



CHAPTER 3:

PROJECT AND STUDY CONTEXT

Trishuli River: Major River Basin Characteristics

There are nine major river systems in Nepal: Mahakali, Karnali, Babai, Rapti, Gandaki, Bagmati, Kamala, Koshi, and the Kankai. The Gandaki River Basin supports 19 percent of the country's population (CBS 2014) and contributes 26 percent of the country's total water availability (WECS 2013). The transboundary Gandaki River system has seven major tributaries: Kali Gandaki, Seti Gandaki, Madi, Marsyangdi, Daraudi, Budhi Gandaki, and Trishuli.

The Trishuli River Basin (TRB), one of the few rivers with a glacier in its catchment areas, originates in the Trans-Himalayan Zone, in the plateau town of Gyirong within Tibet Autonomous Region of the People's Republic of China (where it is known as Bhote Koshi). The Trishuli River cascades from an altitude of 2,600 meters into Nepal at the Rasuwa Pass (Rasuwa District). It continues its descent for 130 kilometers through high-altitude mountains of Nuwakot, Dhading, and Gorkha District before joining the Kali Gandaki River at Devghat (Chitwan District). Only 523 megawatts (MW), 10 percent of the Gandaki Basin's feasible hydropower potential of 5,270 MW (Pandit 2016), has been harnessed.

Based on variation in gradient, the temperature the Trishuli River can be delineated into three zones:

- A steep (3 percent slope) cold water zone (upstream)
- A less steep (1 percent slope) cold-to-cool zone (midstream)
- A milder (<1 percent) cool-to-warm zone (downstream)

The spatial delineation of these zones are provided in "Elevation Profile of the Trishuli River Basin" in Chapter 5.

There are certain common economic, social, and cultural features that link upstream, midstream, and downstream river reaches in the TRB. Likewise, there exist certain similarities and differences in resource utilization patterns (for example, in agriculture, fishing,

and other riverine-based livelihoods) and economic conditions (linked to market access, gender, inequality, and other income-related issues). These are thereafter discussed as a part of the socioeconomic baseline to introduce identified social valued environmental components (VECs).

Map 3.1 and Figure 3.1 present the municipalities in the TRB and attributes that pertain to physiography, demography, and associated vulnerabilities.

Hydropower Projects

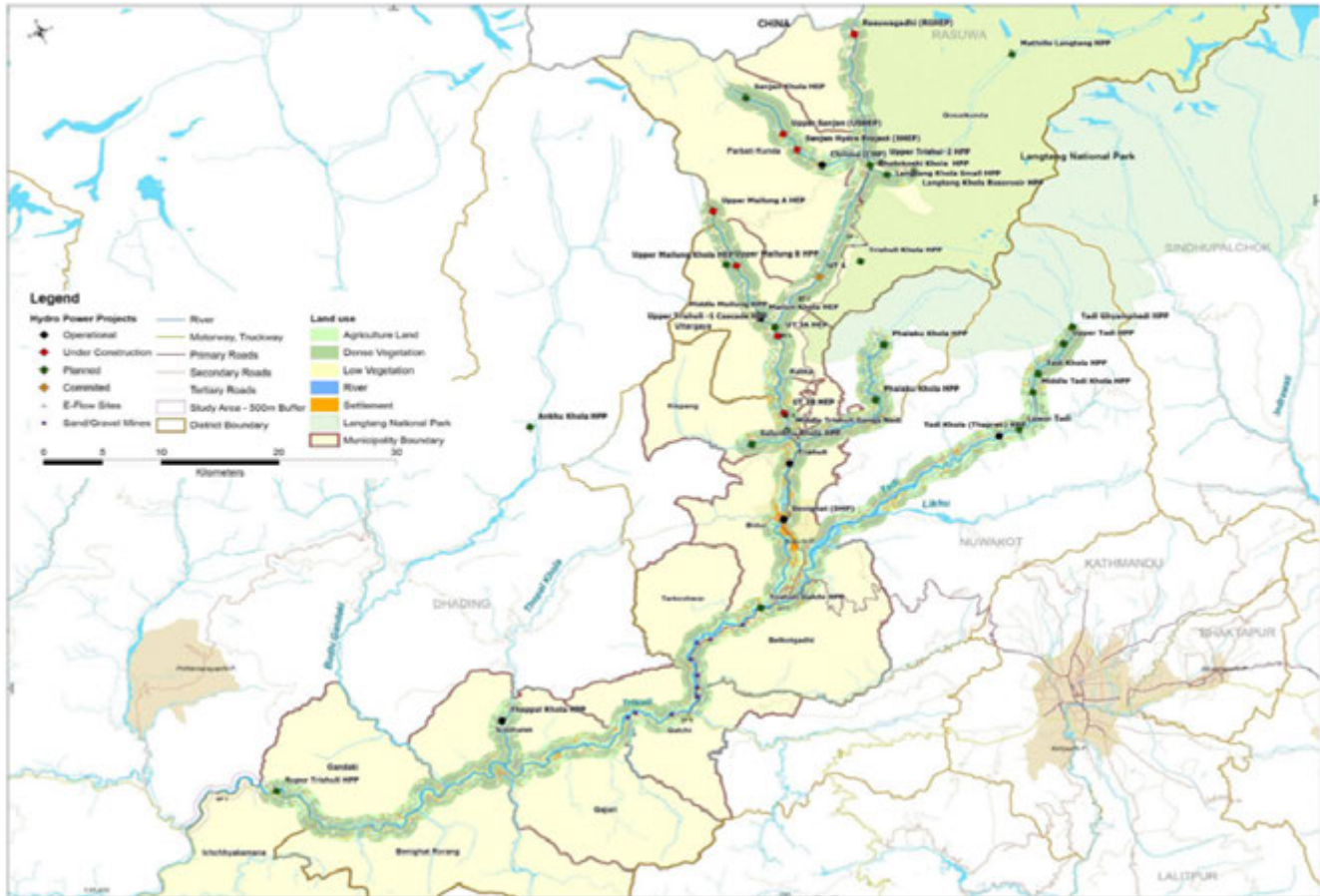
Hydropower development has been the main activity in recent years in the Gandaki River System (including the Trishuli watershed) in view of the basin's potential and the existing power deficit as illustrated in Figure 3.1 under "Vulnerability Downstream." Of the five districts within the TRB, Nuwakot has the highest number of households with access to electricity, at 83 percent (CBS 2012).

In addition to the six operational projects and the seven under-construction projects (that aggregate to 358 MW), another 23 projects are in different stages of planning (from financial closure to being allotted a survey license) as per Department of Electricity Development data (DoED 2018, June). The following Table 3.1 highlights the 36 projects considered for the TRB Cumulative Impact Assessment and Management (CIA).

A majority of the operational and under-construction hydropower projects are understood to be run-of-river projects as indicated during consultations with the DoED (in December 2017) and select hydropower developers at the workshops.

In addition to the major components of the hydropower projects, the CIA has also considered the ancillary and associated facilities, including infrastructure, quarries, access roads, and so forth.

Map 3.1 Trishuli Basin with Municipal Boundaries



Source: Adapted from information obtained in the CHAL Strategy and Action Plan 2016–2025 (Ministry of Forests and Soil Conservation 2015); and Dandekhya et al. 2017.

Transmission Lines

Power evacuation from hydropower projects in the TRB will involve construction of low-tension power transmission lines to a pooling substation, from which a high-tension line will connect the project to a larger substation directly linked to the national grid. Table 3.2 presents the transmission line infrastructure considered for the CIA.

The three key grid-connected substations proposed for location in the TRB include the Chilime hub in Rasuwa District, a Nepal Electricity Authority (NEA) project); Ratmate in Nuwakot District (MCA Nepal Project); and Trishuli 3B hub substation (NEA project). A majority of these transmission lines (with the exception of MCA Nepal) will require an Initial Environment Examination (IEE) for approvals under

the Environment Protection Act of 1997. Also note that at their Investment Summit in March 2019, Investment Board Nepal (IBN) also announced a large solar project that will connect into Chilime power evacuation hub to be developed in Rasuwa District.

Roads and Local Infrastructure

Roads in TRB are concentrated in the middle part of the watershed, where the population density is higher and the topography is more favorable. The development of hydropower projects in the upper part is driving the extension of the road networks into this region. However, construction of roads in this part of the watershed requires significant investments in both construction and maintenance because of the remote location and the harsh topography. Access roads include roads used to bring construction materials and

Figure 3.1 Characteristics of the Trishuli River Basin

Features	Description
Catchment area	6624.7 square kilometers up to the confluence with Budhi Gandaki River
Physiography	<ul style="list-style-type: none"> Varied spatial distribution across mountains of Trans Himalaya to the Middle Hills and the Siwalik range Steep and fragile geomorphology makes the area vulnerable to natural disasters
Hydrology	<ul style="list-style-type: none"> Spatial distribution varies across physiographic zones creating microclimates that affect annual water availability Springs are a major source of water
Key biodiversity areas	<ul style="list-style-type: none"> Langtang National Park and buffer area of Shivpuri National Park Migratory route for aquatic fauna and flyways for migratory birds Link protected areas in the north with Shivpuri National Park toward the east and Chitwan National Park toward the South
Livelihood patterns	Main economic activities include forestry, agriculture and participation in tourism-related activities from rafting, and religious sites

Demographic Trends

- Low population density upstream with a gradual increase downstream (the five districts have an average population density of 144 square kilometers)
- Brahmin Chhetri, Gurung, Magar, Tamang, Newar, Thakali, Tharu, Bhote and Dalit are the major ethnic groups in the region (the majority of the people follow Hinduism and Buddhism)
- Other than Chitwan, most districts have had a negative population growth indicating out-migration

Population density of 144 per square kilometer **42% of the total population is employed** **Skewed sex ratio of 1,117 females per 1,000 males**

These demographic trends, and especially the negative population growth rates and changing sex ratios, have implications on natural resource management and the roles of gender in agriculture and resource governance (Ministry of Forests and Soil Conservation 2015).

Natural disasters are critical drivers of vulnerability for communities, particularly floods, landslides, forest fires, and the Gorkha earthquake of April 2015.

Natural disasters are critical drivers of vulnerability for communities in the basin. Although the most common disasters are floods and landslides, the greatest economic loss in the basin is from forest fires which are triggered by wind in the dry season.

Vulnerability upstream

The mountain areas are fragile, and heavy rainfall during the monsoon triggers landslides that obstruct and wash away road, cultivated land, and houses. UNDP (2015) reported that farmers in Langtang and Rasuwa had reduced intensive agriculture and had opted for petty labor and portering due to increase in the frequencies of landslides (that cause road blocks and interruption while transporting produce to local markets) and variability in rainfall. This has relegated the local community to prefer subsistence farming and production of staple crops.

Vulnerability midstream

The poor state of roads in the villages in Nuwakot and Gorkha district affects the transportation of agriculture outputs to nearby markets, and thus farmers' income.

The lack of provision of basic services by the local government also contributes to local vulnerability; in some places government-constructed drinking water systems have cease to function. As in some other parts of the basin, Nuwakot and Gorkha are characterized by male outmigration. The women left behind are often vulnerable and unable to negotiate for water rights and access to facilities.

Vulnerability downstream

Communities are vulnerable to flash floods and landslides that affect their fields and forests, and thus availability of fuelwood. Electricity is very limited and people depend on the community forests for fuel, but access to the forests is limited (in view of access and activity control imposed arounds the buffer of Chitwan National Park) and people are exposed to risks of wildlife attack. Despite farmers' training programs on alternative agricultural and farming practices, conflicts between humans and wildlife are increasing the community's vulnerability, particularly in view of loss of income.

Source: Adapted from information obtained in the CHAL Strategy and Action Plan 2016–2025 (Ministry of Forests and Soil Conservation 2015); and Dandekhya et al. 2017.

Table 3.1 Hydropower Projects (June 2018)



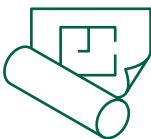
Status	Main stem projects	Capacity (MW)	Tributary	Capacity (MW)
Operational	2	38	4	43
	Trishuli	24	Chilime	22
	Devighat	14	Mailung Khola	5
			Tadi Khola	14
			Thoppal Khola	2
Under construction	3	208	4	78
	Rasuwagadhi	111	Upper Sanjen	14.8
	Upper Trishuli - 3A (UT-3A)	60	Sanjen Hydro	42.5
	Upper Trishuliv- 3B (UT-3B)	37	Upper Mailung A	6.42
			Upper Mailung Khola	14.3
Planned	6	582.6	17	581
	Upper Trishuli-1 (UT-1)	216	Sanjen Khola	78
	Trishuli Galchi	75	Langtang Khola Small	10
	Super Trishuli	100	Salankhu Khola	2.5
	Upper Trishuli 2	102	Phalaku Khola	14.7
	Upper Trishuli 1 Cascade	24.6	Phalaku Khola	5
	Middle Trishuli Ganga Nadi	65	Upper Tadi	11
			Middle Tadi Khola	5
			Lower Tadi	4.993
			Ankhu Khola	49.5
			Bhotekoshi Khola	33.5
			Mathillo Langtang	24.35
			Langtang Khola	310
			Trishuli Khola	4.409
			Upper Mailung B	7.5
		Middle Mailung	10	
		Tadi Ghyamphedi	4.7	
		Tadi Khola	5.5	

Table 3.2 Upcoming Transmission Line Projects in TRB

Project	Voltage (KV)	Length (km)	Route
Millennium Challenge Account (MCA) Nepal—Transmission Line System	400	309	The route consists of five sections and substations up to Hetauda (Makawanpur District) and the Indian Border (Nawalparasi District). Three sections of the transmission line will converge at a new greenfield substation at Ratmate in Nuwakot District in the midstream reach of the TRB.
Upper Trishuli-3A HPP	132	44.7	Paheribesi to Matatirtha substation
Rasuwadadhi HPP	132	10	Powerhouse to Chilime hub
Super Trishuli HP	220	30	Switchyard to Bharatpur substation
Upper Trishuli-1 HP	220		Switchyard of UT-1 at Rasuwa to nearest angle point to Chilime Trishuli
Sanjen Khola HPP	132	10	Sanjen Khola HPP powerhouse to proposed Chilime hub
Upper Trishuli-3B HPP	33	12	Trishuli 3B hub substation to Bhalche substation
Upper Mailung	132	11.5	Upper Mailung switchyard at Champani to Trishuli 3B hub substation
Trishuli-Matatirtha Line	220	1.3	Linked to Trishuli 3A, underground section
Chilime HPP	66	38	Chilime to Devighat
Mailung Khola	66	3	Mailung Dovan to Ramche
Devighat HPP	33	33	Switchyard of HPP to New Chabel
Upper Sanjen HPP	132	5	Switchyard of Upper Sanjen to Chilime hub - 5 km
Sanjen HPP	132	2	Switchyard of Sanjan to Chilime hub - 2 km

Note: Green Indicates projects in planning; gray indicates constructed; light blue indicates under construction. HEP = hydroelectric project.

mechanical and electrical equipment to the site. The length and width of the access road may have important environmental impacts by creating 30-meter wide corridors through landscapes (road, plus associated drainage, foundations, and so forth).

Common adverse environmental impacts associated

with road expansions in mountainous areas include landslides (Box 3.1), slope instability, soil erosion, and roadside runoff. The existing Betrawoti-Mailung-Syabrubesi Road is currently being upgraded, potentially to serve as a segment of China’s One Belt, One Road project.

Box 3.1 Landslides and Hydropower Projects

Landslides are the most important factor in land degradation in Nepal. Landslides occur almost every year, particularly in the sloping areas of high mountains and low hills during the monsoon season. The upper part of the basin is especially affected by this problem. As much as 5 percent of all landslides in Nepal are associated with newly constructed roads and trails (ADB and ICIMOD 2006). Landslides and dumping of spoil from road construction result in solids pollution of the Trishuli River and with a likely significant increase in total dissolved solid levels, degrading aquatic habitats. While carrying out construction activities, it is anticipated that emergency situations may occur at construction sites, which may threaten life and property. A probable emergency may be loose fall or collapsing of tunnels. Tunnels are important structures in hydropower projects, but they pose the possibility of collapse during construction, which may cause significant time and cost overruns (Tun and Singal 2016).

Fatalities associated with tunnel collapse occurred during the construction of the Upper Madi hydroelectric project in Kaski (located in northeast Pokhara) in April 2014 (Petley 2014). A landslide-triggered collapse of the entrance of the tunnel, resulting in the loss of life of 3 of the 15 workers trapped underground. A similar incident at the Arun III hydropower project in June 2018 resulted in the blockage of a tunnel portal because of muck and huge boulders, endangering the lives of 4 workers (Uniindia News Service 2018).

The Trishuli 3A project was severely damaged due to landslides triggered by the 2015 earthquake. The landslides damaged areas close to the dam site, posing a threat to the safety of the dam and the workers. The project subsequently installed concrete on the hill on the right side of the dam along with nets and fences. Due to the earthquake, the dam's two gates were also damaged; they were later repaired. This has caused delays in construction of the tunnel and other structures of the project. Management and mitigation measures can avoid or considerably reduce the extent of tunnel collapse through proper underground excavation support systems during planning and construction of hydropower projects.

Construction Phase Resource Requirements

Ongoing construction activities (see an illustration at Rasuwagadhi in Photo 3.1) and imminent mobilization for projects under planning will require key resources:

- Quarries and borrow areas to meet construction phase requirements, especially for the reservoir wall
- Workforce (mostly skilled workers and some unskilled workers) for headworks, tunnel, and powerhouse construction
- A construction workers' camp, spoils disposal area, laydown areas, access roads, water treatment plant, concrete batching plant, and aggregate crushing plant
- Site preparation and tunneling work generate spoils that need to be properly disposed of in a designated spoils disposal area
- Accommodation arrangements including ancillary elements such as potable water, sewage infrastructure,

utilities to run the worker camps, and so forth, which tend to impinge on and use local infrastructure

These aspects of construction are usually considered for the individual EIA of hydropower projects. However, in view of the number of projects coming up, especially in Rasuwa and Nuwakot Districts, the construction phase timelines are likely to be seven to 10 years, and the demand for resources for the associated facilities will be unprecedented for the basin.

CIA Study Context

Spatial Boundary

The Trishuli River extends into the CHAL region after its confluence with the Budhi Gandaki River at Benighat. The catchment of the Budhi Gandaki River has not been included within this CIA, as it represents a different basin and watershed. However, hydropower development in the Budhi Gandaki River has been considered a stressor and anticipated regional development. For the CIA, the spatial boundary of the

Photo 3.1 Under-Construction Rasuwagadhi HPP (February 2018)



a. Worker camps



b. Batching plants



c. Construction activities for head works

study area includes the entire catchment of Trishuli River in the upper reaches (up to the Tibet Autonomous Region border at Rasuwa Pass) and the lower reach extends up to the point immediately downstream of Super Trishuli HPP (planned 100 MW project). No proposed hydropower projects have been identified in the China portion of the river basin (ERM 2018). Key tributaries, towns, and settlements that are within a two-kilometer-wide corridor (one kilometer along each side of the river) are considered in the study area.

The study area is divided into discrete management units (see “Fragmentation of DMUs Due to Hydropower Development” in Chapter 5 for details) for aquatic habitat and for indicator fish species. For ascertaining the baseline conditions with respect to social receptors and valued ecosystem components, the study area is divided into the upstream, midstream, and downstream

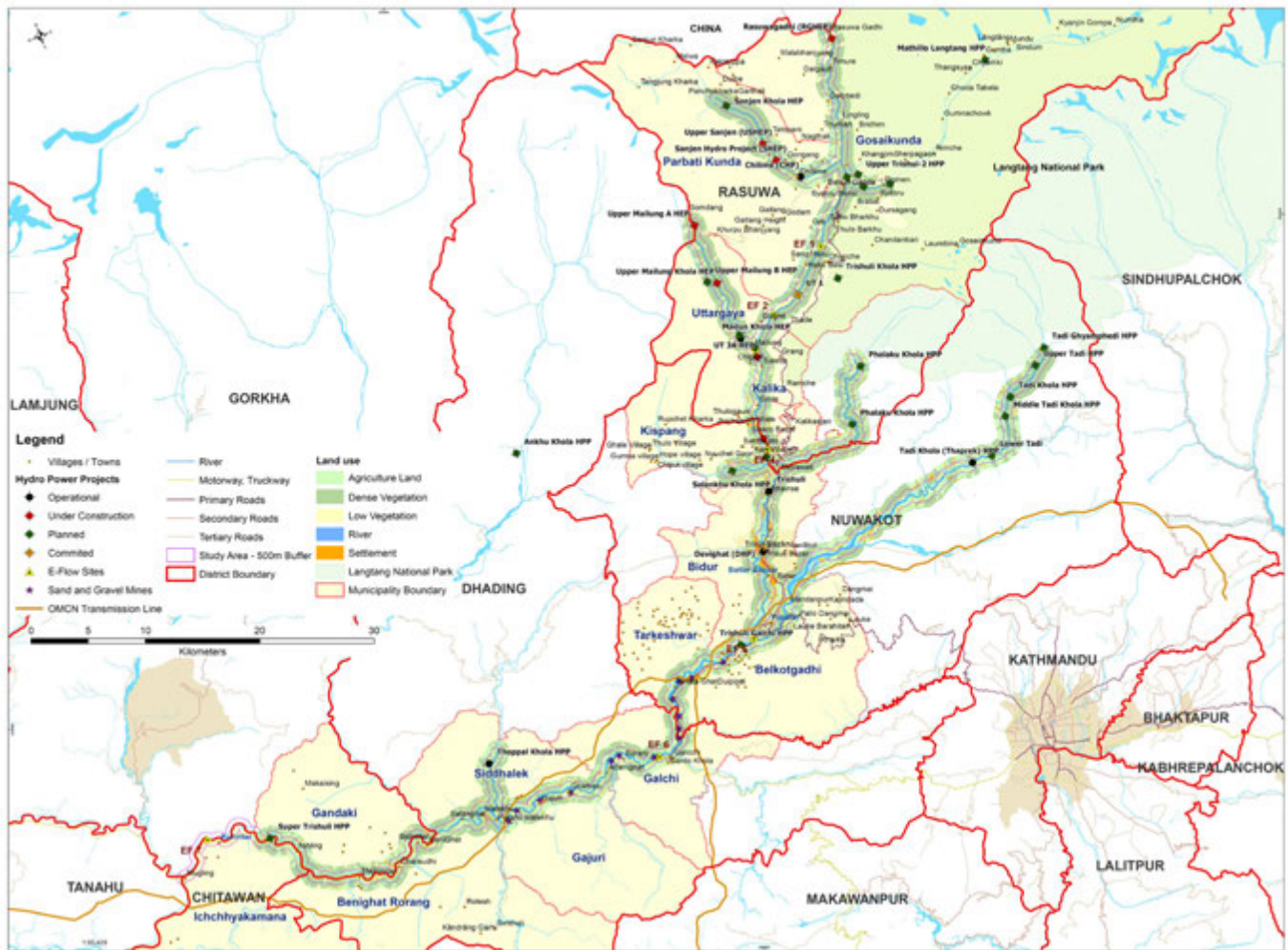
reach based on certain characteristics and features as described in Chapter 7.

Map 3.2 illustrates the study area considered for the CIA (including the 36 hydropower projects identified in Table 3.1).

Temporal Boundary

Temporal boundaries under consideration for the CIA will include projects likely to come up within the next 10 years. The temporal scope will extend to 50 years (which is likely to coincide with the life cycle of large hydropower projects). This temporal boundary is relevant for all HPPs in the basin, as none are likely to be decommissioned due to termination of operations linked to exigencies such as oversiltation of headwaters. Here it is assumed that all projects,

Map 3.2 Overview of the CIA Study Area within the Trishuli River Basin



as typical for large projects, have been designed to withstand earthquakes of at least 9.0 on the Richter scale. However, this assumption may need further verification based on insights received at the developer’s workshop.

Project Development Scenarios

The following project development scenarios are considered for the quantitative ecological flow assessment of the TRB:

- *Scenario 1, Existing Projects (Baseline):* This scenario represents the present conditions in which six of the existing projects as listed in Table 3.1 are operational.
- *Scenarios 2a and 2b, Existing + Under-Construction + Committed Projects (within 10 years):* This scenario

represents the expected conditions in which six of the existing projects, seven of under-construction projects, and the UT-1 project (which is the only project that has presently been committed), as listed in Table 3.1 are operational.

- *Scenario 3, Full Development (within 50 years):* This scenario represents conditions in which all of the above and the planned projects as listed in Table 3.1 are developed.

Initial VEC Identification

During the scoping stage of the CIA, the following VECs were identified through the review of secondary literature and inputs from regulators such as DoED, NEA, and the Ministry of Forests and Environment (MoFE):

- Aquatic habitat
 - Fish species, notably the Golden Mahseer (*Tor putitora*) and Common Snow Trout (*Schizothorax richardsonii*), along with other likely species of conservation importance
 - Water flow, water quality, and sediment transport
 - River flow
 - Sediment transportation
- Terrestrial habitat
 - Habitat fragmentation
 - Migratory birds and any other vulnerable species
- Langtang National Park
- Slope stability
- Water resources (including springs and drinking water quality of surface water)
- Religious and cultural sites: including cremation sites and pilgrimage sites that depend on water flow (for example, Uttargaya and Devighat) as well as potential community forests with religious significance
- Livelihoods: Implications on (i) river-based livelihoods and ecosystem services (based on imposed flow transformation) and (ii) land-based livelihoods due to acquisition of land for multiple hydropower projects and associated facilities
- Indigenous peoples, in view of the ethnical and cultural diversity that exists in the TRB
- Community Forests, in view of potential access interruptions due to their location with the submergence areas of reservoir projects
- Community health linked to water quality, general emissions considering multiple stressors, and microclimates around reservoir areas.

Chapter 4 outlines the process of screening of VECs to identify the ones that were considered for assessment of cumulative impacts.

Stressors and Regional Developments

This section profiles key stressors and anticipated or existing regional developments that are considered significant in view of the baseline conditions of identified VECs.

Climate Change

Recent literature on the effect of climate change on water resources in Nepal cites two impacts as critical: glacial lake outburst floods (GLOF) and variability of river runoff (Bajracharya, Acharya, and Ale 2011). Hydropower projects in the Gandaki Basin face challenges because of the changes in rainfall and temperature and fluctuation in runoff and discharge, which affects power generation. The Gandaki River contains 1,025 glaciers, and this freshwater feeds into its tributary, the Trishuli River (Bajracharya, Mool, and Joshi 2002). According to recent studies, temperatures have already been rising and are projected to increase further over the coming decades. The fluctuations in temperature (most pronounced during winter and least during peak monsoon) directly affect water resources and hydropower-related activities.

GLOFs are described as “a sudden release of a significant amount of water retained in a glacial lake,” which in turn displaces huge quantities of water, leading to dam overtopping and consequently dam failure (Emmer 2017). The Trishuli sub-basin contains 50 glacial lakes—which is 2.59 percent of the total Gandaki Basin (Mool 2011). Hazards associated with shrinking glaciers (potentially dangerous glacial lakes) can adversely affect large infrastructure investment, downstream vulnerability, and property damage (see Box 3.2).

Variability of river runoff is exacerbated by unnatural hydrological shifts because of run-of-river hydropower plants. Inconsistent energy production; with respect to the generation capacity and approved operation plans has been reported from the Trishuli and Chilime hydropower projects due to variations in the water supply (Bajracharya and Shrestha 2011). The managers and operators at the Trishuli run-of-river hydropower plant (15 MW) in Bidur noted that reduced river

Box 3.2 Key Insights: State of Glaciers in Nepal

- The mean flow during the dry season is decreasing at a very slow rate, whereas there is no clear trend for mean annual flows. An increasing trend for maximum flows, with high variability, has also been observed.
- This reflects that the glacier contribution at the dry season is becoming less over time while the rain contribution during the wet season is not uniform.
- Greater unreliability of dry season flows poses potentially serious risks to water supply in the lean season as hydroelectric plants are highly dependent on predictable runoff.
- A reduction of lean season water to the head-works could result in a reduction in the environmental release into diversion reaches. This could further exacerbate degradation of habitats and impediments to migration caused by present low flows.

Source: Bajracharya and Shrestha 2011.

inflow during the summer months of April and May was limiting electricity generation to below optimal capacity.

Both of these climate-change-induced phenomena pose significant impacts, not only to hydropower, but also to rural livelihoods and agriculture within the TRB. Most of the region's agrarian population that depends on subsistence farming will have to alter their farming system as an associated impact of glacial retreat. Incidence of droughts have also increased because of warmer winters and reduced rainfall, which diminishes the area and quality of grazing land—consequently affecting milk production and livestock-rearing practices of rural communities (Agrawala et al. 2003).

Unregulated Fishing

Based on observations and consultations with local communities across the TRB, while unregulated fishing is carried out, the intensity, the patterns and dependence vary. Consultations with the Fishery Research Station in Nuwakot indicate that while overfishing has occurred in the past, presently fishing is carried out mostly for subsistence and to complement existing income and nutrition sources. Certain communities that were traditionally known to predominantly fish (see “Livelihoods” in Chapter 7) have moved toward regular income from sand mining and other livelihoods. In the upstream section of the TRB, there is a possibility for certain localized patches of river and tributary stretches (for example, Mailung Khola, as indicated

during the Fourth Hydropower Developer Forum) where overfishing can be a stressor.

Aftermath of the Earthquake

The Nepal earthquake (April 2015) and its aftershocks affected nearly all districts within the Gandaki River Basin and the Chitwan Annapurna Landscape, with particularly severe effects in four of the five districts within the study area of the CIA: Rasuwa, Nuwakot, Gorkha, and Dhading.

In addition to heavy human mortality and extensive property damage, the following impacts were observed, causing damage to infrastructure (including hydropower, dams, irrigation systems, and water supplies) (Ministry of Forests and Soil Conservation 2015):

- Loss of approximately 2.2 percent of forests due to landslides, with severe landslide impacts in Gorkha and Rasuwa Districts
- Large mounds of sediment entering the rivers and streams of the landscape in the 2015 monsoon from landslides and other earthquake damage, which affected hydropower equipment and irrigation canals (Projects such as Trishuli 3A had to be closed.)
- Increased sedimentation downstream toward Chitwan District due to accelerated rate of sediment deposition; increased the risk of future flooding and river cutting

- Damaged tourism infrastructure in Langtang National Park and near the cultural sites of Uttargaya and Gosaikunda (lodges, teahouses, and trails)

Map 3.3 presents the areas most affected.

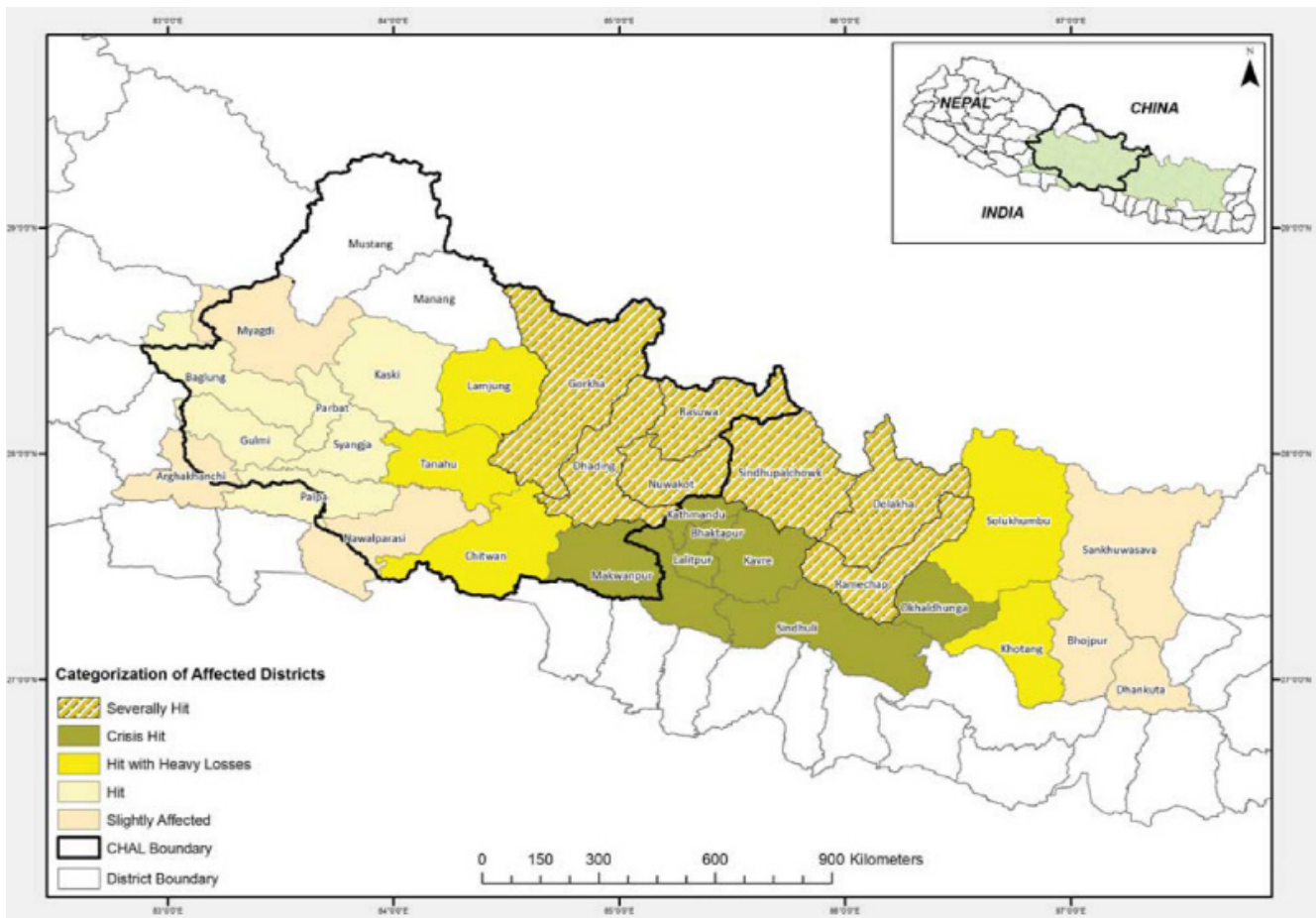
Reconstruction and rehabilitation activities are ongoing and likely to continue until 2020. These activities have the potential to generate localized impacts from reconstruction, such as inappropriate extraction of timber, stone, sand, and gravel for buildings and infrastructure; resettlement in forests and important biodiversity areas; inappropriate disposal of earthquake waste; damage from hastily reconstructed infrastructure; and damage from reconstruction of water supplies and sanitation facilities.

The earthquake has also resulted in movements of communities within the severely affected districts into

internally displaced persons (IDPs) camps, most of which have been established near urban municipalities such as Bidur and do not have adequate waste disposal and sanitation facilities (Box 3.3). Livelihoods of local communities (especially indigenous communities such as the Tamang) living within these camps have also been affected (potentially permanently) due to changes in work and life patterns from subsistence farming to petty labor.

The CHAL strategy (Ministry of Forests and Soil Conservation 2015) has incorporated earthquake recovery as a specific activity to minimize adverse impacts in the landscape and to enable disaster risk reduction and resilient natural resources. It is understood that a Rapid Environment Assessment (2015) was undertaken of the postearthquake reconstruction program and is reported to be under implementation to minimize adverse impacts.

Map 3.3 Earthquake-Affected Districts



Source: CHAL Strategy and Action Plan 2016–2025 (Ministry of Forests and Soil Conservation 2015).

Box 3.3 Case Study: IDP Camp at Bidur, Nuwakot District

Around 83 households are living in Pipaltar, Bidur-5 in a camp for internally displaced persons. They were initially settled in Kalikasthan in Rasuwa following the 2015 earthquake and moved to the current location a year ago after landslides risk in Kalikasthan. The Bidur camp is privately owned by two Tamang landowners and the residents have paid NPR 150,000 or US\$1,500 (one-time payment) for each unit. Each unit has a common area, a kitchen, a bedroom, and a toilet. The camp has access to electricity. Children go to nearby schools in Bidur.

Photo B3.3.1 Bidur Camp



While the female members of the family are engaged in agriculture and daily wage labor, the male members of the family are still working in Rasuwa, as there are more business opportunities there, especially with the increased prospects in construction and trade following the road extension to the Chinese border. Residents living in the camp are predominantly Tamang and are not fluent in Nepali. Integration into the communities nearby, which have mostly Brahmins and Chettri residents, is, therefore, a challenge. The households are, however, reluctant to move back to their village in Rasuwa, not only because they feel unsafe and more at risk of natural disasters, but also because they see more opportunities closer to a bigger city like Bidur.

Source: Field consultations (April–May 2018)

Discussions with the DoED (December 2017) indicate that recently planned projects are being designed to withstand earthquakes of intensity of over 8.5 on the Richter scale.

Hydropower Development in Budhi Gandaki Basin

The Budhi Gandaki River, located in the Central

Western Development Region of Nepal, meets the Trishuli River at Benighat (in Dhading District). The potential for a 600 MW storage-type hydroelectric plant with average annual generation capacity of 2,495 gigawatt hours was identified during the Gandaki Basin study in the late 1970s, with the proposed tailrace located approximately two kilometers upstream of the confluence with the Trishuli River in Gorkha District.

The new prefeasibility study of the project conducted by Tractebel Engineering Company indicated that the capacity of the hydropower plant could be increased to 1,200 MW. Located at the same site, the total catchment area of Dhading and Nuwakot would be 935 square kilometers (MoEWRI 2019). According to a report by Rivers without Boundaries (2017), an international network of organizations and experts who advocate and promote best practices in river management, the major impediments for this project are its long development period, size, resettlement needs, seismicity, geological hazards, and adverse impact on aquatic and terrestrial biodiversity.

Under the new circumstances of the Belt and Road Initiative, the project gained some traction through a new bilateral partnership between Nepal and China. However, in 2017, Nepal cancelled the Budhigandaki project, which was contracted to a Chinese developer company. In 2018, the government announced plans to revive the Budhigandaki Hydropower Project again through funding by the China Gezhouba Group Corporation (UNRCCA 2018).

OBOR and Prithvi Highway Upgrade

The One Belt, One Road (OBOR) initiative is a massive road infrastructure project funded by the Chinese government to link China with all of South and Central Asia. Nepal signed membership to the effort in 2017. Under the mandate of this initiative, China wants to construct a railway line that will connect Gyirong (the Tibet Autonomous Region town where the Trishuli River originates) to Kathmandu. The newly instated Railways Department of Nepal has drafted a 20-year development plan to build 4,000 kilometers of rail services to further link Nepal to its immediate geopolitical neighbors (Map 3.4). A report by the news publication the *Third Pole* (Bhushal 2017) revealed that rail and road development under OBOR are already under way: the road service from Gyirong to Rasuwagadhi is already operational and roads in Nepal to towns that will be connected by rail are in various stages of construction and operation. These include Syafrubeshi-Betrawati (28 kilometers under construction), Betrawati-Galchhi (36 kilometers in operation), and Galchhi-Kathmandu (50 kilometers

Map 3.4 Nepal's Proposed Railway Network



Source: Based on Chinadialogue

in operation), all of which are located in the TRB.

To facilitate quick progress of the project along the Trishuli River, Nepal's army is working to open up the track from Betrawati to Syafrubeshi, situated 17 kilometers from the Chinese border (Bhushal 2017). This stretch of road, expected to be completed by 2018, will link the Tibet Autonomous Region border in the north to the Prithvi Highway.

A spokesperson of the Railways Department stated that there is 90 percent likelihood of the Kathmandu-Gyirong railway construction happening, either over bridges or through tunnels that will trigger infrastructural expansion along the TRB. The network, connectivity, and movement opportunities provided by the OBOR initiative will open up economic opportunities in the form of trade and tourism for the citizens residing in the districts of Rasuwa, Nuwakot, and Dhading. Economic and urban growth is one consequence of the OBOR program, but environmentalists are cautious of the adverse impacts on fragile ecosystems that can aggravate disaster risks such as landslides and flooding because of improper infrastructural development (Sudmeier-Rieux et al. 2018).

Besides plans to expand major trunk roads along existing highway routes, there will be new routes that will connect rural towns and cities in the surrounding areas as feeder roads (Himalayan Times 2018). There

exists a concern that the satellite roads that will develop adjacent to trunk roads along the length of the TRB will be poorly constructed. National roads are generally constructed with proper engineering standards, but these rural roads will lack proper design and could cause significant environmental damage while straining local resources (Himalayan Times 2018).

Riverbed Sand and Gravel Mining

Most of the downstream sections from Devighat are heavily sand and gravel mined. Sand mines are also prevalent upstream on the Tadi Khola near its confluence with the Trishuli River. There are both legal and illegal mines. Local communities believe that water quality and fish abundance are very poor downstream of these sand and gravel mines (Box 3.4, Map 3.5).

The thriving sand and gravel mining industries in the Trishuli riverbed can be attributed to increasing demand for building materials to meet the upswing in urbanization in Kathmandu and surrounding areas as well as demand from hydropower developers for construction-phase requirements. Although Nepal banned riverbed excavation in 1991, the majority of sand comes from illegal mining operations (Third Pole 2017). In spite of certain policy initiatives (see Box 3.5), illegal mining activities continue in the TRB.

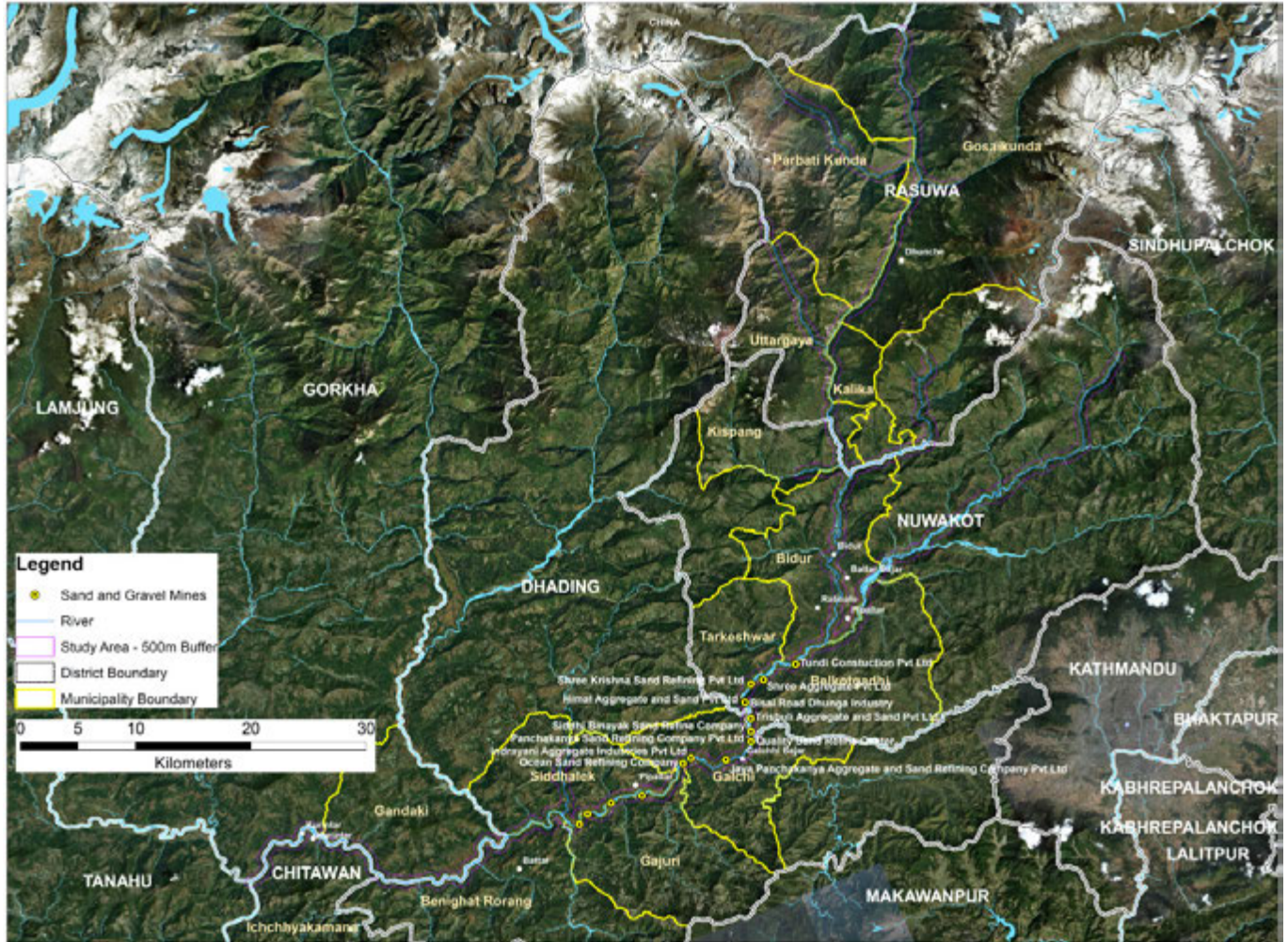
The implication is significant lowering of riverbeds

Box 3.4 Sand and Gravel Mining, 2017–18

- Two hundred sand-washing machines are installed on the banks of the Trishuli River over a distance of 150 kilometers, and more than 47 sand-washing industries operate around the Prithvi Highway.
- More than 1,000 trucks are registered in Dhading District to carry sand and gravel to Kathmandu and other cities.
- Over 400 sand-mining, -washing, and -crushing industries are in Dhading and Nuwakot Districts, and there are 12 sand- and gravel-mining sites and 28 sand-processing centers (Phirphire village development committee) downstream, at about seven kilometers from Galchi.

The illegal and haphazard extraction of sand and aggregates from the Trishuli River at Bidur and the Ratmate section has increased recently. The local administration of Nuwakot District banned sand-mining activities in March 2018. The mining companies filed an appeal to the Supreme Court to lift the ban. The Supreme Court ordered the administration to allow sand mining for a certain period, other than in the monsoon season between July and September 2018. The court has mentioned that due to the postearthquake scenario in the country, several construction activities are ongoing, and this ban could be counterproductive.

Map 3.5 Map of Sand Mining



and increasing river pollution from rock crushing. Slush drained by the sand mines and crusher industries is a major source of pollution in the Trishuli River.

Urbanization and Industrial Development Midstream of the Basin

Prithvi Highway’s proximity to this urban core center has facilitated trade and commerce opportunities through movement of raw materials and finished products to and from upcoming industrial villages situated in the river basin. For example, in Nuwakot District, the provision of rural transportation is providing new opportunities for mobility of people. The District Transport Master Plan for Nuwakot documents that the district is served by transport facilities that link it to national strategic road networks through a combination of highways and feeder roads, namely, the Mahendra Highway,

Dhalkebar-Jankpur-Bindi Highway, and the Dharapani-Janakpur and Birendra Bazaar-Mahinathpur roads. The increasing accessibility through this network of connecting infrastructure has helped in developing access to rural-urban linkages.

One of the main objectives of Nepal’s 2010 Industrial Policy was to promote industrial sector development and boost regional employment opportunities. The government of Nepal proposed special economic zones (SEZs) in eight districts, including Ratmate-Jiling-Devighat Village Development Committees in Nuwakot District of Nepal (Muzzini and Aparicio 2013). They want to promote business, industrial development, foreign trade export, and domestic and foreign investment and provide special incentive packages for upcoming industrial villages. Operationalization of SEZs in the identified districts of Nuwakot in Province three will be implemented. As

Box 3.5 Mining-Control Measures in Dhading District

In 2018, Dhading became the first district to enact standards to regulate the activities of mining firms involved in extraction, operation, and sale of riverbed materials (Rathore 2018a). The provisions of the new standard are as follows:

- Any crusher or sand-washing firms may operate only from 6am-6pm.
- A power supply permit can be received only after a joint supervision of the local body, District Coordination Committee, Department of Survey, Nepal Electricity Authority, Small and Cottage Industries Development Committee, and the local administration. (The power supply of companies in violation of rules was cut off by the Riverbed Materials Supervision and Coordination Committee earlier this year).
- Firms are required to install technology to separate thick and viscous material in muddy water before draining out the water from factories.
- All firms are mandated to install a three-level water tank to separate muddy elements in the water.
- Sand-washing firms should operate away from river area and at least 100 meters from the nearest highway.
- Public areas cannot be encroached upon for operating any factory-related to riverbed materials.

Despite this intervention, there is no decrease in the unlawful extraction of sand and boulders in the Trishuli River in Dhading District. According to a government report, sand mines are operating illegally in areas around Prithvi Highway through the use of fake company registration documents (Rathore 2018b). Out of the estimated 400 sand-mining and -washing factories operating in the district, only 73 factories have obtained a license to operate from the District Administration Office of Dhading. Even registered factories extract sand beyond the specified minimum threshold assigned to them.

an initial phase prerequisite, there are prefeasibility and site assessment studies being conducted for the Ratmate-Jiling-Devighat proposed SEZ. Increased urbanization can be expected if efforts continue to develop and improve infrastructure facilities for the establishment of medium- and large-scale industries in the study area.

Solid Waste Management

The Trishuli River is under threat from two main sources of waste pollution: raw sewage and nonbiodegradable trash. Efficient disposal of waste has been a struggle for local municipal bodies, which results in the release of garbage and plastic directly along the banks of the river. Solid waste management practices in villages and towns along the river is nonexistent. In all towns along the basin, there was excessive dumping of solid and plastic waste in the river.

Bidur Municipality is the largest local unit of Nuwakot District and faces an acute mismanagement of sewage facilities. A lack of this service forces the locals of

Trishuli and Devighat to dump their sewage and garbage released from their houses and toilets directly in the Trishuli River. A report prepared jointly by Clean Energy Nepal and Environment and Public Health Organization indicated that plastics are the single largest portion of the waste stream in Bidur Municipality, much higher than other rural municipalities (Tuladhar and Joshi 2004). The final disposal of the collected waste is done directly at a crude dumping site on the banks of the Trishuli River. The lack of any proposed specially designated landfill site or formal composting facilities for the municipality suggests that the present site will continue to be used in the foreseeable future. The operating Trishuli hydropower plant engineers indicated that they had to close down the turbines frequently due to dumping of waste.

The Betrawoti-Mailung-Syaphrubesi Road is in disrepair along several stretches as a consequence of landslides. Roadwork was observed occurring at several locations with all spoil being dumped in the river. Representative communities consulted during the TRB CIA indicated that building of access roads for

village infrastructure has led to loss of soil stability, exacerbating landslides and loss of biodiversity.

The Nepal River Conservation Trust (NRCT) started five waterkeeper organizations in Nepal, on the Bagmati, Karnali, Trishuli, Sun Koshi, and Seti Gandaki rivers, to protect these important waterways. Organized by the NRCT, Nepal's Youth Alliance Environment and two participating universities, the Second Nepal River Summit (2017) was held on the banks of the Trishuli River to advocate for land and river conservation, including protection from severe pollution (Khan 2017; NRCT 2017). Members of the Trishuli River Waterkeepers are advocating for heritage river status for the Trishuli River.

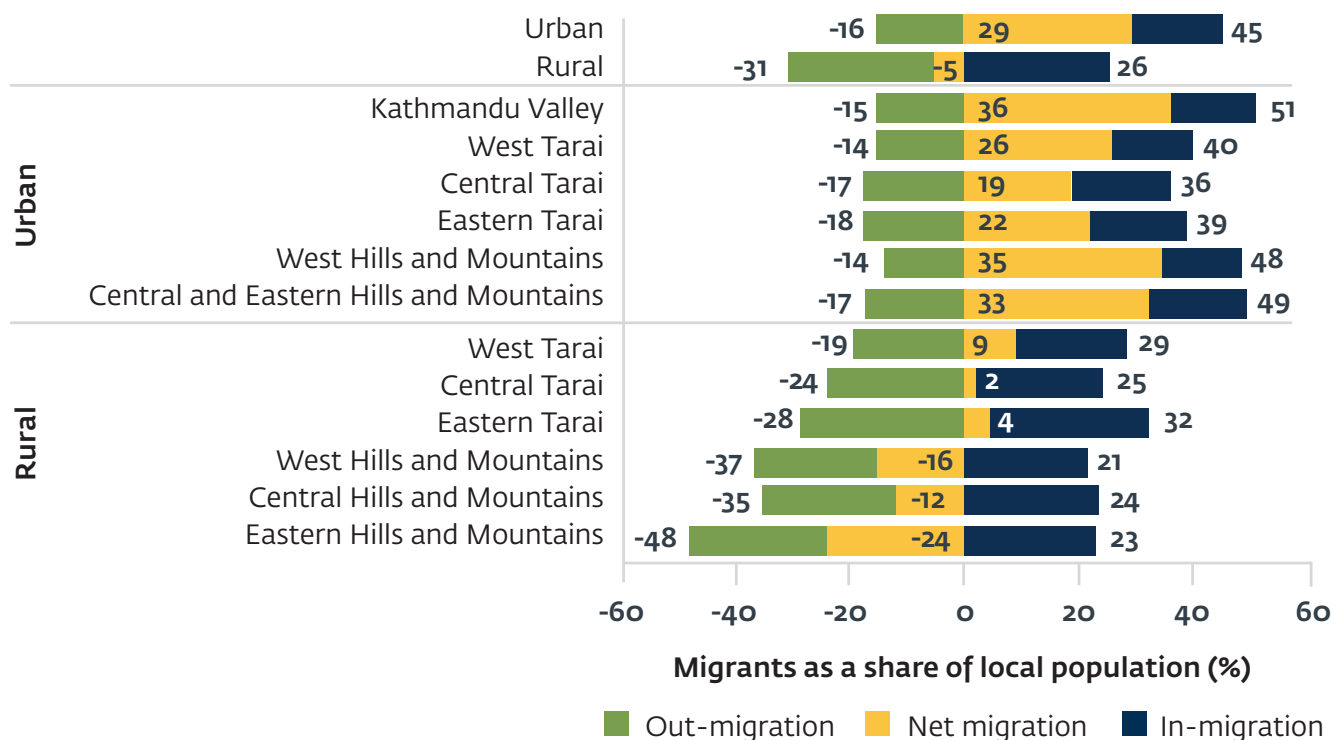
In-migration

Hydropower development offers risks and opportunities that has promoted internal migration into the TRB for livelihoods and for perceived benefits (linked to local development shares and other benefit-sharing mechanisms from hydropower projects). Smaller cities

such as Kurintar downstream, Bidur midstream, and Syabrubeshi upstream are experiencing high levels of urbanization (Bakrania 2015). The projects and processes associated with hydropower are evolving rapidly, causing unanticipated flows and reverse flows related to population migration. Despite an increase in natural calamities like earthquakes, floods, and landslides in the TRB, there is also an increase in opportunities for labor and local businesses due to hydropower development and urban growth in periphery market towns along the Prithvi Highway. Central Hills and Mountains (Figure 3.2) have witnessed an increase in in-migration by 24 percent in rural areas and 49 percent in urban areas.

While in-migration has generated positive effects for the local economy, especially in and around hydropower projects, major challenges include lack of adequate town planning and noncompliance with building codes in urban municipalities; increased unplanned squatting on public and private land, especially in buffer zones of community forests; and unmanaged land-use practices making land unsafe during extreme events. There is

Figure 3.2 Comparative Migration Trends



Source: Labor Force Survey (CBS 2008).

also limited attention to ameliorating availability of local infrastructure in terms of sanitation networks, drinking water, and health care, further exacerbating the adverse impacts of in-migration.

Stakeholder Identification and Engagement

Stakeholder groups have been identified based on the following:

- Groups that directly benefit from proposed developments
- Groups that are directly negatively affected by proposed developments
- Those who directly interact with the ecosystem components that overlap with the proposed developments
- Those who indirectly influence the use or conditions of those environmental and social components—such as regulatory groups, external research agencies, local, national nongovernmental organizations (NGOs), and so forth

A total of 52 stakeholder groups were identified that are a subset of the following broad categories:

- *Hydropower developers:* Entities (independent power producers) that will own and operate under-construction, committed, and planned hydropower projects that were considered for the Trishuli CIA and actively participate in the Trishuli Hydropower Developers Forum (THDF)
- *Government authorities (ministries and national authorities):* Key ministries and departments that manage and establish policies to regulate the resources and VECs
- *District authorities:* Departments of the national authorities and ministries that implement the policies established at a national level under the governance mechanisms put in place by respective Chief District Officers

- *Local authorities:* Urban and rural municipalities and specific local governance bodies (for example, the Wildlife Crime and Control Branch) that have been established for local governance and management of resources within the identified administrative structures and jurisdictions
- *Local and national NGOs:* Entities that are active in promoting development and conservation activities within the TRB
- *International NGOs:* Entities that are engaged at national- and international-level discussions on hydropower development and that may be actively interested in the outcomes of the CIA at a river-basin level
- *External agencies:* Including local contractors and companies engaged in sand mining, local infrastructure development, and so forth that are contributing to localized stressors for the VECs identified
- *Research agencies:* Including fisheries research stations as well as local entities that are undertaking ongoing data collection linked to critical resources such as aquatic ecosystems
- *Affected communities:* Local communities within the 20 urban and rural municipalities that inhabit the area of influence of existing and under-construction hydropower projects across the basin
- *Lenders and project proponents:* Key international finance institutions and relevant project proponents such as NEA, IFC, and Nepal Water and Energy Development Company Limited that are expected to drive the formation of the THDF and the implementation of its objectives.

A qualitative influence mapping was undertaken based on two parameters: (i) interest in cumulative impacts that will affect the TRB and (ii) influence in the assessment and management of cumulative impacts. Based on the qualitative mapping, a rating of “high,” “medium,” or “low” was provided to prioritize stakeholders for engagement over April–July 2018 (see Table 3.3 and Appendix A).

Table 3.3 Stakeholder Profile

Stakeholder group	Emerging concerns on basin-level hydropower development	Relevance for implementation of cumulative impact management in the Trishuli River Basin
Lenders and projects proponents		
Nepal Electricity Authority (NEA)	The NEA, a vertically-integrated government-owned utility, is responsible for generating, transmitting, and distributing adequate, reliable, and affordable power by planning, constructing, operating, and maintaining all facilities in Nepal’s power system, both interconnected and isolated. NEA generates approximately 60 percent of the current electricity output in Nepal and serves as the single buyer for generated electricity for domestic grid-based electricity supply. NEA’s board of directors is chaired by the minister of energy and consists of representatives from the Ministry of Energy, Ministry of Finance, industrial and financial sectors, consumers, and other nongovernmental stakeholders.	NEA has interests in implementing the recommendations of the CIA due to its current operating and under-construction hydropower projects in the TRB.
Hydropower Developers Forum	The IFC has facilitated an interactive forum across more than 30 developers of hydropower projects with interests in the TRB. The forum also includes entities such as Independent Power Producers Association of Nepal (IPPAN) and specific interest groups (for example, MCA Nepal). Since the inception of the CIA study, three formal meetings have been conducted for inputs into the set-up of the spatial and temporal boundaries, selection of VECs, discussion on emerging impacts, and recommendations on cumulative impacts.	Representatives of the current Hydropower Developers Forum for the TRB will regroup and become a part of the Trishuli Basin Co-Management Platform to oversee basin-level implementation of mitigation measures and monitoring of impacts.
Domestic and international lenders and project financiers	The primary aim of development partners is to provide financial and technical support to Nepal’s government and private sector in developing and managing development projects including hydropower plants (HPPs). Domestic lenders are also required to assess E&S risks from project finance under the ESRM Guidelines, which are broadly aligned to international standards.	As funding agencies, lenders will be keen to understand key outcomes of the CIA for the TRB, especially those that are interested in the projects within the study area that are advised to put in place specific mitigations, such as fish passes and attraction flows.
Government and national authorities		
Ministry of Energy, Water Resources, and Irrigation (MoEWRI)	The ministry is primarily responsible for managing Nepal’s energy and water resources sector. The ministry’s main role is to develop energy resources in the country via policy development, planning, energy conservation, regulation, research, and studies for energy and its utilization; construction, operation, maintenance, and promotion of multipurpose electricity projects. The ministry ensures that water resources are used for the benefit of the local people and nation with the generation of economic and affordable electricity and development of irrigation facilities. It also creates a transmission network and promote efficiency in power generation.	MoEWRI is the main government authority with the mandate and responsibility to coordinate management of water resources in Nepal, including HPPs. MoEWRI representative shall be a member of the Trishuli Hydropower Developers Forum (THDF) and will be instrumental in policy formulation and monitoring.

Continued on the next page

Stakeholder group	Emerging concerns on basin-level hydropower development	Relevance for implementation of cumulative impact management in the Trishuli River Basin
Government and national authorities (continued)		
Ministry of Forests and Environment (MoFE)	The ministry is responsible for the conservation of forests and management of the environment in the country. Its main purposes are to enhance sustainable growth of the forest and to manage the biodiversity, flora, and fauna and also to increase the development of forest-related enterprises in order to combat poverty throughout the rural areas of Nepal. The ministry primarily concerned with the implementation of policies and program relating to conservation of the country's natural resources including lakes, rivers, biodiversity, forests, and wildlife, ensuring the welfare of animals and the prevention and abatement of pollution.	MoFE is the key government agency with the mandate and responsibility to coordinate management of environment-related issues in hydropower planning by ensuring that impacts are assessed and control measures are put in place and thereafter monitored. MoFE representative shall be a member of the THDF.
Department of Electricity Development (DoED)	The major functions of the department are to ensure transparency of the regulatory framework; accommodate, promote, and facilitate the private sector's participation in power sector by providing "one stop" service, and license to power projects. The DoED issues licenses for hydropower projects at different stages of a proposal or project based on fulfillment of certain criteria set by the government.	DoED is a critical agency in the effort to ensure that if specific stretches of the river are identified for preservation and conservation, no licenses are issued for the same.
Department of National Parks and Wildlife Conservation (DoNPWC)	The main concern of DoNPWC is conservation of wildlife biodiversity and management of protected areas in Nepal, especially endangered species or cities under the concerned hydro project's footprint.	DoNPWC plays important roles in conserving terrestrial biodiversity, especially endangered or threatened wildlife conservation in CIA management.
Investment Board Nepal (IBN)	The IBN is the administrative body responsible for the implementation of Nepal's large infrastructure projects, including hydropower projects above 500 MW. IBN's legal mandate is to (i) improve the country's investment climate by creating a framework for the selection and evaluation of projects and providing incentives to encourage investments and (ii) negotiate concession agreements (project development agreements, or PDAs).	IBN can function as an advisory group to the THDF and will be critical in policy formulation and monitoring (including specific requirements in the PDA) to ascertain cumulative impacts for any large hydropower projects in the TRB.
Water and Energy Commission Secretariat (WECS)	WECS is responsible for reviewing and recommending multipurpose, large- and medium-scale water resource projects. It formulates, analyzes, and enacts the necessary laws pertaining to the development of water resources and energy and establishes coordination among national and sectoral policies.	WECS is presently in the process of developing basin-level watershed management plans, which will need to be considered in the formulation of the THDF.
Province, district and local authorities		
Provincial government	Provincial governments share important mandates and responsibilities in managing development projects including HPPs within the province. They have authority in developing policies and plans related to overall development of their province and also issuing licenses of HPPs and overseeing their implementation.	Provincial government representative shall be instrumental in policy formulation and monitoring.

Continued on the next page

Stakeholder group	Emerging concerns on basin-level hydropower development	Relevance for implementation of cumulative impact management in the Trishuli River Basin
Province, district and local authorities (continued)		
District Administration Office (CDO Office)	CDO is the main authoritative government administrative unit of the district. CDO is the president of Compensation Fixation Committee in the rapid action plan component of the HPPs. For the smooth and proper functioning of the project, the involvement of CDO is essential. The primary concerns of CDO pertain to the impacts of the project on the villages, especially the project-affected households and individuals. Its concern is that HPPs should pay adequate to implement the mitigation measures to be undertaken by the concerned hydroelectric project.	Any emerging policies for land acquisition and livelihood restoration will need inputs and feedback from the CDO's office.
Local government (Nagarpalika and Gaunpalika)	<p>Nagarpalikas and Gaunpalikas are the local governments in the current government structure in Nepal with authority to make decisions related to natural resources, so they should be considered the key stakeholders. Chairpersons and committee members of the local governments have a major role to play in enforcing the Environment-Friendly Local Governance Framework (2013) and participating in watershed management initiatives that are put in place by hydropower projects.</p> <p>Local governments also have the authority to directly request HPPs to release adequate water for downstream users, including for sustenance of livelihood activities and culturally important rites. They are also involved in the following:</p> <ul style="list-style-type: none"> • Empowering the local communities to get benefits from the HPP as per the provisions of EPA/EPR and EIA report • Being involved in the public hearing of the EIA report • Monitoring the activities of the HPPs to determine whether they are working as per the EPA/EPR, EIA guideline, and EMP <p>The municipality is keen to work with the HPPs for the sustainability of the project and to build a harmonious relationship between people and project, generating high level of ownership.</p>	<p>Local government is a crucial stakeholder under the decentralized federal structure in Nepal for implementing community-based mitigation measures.</p> <p>Local governments can also play a mediation role between the THDF and the local communities and are also important stakeholders providing inputs to compensation-determination committees that are set up for land acquisition.</p>
Langtang National Park (LNP)	<p>LNP was established in 1976 and is spread across three districts (including Rasuwa) with the aim to conserve the unique flora and fauna of the region. Its main concern is to conserve the wildlife and plants found in the Langtang area, such as the red panda. The LNP is concerned with biodiversity conservation and environment friendly development, including hydropower projects. Recently, the main challenges of LNP pertain to the prevention and control of poaching and trade in wildlife and other forest resources across the border, which is attributed to the increase in the number of access roads due to local infrastructure and hydropower development.</p> <p>There are also some planned hydropower projects to be developed within LNP and/or in the buffer areas, and for these the authorities of LNP seek greater participation in environmental approvals and planning.</p>	As a part of the upstream section of the TRB falls within the buffer zone of the LNP, these authorities are crucial participants in implementing specific measures and/or monitoring mechanisms.

Continued on the next page

Stakeholder group	Emerging concerns on basin-level hydropower development	Relevance for implementation of cumulative impact management in the Trishuli River Basin
Province, district and local authorities (continued)		
District Forest Officer (DFO)	<p>The DFO is mandated to reinforce policy and plans related to forest and biodiversity. It operates within the now restructured Divisional and Subdivisional Forest Office. DFOs are concerned with the protection of forests and biodiversity, terrestrial and aquatic ecosystems, forest biodiversity, and environment friendly infrastructure development including HPPs. DFOs are also empowered to:</p> <ul style="list-style-type: none"> • enforce IEEs and EIAs by all the HPPs as per the provision of EPA 1997 and • monitor the implementation of the EMPs developed by the HPPs. 	<p>Part of the TRB comes under the forest areas that DFOs manage and thus they need to be a part of any river-basin planning in order to implement and monitor mitigation measures.</p>
District health posts	<p>The main concern of district health post is to provide health care and related services to health seekers. There may be increased sexually transmitted diseases like Human Immunodeficiency Virus–Acquired Immunodeficiency Syndrome (HIV AIDS) to local communities through workers who come to work in HPPs. There may be increased unwanted pregnancy to women, especially girls due to increased arrival of workers.</p>	<p>The health posts are responsible for providing health services to local people and workers.</p> <p>They also work to increase awareness among local communities, workers, and developers about health issues.</p>
District Coordination Committee (DCC)	<p>DCCs are responsible for coordination and monitoring of development activities, so they have limited human resources and responsibilities with respect to the implementation of development projects, including HPPs. However, DCCs are a key resource group to be informed on progress and made aware of any challenges and/or bottlenecks in basin-level management.</p>	<p>DCCs shall be vital in the effort to coordinate activities among different stakeholders, especially local governments, like rural municipalities, for the smooth implementation of development projects, including HPPs.</p>
Department of Roads (DoR)	<p>The DoR is concerned with development of the road network and upgrading the existing roads to increase access to the people in coordination with the DCC and local municipalities. It is responsible for developing plans for national roads and providing technical support for their development. It is also responsible for reinforcement of the policy and plans related to road construction.</p>	<p>As a key stakeholder, DoRs develop policy and plans and oversee environmentally friendly road construction.</p>
Department of Health (DoH)	<p>The DoH is responsible for the policy and plans related with health issues and infrastructure outreach. The primary concern of DoH is to establish health institutions in the villages where there is no access to health facilities. DoH establishes health institutions and service centers and provides services related to the health of the affected communities and others.</p>	<p>The DoH can support the monitoring of localized health implications from altered flows, water quality, and other parameters across the basin.</p>

Continued on the next page

Stakeholder group	Emerging concerns on basin-level hydropower development	Relevance for implementation of cumulative impact management in the Trishuli River Basin
Community-based organizations and national representations		
Nepal Federation of Indigenous Nationalities (NEFIN)	NEFIN is largely involved in the advocacy of indigenous people's (IPs') rights related to the environment—land, water, forests, and so forth. NEFIN is a pan-Nepal organization working on collective rights of IPs. It has a presence in 71 districts and 2,500 villages in Nepal where the IP population is significant. It works on advocacy, government dialogue, working for the interest of IPs in projects affecting IPs, and running campaigns and spreading awareness on IPs' rights. The primary concern of NEFIN is the issue of displacement of indigenous people from natural resources to which they have been attached materially and culturally. Concerns specific to hydropower projects include impacts on ancestral land and cultural heritage, consideration of compensation for collective rights of IPs, avoidance of customary owned land, impact on poor and landless and measures for poverty alleviation, social integration impacts due to displacement, and livelihood and natural resource management.	NEFIN undertook the free, prior, and informed consent process for UT-1 HPP, upstream of the basin and, thus, any engagement process will need to align with the outcomes of the agreement reached.
Sand-mining groups and associations	Sand-mining groups are concerned with the decline of sand in the mining areas, which largely arises from sedimentation flushing. They are also a major raw material suppliers to hydropower projects under construction and generate local employment.	Municipalities that participate in mechanisms to monitor impacts can engage with sand-mining groups and associations and enforce specific control measures as recommended by certain districts, such as Dhading.
Nepal Association of Rafting Agencies (NARA)	NARA is a formal organization of agencies that are involved in rafting. It coordinates interests and issues of rafting agencies with the intent to introduce and promote whitewater rafting in Nepal among national and international tourists. The key concern of rafting association is reduced flows and therefore impacts on rapids, especially downstream sections of the river basin.	NARA will need to be kept informed of any specific studies that are undertaken to ascertain flow requirements for activities such as rafting and implications if any for tourism.
Fishery Research Stations	There are two government- and donor-funded fishery research stations, at Dhunche and Nuwakot, in the TRB with a focus on Snow Trout and Rainbow Trout hatchlings and intensive riverine aquaculture activities. These agencies are already aware of implications of imposed flow transformations within the river basin and collect data on parameters linked to aquatic habitat.	Fisheries research agencies will be important entities to engage for supporting monitoring and ongoing data collection with the basin.
Federation of Community Forestry Users Nepal (FECOFUN)	FECOFUN is a formal network of Forest User Groups. It plays a key role in promoting and protecting the rights of community forest users through capacity strengthening, economic empowerment, sustainable resource management, technical support, advocacy and lobbying, policy development, national and international networking, and upholding the values of inclusive democracy, gender balance, and social justice. It focuses on self-reliance and empowerment of community forest users through the application of social and economic justice in the equitable use and sustainable management of community forests.	FECOFUN can be a resource group related to localized impacts of hydropower projects on compensation for loss of forest land through restorative afforestation, monetary compensation, and livelihood restoration.

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Stakeholder group	Emerging concerns on basin-level hydropower development	Relevance for implementation of cumulative impact management in the Trishuli River Basin
Affected communities		
Rural communities near operational and under-construction hydropower projects	<p>A majority of these communities are within settlements upstream of the TRB, in the Rasuwa District, where there is multiple hydropower development along the main stem and tributaries (Sanjen and Mailung Khola). These communities are further profiled in the discussion on social VECs. The primary concerns of the communities living nearby the HPPs are the following issues:</p> <ul style="list-style-type: none"> • Access of information of the HPPs of the basin area is lacking, such as their EIA, compensation, and opportunities for local community. • Community infrastructure like temples, schools, hospitals, guthi land, and so forth should not demolished for an HPP transmission line or diverted in other ways. • Water is the main source of livelihood to the local people for drinking and agro-pastoral activities, and the water is gradually being impacted. • There is a lack of consistent employment opportunities within operational projects. • There is a decline of water resources and springs due to the construction of tunnels. • An increase in landslide events are reported due to blasting. 	<p>Key findings and suggestions and mitigation measures of the CIA study need to be shared with the local stakeholders. These stakeholders also need to be involved in the monitoring of impacts on the VECs.</p>
Community Forest User Groups (CFUGs)	<p>There are more than 516 CFUGs in the affected Gaunpalikas and Nagarpalikas area of the TRB, covering more than 95 percent of population of the area. They are concerned with communal management of forests through which local people and CFUGs can fulfill their forest product needs and can generate income through timber and nontimber forest products, thus enabling the following:</p> <ul style="list-style-type: none"> • Participation of local people in forest management and sharing of benefits in an equitable manner • Conservation of forest through local development and poverty reduction by utilizing forest products. <p>The primary concerns of the CFUG (users and executive members) are loss of productive forest patches. CFUGs want to ensure continued supply of ecosystem services and access to remaining forest areas. Of issue is the degradation of forest cover due to project activities. There may be an increase of illegal deforestation and illegal cutting as a result of project-related activities, improved access to forest areas, and location of construction and worker camps in the buffer zones.</p>	<p>CFUGs are legal institutions with a mandate to manage community forests and are one of the major stakeholders to consider for community-led participation in cumulative impact monitoring and management. All the sociocultural, livelihood, biodiversity VECs are directly or indirectly connected with the CFUGs.</p>

Continued on the next page

Stakeholder group	Emerging concerns on basin-level hydropower development	Relevance for implementation of cumulative impact management in the Trishuli River Basin
Affected communities (continued)		
Fishing communities	The key concern of the fishing communities is loss of fishes in the river and tributaries resulting in impacts to the livelihoods of the communities. The availability of fishes in the river, the continued supply of water in the river, and employment opportunities are their key concerns and expectations. Some of the local people rely on fishing for their livelihood. Therefore, continued flow of water in the river is essential for the continuity of livelihoods. At the same time, fishing communities are also responsible for increased fishing pressures, especially in certain stretches of the river.	A critical component of stakeholder engagement during implementation will be to make fishing communities aware of sustainable artisanal fishing techniques and to specifically avoid certain types of fishing.
Indigenous people (IP)	Tamangs, Gurungs, Magar, Majhi, Rai, Gharti/Bujhel, and Baramu are among the key indigenous communities of the TRB. The Tamang community is the dominant community upstream of the basin, where the ethnography of the basin changes as the river moves downstream. IPs have been at the forefront of raising issues on environmentally friendly management of resources through their representatives in Jan Sarokar Samitis and municipalities. IPs are also recently and externally supported through local and national advocacy groups such as NEFIN, LAHURNIP, and so forth and are thus key opinion makers and mobilizers of the local communities. Specific projects in the basin, such as UT-1, have established that IP communities are to be adversely impacted and mitigation measures have been put in place (such as an Indigenous Peoples Development Plan and a consultation process that requires documented free prior and informed consent prior to project development).	In view of the engagement mechanisms that will be put in place by NEFIN to implement the agreement that was facilitated for achieving free, prior, and informed consent for UT-1, other indigenous communities may expect an extension of the same with respect to the outcomes of the CIA. In line with principles of informed consultation and participation, the specific river-basin management plan that is developed should be formally disclosed and an understanding of the components of eventual mitigation should be facilitated among IPs while soliciting their input.
Vulnerable social groups	Discussions with local communities in and around hydropower projects indicated that there are certain social groups that are not able to share the benefits that a hydropower project may bring due to their existing vulnerabilities (social and economic) and/or induced vulnerabilities. These include the following: <ul style="list-style-type: none"> • The Majhi community, midstream and downstream of the TRB, have gradually changed their livelihoods toward petty labor due to inconsistent fish catch and marginal income from artisanal fishing but have not been considered impacted communities in compensation programs. • Communities living within internally displaced persons camps have had to temporarily and/or permanently shift their residence in the aftermath of the earthquake. • Unskilled migrant laborer's have come into the area to obtain employment in hydropower projects. 	Forums at the community level will seek participation and feedback from vulnerable social groups and may require their active engagement for specific activities, such as monitoring of fishing impacts.

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Stakeholder group	Emerging concerns on basin-level hydropower development	Relevance for implementation of cumulative impact management in the Trishuli River Basin
Affected communities (<i>continued</i>)		
Vulnerable social groups (<i>continued</i>)	<ul style="list-style-type: none"> Women's groups (across a range of communities) have reported lack of direct engagement and inclusion by hydropower developers beyond invitations to participate in meetings and public hearings. 	
Non-Governmental Organizations		
Local, regional, and national NGOs	<p>NGOs and advocacy groups such as Langtang Area Conservation Concern Society (LACCoS), Niti Foundation, Hydropower Journalists Association, and Nepal Water Conservation Foundation advocated for different issues related to the HPPs, such as ensuring free prior and consent consultations with the local communities and civil societies, human rights, rights of the local people and stakeholders, and so forth. Some NGOs and advocacy groups engage in wildlife advocacy and environmental conservation.</p>	<p>Local teams of conservation-focused NGOs such as LACCOS that are willing to participate in collaborative basin-level management will be useful in generating overall participation, interest, and awareness.</p>
International conservation-focused inter-governmental bodies and NGOs such as ICIMOD, WWF, and IUCN	<p>Intergovernmental bodies and international NGOs such as the International Centre for Integrated Mountain Development (ICIMOD), World Wildlife Fund (WWF), and the International Union for Conservation of Nature (IUCN) are working in the field of community-enabled wildlife conservation and have a range of funded programs and activities in Nepal. These organizations provide platforms for a wider range of people to learn and appreciate the environment and to acknowledge the link between conservation and sustainable development. Based on recent publications, WWF has been facilitating discussion forums such as the "Regional Sustainable Infrastructure Workshop on Improving Outcomes in Hydropower and Infrastructure Development in Nepal, Bhutan and India" in June 2016 and the IUCN has focused on protected area management along with river-basin-level initiatives to organize consultative forums.</p>	<p>ICIMOD, WWF and IUCN will be interested in supporting research, sharing knowledge, and documenting lessons learned from implementing the recommendations of this study.</p>
Lawyers' Association for Human Rights of Nepalese Indigenous Peoples (LAHURNIP)	<p>LAHURNIP is a pioneer organization of human rights lawyers working for the rights of IPs in Nepal. LAHURNIP is promoting better implementation of ILO Convention No. 169, United Nations Declaration on the Rights of Indigenous Peoples, inter alia other international human rights instruments that Nepal is a party to. It has been working to create solidarity among regional and international IPs' rights promotional movements. In the TRB, LAHURNIP is supporting indigenous communities to manifest their rights, particularly those who are affected by the projects in their land, territories, and natural resources, through laws and policies.</p>	<p>A LAHURNIP (2017) report on impacts of the UT-1 Project on Indigenous Communities in Rasuwa was submitted to the project proponent (as an independent deliverable) along with recommendations to hydropower developers and other stakeholders. LAHURNIP is likely to be a key interest group.</p>

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Stakeholder group	Emerging concerns on basin-level hydropower development	Relevance for implementation of cumulative impact management in the Trishuli River Basin
Non-Governmental Organizations (continued)		
International Rivers and South Asia Network of Dams, Rivers, and People (SANDRP)	<p>International Rivers is working with civil society groups in South Asia (among other geographies) to protect their rivers and watersheds. International Rivers has been actively tracking civil society campaigns on West Seti and Arun III Hydropower Projects in Nepal.</p> <p>SANDRP is an informal network working on issues related to rivers, communities, and large-scale water infrastructure like dams: their environmental and social impacts and their performance and issues related to governance of rivers and dams. SANDRP has been following hydropower development in Nepal and is at the forefront of commenting on documents published online, linked to social and environmental impacts.</p>	Potential interest group that may want to participate in planning, reviewing, and/or monitoring outcomes of the implementation of the CIA.