken as part of this assessment was the consultations with the internal and external stakeholders. The following table provides a summary of the consultations undertaken during this period.

Table 4-2 Consultations with Local Community in IDP Camps after Earthquake

S. No	Stakeholder Group	Location	Date	Key Issues
1.	Local Community,	Mailung	5th April 2016	• Understanding of the impacts from the earthquake; • Status and understanding of the various relief activities being undertaken by the project, NGOs and government in IDP camps; • Change in socio-economic baseline in the area post the earthquake, in terms of social structure, livelihoods and access to infrastructure and services; • Key concerns of the local community in the post-earthquake scenario; • Key expectations of the community from the project and the government
2.	Local Community, in IDP Camp,	Naubise	5th April 2016	
3.	Local Community, in IDP Camp,	Bogetitar	6th April 2016	
4.	PAFs in IDP Camps	Across IDP camps	6th April 2016	
5.	Local Community, in IDP Camp,	Farm Camp	7th April 2016	
6.	Local Community, in IDP Camp,	Kebutol	7th April 2016	
7.	Local Community, in IDP Camp,	Pradhi-karan	7th April 2016	

As part of this gap assessment, ERM engaged with the Tamang population, as part of the larger community. The focus however was on the experiences and issues being faced by the community post-earthquake.

4.1.5 Consultations undertaken in 2017

In 2017, FGDs and key informant interviews were undertaken with key stakeholder groups. The following table provides consultations undertaken with the local community.

Table 4-3 Consultation with Local Community as part of the LALRP Upadation Process

S. No	Stakeholder Name	Date	Mode of Consulation	Summary of Consultations Undertaken
1.	Women group from Haku VDC	5th May 2017	FGD	A discussion with the various stakeholder groups on the following aspects: The impacts from the earthquake Present livelihood profile Role of the project in earthquake relief Present perception towards the project Present expectations from the project in terms of LALRP activities
2.	Women Group from Haku VDC	5th May 2017	FGD	
3.	Tamang Women Group from Satbise	1st May 2017	FGD	
4.	Mixed group in Nuabise	8th May 2017	FGD	
5.	Mixed group in Bogetitar	7th May 2017	FGD	
6.	Mixed Youth Group	29th April 2017	FGD	
7.	Mixed Group from Farm Camp	12th April 2017	FGD	
8.	Women Shop Owner in Nuabise	8th May 2017	KII	
9.	Women Shop Owner in Nuabise	8th May 2017	KII	
10.	Mixed Group in Khalde	13th April 2017	FGD	
11.	Politician in Nuabise	13th April 2017	KII	
12.	Women returned after Foreign Employment	2nd May 2017	KII	
13.	Men Group in Mailung	14th April 2017	FGD	
14.	Men Group from Haku VDC	6th May 2017	FGD	

Note: FGD: Focused Group Discussion
KII: Key Informant Interview

These discussions and interviews were aimed at supplementing and triangulating the information made available during the PAF survey and also for collecting additional qualitative data on certain key areas, such as NGO activity in the area, livelihood restoration mechanisms etc.

4.2 PUBLIC DISCLOSURE OF ESIA AND IPP

A non-technical summary of the project impacts with extensive use of the infographic is prepared in English and translated into Nepali. This booklet will be circulated among the local communities in nine affected villages in project area. NWEDC will also hold village level disclosure meetings where community relation officers with proficiency in Tamang and Gurung dialect/speech will explain the project details, its potential impacts and what mitigation measures are planned towards mitigating or reducing these impacts.

5 SOCIAL IMPACT ASSESSMENT

A detailed ESIA and LALRP for the project was undertaken. As the project area is dominated by IPs, the impacts of the project described therein gives necessary details of the project impacts on environment. The LALRP deals with project's direct impact related to land and asset procurement process. This section provides an overview of potential environment impacts at the habitat level and potential social impacts to be experienced at collective or community level.

5.1 AVOIDANCE OF ADVERSE IMPACTS

As IP population forms the majority in the area, complete avoidance of impacts on IPs was not possible. From an environmental perspective, there are already six existing operating hydropower projects on the Upper Trishuli River, including two along the mainstem of the Trishuli River downstream of the UT-1 Project, and seven more hydropower projects under construction, including the UT-3A project located approximately 1.5 kilometres downstream of the UT-1 Project. Fishery data suggest that the Common snowtrout (*Schizothorax richardsonii*) population (an IUCN-listed Vulnerable species; see Section 6.2.1.1) may be limited in the Trishuli River upstream of confluence with the Mailung Khola tributary (i.e. the approximate location of the UT-1 powerhouse) by the river's cold temperature. Therefore, the proposed location optimizes power generation, while minimizing potential environmental impacts.

NWEDC has carefully located Project facilities to avoid or minimize environmental and social impacts. For example:

- Underground facilities – Locating several Project facilities underground, although primarily for engineering and safety reasons, also avoids disturbance of steep slopes, natural vegetation, and agricultural lands, and minimizes private land acquisition.
- Facilities along the west bank of the Trishuli River – Locating the headrace tunnel, penstock, and powerhouse along the west bank of the Trishuli River minimizes impacts to the Langtang National Park, which is located along the east bank of the river.
- Location of quarry and spoil disposal sites – Locating these facilities so as to avoid cultivated and forest land minimizes impacts to local communities and the environment.
- Location of the Powerhouse Site worker camp – These Powerhouse Site worker camp has been relocated to the east bank of the Trishuli River to reduce landslide risk and to enhance worker safety, since the former worker camp at Mailung School was severely damaged in the 2015 earthquake, resulting in many injuries and fatalities. Suitable sites for a worker camp in the Project area are limited by topography. The proposed

site, although within the Langtang National Park buffer area, is isolated from most of the remainder of the park by steep slopes and the Betrawoti-Mailung-Syabrubesi Road, is already disturbed and has little tree cover, and is not currently occupied, although it was prior to the earthquake.

5.2 KEY IMPACTS OF THE PROJECT AND MITIGATION MEASURES

The following table provides a summary of these impacts on the local community which is mostly comprised of Tamang population and the mitigation measures identified.

5.2.1 *Impact on Use of Community Forest*

The land procurement for the project involved 76.62 Ha of community forest and government land. This community forestland is located in Haku VDC and was under the supervision of five community forest user groups (CFUGs). The membership details of these CFUGs is provided in

Table 5-1: Names and Membership Profile of CFUGs affected by Acquisition of Community Forest Land

Name of the CFUG	*EC Members*	*General Member HHs*	*Total Member HHs*	*Wards (Haku)*	*Male*	*Female*	*Persons*
Dachhin Kalika	11	164	175	8, 9	494	485	979
Darnashila Kanyadevi	9	51	60	9	117	181	349
Lumbudanda	9	25	34	7	64	76	140
Bratar	9	36	45	4,7	97	87	184
Larbangpakha	12	96	108	3	NA	NA	NA
Total			422		772	829	1652

These CFUGs are managing a larger community forest area and the loss of area for UT-1 project would constitute approximately 11% of the total forest area. The community forests, in general is used by its members for collection of timber and NTFPs. Consultation with the *ilaka* (sub-district) Forest official suggested that the quality of forest in the area acquired was poor, and that NTFP species with high market potential were limited.

Table 5-2 Community Forest affected by the project & area diverted for the project

SN	Present Status of CFUG after reorganisation	Total area (ha)	Impacted Area (ha)	% or Area Acquired	Number of trees/ seedlings to be cut
1	Daksin Kalika	373.92	17.25	5%	330
2	Dharnasila Kanya	126.86	24.57	19%	736
3	Bratar	14.22	0.99	7%	105
4	Lumbudanda		9.85		138
5	Larbangpakha	206.36	23.96	12%	308
		707.14	**76.62**	**11%**	**Total 3856**

Source: NWEDC, 2015 (The Total=**1617 Trees+ 2239 Seedlings)**

Upon receiving the application for requirement of the forestland, the DFO communicated the land requirements and its potential impacts to the committee members and a general assembly was held to obtain consent from the members. Based on the outcome of the meeting with executive committee and general assembly, the DFO presented a report to the Nepal Ministry of Forest, which then was forwarded it to the Council of Ministers for its review and approval of the lease agreement. After the payment of the lease fee by NWEDC, the DFO signed the lease agreement.

DFO held meetings with CFUGs in December 2015 when identification of the required land and demarcation of the trees to be cut were made. The second meeting was held in Feb 2015 prior to the cutting of the trees. While clearing the community forestland, the trees were cut and stacked in the area at the cost of the Project. DFO later handed them over to the concerned CFUGs for their use or sale, as they deemed appropriate. The project has also provided monetary compensation for the trees/seedlings lost.

Most of these community forest land was acquired for obtaining the RoW for the Access Road. During the construction of the road, a number of trees in the outside of the area acquired for the project were reported to be impacted as the debris from the blasting and excavation fell down the hill slope. CFUGs consulted informed that complaints were made to the Ilaka officer and the project (both officially and unofficially) to record the damage and compensate accordingly. The Ilaka officer had finally agreed to inspect the community forest areas by the access road construction (somewhere in the last week of February 2015). However, the Gorkha earthquake and subsequent landslides resulted in extensive damage to the community forest area. Since, the earthquake occurred before the inspection by the Ilaka officer could be completed, there is no clarity on the additional trees that were impacted by the project activities.

Mitigation Measures Suggested

Considering the above context, the following additional mitigation measures have been identified under LALRP:

- Provide support to the community forest management initiatives;
- Compensation payment for the extra tree lost during the access road construction. Any other construction related damages on trees to be routed through grievance process of the project (refer ***SEP and GRM***). This payment shall be undertaken in keeping with the provisions of the forest lease agreement signed between DFO and the project which mentions that, "*In the case of any loss or damage out of the forest area made available in the course of construction of the infrastructure or any other construction works, the maintenance, reconstruction and repair thereof shall be carried out by the Project itself. In case of loss or damages to trees and Plants, an action shall be taken as per*

the monitoring report of the DFO in accordance with Forest Act and Rules". This payment of compensation will be undertaken on a regular basis, in a timeline agreed upon with the CFUGs;

- Prohibit firewood usage by the construction workers and ensure there is provision of LPG or other alternate fuel;
- Implementation of the code of conduct put in place as part of the labour Influx Management Plan.
- Conduct training and capacity building of the CFUGs for rejuvenation and management of community forest area. Financial Literacy training may also be provided to the CFUG members for the management of the cash compensation received

5.2.2 Impact on Fish Resources and Fishing

The Project will change the river habitat by creating a 2.1 ha reservoir, constructing a dam across the river, and creating a 10.7-kilometre-long diversion reach that will experience reduced flows. The Project is located at a relatively high elevation in the Trishuli River Basin where high gradient and cold water temperatures limit fish biodiversity. The Common snowtrout is by far the most abundance species found in the Project AoI. This is classified as "Vulnerable" by the International Union for Conservation of Nature (IUCN), and is a migratory species that moves upstream in the spring to spawn.

The Project will divert up to 76 m^3/s of flow from the 10.7-kilometre segment of the Trishuli River between the dam and the powerhouse (i.e. the diversion reach). This flow diversion will reduce the width and depth of water in the diversion reach; thereby potentially impacting aquatic habitat and fish. In Nepal, hydropower projects are required to release 10 percent of the minimum monthly average flow (i.e. 3.9 m^3/s for the UT-1 Project) to preserve the minimum habitat required to support fish and other aquatic life in the diversion reach, and to preserve flow continuity for fish movement/migration through the Project area, which is referred to as an environmental flow, or Eflow. NWEDC has proposed an Eflow that is higher than that required by Nepalese regulations, essentially providing 10 percent of the average monthly flow for each month, rather than the minimum average monthly flow (i.e. ranging from 3.9 m^3/s to over 50 m^3/s, depending on the month).
NWEDC also proposes to install a fish ladder to allow the upstream and downstream passage of migrating Common snowtrout. The fish ladder design was reviewed and found acceptable in ESIA. The provision of sufficient flow to enable upstream migrating adult Common snowtrout to navigate through the diversion reach to the proposed fishway at the dam is critical to the success of the fishway. NWEDC will implement an Adaptive Management Approach based on intensive monitoring during the Project's first few years of operation to ensure migrating Common snowtrout are able to reach their spawning grounds upstream of the UT-1 dam.

According to consultations undertaken, fishing activities in the project impacted stretch were undertaken by approx. 13 families, for sustenance and

recreational purposes. The financial value of fishes caught by these households was estimated to be approx. NR 20-25000 per annum. In the post-earthquake scenario, as people lived in IDP camps which were farther from the river, fishing practices reported by PAFs surveyed shows a sharp decline. However the situation is currently fluid with people starting to resettle, and the use of the river for fishing needs to be monitored.

Mitigation Measures Suggested

The impacts on river and fish (e.g. impoundment of riverine habitat, reduced flow, and fragmentation of the river) are inherent in the design of the Project and cannot be avoided. The next step in the mitigation hierarchy is minimization. The size of the impoundment (and the consequent loss of riverine habitat) also cannot be minimized further. The loss of aquatic habitat in the diversion reach will be minimized through the Eflow.

Common snowtrout has been selected as the indicator species for Eflow analysis; based on the available information on its habitat requirements, the Eflow is likely to be sufficient to maintain habitat connectivity and support spawning in the diversion reach, although there is predicted to be a decrease in Common snowtrout populations, but this is based on assumed fish ladder effectiveness.

Under existing conditions, the sampling data suggests the diversion reach only supports a small population of Common snowtrout. Therefore, the impact of the Project on fish population in the diversion reach is likely small. In any case, the implementation of the robust Eflow Adaptive Management Program as a key component of the Biodiversity Management Plan. NWEDC will conduct further studies as part of the Biodiversity Evaluation and Monitoring Program (BEMP) on the timing of Common snowtrout upstream and downstream migration, the flow depth required to allow upstream migration, and their preferred spawning location (e.g., along the mainstem of the river or in tributaries). NWEDC will share these results with the government and other hydropower developers, along with the design and passage effectiveness of the fish ladder, to help minimize hydropower impacts on aquatic habitat in Nepal and throughout the Himalayan region. NWEDC's commitments towards this include the following:

- Contract with an international fishery biologist to oversee Project construction and early operations;
- Develop and conduct a robust Biodiversity Evaluation and Monitoring Program and share any enhanced understanding of Common snowtrout biology with the Government of Nepal and other hydropower developers in the Himalayan region;
- Demonstrate No Net Loss of Common snowtrout with monitoring metrics; and
- Apply an Adaptive Management Program to ensure Common snowtrout are able to successfully reach their spawning grounds upstream of the dam; and

- Implement the Project's Biodiversity Management Plan.
- Monitor the fishing activity till the initiation of construction and provide entitlements as defined in the LALRP where necessary.

5.2.3 Impact on Ecosystem Services

As Indigenous Peoples' livelihood and cultural practices are usually interwoven with the natural resources in their habitats, impact on ecosystem services is a significant aspect to be examined. The ESIA has assessed impacts of ecosystem services and an overview is provided here.

Table 5-3 Impact on Ecosystem Services

Ecosystem Service	Description
Provisioning Services	
Food: wild caught fish	According to the discussions undertaken with the local community before the 2015 earthquake, 13 households were reported to be fishing in the river for sustenance and/or recreational purposes. These households did not depend on fishing as a primary source of income. However, the fishing activities were reported to play an important part during the 6 months when agricultural produce was not sufficient for sustenance. However, in the post-earthquake scenario, none of the local community was reported to be undertaking fishing activities. The 13 Project-Affected Families identified in 2015 could not be located during the site visit in 2017.
Food: wild meat	None of the local community members were reported to be undertaking hunting in the AoI
Food: cultivated crops	In the pre earthquake survey of 2015, agriculture was reported as the main source of livelihood for the local community in the AoI. However, in the post-earthquake scenario, the dependence on agriculture is reported to have reduced, due to loss or access to and damage to agricultural land. According to the information available, some of the local community, especially in the villages of Haku Besi, Thanku, and Phoolbari, intend to return to their original villages. Those who return are expected to undertake agriculture on their remaining land. In the IDP camps the avenue for agriculture is limited as the crop sharing agreements does not seem to be too encouraging for the people. Agricultural activities could be further impacted due to alteration of water resources/ quality due to Project activities and loss of land where the Project requires 20.6 ha of agricultural land
Food: herbs and plants	Prior to the earthquake, the communities were understood to supplement their diet with uncultivated resources during times of scarcity. Though this dependence has reduced post-earthquake, it is likely to pick up again if the communities return to their original villages. Loss of forest resources in the Project footprint area (76.7 ha) due to Project activities also affects the access to community forest; however it was reported to be only 11% of the total affected community forest.

Ecosystem Service	Description
Livestock Farming	Livestock farming was reported to be an important source of sustenance and livelihood in the pre-earthquake scenario. However, as a result of the earthquake, most of the Project-affected families lost their livestock holdings to a great extent. According to the discussions undertaken, it is understood that most of the households, aim to rebuild/restore their livestock holdings if they move back to their original villages. The community did not report major impact on the livestock due to diversion of the community forest land for the Project. Post-earthquake the community, (wherever accessibility to the native villages is feasible) trying to build up on remaining livestock. These livestock cannot be brought to the IDP camps as the livestock is not able to sustain the changed climate as well as access to grazing land is turning out to be limitation.
Biomass Fuel	The primary source of fuel in the villages in the AoI is firewood, collected at the household level from the surrounding forests. Loss of forest resources in the Project footprint area (76.7 ha) could thus have an impact on the availability of firewood for the community residing in the immediate vicinity. However, with the people shifting in the IDP camps the fuel source has changed. The mobilisation of labour during construction stage could put pressure on the community forest in case the cooking is done on firewood sourced from the community forest.
Timber and wood products	Timber and wood products are commonly used for construction, furniture, farming, fishing, and household utensils by local communities residing in the original villages. Loss of forest resources due to vegetation clearance (76.7 ha), inundation, or decreased water retention in soil could have an impact on dependent communities.
Non-timber Forest Products	Resin, leaves, grasses, and bamboo are commonly utilized non-timber forest products for domestic use and sale by the communities in the villages. According to the discussions it is understood that a few households, reside in the internally displaced persons camps, but make regular fortnightly trips to the forests in the AoI for collecting bamboo to make baskets.
Freshwater	Even though e-flow will be reduced, there is still likely to be adequate freshwater for the communities in the Trishuli river. However, there are several springs in the Project's AoI and 16 of the 45 identified are considered more vulnerable given their status of main sources for water supply for the communities in their vicinity. Some of these springs were reported to have gone dry post-earthquake; however the same could not be confirmed.
Regulating Services	
Regulation of air quality Climate Regulation: global Climate Regulation: local Regulation of water timing and flows Water purification and waste treatment Erosion regulation Fire regulation Pest regulation Pollination	The Project footprint area comprises relatively degraded community forests and even though there may some impact on local climate regulation, these are likely to be low. Changes in water release timing and flow have been predicted to have some impacts on the blunt nosed snowtrout, Schizothrax richardsonii, a species that is harvested for sustenance. However, as indicated earlier, present fishing levels are low to absent and any impacts to fish numbers are unlikely to impact livelihoods. Given the steep slopes in the Project footprint area, vegetation clearing in the Project footprint area (76.7 ha) and the 2.6 ha of the Langtang National Park will impair erosion regulation and thereby runoff regulation which could impact water quality in the Trishuli River.

Ecosystem Service	Description
Cultural Services	
Spiritual, religious or cultural value	Villagers worship some forest-based deities in the AoI. Several tree species are considered sacred and components of many plant species are used in rituals and cultural festivals.
Traditional practices	Traditional places in the AoI include river banks that are utilized for cremation and religious practices. However, no cremation ground is expected to be impacted by the Project activities. Post-earthquake, the community living in IDP camps near Naubise have identified new burial place which will not be impacted by the Project.
Supporting Services	
Aesthetic value	The aesthetic value can be negatively affected by the loss of forest resources, decreased water flow and by Project development (e.g. powerhouse, transmission lines, base camp, construction, etc.).
Non-use value of biodiversity (e.g. existence, bequest value)	There are no obvious non-use values associated within the Project AOI.
Primary production Nutrient cycling Water cycling Soil formation	With lower e-flows the DRIFT modelling has indicated that algae concentrations upstream and downstream of the dam will increase. But due to continued flow, although reduced, this will not result in impacts to fish harvested for sustenance. There will be a decrease in primary production due to clearing of vegetation in the Project footprint area leading to decreased biomass for utilization by local communities and impacts to water and nutrient cycling and perhaps soil formation. These areas will thereby experience lower primary productivity in the future even if revegetation and rehabilitation of top soil were to occur, given that natural ecosystems, even though modified, have been replaced.
Habitat provision	Terrestrial habitats are not used by local communities for hunting and there is presently negligible extraction of aquatic fauna in aquatic habitats.

Mitigation Measures Suggested

The Engineering, Procurement, and Construction Contractor will be responsible for implementing key measures for minimising and mitigating these impacts as required in the Environmental and Social Management and Monitoring Plans (ESMMPs) (see Appendix B), are as follows:

- Formulation and implementation of a livelihood restoration plan;
- Avoid culturally and religiously significant sites for the locals;
- The ESMMP for the construction phase should be widely socialised and understood by the Project contractors and the local communities, so that there is all round confidence that vital ecosystem services will not be impaired in the long run even if there are any temporary disruptions to any of these services ;
- Replanting of trees and vegetation to stabilise slopes through local CFUGs which will also provide an opportunity for employment; and
- Establish a grievance redressal mechanism for the local community.

5.2.4 *Impacts on Tradition and Culture of IPs due to In-migration and Influx*

The Project is expected to employ approximately 1,090 skilled, semi-skilled, and unskilled workers over a 60-month construction period. In terms of influx of labour and migrant population in the area, the highest risk villages are Mailung, Phulbari and Haku Besi because of their proximity to the proposed worker camps.

In addition to the influx of labour in the area, Project development may also result in the in-migration of general population seeking to take advantage of the economic and development opportunities created in the area, or worker families that relocate to the Project area. Impact on IPs as host communities can affect or influence their tradition and socio-cultural practices.

The inventory of religious and cultural sites prepared during ESIA lists following cultural sites.

Table 5-4 List of Sacred Sites

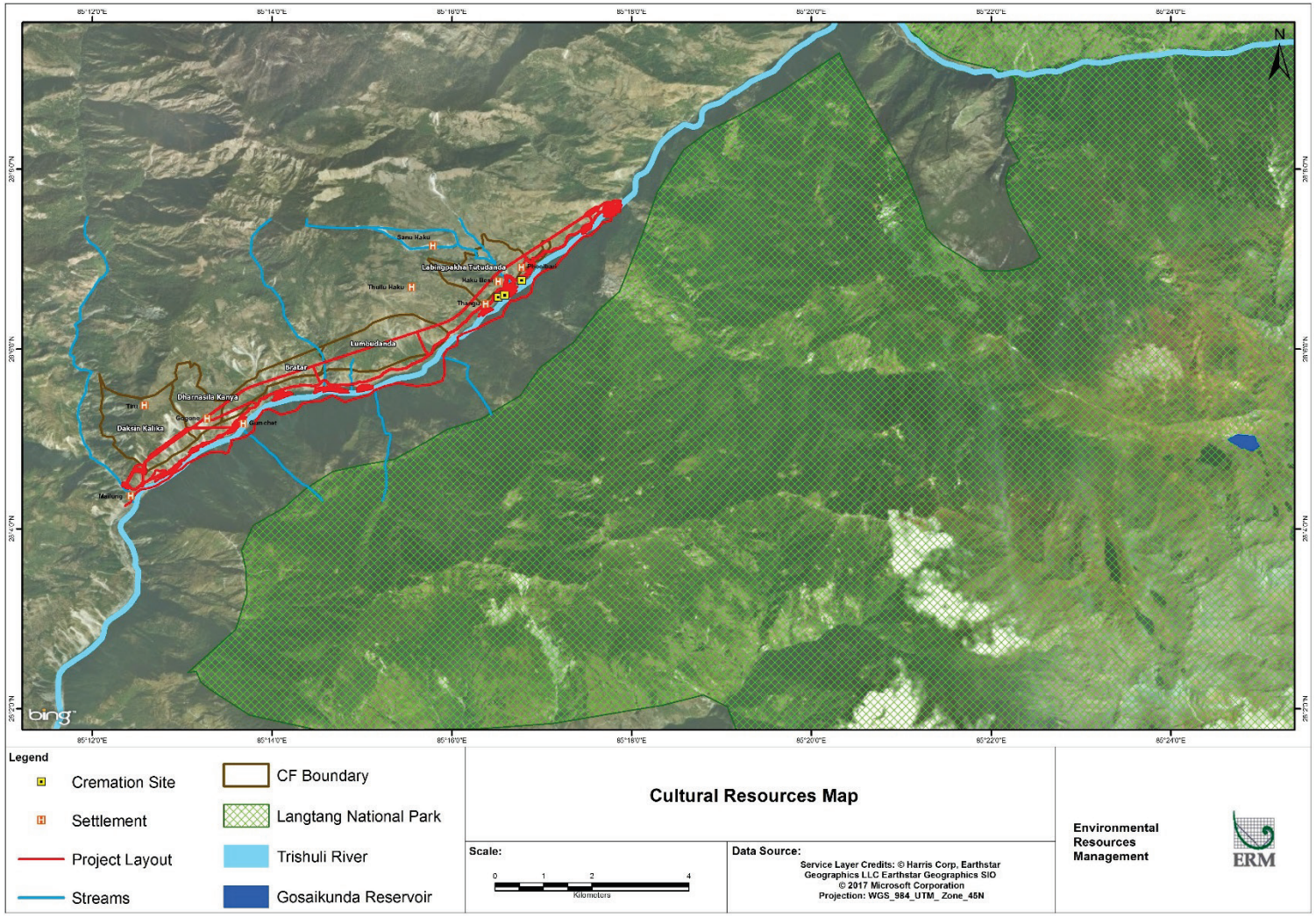
VDC Name	Cultural Practices	Cultural Sites
Haku	There are no built shrine structures in the area acquired for the project. Locals worship their local deities (demons, gods, natural powers) on open land close to the stream (Khola) near the village. They celebrate festivals like Dashain, Bhadra Purnima, Shrawne, and Maghe Sankranti, and Buddha Jayanti of the Hindu and Buddhist religion.	The dead are normally buried. Burial places are located in the upper part of the hills.
Dhunche	Menchyau Dupchyo is a scared site uphill from the village and Pasang Lamu Highway, which is about 3 hours walk within the Langtang National Park. There is a cave located there and springs originate from that place, where people usually bath in the month of Magh. Every year in the month of Magh, many pilgrimage from Dhunche, Ramche visit the site and bathe there. They believe that the many illnesses like scabies, wounds, headaches, and many others will be cured after the bath. The Tamangs worship Paiyu tree as a God.	The constructed structure at the burned place is called Purgam in Tamang language. At the locality, there are about eight Purgams.
Dhunche	Dupla Sambling Gumba is located near to the settlement. People offer prayer in each Dashain. Purnima and Aunsi in the Gumba. A special Mela organized at this site in Buddha Purnima (Baisakhi Purnima). Chenti Garpu, one of the Shrines is nearer to the settlement and people offer Bhumi Puja in the shrine in Fagu Purnima, Jestha Purnima, and Janai Purnima.	At the locality, there are about 16 Purgams.
Ramche	Most of the villagers celebrate Dashain, Tihar, Maghe Sankranti, Shrawan Sankranti but none of them celebrate Loshar.	Most of the locals use their own land as crematory sites for the dead. Lamas cremate their dead at the summit of the hill.

Source: ESSA 2014

The Tamang follow a mixed religion of animism and Tibetan Buddhism. Traditionally, the Tamang social and cultural practices have blended with Buddhist ideologies. The Tamangs have traditional social institutions such as Nangkhor, Gedung, Chokpa, and Ghyang.

Gurungs practice a form of Tibetan Lamaism heavily influenced by a pre-Buddhist and largely animistic form of religion called Bön. Some characteristics of Bön are the belief in natural spirits, spirit possession, and in the existence of supernatural creatures in the forests. Each Gurung clan or village has their own local deities, which are believed to have considerable power over nature and influence in human life. In addition, despite being predominantly Buddhist and animistic, the Gurungs also traditionally observe major Hindu national festivals such as Dasain. The Gurungs have a rich tradition of music and culture. They practice a social tradition called Rodi in which young people meet in the evenings to socialize, share music, dance, and find marriage partners.

Figure 4.1 Important Sacred Sites in Project Area



Mitigation Measures Suggested

To minimise the adverse cultural influence on the host community and to avoid conflict with them, the Engineering, Procurement, and Construction contractor will be responsible for implementing mitigation measures as required by the Environmental and Social Management and Monitoring Plan. Relevant mitigation measures in this aspect are as follows:

- Prioritize the recruitment of local community residents in the Project;
- Provide adequate training to the non-local workers in the Project, especially in terms of interaction with the local IPs community members;
- Provide support to improve access to sacred sites or its beautification;
- Support to encourage preservation and promotion of cultural practices;
- Put in place a grievance redressal mechanism for the host community of IPs;
- Allow local residents to report concerns associated with cultural heritage impact (e.g. loss of access) and loss of cultural values through the grievance mechanism; and
- Establish and enforce a Worker Code of Conduct for the Project, include compliance with this Code in the EPC contract, and ensure all workers are trained and understand its requirements;

6 BENEFICIAL MEASURES

Potential positive impacts expected from the project are livelihood and income opportunities due to the project. The construction phase of the project is likely to result in an increase in the job and livelihood opportunities for the local community. These opportunities will include unskilled, semi-skilled and skilled labour, petty contracts, and creation of market/ indirect benefits for small businesses. The PDA signed between NWEDC and GoN has provisions for following plans to share the project benefits with local communities and steer local development process:

- Local Benefit Sharing Plan;
- Employment and Skill Training Plan;
- Industrial Benefit Sharing Plan

An overview of possible contents of these plans based on provisions under PDA is provided below.

6.1 LOCAL BENEFIT SHARING PLAN (LBSP)

The main objective of the LBSP is to support local development process through direct investments (including local shares, royalty sharing and rural electrification) as well as collaborate and support of complementary projects in the area so that local communities benefit. Thus the LBSP has four components which are discussed below.

6.1.1 Royalty to GoN

NWEDC will pay royalty to GoN as per the provisions under section 11.22.2 of the PDA. There two types of Royalty payable to GoN. First, the Capacity Royalty which is NPR 200 per KW per annum. Second, the Energy Royaly which is 2% of the energy receipts for the first 15 years (from the date of COD) and 10% of the energy receipts for the reminder term of the Concession period. This will contribute to the revenue of GoN which will be used for social welfare and economic development of the country.

According to the Local Self-Governance Rules (2050 BS) the royalty generated from the project will be distributed as follows:

Royalty Allocation	*Government Level*	*Beneficiaries*
50%	Federal Government	Nation
25%	Provincial Government	Residents of the Region
25%	District	Residents of Rasuwa District

6.1.2 *Equity Shares Allocation to Project Affected Communities*

As per PDA section 10.17.1 shares shall be available for purchase by any member within the local community who are residing permanently in the districts of the project area at the date on which the construction activities for the Project commence. A maximum of 10% of the share will be sold or issued directly or indirectly at their face value without applying any premium. These shares will be allocated to project affected communities and NWEDC is not required to issue company shares to the general public.

6.1.3 *Rural Electrification Plan:*

NWEDC in consultation with GoN shall identify 'free electrification area' and identify each beneficiary households. These households will be supplied with 20kWh of free electricity per month. The 'free electrification area' is defined as 500m radius of the headworks and the power station at the commercial operation date. Prior to the COD, NWEDC will build the distribution network to supply such Local Free Power to each eligible household within free electrification area. At present it is estimated that it will cover 350 project area households, which is subject to verification through joint consultation with DoED and NWEDC before financial closure.

6.1.4 *Community Development Plan:*

In addition to the budget committed in EIA, NWEDC shall throughout the term, support community development of affected communities through benefit sharing activities. Local community development activities aim to improve the standard of living of the affected communities through livelihood enhancements and support to construction and maintenance of physical infrastructure.

The Project has undertaken a number of community and infrastructure development activities as part of their CSR activities. The Project was also involved in various relief efforts after earthquake. The Project is also supporting rebuilding of two schools in Haku besi and Dhunche and one health centre.

An overview of the range of the community development activities defined in LBSP which can be implemented in consultation with the affected communities is provided below.

Table 6-1 Activities covered in local benefit plan

Sector	*Activity*	*Description*
Road	Foot trails and foot overbridge	One time grant to develop foot trails typically 3-5km long.
Water Supply	Community water supply	Installing common water taps to serve a cluster of households

Sector	*Activity*	*Description*
	Water supply to educational institutes	Respond to the request by Gaonpalikas to provide one-time grant to improve the existing water supply to schools.
	Water supply to health facilities	One time grant to health facilities serving affected Gaonpalikas to rehabilitate or improve existing water supply system
Education	Upgrading school infrastructure	One time grant to schools for construction of new classroom, laboratories, library etc.
	Furniture and Stationaries Supply	One time support to schools to purchase desks, tables, chairs, blackboard, books for library etc.
	Computer and IT Peripherals	One time support to schools for purchasing computers and peripherals such as UPS, printers, LCD projectors etc.
Health	Upgrading health center infrastructure	One time grant to improving infrastructure which may include construction of new rooms, toilets, solar panels and such other infrastructure which improves their capacity to cater to more patients or improve quality of health services.
	Furniture support to health centers	Onetime grant to purchase furniture including desks , beds, tables, chairs, notice boards, etc.
	Support to birthing centers	Onetime support to establish birthing centers which includes construction of building, furniture and requisite equipment.
Community Infrastructure	Storage facility	Onetime support to construct storage facility for horticulture, herbs where farmers can bring their produce and sale at profitable price points.
	Upgradation of Community Halls	One-time grant to upgrade or improve existing community halls by supporting civil and electrical works.
Community Organization and Events	Community Organizations	Support to community organizations for training programs, infrastructure, equipment etc.
	Community Events	Support to major sporting events, cultural events through organizing committees.
Livelihood	Agriculture and livestock support	Support to training and equipment for agriculture and livestock rearing.
	Cottage industries	Support for purchase assistance of equipment, assistance in procuring raw materials, market linkages and capacity building trainings.
	Eco-tourism promotion	Support to include promotion and marketing of home-stays and associated training for trekking, camping, sight-seeing etc.

Institutional Mechanism:

These programs are planned to be financed from a community development fund which will function through a joint management of GoN, Local Community and NWEDC. The funds will be approved by 'Benefit Sharing Committee' (BSC) and its implementation will be monitored by 'implementation monitoring committee' (IMC). The composition of BSC will be as follows:

Institution	*Position*
Local Development Officer of Rasuwa (or an equivalent government officer in the new federal structure)	Chair
DoED representative	Member
NWEDC CEO or his representative	Member
Local community representative	Member
ESMC Head, NWEDC	Member-Secretary

The Implementation and Monitoring Committees (IMC) will be constitutes for each broad areas of intervention which will be responsible for implementation, monitoring and evaluation. Each IMC will have five members, *viz.*,

- NWEDC CEO or his representative/NWEDC ESMC;
- Official of the respective local level government line agency;
- NWEDC field project representative;
- An elected representative of the ward in which the project is located; and
- Representative from among the beneficiaries.

6.2 NEPAL EMPLOYMENT AND SKILL TRAINING PLAN

This plan was prepared based on literature review, survey of 369 PAFs, rapid market appraisal, field observation and informal meetings with district level government officers and workers of non-government organizations. The Plan has two key-components, i.e. technical and vocational training, and merit based scholarship for Diploma courses.

6.2.1 Technical and Vocational Training

The plan proposes to conduct skill-based training to these 369 PAFs and members of other vulnerable households in 14 different technical trades within a timeframe of five years. These trainings will be provided by a number of empanelled training service providers. The trainings will be CTVET endorsed Level-1 training courses which includes 390hours of training spanning over 90 days. An overview of the types of training and its basic contents is provided below.

SN	Name of training	Basic contents	Duration	
			Hours	Month
1.	Tailoring	Introduction & identification of measurements, tools & equipment, safety & precautions, Installation of tailoring machine, *measurement, design, cutting, weaving,* finishing, account, management, communication, entrepreneurship development	390 hours	3 months
2.	Mason	Health & safety measures, Basic knowledge of masonry, knowledge of cement and plaster, Stone Masonry, Stone Masonry, foundation, Bamboo & Wooden Plank,	390 hours	3 months
3.	Building Electrician	Basic knowledge of electricity, health & safety, instruments, drawing, wiring, earthling, maintenance, communication, entrepreneurship	390 hours	3 months

SN	Name of training	Basic contents	Duration	
			Hours	Month
4.	Basic computer	Introduction to Computer, Operating System CUI: DOS GUI: Windows XP, Windows 7, Windows 8, Open source, Word Processing Program, Spreadsheet Program, Presentation Program, Database Program, Photo Editor Program, Email, Internet & Webpage & Networking, Computer Security.	220 hours	2 months
5.	Carpenter	Introduction to wood work; bench work related to carpentry; perform members erection in horizontal and vertical alignment; erect formwork for different foundations; formwork erection for column, beam and slab in separately and combinable situation; apply simple mathematical techniques; occupational health and safety measures	390 hours	3 months
6.	Indian cook	Equipment, tools and security, Personal Hygiene, workspace cleanliness and food security, Pre-preparation, Continental cuisine, Indian cuisine, Chinese Cuisine, Nepali thali	390 hours	3 months
7.	Light vehicle driving	Understanding the vehicle, function of parts and its controls, Basic driving skills: road signs, signal lights, and road markings, Rules of the road: speed limits, railroad crossings, and laws on texting and cell phone use. Sharing the road with pedestrians, bicyclists, commercial vehicles, motorcyclists, and wildlife	390 hours	3 months
8.	Gabion weaver	Use of equipment and tools; safety measures; preparatory tasks for gabion weaving, Functions of "charkha" (weaving machine), Rings of gabion wires and weaving styles, weaving, finishing, storage and record keeping, practical mathematics, occupational health and safety, communication	390 hours	3 months
9.	Heavy equipment	Introduction of Excavator, safety measure, daily monitoring of machine, Start Engine and Test Machine Functions, Perform Excavator Operation, Transport, Maintenance, management, communication & managerial skill, entrepreneurship skill,	390 hours	3 months
10.	Motorcycle repair	Motorcycle service and beginner mechanic, motorcycle electrical mechanic, motorcycle engine and transmission mechanic, motorcycle driving, common module	390 hours	3 months
11.	Plumbing	Safety measure, instrument and tools, basic bench-work, fitting of polythene pipe, layout design, fixing of sanitary unit and its maintenance, cost estimation, communication, management & entrepreneurship development	390 hours	3 months
12.	Security guard	Security management, security service, security tools, electronic security tools, security provision at workplace, receiving orders, gatekeeping, safety of personnel and physical property	390 hours	3 months
13.	Welding	Perform cutting and notching; straight cutting by hand; Introduction of snips and its types; marking and layout; circle cutting by hand; cut irregular figure; seaming; bending; classification and application of welding types; groove single seam, etc.	390 hours	3 months
14.	Beauty parlour	Shampooing hair; cutting hair in simple way; performing hair blow dry/setting; setting roller; performing simple hair massage; performing simple	390 hours	3 months

SN	Name of training	Basic contents	Duration	
			Hours	Month
		hair put up; applying herbal hair dye; shaping eyebrow; performing face cleansing; applying simple make-up; performing manicure/pedicure; removing unwanted hair in simple method (waxing/threading, tweezers); and applying *Mehendi* art		

The surveyed households will be given priority over other candidates in these training programs. The eligibility criteria for these trainings are:

- Education: basic reading, writing and numeracy skills or as entry criteria of CTEVT;
- Age: Between 16 to 45 years;
- Training participants should be the permanent residents from the project affected VDCs of Upper Trishuli-1 HEP; and
- Trainees must possess valid Nepali citizenship certificate.

The selection of options for different kinds of trainings in the three affected VDCs is provided below.

SN	Interested trade	Name of villages/settlements			Total
		Haku	Gogone and Tiru	Mailung	
1.	Tailoring	88	2	28	118
2.	Mason	7	2	7	16
3.	Building Electrician	1		4	5
4.	Computer	23	1	16	40
5.	Carpenter	3	3	8	14
6.	Indian Cooking	20		2	22
7.	Light Vehicle Driving	50	2	33	85
8.	Gabion Weaving			4	4
9.	Heavy Equipment	2		14	16
10.	Motor Cycle Repair	2		3	5
11.	Plumbing	1			1
12.	Security Guard	25		2	27
13.	Welding	6			6
14.	Beauty Parlour	10			10
Total number of trainees		**238**	**10**	**121**	**369**

Post-training support is critical to ensure that training leads to employment. As a facilitator, NWEDC will try its best to accommodate training beneficiaries within the project by providing employment opportunities. However, the project will strictly follow its existing recruitment standards by giving preference for indirect employment through outsourcing in major contract works based on specific requirements and suitability of the candidates. On the other hand, skill training providers will guide trainees for job placement and employment opportunity after the successful completion of training.

6.2.2 *Merit Scholarship for Diploma Courses*

The CTEVT-designed three-year semester system course is aimed at producing middle level technical workforce equipped with knowledge and skills related to the areas of civil engineering, surveying, sub-overseer, etc. NWEDC will provide merit-based Diploma level scholarship to eligible students from project affected families. Scholarship will be strictly restricted to five years and admission will be solicited only for first three years, *viz*., 2 students in Year 1, one student each in Year 2 and 3 respectively. The scholarship will be provided for 3 Year course only for each candidate.

6.2.3 *Monitoring of Implementation*

Internal and external monitoring will be conducted: (a) to keep record the number of PAFs due to the implementation of the project and impacted assets, b) confirm that the living standard of the affected persons/households improved or at least restored to pre-project level, and (c) to ensure restoration of impacted public assets.

NWEDC will submit bi-annual report to DoED for the first three years of the construction period and annual report thereafter, describing in detail (a) its employee training programmes; (b) implementation status of such training programmes; and (c) progress made towards meeting the objectives set forth in Section 11 .9 of PDA. In addition, NWEDC will conduct annual review and monitor skill training activities by December 2018.

6.3 *INDUSTRIAL BENEFIT SHARING PLAN (IBP)*

The objective of the industrial benefit plan (IBP) is to enable Nepal-based firms to gear up to meet the needs for supply of goods and services at competitive prices in accordance with the timelines and quality standards required by the company. Following list of materials, equipment, supplies and services required for the project was identified by NWEDC

Table 6-2 List of materials, equipment, services and supplies required for the Project

Materials/equipment	Supplies	Services
Steel	MS tube	Legal consultations
Cement	MS sections	Hospitality
Aggregate	SS pipes and sections	Catering
Fabricated metal products	Construction chemicals	Food and beverage
Ready mixed concrete	Silica fume and flyash	Overhauling and mechanic stores
Lumber, timber and bricks	Construction machinery	Refurbishing and repairs
Chemical products (explosives, hardeners, curing compounds)	Construction equipment	Electrical appliances
Rubber products (waterstops)	All types of industrial hardware	IT and communications
Clay and glass products	Welding equipment and consumables	Transportation

Materials/equipment	Supplies	Services
Electricals and electronics	Light and heavy duty hand tools	Sanitary ware, home furnishings, security guards
Trucks, tractors, bulldozer, crane, dumpers, dragline, shovel, scraper, grader, drilling machines	Power tools and prefabs	Skilled manpower such as welders, scaffolders, plumbers, masons, carpenters, electricians, foreman, driver, etc.
Blasting materials and drilling machines	Pneumatic tools	Groceries
Asphalts and bitumen	Hydraulic tools and equipment	Ticketing and travel
Transit mixers and water sprinklers	Sediment flushing facilities	Information communication and technology (ICT)
Hydro-mechanical equipment such as safety and other gates, stoplog, trash rack/ cleaning machine, steel liner, penstock, bifurcation	Compressors, pumps and safety gears and appliances	Insurance
Fire protection	Material handling equipment	Medical service
Heating, ventilation, air conditioning	Fuel (gasoline and diesel)	Advertising services
Oil treatment system	Oxygen cylinders	Stationery services
Hydraulic scaffolding	Food and beverage	
Power plant equipment	Work shop machinery	
Main transformer		
Switchyard		

Through a consultation process, the IBP has identified 75 potential Nepali commodity associations and key suppliers of goods and services with whom the HEP contractors could approach to compete in the procurement process. In order to facilitate these Nepali business units, NWEDC has planned following activities.

6.3.1 Interaction Workshops

NWEDC will organize two Interaction Workshops in Battar and Kathmandu in October 2018. This will immensely help potential Nepali business entities to understand the timing, quantity and quality requirements of goods and services.

6.3.2 Stimulate business linkages.

National and international joint venture partnerships and inter-institution linkages provide local firms based in Rasuwa and Nuwakot districts and adjoining market areas with the necessary externalities and confidence to initiate joint ventures and promote more inclusive business linkages models, including support for the development of local processing units; fostering inclusive markets, and encouraging joint ventures between local and foreign suppliers to develop inclusive business linkages and enhance knowledge transfer.

6.3.3 Maximize benefits to local suppliers.

The contractor should give highest priority to promote local business development and sourcing initiatives in the bidding process fulfilling tendering compliance.

6.3.4 Disseminate information.

Information associated with goods and services required over the project life cycle will be shared with Nepal Industries through meetings and announcements in media.

6.3.5 Setting up suppliers' database.

NWEDC will set up a database of Nepali suppliers of goods and services and share this database project's contractor to ensure full and fair opportunity for Nepal-based suppliers of goods and services is provided. NWEDC will update and manage this database periodically.

6.3.6 Encourage full and fair access.

NWEDC to designate an Industrial Benefits Officer who will work with domestic suppliers on opportunities to meet mutual needs.

6.3.7 Harmonize with EPC contractors.

The EPC contractor will prioritize putting potential Nepali suppliers in quality control of raw materials and electro-mechanical equipment meeting the plan's standard operating procedures.

6.4 COMMUNITY SUPPORT PROVISIONS IN EIA REPORT

There are certain community development initiatives which have been included as part of the commitments in the EIA for the project. The same shall be incorporated into the community development plan thus formulated. The EIA commitments of relevance are:

- Local people will be prioritized for employment in project construction works;
- Local people specifically women will be encouraged in agricultural practice through agricultural enhancement programme;
- The project will assist the school of the Haku VDC to provide education to the children of project staff and workers;
- The project will assist the local health institutions;
- The ethnic group 'Tamang' of the project area will be supported to preserve their, tradition, culture, identity as well as their traditional occupation;

- Dalit group will be prioritized in project works as per their skills and capacities with certain percentage reservation for dalit;
- Local people will be provided training on business and trade;
- Local people will be prioritized in training in project related works;
- The project affected VDCs will be supported for rural electrification;

Some of the environment protection measures in EIA which will also benefit local communities are as follows:

- The erosion of river bank will be minimized by implementing river bank protection measures in susceptible site downstream of weir;
- The area equivalent to occupied forest area (27.20 hectares) for project physical infrastructures will be afforested and protected for 5 years and handed over to concerned stakeholders as per the Forest Guideline for the Allocation of the Forest land to other Development Projects. The afforestation area will be as per the area designated by the respective district forest office and LNP;
- The project will carried out compensatory plantation of 4797 felled trees at a ratio of 25 seedlings for each lost tree equivalent to 119925 numbers as per the Forest Guideline, 2006 in an area as directed by the District Forest office of Rasuwa district and LNP authorities;
- The construction workers will be prohibited to collect firewood, timber and other forest products from the local community forest of Haku VDC and such act will be termed illegal.

7 PROPOSED FPIC PROCESS

This section describes the proposed FPIC process to be carried out for the project. It outlines broad principles which are aligned with the requirements of IFC PS-7, ADB Safeguard Statement and other international FPIC Guidelines. The proposed process is broadly guided by these principles, yet the specific context of the project determines areas or aspects which are more relevant for this project.

7.1 PRINCIPLES OF FREE PRIOR INFORMED CONSENT

The FPIC process proposed will be based on the following principles:

Table 7-1 Principles of FPIC

Principles	Attributes
Free	• This principle implies the process should be conducted in the absence of any manipulation, coercion or intimidation from any other groups, bodies and entities in the decision-making process of indigenous peoples. • Any external influence that hinders self-determination in the process of decision-making and the outcome of their decision is a clear violation of this principle. • Consent cannot be valid if it is taken from the authority or the group that is not recognized by the indigenous communities or not accountable to them. Further, the independence of their decision-making process and the outcome must be verifiable with the members of the indigenous communities.
Prior	• The informed consent must be sought first as a precondition before implementing any activity and project. • It is an advanced authorization from affected indigenous peoples' communities before the commencement of any activities or project. • It shall respect the time requirements of indigenous peoples' consultation and consensus processes defined by them. • The prior consent requires a comprehensive procedure to ensure that indigenous peoples have sufficient time to understand, analyze and discuss the information they receive collectively. All parties requiring the consent of indigenous peoples must thereby engage them in good faith discussions to reach a mutual agreement on the timeline of the decision-making process. • The element of prior also denotes respecting the duration of time for indigenous peoples to undertake their decision-making process according to their pace and circumstances.
Informed	• This is a core element of the FPIC decision-making process to reach or achieve a well-informed decision. It is thereby important not only to have access to information, but also to clearly understand the information provided to them. • If necessary, information should be translated to the local language and put in a form and manner that is understood by the indigenous communities to facilitate better understanding. • Further, indigenous community members must have a level of satisfaction on the level of information provided to them. • This includes information to clarify or answer their questions as well as information that shall provide them with a comprehensive understanding

Principles	Attributes
	especially on the implications of the activity, project or matter for their collective decision. • Information disclosure for the FPIC process should include full and legally accurate exposure of data pertaining to any activity or proposed developments or projects. • The project proponent is responsible for the full disclosure of the information to indigenous communities, including providing the information in forms understood to them. • Indigenous communities shall also have the freedom to secure additional information from other sources, besides the project proponent.
Consent	• It is a collective decision-making process of indigenous peoples that entails several steps. This may include series of consultation as needed and it should allow enough time for indigenous communities to undertake their own internal deliberations prior to making their collective decision. • The consultations shall allow community members, including women and youth, to express their views, raise their concerns, seek additional information, if needed, and seek clarifications on their questions and/or concerns. • It should be transparent, inclusive and well-informed with meaningful and accountable participation of the indigenous leaders in the consultation processes and the collective decision-making process. • The consultation processes shall be documented properly. The project proponents shall provide for more information, if requested, and respond to the clarifications and conditions set by indigenous communities. In addition, consultations require an effective system of communication and understanding information among indigenous peoples.

Source: UN- REDD Programme: Guidelines on Free, Prior and Informed Consent, 2013

FPIC is a lender requirement and not currently required under Nepali law. The original GoN decision to develop a hydropower project at this location and the subsequent acquisition of a portion of affected IP lands which occurred early in the project development process, pre-date Lender involvement and were not subject to an FPIC process.

Therefore, in the project-financing context for this specific project, the concept of seeking 'prior consent' shall imply seeking consent from affected IP communities for a draft package of proposed impact mitigation measures and benefits prior to the main phase of UT-1 project development (i.e. prior to the main construction phase). The proposed mitigation measures would incorporate any supplemental compensation and/or livelihood restoration measures needed to fully mitigate the impacts of completed land acquisition and resettlement efforts to date.

7.2 PROCESS FOR SEEKING FPIC

FPIC process proposed is a shared tripartite (NWEDC, community, local government) decision-making for Indigenous Peoples Plan (IPP) creation and evolving a mechanism for joint management of IPP implementation and Grievance Redress Mechanism (GRM). The process will be carried out through following steps.

Step-1: Project Disclosure: ESIA and related plans disclosed to members of 9 project-affected villages (including those in IDP camps if any).

Step-2: Working Group (WG) Selection Process: Each partner selects participants to join in a collaborative Working Group to manage the IPP/FPIC process; separate meetings of each partner to formally select IPP Working Group representatives.

Step-3: First IPP Working Group Meeting: (i) receipt of IPP suggestions from all partners (including NWEDC draft Plans), (ii) determination of the consent process, (iii) determination of IPP Writing Team (WT) members [those WG members tasked with actually writing/revising IPP and FPIC document.

Step-4: Writing/revising of IPP and the disclosure of this draft IPP to communities.

Step-5: Consultations Round 1: Community Priorities: presentation by WG of possible mitigation, benefits and management structure in an IPP based on LBSP/IPP and other inputs; collection of concerns and requests for draft IPP.

Step-6: Drafting/revising of IPP by WT/WG based on community inputs. Disclosure of revised IPP to communities.

Box 8.1 ***Language Policy for Information Disclosure and Consultation Process***

The disclosure of the written documents will take place in a common language on which affected Tamang, Gurung and Newar community is proficient.

The consultations with a particular IPs community will be carried out in their respective mother-tongues/dialects for their easy comprehension. NWEDC will engage expert translators with adequate knowledge in Tamang, Gurung and Newar dialect/language.

Where participants in a consultation are heterogeneous, selection of the language will be done with mutual agreement.

Step-7: Consultations Round 2—IPP Confirmation: submission of detailed Plan with proposed components, management structure and budget to 8 villages by WG.

Step-8: Revision of Final Draft IPP by WT/WG based on community inputs. Disclosure of revised IPP to communities.

Step-9: WG Process Decision Point: determine if another consultation round is needed, or if facilitation/mediation is needed to resolve outstanding issues, or if the previously agreed upon consent decision process can now take place.

Step-10: Consent Process: The consent process is carried out and if consent is obtained for approval of i) IPP and ii) MoU document indicating Consent.

Step-11: IPP Implementation: If consent is obtained NWEDC would initiate IPP implementation under tripartite supervision and each party fulfils their commitments.

8 PROVISIONAL ESTIMATE AND FINANCING

8.1 BUDGET REQUIREMENT FOR IMPACT MITIGATION MEASURES

Budget provision for some of the mitigation measures recommended in Chapter-5 are covered in other action plans. The mitigation measures which are not covered in any other action plan are listed and an indicative budget provision is made in Table 8-1 below.

Table 8-1 Estimate for implementing mitigation measures

Impacts	Mitigation Measures Requiring Budget Provision	Amount in NPR
Impact on CFUGs	• Compensation payment for any extra tree loss during the construction. • Conduct training and capacity building of the CFUGs for rejuvenation and management of community forest area. • Financial Literacy training may also be provided to the CFUG members for the management of the cash compensation received	10,00,000
Impact on Fish Resources and Fishing	• Monitor the fishing activity till the completion of construction and provide entitlements as defined in the LALRP where necessary.	5,00,000
Impact on Eco-system Services	• Replanting of trees and vegetation to stabilise slopes through local CFUGs which will also provide an opportunity for employment	5,00,000
Impact on Tradition and Culture	• Provide adequate training to the non-local workers in the Project, especially in terms of interaction with the local IPs community members; • Provide support to improve access to sacred sites or its beautification; • Support to encourage preservation and promotion of cultural practices.	15,00,000
Total		**35,00,000**

8.2 BUDGET REQUIREMENT FOR PROJECT BENEFITS

The budget requirement for four components of the project benefits discussed in Chapter-6 are covered in this section.

8.2.1 LBSP Budget

The budget for the local benefit sharing components is provided in Table 8-2 below.

Table 8-2 Estimate for local benefits

Components	*Description of activities*	*Budget (NPR)*
Access enhancement	• Trails and associated infrastructure • Foot bridges	50,00,000
Water supply	• Community drinking water supply • Institutional water supply (health centers and schools) • Community small scale Irrigation	77,50,000
Education	• School and education facility support programmes	23,500,000
Health and sanitation	• Health posts/centers • Sanitation improvement	50,00,000
Community infrastructure, local organizations support & events	• Community Centers • Support to cultural, heritage and religious sites • Support for local organizations • Community sport & cultural events	90,00,000
Women development	• Women empowerment training	75,00,000
Office and secretarial training	• Training to PAFs, SPAFs and local people of Haku	50,00,000
Livelihood	• Agriculture enhancement • Cottage industries • Tourism industry (Langtang NP)	33,000,000
Rural electrification	• Support for rural electrification extension	50,00,000
Share allocation	• Support for share allocation	10,00,000
Total		**101,750,000**

8.2.2 Nepal Employment and Skill Training Plan

The employment and skill training plan has two broad components and the budget provision for them is provided in Table 8-3 below:

Table 8-3 Estimate for employment and skill training plan

Component	*Budget in NPR*
Technical and Vocational Training	15,835,255
Merit based Diploma Scholarship	1,789,200
Total	**17,624,455**

8.2.3 Industrial Benefit Plan

The expenses for the Industrial Benefits Officer is covered under the manpower and administrative cost. There is a provision of **NPR 5,00,000** for organizing two Interaction Workshops with Nepal industries and service providers.

8.3 SUMMARY BUDGET STATEMENT

The total budget estimate for the activities discussed in IPP will be **NPR 12,33,74,455** (Twelve Crores thirty three lakhs seventy four thousands four hundred fifty five only) and the details are provided in Table 8-4 below.

Table 8-4 Summary Estimate of different Components of IPP

Component	*Budget in NPR*
Estimate for mitigation measures	35,00,000
Estimate for Project benefits	
Local Benefit Sharing Plan	101,750,000
Nepal Employment and Skill Training Plan	17,624,455
Industrial Benefit Plan	5,00,000
Grand Total	**12,33,74,455**

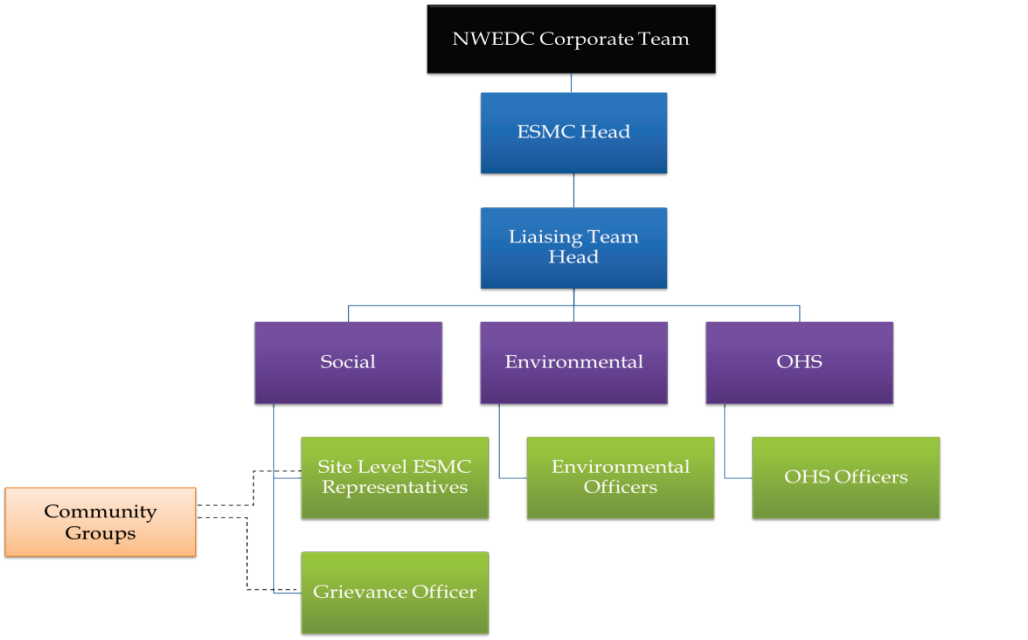
9 IMPLEMENTATION MECHANISM AND GRIEVANCE SYSTEM

This section describes the overall implementation process of the IPP. As most of the PAFs and local community in the AoI are categorized as IP population, the IPP implementation mechanism is synchronised with the implementation mechanisms of the ESIA and SIMF for the project. This section includes a summary discussion on the resources requirements and steps involved in implementation, including disclosure, engagement, grievance redressal and monitoring and review.

9.1 ORGANIZATION STRUCTURE AND STAFF REQUIREMENTS

The IPP will be implemented by the Environmental and Social Management Cell (ESMC) set up for the project. The reporting structure to be followed for the ESMC is provided in the figure below.

Figure 9.1 Organizational Structure for ESMC



As can be seen in the figure above, the ESMC head will lead the overall implementation process. The Liaising Team Head will report to the ESMC head at NWEDC and will be supported by Site Level ESMC Representatives (also referred to as the Community Liaison Officers or CLOs) who will be primarily responsible for undertaking regular interaction and mobilisation activities with the community.

There are two CLOs engaged at the project site, one of whom is a Tamang PAF. In addition to this the recruitment of a female Mobilization officer should be considered at the time of implementation. This institutional

structure may be further strengthened or get extra support, as such experts/scholars working with the Tamang community or NGOs working in the area as required through the implementation of the IPDP.

9.2 DISCLOSURE AND IMPLEMENTATION MONITORING PROCESS

In addition to the above mentioned mitigation measures, the project shall undertake regular engagement and information disclosure to the external stakeholders through the project lifecycle. This process of engagement shall be undertaken in keeping with the principles of inclusivity and cultural appropriateness. The SEP formulated for the project provides a detailed engagement plan to be followed for the project lifecycle. The following section provides the process to be followed for information disclosure which shall be updated based on the suggestion from the FPIC process.

9.2.1 Continuation of Disclosure of Information in Operation Phase

The project shall undertake regular information disclosure through the project operation lifecycle. This information disclosure shall be as per the SEP adopted for the project. The mandatory disclosure shall be comprised of the monitoring and review reports in keeping with the SIMF and regulatory requirements. In addition to this, the project shall organize public meetings and consultations, at least on an annual basis. These consultations shall be aimed at providing a general update of the project status and activities to the local community and receiving their feedback on any key aspects.

9.2.2 Monitoring of Implementation and Reporting Back

In addition to the information disclosure process, the key stakeholder groups, including the PAFs, vulnerable groups, Jan Sarokar Samiti etc. shall be involved in the annual review process for the SIMF including the IPP. The process and components of monitoring to be undertaken for each of the constituent action plans under the SIMF is provided in these individual action plans. Similarly, the documentation and reporting requirements for these individual action plans is also provided.

9.3 GRIEVANCE MECHANISM

Another key form of engagement is the access to the Grievance Redressal Mechanism formulated for the project. The process to be followed for the redressal of the external stakeholder grievances is summarized below. This grievance redressal mechanism is aimed at allowing all external stakeholders, including the IP population to communicate any concern or grievance in a format which is convenient to them. In keeping with the literacy profile of the IP population and general community, the option of communicating the grievances verbally is made available.

Figure 9.2 Schematic Representation of External Grievance Mechanism