Environmental and Social Impact Assessment Final Report (Part 1)

Project Number: 49086-001
June 2018

NEP: Upper Trishuli-1 Hydropower Project


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Non-Technical Updated Environmental and Social Impact Assessment Summary Report

Final

UPPER-TRISHULI HYDROPOWER PROJECT, NEPAL

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
Aol  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
CH4  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
CO2  carbon dioxide
CO2e  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
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>NO³</td>
<td>nitrate</td>
</tr>
<tr>
<td>NPR</td>
<td>Nepalese Rupees</td>
</tr>
<tr>
<td>NT</td>
<td>Near Threatened</td>
</tr>
<tr>
<td>NTFP</td>
<td>non-timber forest products</td>
</tr>
<tr>
<td>NTU</td>
<td>nephelometric turbidity unit</td>
</tr>
<tr>
<td>NWEDC</td>
<td>Nepal Water and Energy Development Company Limited</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>operations and maintenance</td>
</tr>
<tr>
<td>OM</td>
<td>Operations Manual</td>
</tr>
<tr>
<td>OP</td>
<td>Operational Policy</td>
</tr>
<tr>
<td>PAF</td>
<td>Project Affected Family</td>
</tr>
<tr>
<td>PAG</td>
<td>potentially acid generating</td>
</tr>
<tr>
<td>PDA</td>
<td>Project Development Agreement</td>
</tr>
<tr>
<td>PDP</td>
<td>Public Disclosure Policy</td>
</tr>
<tr>
<td>PM</td>
<td>particulate matter</td>
</tr>
<tr>
<td>POL</td>
<td>petroleum, oil, and lubricant</td>
</tr>
<tr>
<td>PS</td>
<td>Performance Standard</td>
</tr>
<tr>
<td>REA</td>
<td>Rapid Environmental Assessment</td>
</tr>
<tr>
<td>RLNB</td>
<td>Red List of Nepal’s Birds</td>
</tr>
<tr>
<td>RoW</td>
<td>right of way</td>
</tr>
<tr>
<td>RP</td>
<td>Resettlement Plan</td>
</tr>
<tr>
<td>SANS</td>
<td>S.A.N. Engineering Solutions</td>
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<tr>
<td>SP</td>
<td>spring</td>
</tr>
<tr>
<td>SPS</td>
<td>Safeguard Policy Statement</td>
</tr>
<tr>
<td>TAR</td>
<td>Tibet Autonomous Region</td>
</tr>
<tr>
<td>ToR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>TSS</td>
<td>total suspended solids</td>
</tr>
<tr>
<td>UNDRIP</td>
<td>United Nations Declaration on the Rights of Indigenous Peoples</td>
</tr>
<tr>
<td>UT-1</td>
<td>Upper Trishuli 1</td>
</tr>
<tr>
<td>VAT</td>
<td>Value-Added Tax</td>
</tr>
<tr>
<td>VDC</td>
<td>Village Development Committee</td>
</tr>
<tr>
<td>VEC</td>
<td>Valued Environmental and Social Components</td>
</tr>
<tr>
<td>VU</td>
<td>Vulnerable</td>
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<td>WB</td>
<td>World Bank</td>
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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\textsubscript{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\textsuperscript{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.
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](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 continuuity 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

<table>
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<tr>
<th>Flow Management Scenarios</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing average river flow regime</td>
<td>43.7</td>
<td>38.6</td>
<td>38.6</td>
<td>49.5</td>
<td>87.5</td>
<td>230.4</td>
<td>487</td>
<td>557.8</td>
<td>370.8</td>
<td>160.4</td>
<td>79.9</td>
<td>54.6</td>
</tr>
<tr>
<td>Govt Required minimum diversion reach flow regime</td>
<td>3.9</td>
<td>3.9</td>
<td>3.9</td>
<td>3.9</td>
<td>3.9</td>
<td>3.9</td>
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<td>3.9</td>
<td>3.9</td>
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<td>3.9</td>
</tr>
<tr>
<td>Proposed minimum diversion reach Eflow regime</td>
<td>4.4</td>
<td>3.9</td>
<td>3.9</td>
<td>5.0</td>
<td>8.8</td>
<td>23.0</td>
<td>48.7</td>
<td>55.8</td>
<td>37.1</td>
<td>16.0</td>
<td>8.0</td>
<td>5.5</td>
</tr>
</tbody>
</table>

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). 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**

<table>
<thead>
<tr>
<th>Government Land</th>
<th>Langtang National Park Land</th>
<th>Private Land</th>
<th>Trust Land (Guthi)</th>
<th>Mailung HEP Land</th>
<th>Total (ha)</th>
<th>Number of Affected Private Land Owners</th>
</tr>
</thead>
<tbody>
<tr>
<td>78.646</td>
<td>5.41</td>
<td>5.05</td>
<td>15.53</td>
<td>3.15</td>
<td>107.79</td>
<td>39</td>
</tr>
</tbody>
</table>

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

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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

<table>
<thead>
<tr>
<th>Resource</th>
<th>Activity/Impact</th>
<th>Avoidance, Minimization, and Mitigation Efforts</th>
<th>Applicable Management Plan</th>
<th>Residual Risk</th>
<th>Responsibility</th>
</tr>
</thead>
</table>
| 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 |
<table>
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<tr>
<th>Resource</th>
<th>Activity/Impact</th>
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<th>Applicable Management Plan</th>
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</tr>
</thead>
</table>
| 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 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                          |
<table>
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</thead>
</table>
| 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<br>
• Provide training for recycling and reducing waste<br>
• Conduct an audit to identify available and appropriately permitted waste management facilities for Project wastes<br>
• Apply appropriate storage, transport and use practices to recognized standards for fuels, chemicals, explosives, hazardous substances<br>
• 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<br>
• Explosives, chemicals, and hazardous substances to be handled by authorized personnel<br>
• 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<br>
• Dikes to capture 100 percent of fuel must be placed around fuel storage area<br>
• All refuelling to be done on flat ground<br>
• Spill kits and emergency procedures shall be used and staff trained<br>
• 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;<br>
• Prohibit deliberate discharge of oil, diesel, petrol or other hazardous materials to the surrounding soils and waterways. | • Materials Handling and Storage MP<br>
• Spill Prevention and Response MP<br>
• Waste MP<br>
• Wastewater MP<br>
• Water Quality MP | Minor           | EPC Contractor     |
<table>
<thead>
<tr>
<th>Resource</th>
<th>Activity/Impact</th>
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<th>Applicable Management Plan</th>
<th>Residual Risk</th>
<th>Responsibility</th>
</tr>
</thead>
</table>
| 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            |
<table>
<thead>
<tr>
<th>Resource</th>
<th>Activity/Impact</th>
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</tr>
</thead>
</table>
| 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  |
<table>
<thead>
<tr>
<th>Resource</th>
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</tr>
</thead>
</table>
| 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 |
<table>
<thead>
<tr>
<th>Resource</th>
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<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts to Wildlife</td>
<td></td>
<td>• Provide awareness training and prohibit hunting, fishing, or poaching by construction and operation contractors&lt;br&gt;• Terminate any employees found illegally hunting, poaching or trading protected species&lt;br&gt;• Include terms in contracts with EPC and O&amp;M contractors indicating that exploitation of biodiversity resources will result in penal action.&lt;br&gt;• Use signage and speed humps in areas where wildlife crossing is likely.&lt;br&gt;• Train vehicle drivers regarding the driving risks through biodiversity sensitive areas and along remote roads.&lt;br&gt;• Prohibit wildlife meat at the worker camps</td>
<td>Biodiversity MP</td>
<td>Minor</td>
<td>NWEDC/EPC Contractor</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Impacts to Birds related to Transmission Lines</td>
<td>• Raise the transmission poles with suspended insulators&lt;br&gt;• Require bird-safe strain poles with insulating chains of at least 60 centimetres length.&lt;br&gt;• Check for vacuums or holes in the towers to avoid nesting by any of the birds;&lt;br&gt;• Monitor bird carcasses electrocuted on a monthly basis and record any threatened or migratory species observed</td>
<td>Biodiversity MP</td>
<td>Minor</td>
<td>NWEDC/EPC Contractor</td>
</tr>
<tr>
<td>Community Health, Safety, and Security</td>
<td>Dam Safety</td>
<td>• Modified Project design to account for better defined seismic hazards and climate change predictions&lt;br&gt;• Dam design to be reviewed by Project’s Panel of Experts and Lender’s Independent Engineer&lt;br&gt;• A siren network will be installed to inform those in the dewatered portion in case of a sudden release of water</td>
<td>Emergency Preparedness and Response MP</td>
<td>Minor</td>
<td>NWEDC/EPC Contractor</td>
</tr>
<tr>
<td>Seismic Hazard and Risks</td>
<td></td>
<td>• Maintain a 0.39 g seismic acceleration coefficient for concrete structures, and use prefab for other light structures</td>
<td>Emergency Preparedness and Response MP</td>
<td>Minor</td>
<td>EPC Contractor</td>
</tr>
<tr>
<td>Resource</td>
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</tbody>
</table>
| 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 |
<table>
<thead>
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</tr>
</thead>
</table>
• 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 |
### Upper Trishuli Hydroelectric Power Project - Executive Summary

<table>
<thead>
<tr>
<th>Resource</th>
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<th>Applicable Management Plan</th>
<th>Residual Risk</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest Land Loss</td>
<td></td>
<td>• Support to the community forest management initiatives as agreed to with the Nepal Ministry of Forest</td>
<td>• Land Acquisition and Livelihood Restoration Plan</td>
<td>Minor</td>
<td>NWEDC/EPC Contractor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide payment for extra losses of tree during the access road construction or during further construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Implement a Grievance Redressal Mechanism</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Prohibit firewood usage by the construction workers</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Provide training and capacity building of the Community Forest User Groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource</td>
<td>Activity/Impact</td>
<td>Avoidance, Minimization, and Mitigation Efforts</td>
<td>Applicable Management Plan</td>
<td>Residual Risk</td>
<td>Responsibility</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
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<td>-----------------------------</td>
</tr>
</tbody>
</table>
| 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 |
### Table ES5-2: Project Operation Phase Environmental and Social Risk Management Measures

|-------------|------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------|---------------|----------------|
| **Air Quality** |                  | • 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 |
| (Fugitive dust, Vehicle Emissions, Climate Change) |                  | | | | |
| **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 |

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
|------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------|----------------|
| Water Quality    | Solid and hazardous wastes        | • 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           |
|----------|----------------|-----------------------------------------------|--------------------------------------|---------------|----------------|
| 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 |
|-------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------|----------------|
| Community H&S and Security    | • Dam Safety                        | • 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 |
|                               | • Landslide Hazard                 |                                                                                                                                  |                                                                                                        |               |                |
|                               | • Traffic                          |                                                                                                                                  |                                                                                                        |               |                |
|                               | • Natural Disasters                |                                                                                                                                  |                                                                                                        |               |                |
| 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](image-url)
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 Fish 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;
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

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.

- 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
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 1-5: 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 (m³/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](image)

Table 2-1: UT-1 Hydropower Project Facilities

<table>
<thead>
<tr>
<th>Project Facility</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dam</td>
<td>100.9 m long x 30.85 m wide x 29.5 m high concrete gravity dam</td>
</tr>
<tr>
<td>Spillway Gates</td>
<td>Three 11.0 m wide x 16.5 m high spillway gates capable of passing 200 year storm (2,555 m³/s)</td>
</tr>
<tr>
<td>Reservoir</td>
<td>2.1 ha impoundment at normal operating elevation (1255.0 m)</td>
</tr>
<tr>
<td>Intake Structure</td>
<td>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</td>
</tr>
<tr>
<td>Desander</td>
<td>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</td>
</tr>
<tr>
<td>Headrace Tunnel</td>
<td>6.5 m diameter x 9.7 km long low pressure tunnel</td>
</tr>
<tr>
<td>Surge Tank</td>
<td>8.5 m diameter x 38 m high tank to manage pressure changes in headrace tunnel</td>
</tr>
<tr>
<td>Vertical Pressure Tunnel</td>
<td>6.5 m diameter x 292 m long concrete lined high pressure tunnel</td>
</tr>
<tr>
<td>Horizontal Pressure Tunnel</td>
<td>6.5 m diameter x 40 m long concrete lined high pressure tunnel</td>
</tr>
<tr>
<td>Penstock</td>
<td>110.7 m long x 1.6 m to 6.5 m diameter concrete (upper section) and steel (lower section) high pressure pipe</td>
</tr>
<tr>
<td>Powerhouse</td>
<td>Underground 3 vertical axis Francis turbine generating units each with 72 MW of capacity accessed by a tunnel</td>
</tr>
<tr>
<td>Tailrace Tunnel</td>
<td>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</td>
</tr>
<tr>
<td>Tailrace Outlet</td>
<td>6.5 m diameter x 38.15 m long outlet at elevation 910.0 m</td>
</tr>
<tr>
<td>Transformer Cavern</td>
<td>Main transformer and 220 kV gas insulated switchgear</td>
</tr>
<tr>
<td>Cable Tunnel</td>
<td>381.5 m long</td>
</tr>
</tbody>
</table>
# Chapter 2
## Project Description

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

Source: DKJV 2017

ha = hectare; km = kilometre; kV = kilovolt; m = metre; mm = millimetre; m³/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 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

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

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

<table>
<thead>
<tr>
<th>Worker Camp</th>
<th>Location</th>
<th>Capacity</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fulbari</td>
<td>Near dam site</td>
<td>Not yet determined</td>
<td>2019 - 2023</td>
</tr>
<tr>
<td>Thangu</td>
<td>Near Adit #1</td>
<td>400 workers</td>
<td>2020 - 2023</td>
</tr>
<tr>
<td>Bajet Phat</td>
<td>Near Adit #2</td>
<td>380 workers</td>
<td>2019 - 2022</td>
</tr>
<tr>
<td>Mailung</td>
<td>Near powerhouse and take off yard</td>
<td>500 workers</td>
<td>2018 - 2023</td>
</tr>
</tbody>
</table>

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

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

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

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

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)

<table>
<thead>
<tr>
<th>Work items</th>
<th>Excavation</th>
<th>Requirement</th>
<th>Replacement</th>
<th>Spoil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access road</td>
<td>981,681</td>
<td>103,127</td>
<td>91,265</td>
<td>900,416</td>
</tr>
<tr>
<td>Diversion facilities</td>
<td>88,278</td>
<td>13,509</td>
<td>68,278</td>
<td></td>
</tr>
<tr>
<td>Weir &amp; spillway</td>
<td>344,345</td>
<td></td>
<td>344,345</td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>19,646</td>
<td></td>
<td>19,646</td>
<td></td>
</tr>
<tr>
<td>Desander</td>
<td>187,249</td>
<td></td>
<td>187,249</td>
<td></td>
</tr>
<tr>
<td>Headrace tunnel</td>
<td>632,298</td>
<td>178,763</td>
<td>453,535</td>
<td></td>
</tr>
<tr>
<td>Surge tank</td>
<td>84,606</td>
<td></td>
<td>84,606</td>
<td></td>
</tr>
<tr>
<td>Horizontal pressure tunnel</td>
<td>1,742</td>
<td></td>
<td>1,742</td>
<td></td>
</tr>
<tr>
<td>Vertical pressure tunnel</td>
<td>20,046</td>
<td></td>
<td>20,046</td>
<td></td>
</tr>
<tr>
<td>Still penstock tunnel</td>
<td>9,070</td>
<td></td>
<td>9,070</td>
<td></td>
</tr>
<tr>
<td>Powerhouse</td>
<td>96,689</td>
<td>42,680</td>
<td>54,009</td>
<td></td>
</tr>
<tr>
<td>Transformer cavern</td>
<td>68,811</td>
<td></td>
<td>68,811</td>
<td></td>
</tr>
<tr>
<td>Access tunnel</td>
<td>25,098</td>
<td></td>
<td>25,098</td>
<td></td>
</tr>
<tr>
<td>Tailrace tunnel</td>
<td>16,266</td>
<td></td>
<td>16,266</td>
<td></td>
</tr>
<tr>
<td>Outlet</td>
<td>15,172</td>
<td></td>
<td>15,172</td>
<td></td>
</tr>
<tr>
<td>Take off yard</td>
<td>29,133</td>
<td>25,371</td>
<td>3,762</td>
<td></td>
</tr>
<tr>
<td>Cable tunnel</td>
<td>19,930</td>
<td></td>
<td>19,930</td>
<td></td>
</tr>
<tr>
<td>Adit tunnel</td>
<td>99,476</td>
<td></td>
<td>99,476</td>
<td></td>
</tr>
<tr>
<td>Aggregate production</td>
<td>2,740,338</td>
<td>338,079</td>
<td>338,079</td>
<td>2,402,250</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Spoil Disposal Areas (DA)</th>
<th>Location</th>
<th>Spoil Capacity (m³)</th>
<th>Size (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DA-1</td>
<td>Mailung</td>
<td>190,919</td>
<td>1.09</td>
</tr>
<tr>
<td>DA-2</td>
<td>Mailung</td>
<td>278,047</td>
<td>1.65</td>
</tr>
<tr>
<td>DA-3</td>
<td>Mungtabar</td>
<td>99,478</td>
<td>2.09</td>
</tr>
<tr>
<td>DA-4</td>
<td>Dharnatar &amp; Tungabagar</td>
<td>862,674</td>
<td>5.38</td>
</tr>
<tr>
<td>DA-5</td>
<td>Bugetphat</td>
<td>291,565</td>
<td>2.59</td>
</tr>
<tr>
<td>DA-6</td>
<td>Bugetphat</td>
<td>418,369</td>
<td>2.22</td>
</tr>
<tr>
<td>DA-7</td>
<td>Thangu</td>
<td>358,860</td>
<td>1.79</td>
</tr>
<tr>
<td>DA-8</td>
<td>Fulbari</td>
<td>52,780</td>
<td>0.26</td>
</tr>
<tr>
<td>DA-9</td>
<td>Fulbari</td>
<td>95,600</td>
<td>0.48</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>2,648,652</td>
<td>17.56</td>
</tr>
</tbody>
</table>

ha = hectare; m³ = cubic metre, m² = 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

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

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 m³/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**

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

GWH = gigawatt hour; m = metre; m$^3$/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**

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Documentation</th>
<th>Government Agency Review Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Project</td>
<td>Original National EIA</td>
<td>The original national EIA was approved by Ministry of Science, Technology, and Environment on February 17, 2013</td>
</tr>
<tr>
<td>Powerhouse Worker Camp</td>
<td>Environmental Management Plan (EMP)</td>
<td>The EMP for the revised powerhouse (Mailung) Worker Camp was approved by the Ministry of Population and Environment on December 31, 2017</td>
</tr>
<tr>
<td>Transmission Line</td>
<td>Initial Environmental Evaluation (IEE)</td>
<td>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.</td>
</tr>
<tr>
<td>Project Component</td>
<td>Documentation</td>
<td>Government Agency Review Status</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>-------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Thangu and Bajet Phat Worker Camps</td>
<td>Original National EIA</td>
<td>The addition of these worker camps returns the Project to the original design approved in 2013</td>
</tr>
<tr>
<td>Additional bridges and access roads to connect with the Army Road</td>
<td>Letter authorization</td>
<td>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.</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Regulation/ Standard</th>
<th>Description and Key Provisions</th>
<th>Applicability to the Project</th>
</tr>
</thead>
</table>
| 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. |
<table>
<thead>
<tr>
<th>Regulation/ Standard</th>
<th>Description and Key Provisions</th>
<th>Applicability to the Project</th>
</tr>
</thead>
</table>
| 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 |
### Legislative and Regulatory Framework

<table>
<thead>
<tr>
<th>Regulation/Standard</th>
<th>Description and Key Provisions</th>
<th>Applicability to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solid Waste Management and Resource Mobilization Act (1987 AD)</strong></td>
<td>- 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.</td>
<td>Applicable to the Project as solid wastes will be generated during construction and operation phases.</td>
</tr>
</tbody>
</table>
| **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. |
- 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 hydropower 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. |
### Legislative and Regulatory Framework

#### Chapter 3

**Upper-Trishuli Hydroelectric Power Project**

<table>
<thead>
<tr>
<th>Regulation/Standard</th>
<th>Description and Key Provisions</th>
<th>Applicability to the Project</th>
</tr>
</thead>
</table>
| **Explosives Act (1961 AD)** | • 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 | 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)** | • 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).  
• 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. |
| **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. | |
<table>
<thead>
<tr>
<th>Regulation/ Standard</th>
<th>Description and Key Provisions</th>
<th>Applicability to the Project</th>
</tr>
</thead>
</table>
| 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 aitani, 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. |
<table>
<thead>
<tr>
<th>Regulation/ Standard</th>
<th>Description and Key Provisions</th>
<th>Applicability to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Land Revenue or Malpot Aien (Land Administration and Revenue) Act, 2034 BS (1977 AD)</td>
<td>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).</td>
<td>This Act guided the process of transfer of land from private landowners to the Project.</td>
</tr>
</tbody>
</table>
| 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; ESMP = 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**

<table>
<thead>
<tr>
<th>Guideline</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>National EIA Guidelines, 1993</td>
<td>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.</td>
</tr>
<tr>
<td>EIA Guidelines for Water Resource Sector, 1994</td>
<td>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.</td>
</tr>
<tr>
<td>EIA Guidelines for Forestry Sector, 1995</td>
<td>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.</td>
</tr>
<tr>
<td>Community Forest Guidelines, 1997</td>
<td>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.</td>
</tr>
<tr>
<td>Forest Product Collection and Sales Distribution Guidelines, 2000</td>
<td>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.</td>
</tr>
<tr>
<td>Guidelines on Environmental Management Plan, Monitoring and Auditing Published by MoEST, 2006</td>
<td>Details methods and procedures for the preparation of EMPs, environmental auditing and environmental monitoring of hydropower development projects</td>
</tr>
</tbody>
</table>

EIA = Environmental Impact Assessment; EMP = Environmental Management Plan; GoN = Government of Nepal; IEE = Initial Environmental Examination; km = kilometre; KV = kilovolt; MoEST = 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**

<table>
<thead>
<tr>
<th>International Convention/ Treaties</th>
<th>Description</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramsar Convention, 1971</td>
<td>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.</td>
<td>Ratified in 1987</td>
</tr>
<tr>
<td>Convention on the International Trade in Endangered Wild Fauna and Flora (CITES), 1973</td>
<td>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.</td>
<td>Ratified in 1975</td>
</tr>
<tr>
<td>International Tropical Timber Agreement, 1983</td>
<td>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.</td>
<td>Accession to the agreement in 1990</td>
</tr>
<tr>
<td>Biodiversity Convention, 1992</td>
<td>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.</td>
<td>Ratified by Parliament in 1993, and entered into force in Nepal on 21 February 1994</td>
</tr>
</tbody>
</table>


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

<table>
<thead>
<tr>
<th>Policy/Guideline</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADB Public Communications Policy, 2011</td>
<td>Sets out disclosure requirements for consultation and information disclosure during project preparation and operation to affected populations and other key stakeholders. Requires the borrower to 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.</td>
</tr>
<tr>
<td>ADB Social Protection Strategy, 2001</td>
<td>Social protection is a key step in ADB's battle to have Asia and the Pacific region &quot;free of poverty.&quot; 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.</td>
</tr>
<tr>
<td>ADB Operations Manual (OM) C3 Sector and Thematic Policies on Incorporation of Social Dimensions, 2011</td>
<td>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.</td>
</tr>
</tbody>
</table>
| 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**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Remarks</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Categorization</td>
<td>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.</td>
<td>A</td>
</tr>
<tr>
<td>Indigenous Peoples Category</td>
<td>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.</td>
<td>A</td>
</tr>
<tr>
<td>Involuntary Resettlement Category</td>
<td>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.</td>
<td>B</td>
</tr>
</tbody>
</table>

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 PSs provide ways and means to identify impacts and affected stakeholders and lay down processes for management and mitigation of adverse impacts, see Table 3-6.

**Table 3-6: IFC Performance Standards**

<table>
<thead>
<tr>
<th>Performance Standard</th>
<th>Description</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| 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 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.

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• 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 \([\text{m}^3/\text{s}]\)). Project designs with less capacity (e.g. 175 MW option with a hydraulic capacity of 60 \([\text{m}^3/\text{s}]\)) 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 \([\text{m}^3/\text{s}]\), 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

<table>
<thead>
<tr>
<th>Impacted Village</th>
<th>Total Population</th>
<th>Old Administrative Structure</th>
<th>New Administrative Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haku Besi, Sanu Haku, Thullu Haku, and Gumchet</td>
<td>1528</td>
<td>Haku Ward number 3</td>
<td>Parvati Kunda Ward numbers 1 &amp; 2</td>
</tr>
<tr>
<td>Gogone and Tiru</td>
<td>427</td>
<td>Haku Ward numbers 8 &amp; 9</td>
<td>Uttargaya Ward number 1</td>
</tr>
<tr>
<td>Mailung</td>
<td>47</td>
<td>Dada Gaun Ward number 9</td>
<td>Uttargaya Ward number 1</td>
</tr>
<tr>
<td>Thanku</td>
<td></td>
<td>Haku Ward number 5</td>
<td>Parvati Kunda Ward numbers 1 &amp; 2</td>
</tr>
<tr>
<td>Phoolbari</td>
<td></td>
<td>Haku Ward number 3</td>
<td>Parvati Kunda Ward numbers 1 &amp; 2</td>
</tr>
<tr>
<td>No directly affected villages</td>
<td>2268</td>
<td>Ramche</td>
<td>Kalika Ward number 1</td>
</tr>
<tr>
<td>No directly affected villages</td>
<td>2744</td>
<td>Dhunche</td>
<td>Gosaikunda Ward number 6</td>
</tr>
</tbody>
</table>
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 Gaunpalika¹), 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.

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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 SyabruBesi 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 colluvium 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

<table>
<thead>
<tr>
<th>S.N</th>
<th>Project Component</th>
<th>Geological Formations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dam Site</td>
<td>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.</td>
</tr>
<tr>
<td>2</td>
<td>Tunnel</td>
<td>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.</td>
</tr>
<tr>
<td>3</td>
<td>Powerhouse</td>
<td>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.</td>
</tr>
</tbody>
</table>

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).
Figure 6.1-1: Geology of Nepal

Source: Robinson 2008
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).

**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

<table>
<thead>
<tr>
<th>S.N</th>
<th>Date</th>
<th>River basin</th>
<th>Lake</th>
<th>Cause</th>
<th>Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1N</td>
<td>450 years ago</td>
<td>Seti Khola</td>
<td>Machhapuchchhre</td>
<td>Moraine</td>
<td>Pokhara valley covered by 50–60-meter-deep debris</td>
</tr>
<tr>
<td>2N</td>
<td>1977</td>
<td>Dudh Koshi</td>
<td>Nare</td>
<td>Moraine collapse</td>
<td>Human lives, bridges, others</td>
</tr>
<tr>
<td>3N</td>
<td>1980</td>
<td>Tamor</td>
<td>Nagma Pokhari</td>
<td>Moraine collapse</td>
<td>Villages destroyed 71 kilometres from source</td>
</tr>
<tr>
<td>4N</td>
<td>1985</td>
<td>Dudh Koshi</td>
<td>Dig Tsho</td>
<td>Ice avalanche</td>
<td>Human lives, hydropower station, 14 bridges, etc.</td>
</tr>
<tr>
<td>5N</td>
<td>1991</td>
<td>Tama Koshi</td>
<td>Chubung</td>
<td>Moraine collapse</td>
<td>Houses, farmland, etc.</td>
</tr>
<tr>
<td>6N</td>
<td>1998</td>
<td>Dudh Koshi</td>
<td>Tam Pokhari</td>
<td>Ice avalanche</td>
<td>Human lives and more than Nepal Rupees (NRs) 156 million</td>
</tr>
<tr>
<td>7N</td>
<td>2003</td>
<td>Madi River</td>
<td>Kabache Lake</td>
<td>Moraine collapse</td>
<td>Not known</td>
</tr>
<tr>
<td>8N</td>
<td>2004</td>
<td>Madi River</td>
<td>Kabache Lake</td>
<td>Moraine collapse</td>
<td>Not known</td>
</tr>
<tr>
<td>9N</td>
<td>Unknown</td>
<td>Arun</td>
<td>Barun Khola</td>
<td>Moraine collapse</td>
<td>Not known</td>
</tr>
<tr>
<td>10N</td>
<td>Unknown</td>
<td>Arun</td>
<td>Barun Khola</td>
<td>Moraine collapse</td>
<td>Not known</td>
</tr>
<tr>
<td>11N</td>
<td>Unknown</td>
<td>Dudh Koshi</td>
<td>Chokarma Cho</td>
<td>Moraine collapse</td>
<td>Not known</td>
</tr>
<tr>
<td>12N</td>
<td>Unknown</td>
<td>Kali Gandaki</td>
<td>Unnamed (Mustang)</td>
<td>Moraine collapse</td>
<td>Not known</td>
</tr>
<tr>
<td>13N</td>
<td>Unknown</td>
<td>Kali Gandaki</td>
<td>Unnamed (Mustang)</td>
<td>Moraine collapse</td>
<td>Not known</td>
</tr>
<tr>
<td>14N</td>
<td>Unknown</td>
<td>Mugu Karnali</td>
<td>Unnamed (Mugu Karnali)</td>
<td>Moraine collapse</td>
<td>Not known</td>
</tr>
</tbody>
</table>

**Originated in Tibet Autonomous Region/China and caused damage in Nepal**

<table>
<thead>
<tr>
<th>S.N</th>
<th>Date</th>
<th>River basin</th>
<th>Lake</th>
<th>Cause</th>
<th>Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1C</td>
<td>1935</td>
<td>Sun Koshi</td>
<td>Tara-Cho</td>
<td>Piping</td>
<td>66,700 square meters of wheat fields, livestock, etc.</td>
</tr>
<tr>
<td>2C</td>
<td>1964</td>
<td>Trishuli</td>
<td>Longda</td>
<td>Not known</td>
<td>Not known</td>
</tr>
<tr>
<td>3C</td>
<td>1964</td>
<td>Arun</td>
<td>Gelhaipuco</td>
<td>Glacier surge</td>
<td>Highway and 12 trucks</td>
</tr>
<tr>
<td>4C</td>
<td>1964</td>
<td>Sun Koshi</td>
<td>Zhangzangbo</td>
<td>Piping</td>
<td>No remarkable damage</td>
</tr>
<tr>
<td>5C</td>
<td>1968</td>
<td>Arun</td>
<td>Ayaco</td>
<td>Not known</td>
<td>Road, bridges, etc.</td>
</tr>
<tr>
<td>6C</td>
<td>1969</td>
<td>Arun</td>
<td>Ayaco</td>
<td>Not known</td>
<td>Not known</td>
</tr>
<tr>
<td>7C</td>
<td>1970</td>
<td>Arun</td>
<td>Ayaco</td>
<td>Not known</td>
<td>Not known</td>
</tr>
<tr>
<td>8C</td>
<td>1981</td>
<td>Sun Koshi</td>
<td>Zhangzangbo</td>
<td>Ice Avalanche</td>
<td>Hydropower station</td>
</tr>
<tr>
<td>9C</td>
<td>1982</td>
<td>Arun</td>
<td>Jinco</td>
<td>Glacier surge</td>
<td>Livestock, farmland</td>
</tr>
<tr>
<td>10C</td>
<td>1995</td>
<td>Trishuli</td>
<td>Zanaco</td>
<td>Not known</td>
<td>Not known</td>
</tr>
</tbody>
</table>

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).

![Landslide Map](https://example.com/landslide_map.png)

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

<table>
<thead>
<tr>
<th>Landslide</th>
<th>Locations</th>
<th>Damage or effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhunche landslide</td>
<td>Dhunche village, near the bridge across the Trishuli River</td>
<td>Road blockages and damage affected access to farmland and transportation.</td>
</tr>
<tr>
<td>Ramche landslide</td>
<td>36-kilometre section of the Trishuli-Dhunche motor road in Rasuwa district. It was first activated in 1983 and reactivated 14 August 2003.</td>
<td>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</td>
</tr>
<tr>
<td>Thade landslide</td>
<td>Location within the Project area road alignment, tunnel, Adit 4 construction facility area, and spoil disposal area</td>
<td>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.</td>
</tr>
<tr>
<td>Haku landslide</td>
<td>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.</td>
<td>Crop loss, road blockages, and damage to property</td>
</tr>
<tr>
<td>Sarghang landslide</td>
<td>Near the proposed Adit 1. It lies between Hakubesi-Fulbari and Hakubesi.</td>
<td>-</td>
</tr>
</tbody>
</table>

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 Bhothe 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).

![Watershed Map of Trishuli River within Nepal](image)

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