Environmental Impact Assessment

September 2019

PAK: Balakot Hydropower Development Project

Executive Summary

Prepared by Pakhtunkhwa Energy Development Organization (PEDO), with support from Hagler Bailly Pakistan for the Asian Development Bank. This is an updated version of the draft originally posted in December 2018 available on https://www.adb.org/projects/documents/pak-49055-003-eia.

Hagler Bailly Pakistan

Balakot Hydropower Development Project

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Final

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Executive Summary

The Pakhtunkhwa Energy Development Organization (PEDO) intends to construct a 300 megawatt (MW) run-of-river hydropower plant, Balakot Hydropower Development Project (BHDP) (referred to as Project in this report) at Balakot, in Mansehra District of Khyber Pakhtunkhwa (KP), Pakistan. The Project site is located on the Kunhar River about 18.6 kilometer (km) upstream of the town of Balakot. The location of the Project is shown in **Exhibit I**.

Project Background

A feasibility study of the Project was prepared in 2013 (the "FS 2013").1 The Asian Development Bank ("ADB" or the "Lenders") is evaluating the Project for financing under its Hydropower Investment Development Program. As part of the evaluation of the Project, ADB, on advice of technical consultants, deemed the design proposed in 2013 as unfeasible and had it modified by Aqualogus. Aqualogos proposed and assessed dam site and powerhouse option alternatives and released a draft report of their findings in May 2018. Hagler Bailly Pakistan (Private) Limited (HBP) contributed to the environmental and social assessment of options. ADB has now acquired the services of HBP as Safeguard Consultants to prepare the documents required for ensuring that the project meets the environmental and social safeguards of the ADB, and also conforms to environmental legislation of KP.

Study Area

The selection of the Study Area for the ESIA considered environmentally sensitive receptors that are most likely to be impacted by the Project's development activities during construction and operation. For assessment of cumulative impacts, the Study Area was selected to be large enough to allow the assessment of the Valued Ecosystem Components (VECs) that may be affected by the Project activities. The Study Area defined for the baseline studies and impact assessment is shown in **Exhibit II**.

Policy and Legal Framework

The ESIA process and the environmental and social performance of the Project will be governed by the policies of the GoP, the laws of the Government of KP, and international environmental agreements to which Pakistan is a party. The Project is following ADB's guidelines as ADB is a lender.

1 Mirza Associates Engineering Services (Pvt.) Ltd., Feasibility Study of , for Pakhtunkhwa Energy Development Organization (PEDO), December 2013

Exhibit I: Project Location

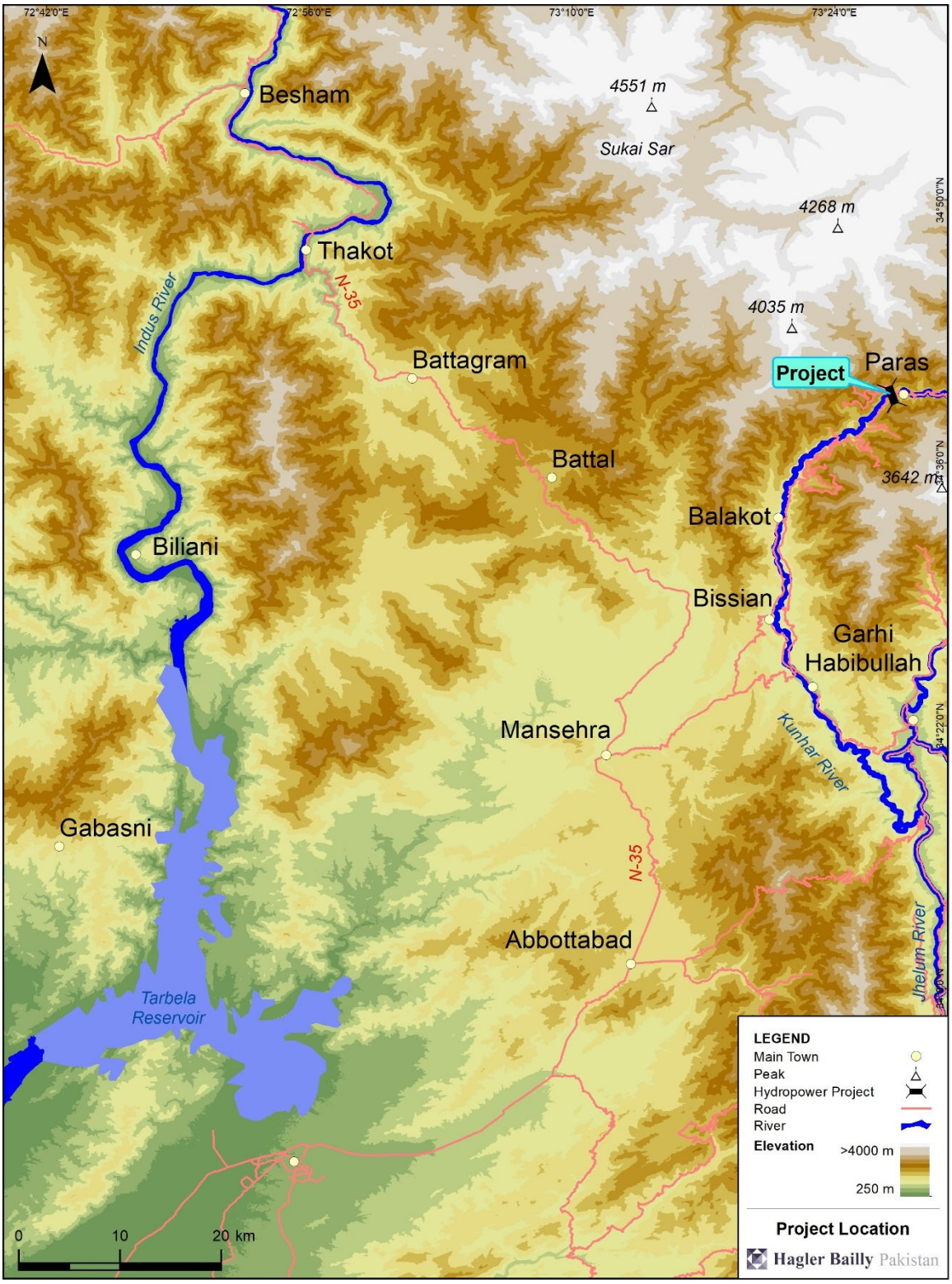
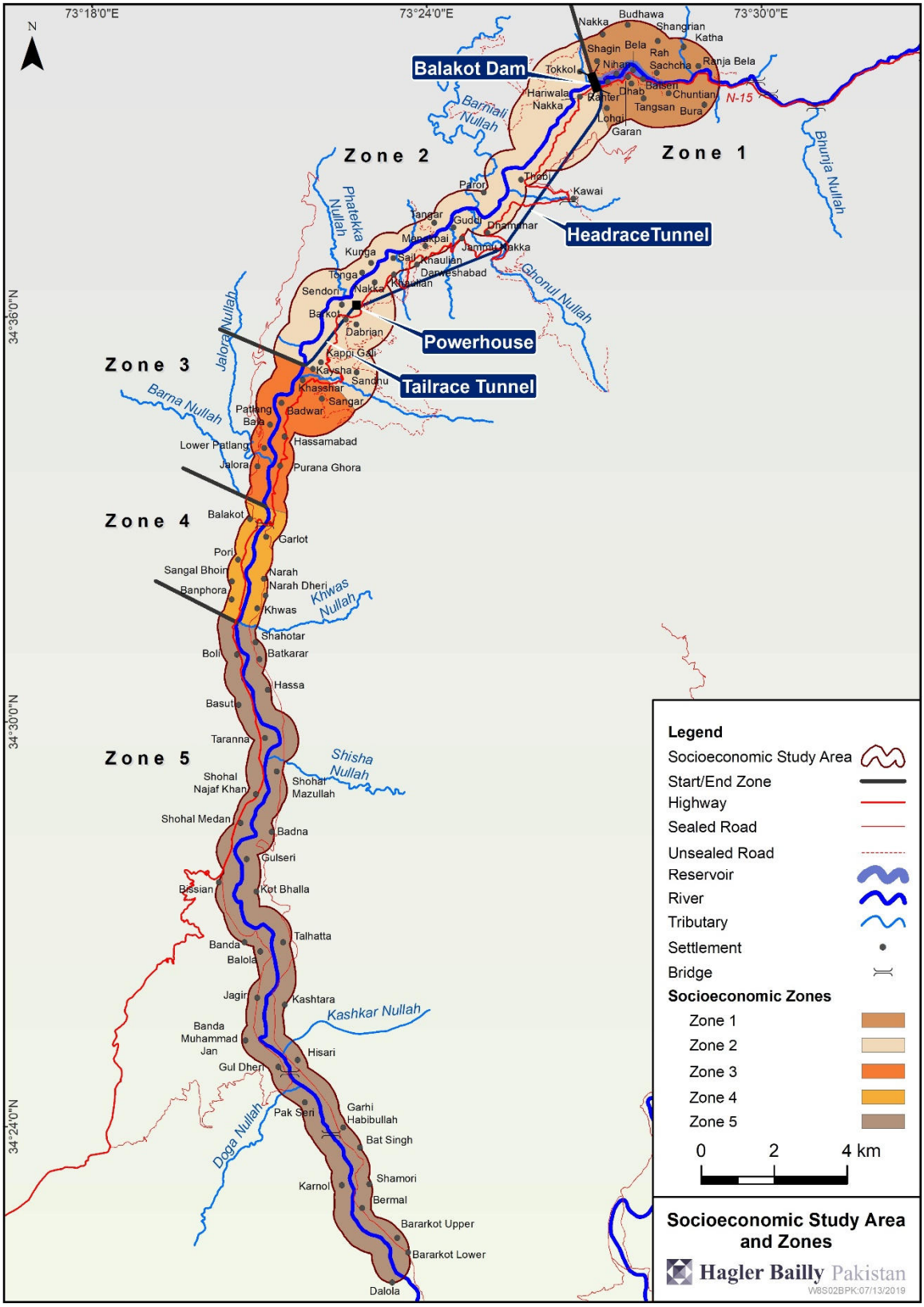


Exhibit II: Study Areas



Khyber Pakhtunkhwa Environmental Laws

Matters related to environment in KP are governed by the KP Environmental Protection Act 2014. This Act is applicable to a broad range of issues and extends to air, water, industrial liquid effluent, and noise pollution, as well as to the handling of hazardous wastes. The responsibility to implement the provisions of the Act lies with the KP Environmental Protection Agency (KP EPA). The act requires proponents to submit either an EIA or IEE, as the case may be, and obtain approval in respect thereof before commencing construction.

ADB's Policy on Environmental Safeguards

The ADB has a Safeguard Policy Statement (SPS) which is used to manage environmental and social risks associated with projects. The SPS aims to promote sustainability of Project outcomes by protecting the environment and people from Project's potential adverse impacts by avoiding adverse impacts of projects on the environment and affected people, where possible; minimizing, mitigating, and/or compensating for adverse project impacts on the environment and affected people when avoidance is not possible; and helping borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

Project Description

The Project is a run-of-the-river hydropower project to be constructed on the Kunhar River. The catchment area of Kunhar River at the proposed dam site is 2,535 square kilometer (km^2), at an elevation ranging from 600 to 5,000 m. The Project Dam is located near the village of Rahter while the Powerhouse is located near the village of Barkot.

Power Generation Capacity

The proposed Project is designed to operate with the reservoir at maximum operating level of 1,288 m above mean sea level (amsl) with a reservoir capacity of 3.6 million m^3. At these conditions, the total installed capacity of the hydropower station will be 300 MW. The average annual energy generation of the main power station will be 1,143 Giga Watt hour (GWh).

Land Requirement

The total land requirement is 32.8 hectare. Out of total 32.8 hectares of required land 3.05 hectare will be required for staff colony, 3.05 hectare will be required for 2 construction camps, 1.32 hectare will be required for access roads and 23.36 hectare will be required for reservoir and dam.

Main Components of the Project

Dam and Reservoir

The dam will be a concrete dam with a maximum height of 35 m. The reservoir will have a length of approximately 2.2 km. During the low flow periods, the live storage will be used to store water during off peak hours to improve the flows for power generation in peak hours. It has been estimated that 1.2 million m^3 net storage would provide additional flows in four peak hours.

Reservoir Sediment Flushing

Reservoir capacity can be preserved by annual flushing increasing the life of the Project. when required with the discharge of about 100 cubic meter per second.

Lateral Power Intake

This will be located on the left bank of Kunhar River and will comprise 4 bays split by three vertical piers to provide a design discharge of 154 m^3/s. It will include trash racks for passing the design discharge.

Headrace and Tailrace Tunnels

This will be a length of about 9.1 km and a diameter of 8 m.

Powerhouse

The powerhouse design comprises three Francis type turbines and generators. The transformer hall cavern will have dimensions of length 88 m, width 14 m and height 20 m. Geographic Information Systems (GIS) equipment and the facility for transfer of the power cable to the cable tunnel will also be provided.

Construction Material and Waste

Materials required to carry out the construction of civil works for the Project include concrete aggregate, cement, pozzolans, various types of fill materials, construction chemicals, steel products etc.

Construction Timeline

The construction will require about 6.5 years (78 months).

Stakeholder Consultation

The consultation process was designed to be consistent with the relevant national legislation and the ADB's Safeguard Policy Statement (SPS). Consultations with the Project stakeholders were undertaken in late April, May and June 2017 and June -July 2018. A Background Information Document (BID) prepared in English and Urdu that informed the stakeholders about the ESIA process and provided a background about the Project was shared with the stakeholders. The feedback from the communities was recorded and the detailed logs of consultations were prepared. A basin wide study approach was adopted, and 35 rural communities were consulted along the Kunhar River. Local government and officials were also consulted.

The list of groups consulted by type is provided in **Exhibit III**.

Exhibit III: List of Institutional Stakeholders

Stakeholder Group	*Stakeholders*
Regulatory Institutions	Khyber Pakhtunkhwa Environmental Protection Agency (KP EPA)
Government Institutions	▶ Forest Department, Khyber Pakhtunkhwa ▶ Wildlife Department, Khyber Pakhtunkhwa ▶ Fisheries Department, Khyber Pakhtunkhwa

Stakeholder Group	*Stakeholders*
	▶ Social Welfare Department, Khyber Pakhtunkhwa ▶ Kaghan Development Authority ▶ Tourism Corporation, Khyber Pakhtunkhwa ▶ Revenue Department, Khyber Pakhtunkhwa ▶ Deputy Commissioner, Mansehra, Khyber Pakhtunkhwa
Non-Governmental Organizations and Civil Society Organizations	▶ World Wildlife Fund – Pakistan ▶ Himalayan Wildlife Foundation ▶ Adventure Time Pakistan
Educational Institutions	▶ Archaeology Department, Hazara University ▶ Archaeology Department, University of Peshawar
Private sector	▶ Star Hydropower (Pvt.) Ltd ▶ International Finance Corporation (IFC)
Communities being relocated	Communities with river-dependent livelihoods and being relocated/resettled
Communities within a 500 m buffer of the river	Communities with river-dependent livelihoods
Communities within 1 km of the Project infrastructure	Communities that may be directly impacted by the Project

Summary of Consultation

Following is a summary of concerns expressed by the communities:

- Sediment mining and fishing will be affected as areas will be submerged. This may affect the well-being of the local community. In addition, dam construction will change flows which will result in reduction in driftwood for the locals. As a result, deforestation may increase.
- Women use the river for a variety of purposes and this may be affected by the Project.
- Environmental issues will increase due to construction activities. Some of these include land sliding, congestion on roads, damage to structures due to vibrations from blasting, change in aesthetics and dust pollution.
- The presence of the dam will increase water temperature and disrupt sewage dilution. In addition, if there is a catastrophic flood there is a high risk of damage.
- Water supply from springs may be affected. People rely on water from springs for drinking.
- Agricultural land will be affected which will have an impact on local incomes.

- ► Locals need high priority in employment opportunities. They do not want outsiders allowed.
- ► Locals should be provided in free classes for English and Chinese languages to improve the employment opportunities for their children.
- ► The local communities should be provided with free electricity.
- ► Appropriate negotiations are required between affected peoples and the government.
- ► Locals are concerned that the government will not keep its promises.
- ► There is a concern that people of different cultures will enter the area and disturb the locals. This will affect the locals' social fabric.
- ► Women do not want the dam here as it will disrupt their privacy and way of life.

Following is a summary of concerns expressed by the institutions:

- ► The project will result in disturbance to the existing ecosystem. This includes the forests which will be cleared or disturbed. However, it is of note that the project will not disturb large areas of forests and that the existing forest is already highly fragmented.
- ► The project will generate much needed electricity. Any loss of forest can be compensated.
- ► It is important to know the modifications in flows as a result of the project. Communication between the various developers in the basin is important along with consideration of mitigation measures such as fish ladders.
- ► The agreed environmental flow needs to be maintained.
- ► Important archaeological sites can be affected especially if there is flooding.
- ► A robust impact assessment is required in which impacts due to peaking and changes sediment flows are addressed.
- ► There should be a review of impacts on downstream projects. A cumulative impact assessment should also be carried out.
- ► The EIA process should be risk based and should consider past data.
- ► Impacts of climate change should be considered.
- ► Changes in flows can affect spawning grounds for fish fauna. Due to this native species can be affected.
- ► Use of hatcheries is recommended.
- ► The EIA should develop biodiversity management measures, sediment mining management measures and fish monitoring plans.
- ► The project will affect fishing in the area.
- ► Submergence and rise in water levels is a concern as it will affect vegetation and biodiversity.

- The land acquired for the project will affect the local communities.
- The influx of labor from outside will disrupt local ways of life.
- Locals should be given preference in the jobs created as a result of the project.
- Local contractors should be hired as far as possible.
- The local community should be provided with uninterrupted electricity supply.
- The affected community should be wealthier and have an improved quality of life after the project.
- The EIA should develop a framework for dealing with conflicts, security management, livelihood restoration etc.
- Displaced households should be rehabilitated.
- Graves should be managed with consent of the community.
- Vulnerable households should be provided with special assistance.
- Mitigation measures should be implemented to minimize impacts from construction related activities.
- Flushing will impact the fish fauna of the reservoir.
- An analysis of alternatives should be carried out.
- Peaking should be analyzed and run-of-river operation should be considered.
- Changes in water levels may affect tourism in the area.
- Waste management should be carried out effectively.
- The Kaghan Development Authority should be given appropriate notice and resources to deal with changes due to the project.
- Other hydropower developer should be consulted and management should be coordinated.
- Existing pressures can be mitigated by the project. For example, there is limited data on wildlife, limited protection, release of sewage which pollutes the river, lack of staff, lack of awareness. These can be addressed to some extent using mitigation measures as part of the project.

Overview of the Physical Environment

Topography

The relief in the catchment of the dam varies from 629 m amsl to 5,199 m amsl. The dam site is at an elevation of 1,257 m amsl and the powerhouse site at an elevation of 1,316 m amsl.

Land Use and Cover

The land use distribution is demarcated as per the Socioeconomic Zones within the Socioeconomic Study Area. Pine and scrub forests cover the majority of the area (59% of

the total zones combined) followed by agricultural intensity (26%). Density of built-up area is low about 8% and same is the percentage of water bodies in the Study Area.

Geology, Soils and Seismicity

Tectonics

The Project lies along a major and active continental margin, at the confluence of Eurasian and Indian Plates that has resulted in the Himalayan orogeny. The Project area has been affected considerably by tectonics which has produced some prominent faults like the Main Boundary Thrust (MBT), the Panjal Thrust[2], and the Himalayan Frontal Thrust[3] (HFT). MBT passes along the right bank of the Kunhar River, while the powerhouse area and headrace tunnel run parallel on the left bank. This fault is about 2.4 km west of Kunhar River at the dam site. The maximum distance of headrace tunnel from MBT is about 4.64 km. It continues in a southern direction through the rock formation some 2 km away from the powerhouse site.

Earthquakes and Seismicity

Earthquakes occur very frequently in the Project area, which is within a highly seismically active area. Several regional faults, which are some of the most active faults in the Himalayas, pass through the close vicinity of the Project site. The area is known for recent seismic events including 2004 Paras Earthquake of magnitude 5.2 and 2005 Earthquake of magnitude 7.6.

The peak ground acceleration (PGA) with 10% probability of exceedance in 50 years (475-year average return interval) is reported and is between 1.6 meter per second squared (m/s^2) and 2.4 m/s^2 at the Project site as per Global Seismic Hazard Assessment Project (GSHAP).

According to the revised Building code of Pakistan with Seismic Provision (PBC, 2007) the Project location is classified under seismic Zone 4 for which the Project is required to withstand a PGA greater than 0.32g (3.2 m/s^2).

Lithology

The Project is located in rocks belonging to Murree Formations. The Murree Formation is of early Miocene age, and consists of dark red to purple and greenish grey sandstone and siltstone, purple to reddish brown shale, mudstone and lenses of conglomerates. These rocks are exposed at the dam site and consist of alternate beds of sandstone and shale. Structurally, the formation shows a high degree of compression in the form of tight folding with repeated faulting and fracturing. At places, it shows open broad folds which have been weathered into steep ridges and valleys with a succession of cliffs and steep slopes.

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[2] In some literature, sections of the Panjal Thrust are synonymous with the Main Central Thrust (e.g. see Robert Yeats, Active Faults of the World, 2012, Cambridge University Press)

[3] This is considered part, or synonymous with the Muzaffarabad Thrust depending on the literature and synonymous with the Balakot-Bagh Frontal Thrust

The Murree Formation exposed in the Balakot area represent as last stages of Neo-Tethys and the beginning of Siwalick system in the area which is indicated by sandstone and shale deposits.

Soils

The soils of the Project area are composed of piedmont alluvial deposits, where upper layer of the plain/leveled land consists mostly of silty clay loam soils, rich in organic matter content. The subsurface strata are generally sandy loam with gravel. The soils of the hill slopes consist mostly of thin layered sandy loam soils, underlain by rocks or gravelly materials. The valley terraces in-between the mountains are very fertile and used for intensive cropping, while, the hill slopes are used for forest vegetative cover.

Soil samples were collected on April 13, 2017 and analyzed for establishing baseline conditions to establish soil fertility and identify any current soil contamination. A total of 4 samples were collected and analyzed in the HBP Laboratory and ALS Malaysia.[4]

Key observations are as follows:

- **Physical:** The pH of soil samples at all sampling locations ranges between 7.9 and 8.1. Higher values of EC are observed under forest-based land use system compared to the agricultural land.
- **Nutrients and Organics:** Organics at all sampling locations don't vary significantly. The maximum organic matter and organic carbon values are observed as 5.46% and 3.13%, respectively. Phosphates were not detected at any of the sampling locations. Nitrates are only observed on agricultural land with the maximum value as 11.6 mg/kg. Potassium is also high on agricultural lands with the maximum value as 2,220 mg/kg. Macronutrient contents shows high fertility on agricultural lands.
- **Metals and Major Ions:** Metal contents do not vary significantly through the area sampled, indicating absence of contamination from any industrial activity or spills. Results for boron, cadmium, mercury, selenium and silver were below the level of reporting.

Visual Character

The visual baseline documents the current aesthetic and visual conditions of the proposed Project site as seen from the nearby receptors. A survey was conducted on May 5, 2017 at four locations and photographs were stitched to form 180° panoramic views in the direction of Project activities.

The mountainous landscape, deep gorges and vegetation greatly restricts visibility to a maximum of 0.5 to 1.5 km at receptor locations.

Climate

A regional climate overview was established using available data from Balakot weather station. This is the nearest Pakistan Meteorological Department (PMD) weather station to

[4] HBP Lab conducted pH, EC and organic matter tests, whereas the remaining were conducted at ALS Malaysia

the Project. The climate analysis of Study Area was carried out based on climatic normal (1961 – 1990) developed by PMD and by classifying it into different seasons as follows:

Summer (mid-March to mid-June)

Characterized by high temperatures, moderate rainfalls with moderate humidity and high speed-winds.

Summer Monsoon (mid-June to mid-September)

The summer monsoon, hereafter referred to as the Monsoon, is characterized by high temperatures (although milder than the summer), significantly high rainfalls with high humidity and moderate speed-winds, slightly lower than summers.

Post-Monsoon summer (mid-September to mid-November)

Characterized by moderate temperatures, low rainfalls with moderate humidity higher than summers, as the humidity again reduces after monsoon and low speed-winds.

Winter (mid-November to mid-March)

Characterized by very low temperatures, moderate rainfalls, with an increasing amount of rainfall at the end of the winter, with relative humidity greater than post-monsoon summer and moderate speed-winds.

Climatic normal data for the time period of 1961 – 1990 was compared with more recent data from 1991 – 2011 for temperature and precipitation. Climatic normal are based on 30-year period and developed by the PMD. The following conclusions can be drawn:

- **Temperature:** There is slight variations in temperature observed in recent data as compared to climatic normal. The increase in mean temperatures in recent years is 0.2 ^{0}C. This shows that overall temperature is increased at the Project site.
- **Rainfall:** The amount of rainfall only increased in the months of January, June and September by an amount of 1 mm, 3 mm and 29 mm, respectively. However, in the rest of the months the amount decreases. The decrease in annual amount of rainfall is 175 mm.

Possible reasons for the change in weather parameters may be because of climate change or urbanization, which can explain increased temperatures and decreased amount of rainfalls.

Water Resources

Water resources in the area consist of surface water including rivers and nullahs and groundwater including springs and boreholes.

Regional Hydrology

The Dam and Powerhouse are located on the Kunhar River. The Kunhar River originates from the glaciers above Lulusar Lake in the Kaghan Valley of KP. Glaciers of Malka Parbat and Makra Peak and the waters of Saiful Muluk Lake feed the river. It passes through Jalkhand and meets Jhelum River at Rarra. The drainage area of the river is

2,535 km^2, with elevation ranging from 600 to 5,000 m.[5] It is one of the biggest tributaries of the Jhelum River Basin and the only main tributary situated entirely in Pakistan's territory. Snowmelt from the Kunhar Basin contributes 65% of the total discharge of the Kunhar River and 20-40% of the Jhelum River at Mangla.[6]

Although, the Kunhar River discharges into the Jhelum River, flow changes due to the will not result in flow changes in the Jhelum River due to the near complete Patrind HPP downstream of the . The Kunhar River has a steep gradient and flows through narrow gorges through much of its length. It can be observed that peak flows are observed during June on the river throughout the river.

The Kunhar River has two temperature regimes; upstream of Kaghan the water is cooler with average summer temperatures of 8-10 ºC and downstream of Kaghan temperatures are higher and near 12-13 ºC. The Jhelum River at its confluence with the Kunhar has a temperature of 16-17 ºC and the cooler waters of the Kunhar have a moderating influence on the Jhelum.

Dam Site Hydrology

The hydrology at the dam site is typical of Himalayan rivers, characterized by peak flows in the month of June associated with melting of snow at higher elevations in the catchment, followed by declining flows in the summer supported by monsoon rainfall and continuing snowmelt in the months of July and August. The dry or low flow winter season typically extends from October through February when the flows are reduced to the order of one sixth of peak in the month of June.

Community Water Supply Census

A census was carried out to map the community water resources for villages near Project facilities. A 500 m buffer around the underground headrace tunnel in the uphill direction and up till the Kunhar River in the downward direction was demarcated for the survey to account for the distance to which the impact of the tunnel on groundwater might possibly extend.

During survey a total of 70 springs were identified and characterized within the hydro census area. Of the 70 springs, 1 went dry completely and did not used after the 2005 earthquake.

Based on the pH and electrical conductivity of the springs sampled the water is fresh and potable. The total number of households relying on the springs within the area covered by the hydro census is 1,905. The springs are the sole supply for the majority of households for potable water. 50% of active water sources are used to supply drinking water to livestock as well. This is in line with the socioeconomic surveys and discussions during the surveys across the Study Area, where it was reported the drinking water supply is largely, given some exceptions, from springs, and, given some exceptions, the livestock

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5 Mahmood R, Jia S, Babel M. S., January 16, 2016, Potential Impacts of Climate Change on Water Resources in the Kunhar River Basin, *Water, Multidisciplinary Digital Publishing Institute*, Basel, Switzerland

6 Ibid

do not typically venture close to the river to drink river water, and are therefore, also reliant on spring water.

Small tanks are typically built around springs to store water, and act as constant head for water supply pipelines, or such that communities can manually draw water from the tank.

Demand for River Water for Other Uses

River water is not used for irrigation as the slopes on the river bank are steep, cost of pumping water to agricultural lands located at elevations above the river is high, and agriculture depends on rain and water available from streams flowing down the mountain slopes. There is no large or medium scale industry that depends on water, and level of industrialization is very low. River water is not suitable for drinking as it is contaminated by fecal coliform, and communities use water from springs for drinking purposes. Livestock is also mainly dependent on spring water and water from open mountain streams flowing down the slopes. River water can be turbid in seasons and use of river water by livestock is limited to a relatively small fraction of total households that are located close to the river. These uses are insignificant in comparison to the total flow of the river. Quantification of river water use was therefore not considered to be necessary. Identifications of community sources of drinking water, mainly springs, that could be potentially impacted by the project was carried out in detail and is described in the previous section.

Water Quality

Water quality samples from Kunhar River and community springs were collected and analyzed for establishing baseline conditions for surface and groundwater.

A total of seven samples and two quality control duplicates were collected and analyzed. Of these, four surface water samples were collected and analyzed from different sections of the Kunhar River and one from a main tributary. Two were collected from community springs located along the headrace tunnel of the Project.

Key observations on the basis of the results are as follows:

- All the water quality parameters (with the exception of microbiology) are within NEQS and WHO drinking water standards.
- All river and tributary water samples were found bacteriologically contaminated and unsatisfactory for drinking due to fecal contamination. Of the two springs tested, one contained bacteriological contamination while the other was satisfactory for drinking.
- Fifteen metals were analyzed for metal content and are found within permissible levels for drinking water NEQS. However, reported aluminum value at one location W4 (Talhatta gauging station, Kunhar River) is highest among all samples and is exceeding both the NEQS and WHO standards. This can be attributed due to higher colloidal particles in river water.
- No major differences were found within the water quality at all sampling locations.

Ambient Air Quality

The ambient air quality was measured for respirable particulate matter (PM), sulfur dioxide (SO_2) and oxides of nitrogen (NO_X). Air quality sampling was carried out at four different locations in the Study Area between March 19 and May 8, 2017.

Key observations on the basis of the results are as follows:

- The annual and 24-hour concentrations of SO_2, NO_x, NO_2 and NO comply with both the NEQS and IF-EHS limits.
- The 24-hour PM_{10} concentration comply with both the NEQS and IFC-EHS limits at all sampling locations. The 24-hour $PM_{2.5}$ concentration exceeds the NEQS at all sampling locations however, it complies with IFC-EHS interim target 1 at all locations except at A4 (Balakot town) where it exceeds both the NEQS and IFC-EHS limits.
- The concentration of all pollutants at A2 (near dam site) are lowest among all sampling locations.

Traffic

Traffic baseline is prepared to assess the current traffic conditions on the road route that will be used for the Project related transportation of services during construction and operation of the Project. The objectives of the traffic study are to document present traffic situation, identify existing road capacity, bottle necks (congestion points) and potential impacts due to the Project traffic during construction and operation.

Traffic counts were conducted at four locations. At the counting site, two people were stationed for daytime and two for nighttime to separately count the daily traffic in both directions. The traffic count was recorded over a 24-hour period on a weekday (May 4, 2017) and a weekend (May 7, 2017).

Key findings of the traffic count are presented below:

- There was an increase in traffic over the weekends for points T1 - Paras (about 25 to 30% more vehicles) and T2 - Sendori (50% increase in vehicles heading to Balakot town) as they are on the transit route to tourist locations.
- Although the morning peak (9 am) shows a significant drop over the weekends at T3 - Balakot market and T4 - Balakot (from 700-800 vehicles to 500-600 vehicles), the traffic volumes are still generally higher on the weekend with steady flows throughout the day.

Noise Levels

This section defines the baseline ambient noise levels in the Study Area in a manner that can be used for the assessment of the noise impact of the proposed Project. Noise measurements were taken at four locations considered representative of the nearby receptors of possible noise pollution from the Project. Noise readings were taken for 24 hours at each site between May 4 and May 8, 2017.

Key findings of the noise measurements are presented below.

- **Small Town:** Noise levels in both the small towns of Paras (N1) and Sangar (N3) are well within NEQS noise limits and within IFC-EHS limits for most hours other than early morning hours in Paras where the nighttime limits are crossed.
- **Large Town:** The noise levels at N4, which was located within the market of Balakot Town were high and exceed both daytime and nighttime NEQS and IFC-EHS limits. Natural sources such as wind (of which the speed went up to 5.4 m/s during sampling) and river noise may also have contributed to the high noise levels.
- **Forests:** Noise levels at powerhouse site (N2) are steady throughout the day and night at around 50 dbA as there are no varying anthropogenic sources of noise in the area. Constant sources of noise include noise from the river and wind.

Project Impacts

During the scoping stage of the ESIA process, several potential environmental and social impacts of the project were identified. The baseline surveys were conducted keeping in consideration the potential impacts. The potential environmental and social impacts were evaluated based on consideration. A summary of Project impacts is presented in **Exhibit IV.**

Exhibit IV: Summary of Project Impacts

ID	*Aspect*	*Impact*	*Phase*	*Stage*	*Magnitude*	*Timeframe*	*Spatial Scale*	*Consequence*	*Probability*	*Significance*	*+/-*
8	Ambient air quality	Increase in ambient and ground level concentration of air pollutants from construction activities and vehicular movement may cause health impacts to the community.	C	Ini.	Moderate	Medium Term	Small	Medium	Possible	Medium	-
				Res.	Minor	Short Term	Small	Low	Possible	Low	-
9	Blasting and vibration	Vibration from blasting during the construction phase may disturb local communities.	C	Ini.	Moderate	Medium Term	Intermediate	Medium	Possible	Medium	-
				Res.	Minor	Short Term	Small	Low	Possible	Low	-
10	Blasting and vibration	Blasting may pose a health hazard due to flying debris.	C	Ini.	Moderate	Short Term	Intermediate	High	Possible	Medium	-
				Res.	Minor	Short Term	Small	Low	Possible	Low	-
11	Hydrology and water quality	Alterations of natural passage of springs due to blasting for tunnels may disrupt the water supply for mountain spring users.	C	Ini.	Moderate	Long Term	Intermediate	High	Possible	High	-
				Res.	Minor	Medium	Intermediate	Low	Possible	Low	-
12	Hydrology and water quality	Use of local water resources for construction activities may reduce the water availability for local communities.	C	Ini.	Moderate	Short Term	Intermediate	Medium	Possible	Medium	-
				Res.	Minor	Short Term	Small	Low	Unlikely	Low	-
13	Hydrology and water quality	Discharge from construction activities can potentially result in the contamination of groundwater and surface water.	C	Ini.	Moderate	Short Term	Small	Low	Possible	Low	-
				Res.	Minor	Short Term	Small	Low	Unlikely	Low	-

ID	Aspect	Impact	Phase	Stage	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance	+/-
14	Construction noise	Increase in ambient noise levels due to operation of construction equipment, movement of construction traffic and blasting may create nuisance for nearby communities and visiting tourists.	C	Ini.	Moderate	Short Term	Small	Low	Possible	Low	-
				Res.	Minor	Short Term	Small	Low	Possible	Low	-
15	Soil, topography and land stability	Contamination of soil as a result of accidental release of solvents, oils and lubricants can degrades soil fertility and agricultural productivity.	C	Ini.	Moderate	Medium	Intermediate	Medium	Possible	Medium	-
				Res.	Minor	Medium	Intermediate	Low	Unlikely	Low	-
16	Soil, topography and land stability	Land clearing, excavation, tunnel boring and other construction activities may loosen the top soil in the Project area resulting in loss of soil and possible acceleration of soil erosion and land sliding, especially in the wet season.	C	Ini.	Moderate	Short Term	Small	Low	Definite	Low	-
				Res.	Minor	Short Term	Small	Low	Possible	Low	-
17	Soil, topography and land stability	Failure of spoil dumping sites resulting in increased erosion and sediment load entering river.	C, O	Ini.	Moderate	Long Term	Intermediate	High	Possible	High	-
				Res.	Moderate	Medium Term	Intermediate	Medium	Unlikely	Low	-
18	Aesthetics	Deterioration of aesthetics and visual amenity of nearby receptors due to construction activities, including vehicular movement on roads, may cause disturbance in aesthetics for tourists, businesses and nearby communities.	C	Ini.	Minor	Short Term	Small	Low	Possible	Low	-
				Res.	Minor	Short Term	Small	Low	Possible	Low	-

ID	Aspect	Impact	Phase	Stage	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance	+/-
19	Aesthetics	Deterioration of aesthetics and visual amenity of nearby receptors due to low flow in the river may affect the scenic value of the area.	O	Ini.	Minor	Medium	Small	Low	Possible	Low	-
				Res.	Minor	Medium	Small	Low	Possible	Low	-
20	Aesthetics	Permanent impact in aesthetics due to proposed developments.	O	Ini.	Minor	Medium	Small	Low	Possible	Low	-
				Res.	Minor	Medium	Small	Low	Possible	Low	-
21	Traffic and roads	Improved accessibility due to construction of Project access roads.	C	Ini.	Minor	Short Term	Small	Low	Possible	Low	+
				Res.	Minor	Short Term	Small	Low	Possible	Low	+
22	Traffic and roads	Increase in congestion, due to increased traffic volume will cause delays.	C	Ini.	Minor	Short Term	Small	Low	Possible	Low	-
				Res.	Minor	Short Term	Small	Low	Possible	Low	-
23	Traffic and roads	Increase in traffic volume will deteriorate the air quality.	C	Ini.	Minor	Short Term	Small	Low	Possible	Low	-
				Res.	Minor	Short Term	Small	Low	Possible	Low	-
24	Traffic and roads	Increased risk to community safety due to increased traffic volume during the construction phase near communities.	C	Ini.	Minor	Short Term	Small	Low	Possible	Low	-
				Res.	Minor	Short Term	Small	Low	Possible	Low	-
25	Traffic and roads	Degradation of the pavement due to use by heavy construction traffic.	C	Ini.	Minor	Short Term	Small	Low	Possible	Low	-
				Res.	Minor	Short Term	Small	Low	Possible	Low	-

C: Construction (and pre-Construction); O: Operation; Init: Initial; Res: Residual; Duration: Short (less than four years), Long (beyond the life of the Project)
Frequency: High (more than 10 times a year), Low (less than once a year)

Overview of Biodiversity Values

Aquatic Biodiversity

The main aspects of the aquatic biodiversity in the Aquatic Study Area include the fish fauna, macro-invertebrates, and riparian vegetation.

Overview of Fish Fauna in Jhelum River

The long-distance migratory species Alwan Snow Trout *Schizothorax richardsonii,* as well as the Himalayan Catfish *Glyptosternum reticulatum* and Kashmir Hillstream Loach *Triplopysa Kashmirensis* are widely distributed species and found in the Kunhar River upstream and downstream of proposed Project. The species Nalbant's Loach *Schistura nalbanti*, Stone Barb *Schistura alepidota*, Arif's Loach *Shistura arifi* and Flat Head Catfish *Glyptothorax pectinopterus* are mainly found in Kunhar River and tributaries downstream of the proposed Project dam but they are also recorded from few places upstream. The species Kunar Snow Trout *Schizothorax labiatus* is exclusively found in Kunhar River downstream of the proposed dam site. They tend to migrate in summers towards upper parts of the river. Two introduced species Brown Trout *Salmo trutta fario* and Rainbow Trout *Oncorhynchus mykiss* are found exclusively upstream of the proposed dam. These two are cold water species and of high food value. There is an extensive raceway7 culture of Rainbow Trout in the areas upstream and downstream of the proposed dam. Alwan Snow Trout (both upstream and downstream of the dam) and Kunar Snow Trout (mostly downstream of the dam) are two other species of food value. They are not cultured but are captured from the river.

A total of ten species have been reported from the Kunhar River based on the surveys carried out in February 2017 and May 2017 as a part of this study, in July 2016 as a part of the Biodiversity Strategy for Jhelum Poonch River basin – Preparatory Phase,8 and advice from Dr Muhammad Rafique, a fish expert with the Pakistan Museum of Natural History (PMNH). Out of these, one species is a long-distance migratory species and two are endemic to the Jhelum Basin.

Migratory Fish Species

Based on the surveys carried out in July 2016 and February and May 2017, the Aquatic Study Area contains one long distance migratory species, the Alwan Snow Trout *Schizothorax richardsonii*. The species is listed as Vulnerable on the IUCN Red List. A map showing the range of the species is provided in **Exhibit V**.

Endemic Fish Species

There are two fish species endemic to the Jhelum Basin, found in the Aquatic Study Area the Nalbant's Loach and the Kashmir Hillstream Loach. The ranges for these species are shown in **Exhibit VI** and **Exhibit VII**. The Nalbant's Loach prefers shallow water, mainly riffle habitat in tributaries. Damming will alter its habitat irreversibly causing drastic population declines. The Kashmir Hillstream Loach prefers shallow riffles and spawns in side channels. A Critical Habitat Assessment, carried out as part of the

7 Raceway is based on the continuous water flowing through the culture tanks

8 Hagler Bailly Pakistan, September 2016. Biodiversity Strategy for Jhelum Poonch River basin – Preparatory Phase, for the International Finance Corporation, Washington D.C.

Ecology Baseline, determined that the Project is located in Critical Habitat based on the population of the endemic species in the Discrete Management Unit (DMU) defined for the Critical Habitat Assessment of the Project.

Exhibit V: Range of the Alwan Snow Trout

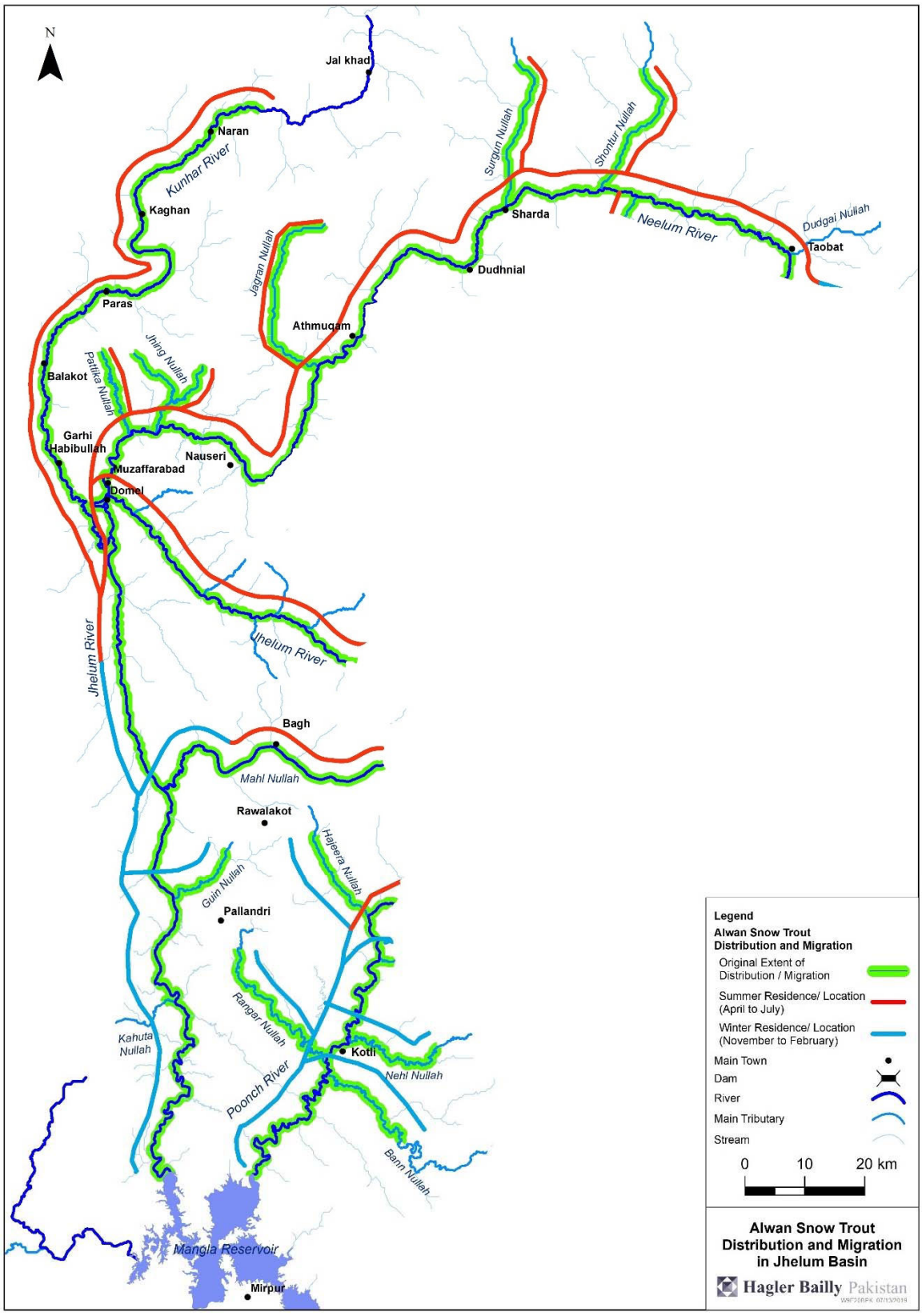


Exhibit VI: Range of the Nalbant's Loach

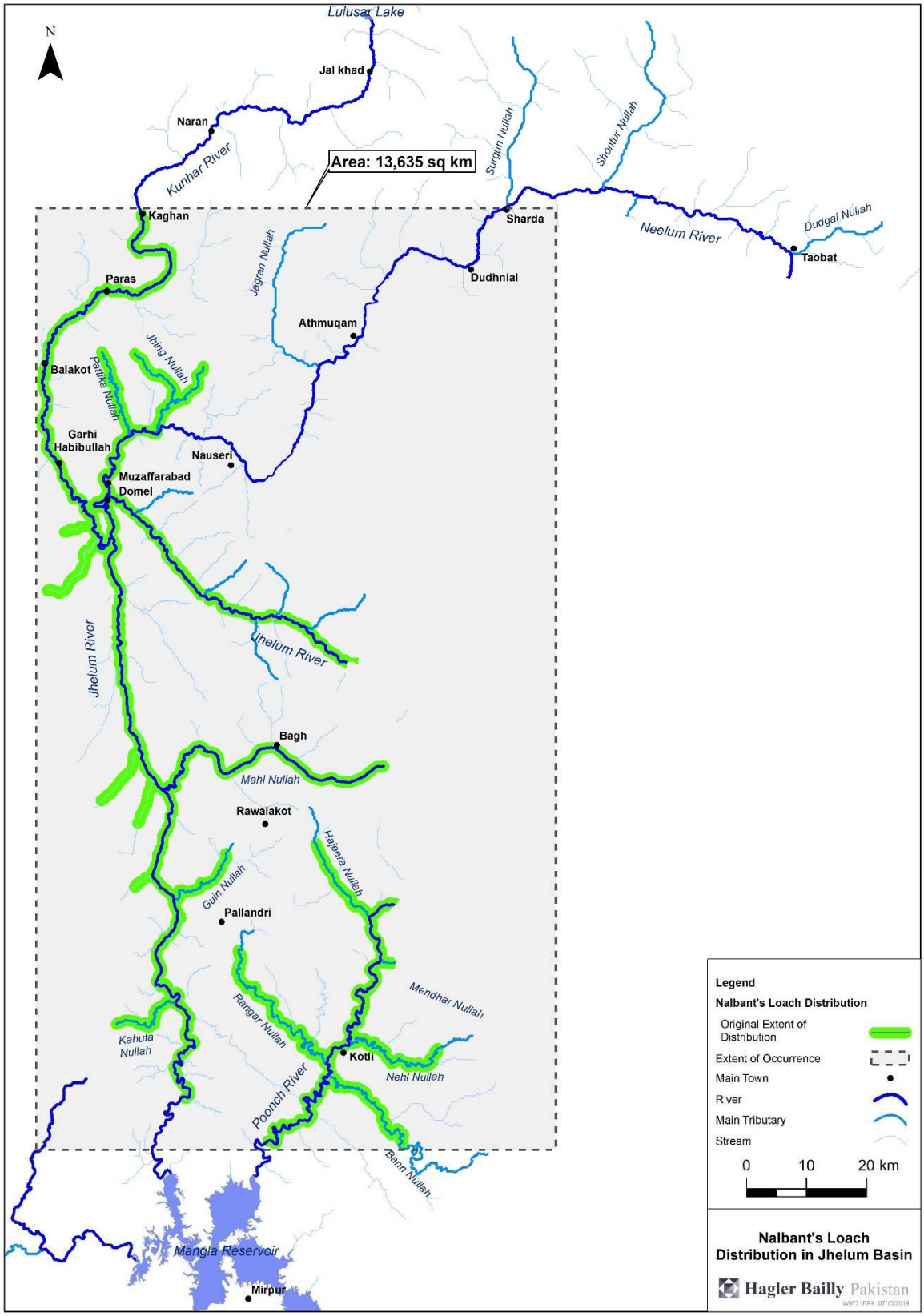
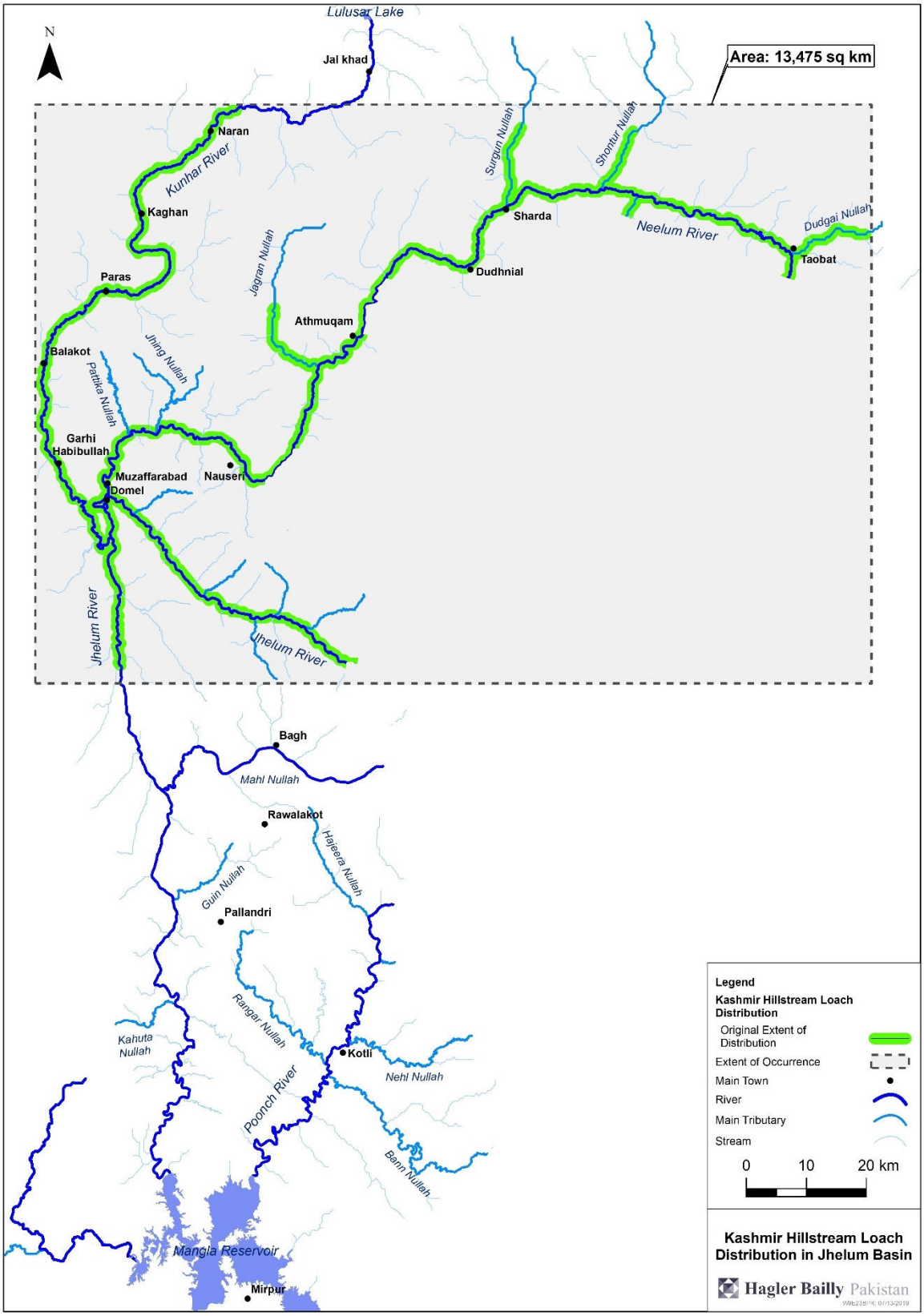


Exhibit VII: Range of the Kashmir Hillstream Loach



Macro-invertebrates

Based on surveys carried out for the ESIA the most abundant macro-invertebrate taxa reported include *Baetis sp*. followed by *Rhithrogena sp.*. Abundance was found to be highest upstream of Paras village. Species richness was found to be the same throughout the Aquatic Study Area.

Riparian Vegetation

The dominant species include *Parthenium hysterophorus*. *Conyza Canadensis* and *Rumex dissectus*. Vegetation cover was reported as ranging between 1.48% and 0.52%, average plant count was 27.5 and floral diversity was reported as 3.25 species per Sampling Location. One of the dominant plant species in the Riparian zone is the invasive species *Parthenium hysterophorus*.

Terrestrial Biodiversity

Terrestrial Flora

This area is mountainous and the Terrestrial Study Area has an elevation range of 1,023 m to 2,199 m.[9] A total of 42 plant species were identified in the surveys carried out. None of the species observed are on the IUCN Red List or are globally/nationally threatened species, endemic species or protected species with the exception of Common Walnut *Juglans regia*, which is Near Threatened based on the IUCN Red List. The locals are dependent on the plants for numerous uses, some of which include food sources, medicinal products, fodder and fuel.

Mammals

The forests of the area provide habitat for mammal species including Yellow-throated Marten *Martes flavigula*, Giant Red Flying Squirrel *Petaurista petaurista*, Small Kashmir Flying Squirrel *Hylopetes fimbriatus*, Leopard Cat *Prionailurus bergalensis*. Grey Langur *Semnopithecus entellus*, Rhesus Macaque *Macaca mulatta*, Common Leopard *Panthera pardus*, Asiatic Black Bear *Ursus thibetanus*, Grey Goral *Nemorhaedus goral*, Porcupine *Hystrix indica*. Murree Vole *Hyperacrius wynnei*. Turkestan Rat *Rattus turkestanicus*, Long-tailed Field Mouse *Apodemus sylvaticus*. Whiskered Bat *Myotis muricola* and Grey Long-eared Bat *Plecotus austriacus*. The locals reported common sightings of the Asiatic Jackal, Red Fox, Common Leopard and Wild Boar in Terrestrial Study Area. During the July 2017 Survey no mammal species of conservation importance were observed in the Terrestrial Study Area.

Avifauna

A total of 48 species of birds were observed during surveys carried out as part of the ESIA. Highest abundance and species diversity were found at Sampling Locations located in Scrub Forest habitat type. Abundant bird species in the Terrestrial Study Area included the Common Raven *Corvus corax*, the Bank Myna *Acridotheres ginginianus*, the White-cheeked Bulbul *Pycnonotus leucotis*, Black Drongo *Dicrurus macrocercus*, and Great Tit *Parus major*.

9 Nasir, Yasin J., and Rubina A. Rafiq. "Wild flowers of Pakistan." Karachi: Oxford University Press xxxiii, 298p., 104p. of plates-illus., col. illus. ISBN195775848 (1995).

None of the bird species observed are of conservation importance based on the IUCN Red List of Species.

Herpetofauna

A total of six species of reptiles were during the surveys carried out as part of the ESIA. The highest reptile abundance, species diversity and density were observed in Pine Forest habitat type. None of the species observed are of conservation importance based on the IUCN Red List of Species. Three species are listed on the CITES Appendices. These include the Jan's Cliff Racer *Platyceps rhodorachis* (I), the Caspian Cobra *Naja oxiana* (II) and Checkered Keelback *Xenochrophis piscator* (III). None of the species observed are endemic.

Overview of Socioeconomic Environment

Rural settlement surveys were undertaken in selected settlements with river dependence or within 1 km of Project facilities. Detailed interviews were conducted with key informants to gather information on each settlement's social and economic setup, with focus on infrastructure and livelihoods. Key physical and socioeconomic features of the Study Area are illustrated by the photographs in **Exhibit VIII**.

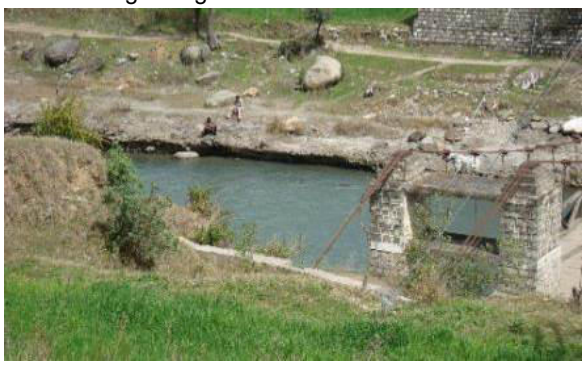
Exhibit VIII: Physical and Socioeconomic Features of the Study Area

Roads and transport in the study area

Water Supply system in study area

Sand Mining Trough at Bararkot

Sand mining with excavator



Fishing with Rod at Talhatta

Fishing at Karnol

A total of 31 settlements were surveyed during the field work, ranging in size from 3 households to 1,500 households. Both the right and left banks of the river are almost similar in terms of settlement distribution and size, and the average households per settlement in all zones is 128. The average household size in the Socioeconomic Study Area is 6.2 individuals, with a minimum of 3.5 and a maximum of 10.

People in the pastoral communities within the Socioeconomic Study Area have a trend of seasonal migration, with one home close to the river and one at higher elevations. These communities move their livestock herds to higher elevations in the mountains for grazing during the summer. Migration into and out of the Socioeconomic Study Area was found to be insignificant over the past 7 years.

People from 7 different casts are resident in the Socioeconomic Study Area, with Gujjar and Syed being the biggest groups. The predominant language is Hindko, however, Gojri is also widely spoken. Urdu, the language of communication is also understood everywhere especially amongst the youth.

School enrolment for both boys and girls was found to be comparable at all levels, in fact enrolment of girls is actually higher in many cases.

Most parts of the Socioeconomic Study Area have access to basic health facilities, such as pharmacies, lady health visitors/workers and dispensaries. No disease was reported as an epidemic, and as expected, the most common illness reported in the adult male and female populations was flu/fever. Other illnesses reported included dysentery, diabetes and jaundice.

The settlements situated on the left bank of Jhelum River in the Socioeconomic Study Area are well connected as there is a road running along the river for its entire length in the area. Communities residing on the right bank are not as well connected, however suspension bridges and unsealed roads do connect them to major roads.

Most surveyed settlements reported having access to a public potable water supply system consisting of a central water storage system, where water collects from a mountain spring and is supplied to the community via a pipeline up to a central point in the community. Almost all surveyed settlements also reported having access to spring water at relatively short distances.

None of the settlements surveyed in the Socioeconomic Study Area are connected to a municipal sewage system. Most human waste is disposed of in septic tanks and all other wastewater eventually runs off into the Jhelum River. Most settlements surveyed reported access to pit latrines of some type.

The three major fuel sources in the Socioeconomic Study Area include electricity, fuelwood and liquefied petroleum gas (LPG). Natural gas is not supplied in the area. None of the settlements are connected to the country's landline telephone network, however most of the area does receive a mobile phone signal.

The Socioeconomic Study Area and surroundings are generally peaceful, and there are no major law and order problems reported. Police check posts are only present on main Kaghan Highway. Police check posts monitor incoming traffic to tourist areas, to determine purpose of visitors to the valley.

Banks and markets are available mainly in Balakot city. Shops are present on main Kaghan Highway. The shops provide for the day to day needs of the local communities or to supply travelers and tourists. For major purchases all settlements in the survey area depends mainly on Balakot city, which is the hub of economic activity in the region.

55% of the total employable population is employed while 25% are unemployed. The remaining are students, retired and others such as labor and small business operators.

The major sources of income are private and government services and business while other significant livelihoods include wage labor, and work as skilled artisans. A significant portion of households in the Socioeconomic Study Area earn less than PKR 25,000 and can therefore be considered impoverished.

The average landholding in all settlements ranges from 4 to 7 kanals per household. The largest landholding size was reported as 7.67 kanals. The main winter crop in all zones is wheat and the main summer crop is maize. Most agricultural land is rain fed with almost no dependence on river water for irrigation. The agricultural economy is purely subsistence in nature.

Livestock commonly owned include bullocks/buffalos, cows and goats. Livestock owners often engage herders to rear goats, whereas poultry, cows and buffalo are reared at home.

River dependent socioeconomic activities in the Socioeconomic Study Area were found to be quite limited.

Sediment (sand, gravel and cobble) mining is carried out throughout the Study Area. The mineable sediment resource is being extracted to meet small-scale construction demand,

involving construction and maintenance of local residential and commercial buildings as well as for roads. Miners in the Balakot area reported that the import of sediment varies from year-to-year depending on the status of construction industry.

The mining techniques are crude, involving use of labor for dredging. No mechanical extraction was observed anywhere in the Study Area except Jagir (Thanda Mor) where sand is extracted through an excavator. The sand and gravel is mined using shovels and spades and is loaded onto animals and vehicles, from where it is transported to the roadside.

Fishing for self-consumption was observed in the Study Area. Fishing as a business was not observed in any of the six zones except in Zone 5 at Balakot. Even here it was on a small scale to meet the local restaurant clientage. The fishing season lasts between six months through the year, depending on the fish species caught.

Fuel wood is the main source of energy for domestic cooking and heating. Respondents reported that fuel wood is collected from the farmlands and dead-fallen trees in the forests. There is limited dependence on driftwood collected from the riverbanks as source of fuel wood except in settlements at the peripheries of Balakot where the river flows through more plain areas creating room for such activities

Recreational dependence on the river was reportedly low in all the zones. During the survey the respondents did not cite riverside fishing, boating or picnics as a major recreational activity. However, the roadside hotel owners reported that riverside recreation was popular to certain extent among the tourists from other areas.

Environmental Flow Assessment and Impacts on Aquatic Ecology

The assessment of impact on aquatic ecology presented in the report provides predictions for changes in fish populations due to the Project associated with the barrier created by the dam, and change in flow conditions in the Kunhar River. The assessment also takes into account other anthropogenic factors such as harvesting of fish and sediment from the river system that contribute to degradation of aquatic ecosystems and hence fish populations in parallel. Given the dynamic nature of changes caused by both the Project and non-Project related pressures, holistic assessment methodologies already tested in the Jhelum Basin were adopted that provide a time series forecast of changes, as opposed to a snap-shot prediction of post Project conditions.

The predictions presented in the report are for a selected set of fish species that represent the range of fish species occurring in the river and tributary system that will be impacted in terms of behavior and response to changes imposed by the Project. The changes in fish populations incorporate and reflect the impacts of changes in other ecosystem indicators, and were therefore considered relevant for discussion in this section.

Baseline Scenario

There are several other major hydropower projects (HPPs) under construction on the Kunhar River, and several more are proposed. The ones under construction include the Patrind HPP and the Sukki Kinari HPP while the one proposed include the Naran HPP and the Batakundi HPP. All of the HPPs under construction or nearing completion will create barriers to inter alia, fish and sediment movement in the Kunhar Basin.

More specifically:

- The PHPP has blocked the passage of migrating fish from the Jhelum River into the Kunhar River;
- SKHPP is expected to operate as a peaking plant it will discharge peaking flows in the 1.5 km reach between its outfall and the reservoir; and
- SKHPP will reduce sediment flow downstream and block fish migrations due to its dam.

Environmental Flow Release Scenario

For operational scenarios both baseload and peaking operations were considered. EFlow release was varied at 20%, 35% and 50% of the minimum 5 day dry season flow[10] of 17.4 m^3/s along with the EFlow release of 1.5 m^3/s as suggested in the feasibility study.

Management Scenario

Anthropogenic pressures on the Kunhar River, which impact the selected indicators include the following:

1. Selective fishing pressure,
2. Non-selective fishing pressure,
3. Sediment mining,
4. Nutrient enrichment,
5. Tree cutting.

Four management scenarios, which represent the predicted river condition in 51 years[11] under different levels of protection/management were considered. The protection levels considered were:

- **Business as Usual Protection (BAU):** increase non-flow-related pressures in line with current trends, i.e. 2017 pressures double in intensity over the next 51 years.
- **Low Protection (LP):** maintain 2017 levels of non-flow-related pressures on the river; i.e., no increase in human-induced catchment pressures over time.
- **Moderate Protection (MP):** reduce 2017 levels of non-flow-related pressures by 50%, i.e., decline in pressures (relative to 2017) over time.
- **High Protection (HP)**: reduce 2017 levels of non-flow-related pressures by 90%, i.e., decline in pressures (relative to 2017) over time.[12]

Results and Conclusions

Two operational scenarios are recommended for consideration of the stakeholders:

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[10] Min 5 day dry season flow is calculated by DRIFT. It calculates the median value of a running 5 day average over the 51 year record.

[11] This is the length of the historical hydrological record that was used in the assessment.

[12] Experience in neighboring rivers has shown that it is easier to impose a complete ban on activities such as illegal fishing and mining than it is to reduce these activities by half.

- Preferred Case: Baseload operation with an EFlow of 1.5 m^3/s and High Protection
- Alternate Case: Peaking operation with an EFlow of 6.1 m^3/s and High Protection

With a baseload operation it will be possible to meet the requirement of Net Gain in population of fish species that trigger Critical Habitat, with a margin for uncertainties in predictions of EFlow modeling of the order of 15% above and below the predicted mean change in populations, and a more conservative baseline of LP level of protection against which Net Gain is calculated.

With a peaking operation and EFlow release of 6.1 cumec, there will be a loss in power generation of the order of 3.5% compared to the loss under a baseload operation with an EFlow release of 1.5 cumec. While the basic requirement of Net Gain will be met assuming a Business as Usual Baseline, there will be limited margin for accommodating uncertainties in EFlow modeling predictions. Net Gain requirement will not be met assuming a conservative baseline with a Low Protection level of protection.

Study of Alternatives

No Project Option

KP and Pakistan are going through an acute power shortage. The gap between supply and demand has crossed 5,000 MW. The proposed Project will supply the much needed power to reduce the current gap. Environmentally, this Project will contribute towards improving the air quality as in the long run it will displace fossil fuels used in power generation. The Project also aims to protect fish fauna in the Jhelum River and its tributaries to achieve improvement in fish populations for fish species of conservation importance. A Biodiversity Management Plan has been prepared and will be implemented as a part of the Project to achieve this objective. Therefore the 'no project' option will have a negative impact on the economy as well as on the environment in the Jhelum River.

Alternative Technologies and Scale for Power Generation

The alternatives to the proposed run-of-the-river (RoR) hydropower project include power generation from LNG/imported natural gas based combined cycle gas turbines (CCGTs), coal fired steam plants, and fuel oil based diesel engines. In addition, other technologies such as nuclear, and wind and solar renewable energy power plants could also be considered as alternatives. An analysis of the life cycle average cost of generation shows that cost of power generation for the proposed large size run of river (RoR) hydropower project is presently comparable to that for LNG and coal based options. Cost of power generation for the large hydropower projects is also presently lower than that for wind energy and solar PV projects where power generation is intermittent and weather dependent.

Project Impacts

During the scoping stage of the ESIA process, several potential environmental and social impacts of the project were identified. The baseline surveys were conducted keeping in

consideration the potential impacts. The potential environmental and social impacts were evaluated based on consideration. A summary of Project impacts is presented in

Exhibit IX**.**

Exhibit IX: Summary of Significant Impacts

ID	*Aspect*	*Impact*	*Phase*	*Stage*	*Magnitude*	*Timeframe*	*Spatial Scale*	*Consequence*	*Probability*	*Significance*	*+/-*
1	Aquatic Ecology	Change in the Ecological Integrity through implementation of the BAP (see Volume 2C of the EIA)	C, O	Init	Major	Long Term	Extensive	High	Definite	High	+
2	Aquatic Ecology	Loss of riverine ecosystem due to inundation by Project Reservoir	C, O	Init	Major	Long Term	Intermediate	High	Definite	High	-
				Res	Major	Long Term	Intermediate	High	Definite	High	-
3	Aquatic Ecology	Degradation of the river ecosystem in the low flow segment downstream of the Project dam	C, O	Init	Major	Long Term	Intermediate	High	Definite	High	-
				Res	Major	Long Term	Intermediate	High	Definite	High	-
4	Aquatic Ecology	Degradation of the River Ecosystem Downstream of the Tailrace	C, O	Init	Major	Long Term	Intermediate	High	Definite	High	-
				Res	Moderate	Long Term	Intermediate	High	Definite	High	+
7	Terrestrial Ecology	Project operation leading to animal disturbance, displacement and decline.	O	Init	Minor	Long Term	Small	Medium	Possible	Medium	-
				Res	Minor	Medium	Small	Low	Possible	Low	-
8	Ambient Air Quality	Increase in ambient and ground level concentration of air pollutants from construction activities and vehicular movement may cause health impacts to the community.	C	Init	Moderate	Medium Term	Small	Medium	Possible	Medium	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
9	Blasting and Vibration	Vibration from blasting during the construction phase may disturb local communities	C	Init	Moderate	Medium Term	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
10	Blasting and Vibration	Blasting may pose a health hazard due to flying debris.	C	Init	Moderate	Short Term	Intermediate	High	Possible	Medium	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
11	Hydrology and Water Quality	Alterations of natural passage of springs due to blasting for tunnels may disrupt the water supply for mountain spring users.	C	Init	Moderate	Long Term	Intermediate	High	Possible	High	-
				Res	Minor	Medium	Intermediate	Low	Possible	Low	-

ID	Aspect	Impact	Phase	Stage	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance	+/-
12	Hydrology and Water Quality	Use of local water resources for construction activities may reduce the water availability for local communities.	C	Init	Moderate	Short Term	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Short Term	Small	Low	Unlikely	Low	-
15	Soil, Topography and Land Stability	Contamination of soil as a result of accidental release of solvents, oils and lubricants can degrades soil fertility and agricultural productivity.	C	Init	Moderate	Medium	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Medium	Intermediate	Low	Unlikely	Low	-
17	Soil, Topography and Land Stability	Failure of spoil dumping sites resulting in increased erosion and sediment load entering river.	C	Init	Moderate	Long Term	Intermediate	High	Possible	High	-
				Res	Moderate	Medium Term	Intermediate	Medium	Unlikely	Low	-
26	Livelihood and Well-being	Direct, indirect and induced employment at the local levels, resulting in increased prosperity and wellbeing due to higher and stable incomes of people.	C, O	Init	Minor	Long term	Extensive	Medium	Possible	Medium	+
				Res	Moderate	Long term	Extensive	High	Definite	High	+
27	Livelihood and Well-being	Increase in the stock of skilled human capital due to transfer of knowledge and skill under the Project resulting in enhanced productivity of the local labor.	C, O	Init	Minor	Long term	Intermediate	Medium	Possible	Medium	+
				Res	Moderate	Long term	Extensive	High	Possible	High	+
28	Livelihood and Well-being	Increase in recreational and subsistence fishing due to increase in catch of fish following creation of favorable habitats for the fish in the Kunhar River	C, O	Init	Minor	Long term	Extensive	Low	Possible	Low	+
				Res	Minor	Long term	Extensive	Low	Possible	Low	+
29	Livelihood and Well-being	Loss of income from sediment mining due to change in pattern of sediment deposition following construction of the dam	O	Init	Major	Long term	Extensive	High	Definite	High	-
				Res	Minor	Medium	Small	Low	Possible	Low	-

ID	*Aspect*	*Impact*	*Phase*	*Stage*	*Magnitude*	*Timeframe*	*Spatial Scale*	*Consequence*	*Probability*	*Significance*	*+/-*
30	Livelihood and Well-being	Loss of assets and livelihood as a result of land acquired for the Project	D, C	Init	Major	Long term	Extensive	High	Definite	High	-
				Res	Minor	Medium	Small	Low	Possible	Low	-
31	Socio-Cultural Impacts	Increase in population due to in-migration of job seekers (in-migrants) leading to pressure on existing social infrastructure and services in the Study Area.	C	Init	Moderate	Medium	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Medium	Intermediate	Low	Possible	Low	-
32	Socio-Cultural Impacts	Disputes over distribution of Project employment within and between Study Area inhabitants and the in-migrants resulting in social unrest	C	Init	Moderate	Medium	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Short term	Intermediate	Low	Possible	Low	-
33	Socio-Cultural Impacts	Potential social unrest in the Study Area due to conflicting socio-cultural norms amongst the inhabitants and in-migrants.	C	Init	Minor	Short term	Small	Low	Possible	Low	-
34	Socio-Cultural Impacts	Submergence of the graveyards.	C	Init	Moderate	Medium	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Short term	Intermediate	Low	Possible	Low	-

C: Construction (and pre-Construction); O: Operation; Init: Initial; Res: Residual; Duration: Short (less than four years), Long (beyond the life of the Project)

Frequency: High (more than 10 times a year), Low (less than once a year)

Climate Change Risk

A climate change risk assessment carried out in collaboration by Aqualogous, Team Consultants and Hagler Bailly Pakistan, included as part of the Feasibility Study, indicates the following based on analysis of multiple models, as well as literature:

- General potential increase in annual precipitation associated with increase in summer Monsoon precipitation.
- Decrease in winter and spring precipitation.
- Likely increase in the Probable Maximum Flood, based on the Maximum Precipitable Water.

The changes will have consequence on dam operations covered under the scope of the Feasibility Assessment. With respect to environmental impact, i.e. impact on receptors, the following impacts with dam in place, in conjunction with climate change are likely:

- Decreased environmental flow release downstream of the dam, particularly during low flow conditions in winter, based on assessed future green-house gas emissions scenarios and climate change models utilized by the IPCC Fifth Assessment Report (AR5).
- Increase risk of dam failure due to increase in Probable Maximum Precipitable water, and thereby Probable Maximum Flood, under high green-house gas concentration scenarios (representative concentration pathway 8.5) by 2070-2100.

With respect to the risk of decreased environmental flow releases, the design is resilient to climate change, since low level outlets are available and can be utilized to release environmental flow.

In addition, with respect to increase in Probable Maximum Precipitation, based on consultation with dam engineers, the dam is already over designed and an increase of 30-35% in probable maximum precipitation peak, a conservative estimate based on a 30-35% increase in maximum precipitable water, and the dam break risk assessment considers similarly large floods, that are unlikely to cause failure of the dam. Therefore, with respect to environmental impacts on receptors, in alignment with the impact assessment methodology (**Section 7.1**), the dam is resilient to climate change.

Cumulative Impact Assessment

The methodology used for the CIA of the Project has been adapted from the guidelines of the International Finance Corporation. The study area selected for the CIA (CIA Study Area) includes the entire length of the Kunhar River from Lulusar Lake down to its confluence with the Jhelum River, a total length of 116.3 km. The temporal scope of the CIA spans a period of 51 years up till the year 2068.

Priority VECs were identified through an Ecosystem Services Review and from ecological studies. The ecosystem services and biodiversity values identified as important were combined to develop a list of prioritized VECs for the purpose of this study. The prioritized VECs for this CIA are:

- River ecology with emphasis on fish fauna

- Recreation and tourism

Impact on Fish Fauna

Three environmental management scenarios were considered when assessing the impact on fish fauna in the CIA Study Area.

A 'Business as Usual' (BAU) scenario, which predicts the health of the river ecosystem in the absence of any additional dams (both planned and under construction) but with present day non-flow pressures maintained at Business as Usual levels.

A 'Baseline Management' (BM) scenario predicts the health of the river ecosystem after the construction of all five dams, with the following operational and environmental management measures in place:

- Project will operate with a constant baseload flow and an EFlow of 1.5 m^3/s
- Sukki Kinari HPP, Naran HPP and Batakundi HPP will operate following a peaking regime
- Patrind HPP will continue to operate with a baseload flow, however this has no impact on the Kunhar River as its powerhouse is located on the Jhelum River and the impacts of peaking will occur in the Jhelum River
- Protection Level 3, or Pro 3 level of protection will be implemented in the Project area of management
- Protection Level Business As Usual (BAU) will be implemented in the Patrind HPP, Sukki Kinari HPP, Naran HPP and Batakundi HPP areas of management

An 'Enhanced Management' (EM) scenario predicts the health of the river ecosystem after the construction of all five dams, with the following operational and environmental management measures in place:

- Project, Naran HPP and Batakundi HPP will operate with a constant baseload flow
- Sukki Kinari HPP will operate following a peaking regime
- Patrind HPP will continue to operate with a baseload flow, however this has no impact on the Kunhar River as its powerhouse is located on the Jhelum River and the impacts of peaking will occur in the Jhelum River
- Protection Level 3, or Pro 3 level of protection will be implemented in the areas of management of all HPPs

The likely cumulative impacts on three indicator fish species are described in the following sections.

Alwan Snow Trout

The Alwan Snow Trout faces heavy selective fishing pressures, which are expected to increase significantly under the business as usual scenario. This is predicted to reduce Alwan Snow Trout populations by around 70% throughout the Kunhar River. The expected impact of all dams will result in the complete elimination of the Alwan Snow

Trout in most of the Kunhar River. The only exception under this scenario is the stretch between Project dam to Patrind reservoir, where a 25% decrease compared to current levels is expected. This stretch will continue to support Alwan Snow Trout populations because of the 1.5 m3/s EFlow from the dam to the powerhouse, and the base flow from the power house to the Patrind reservoir. Under Enhanced Management strict protection is applied throughout the river basin and baseload flow is maintained from all dams except Sukki Kinari. However, the barrier effect of the dams combined with reduced flows, especially between dams and powerhouses is enough to eliminate the Alwan Snow Trout in most of the river. River sections downstream of Project dam continue to support fish populations largely due to the dam's EFlow. Other sections or river, such as Sukki Kinari dam to tailrace and Patrind reservoir to the Jhelum confluence retain significantly depleted populations of the Alwan Snow Trout (reduction of 65 to 70%).

Nalbant's Loach

The Nalbant's Loach is currently only found downstream of the Sukki Kinari dam site. Under the Business as Usual scenario, the Nalbant's Loach populations reduce by 60% compared to current populations. The Nalbant's Loach is sensitive to pollution, and the growing impact of runoff from human settlements and habitat degradation due to activities such as sand mining will result in the reduced population under BAU. The Baseline Management scenario representing the impact of all five dams results in the elimination of the Nalbant's Loach from most stretches of river due to the combined effect of human impacts and changes in hydrology. However, between Project dam to the tailrace there is a 70% decline, and between Project tailrace to Patrind reservoir there is actually a 10% increase. This increase in the Nalbant's Loach population is a result of this stretch of river retaining sufficient water flow due to the EFlow from Project dam and baseload flow from the powerhouse, combined with reduced human impacts due to the conservation measures in the Project implemented under BM. Under the Enhanced Management scenario, increased protection throughout the river basin result in other stretches retaining some of the Nalbant's Loach population. The stretch between Sukki Kinari dam and its tailrace and Patrind dam and the Jhelum confluence retain 30% of the current population. The Project dam to tailrace and Project tailrace to Patrind reservoir remain unchanged from the BM scenario.

Kashmir Hillstream Loach

The Kashmir Hillstream Loach distribution is similar to that of the Nalbant's Loach, and it is only found downstream of the Sukki Kinari dam site. Under the Business as Usual scenario, the Kashmir Hillstream Loach populations will reduce by 70% in all stretches where it is currently found. The Kashmir Hillstream Loach is sensitive to human impacts such as habitat degradation and water pollution, and growing population pressure and its associated impacts will result in the reduced population under BAU. Under the Baseline Management scenario changes in hydrology combined with human impacts result in the elimination of the Kashmir Hillstream Loach from most stretches of the Kunhar River. Downstream of Project dam, where an EFlow is maintained, 10% of the existing population will remain. Between the Project tailrace and the Patrind reservoir the combination of EFlow from the dam, baseload flow from the powerhouse and increased protection in this area are expected to result in a 10% increase in the population. Increased protection under Enhanced Management results in the Sukki Kinari dam to

tailrace and Patrind Dam to confluence sections retaining 10% of the current Kashmir Hillstream Loach populations. The Project dam to tailrace (90% reduction) and Project tailrace to Patrind reservoir (10% increase) sections remain unchanged from the BM scenario.

Overall Impact on Ecosystem Integrity

The cumulative impact of the proposed HPPs on the overall ecosystem condition and integrity of the Kunhar River was studied, and categories used to describe the Kunhar River's Present Ecological State are based on modification from the natural (see **Exhibit X**). At present, sections of Kunhar River upstream of Patrind reservoir are largely natural, and fall within Category B. Downstream, sections of river between the Patrind reservoir and the Jhelum confluence are already affected by the construction and operation of Patrind dam, and these sections have therefore been placed in Category B/C.

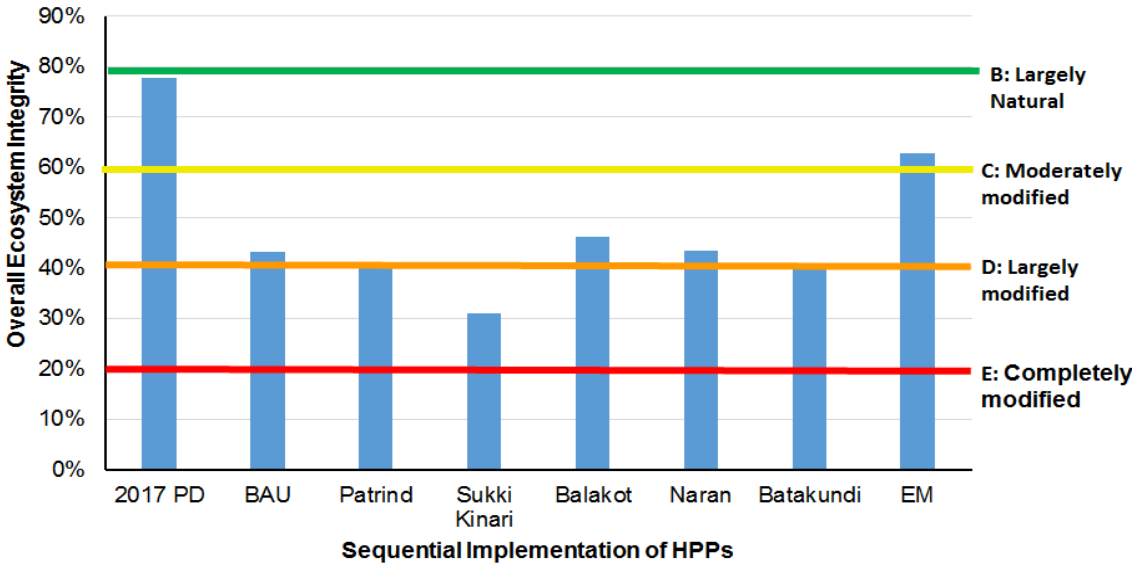
Exhibit X: Definitions of the Present Ecological State (PES) Categories

A	Unmodified, natural	As close as possible to natural conditions.
B	Largely natural	Modified from the original natural condition but not sufficiently to have produced measurable change in the nature and functioning of the ecosystem/community.
C	Moderately modified	Changed from the original condition sufficiently to have measurably altered the nature and functioning of the ecosystem/community, although the difference may not be obvious to a casual observer.
D	Largely modified	Sufficiently altered from the original natural condition for obvious impacts on the nature and functioning of the ecosystem/community to have occurred.
E&F	Completely modified	Important aspects of the original nature and functioning of the ecosystem community are no longer present. The area is heavily negatively impacted by human interventions.

A weighted average score for the CIA Study Area was calculated on the basis of the score for ecological integrity in each segment of the river and length of the segment.

Exhibit XI illustrates the calculated changes in overall ecosystem integrity for the CIA Study Area with sequential implementation of the HPPs.

Exhibit XI: Predicted Ecosystem Integrity in the CIA Study Area with Sequential Implementation of Hydropower Projects



1. Starting with a Present Day score of 78% corresponding to ecosystem integrity of B, the ecosystem integrity deteriorates to D, or a score of about 43% under the BAU scenario without any project. This deterioration is due to poor protection and increasing pressures on the ecosystem from fishing, sediment mining, and deterioration in water quality over time.
2. With Patrind HPP added, the overall score drops to 40%, still within Category D. However, with the addition of Sukki Kinari the score reduces further to 31%, which is Category D/E. This reduction is due to the impacts downstream of Sukki Kinari dam.
3. Since Project includes an EFlow, baseload flow and Pro 3 level protection (within the Project area), the addition of this HPP improves the overall ecosystem integrity to a score of 46%, or Category C/D.
4. The addition of Naran HPP brings the score down to 43% and Batakundi HPP brings it further down to 40% or Category D.

Finally, with implementation of the Enhanced Management scenario, the ecosystem integrity can be improved to a score of about 63%, corresponding to an ecological integrity slightly higher than Category C. This is a significant improvement over the BAU and BM scenarios.

Livelihoods Related to Sediment Mining

There is expected to be a significant impact on recreation and tourism in the Kaghan and Naran areas as a result of the construction and operation of Sukki Kinari HPP and Naran HPP. Of the two riverside towns, Naran is the bigger center for recreation and tourism. According to the Tourism Corporation of KP there are currently over 100 hotels operating in and around Naran. Tourism in the area is seasonal, with most tourists visiting during the months of June, July and August. During these months a very significant

proportion of local residents work in tourism related activities. Through the provision of tourism related services local communities in these areas derive a very significant portion of their annual income from recreation and tourism during the three summer months.

For the most part the construction and operation of Sukki Kinari and Naran HPPs is expected to have a negative impact on tourism in the area. There will be major changes to the present day largely natural environment as a result of access road construction, dam and powerhouse construction, inundation and changes in hydrology (reduced flows, peaking), which will have a detrimental impact on the aesthetics of the area and on activities such as recreational fishing. Dam operation will also create potential safety issues since peaking operations could result in accidents and fatalities as unaware tourists are swept into the river by sudden increases in water flow downstream of powerhouses.

In an area such as Naran with a well-established tourism sector there is a very high dependency on recreation and tourism for income. Any reduction in the number of tourists will have very serious socioeconomic consequences.

Guidelines and mitigations must be prepared as a part of the Sukki Kinari HPP and Naran HPP BAP/BMPs to minimize the impact of the developments on tourism in the area.

Management Strategy and Measures

The CIA presents two management scenarios including the following:

- Baseline Management
- Enhanced Management

The enhanced management scenario is recommended as it will effectively mitigation the impacts of the project.

The long term outcome of the baseline management scenario in terms of prioritized VECs will be a high level of degradation of the river habitat and ecosystems resulting in substantial and irreversible loss of ecosystem functions and services. Some parts of the river ecosystems protected under the BAP/BMP developed for hydropower projects such as Project will survive and improve due to improved protection and surveillance supported by the projects.

Under this scenario the number of tourists visiting the Kaghan and Naran area is likely to decrease as the area's aesthetics and activities such as recreational fishing are negatively affected.

Under the enhanced management scenario, the owners of hydropower projects located within the CIA Study Area would individually and collectively fulfill their environmental and social responsibilities as mandated by law, and manage their corporate and reputational risks.

The long-term outcome of this scenario in terms of river ecosystems and ecosystem services will be maintenance and most likely enhancement of ecosystem functions and services in selected segments of the river, and sustainable livelihoods. Under this scenario there is a likelihood of achieving an increase of about 10% (over the current baseline) in the population of endemic fish species in certain sections of the river.

The transition from the present Baseline Management to this scenario will require extensive and sustained effort over a period of time, and will essentially consist of building upon initiatives that have already been identified and partly tested by the Wildlife Department, KP in other parts of the province.

The Biodiversity Management Plan

A Critical Habitat Assessment deduced that the Project is located in a Critical Habitat due to the presence of valued aquatic biological resources, including the restricted range or endemic fish species Nalbant's Loach *Schistura Nalbanti* and Kashmir Hillstream Loach *Triplophysa kashmirensis*. In addition, the Kunhar River provides habitat for the Alwan Snow Trout *Schizothorax richardsonii* which is migratory fish and listed as Vulnerable in the IUCN Red List. According to the International Finance Corporation's Performance Standard 6 (IFC PS6), in Critical Habitats 'Net Gain' is required for those values for which Critical Habitat has been designated. This can be done through the development of a biodiversity offset and/or, through the implementation of programs that could be implemented in situ (on-the-ground) to enhance habitat, and protect and conserve biodiversity.' This Biodiversity Action Plan (BAP) has, therefore, been prepared to support the corporate commitments of the Pakhtunkhwa Energy Development Organization (PEDO) for conserving biodiversity as well as to meet the requirements of IFCs PS6 and ADB's Safeguard Policy Statement 2009 for the Project.

Objectives of the BMP

This BAP includes a set of actions for the conservation and enhancement of biodiversity in an area where biodiversity will be directly impacted by the Project. Specific objectives of the BAP are to ensure that the Project:

- Implements the mitigation and monitoring of biodiversity as proposed in the EIA, and as refined and/or modified by the BAP itself
- Complies with national legislation and policy requirements
- Complies with lender and other international requirements
- Addresses the concerns and expectations of the stakeholders
- Implements best practice and sustainable solutions

This BAP also includes basin wide measures for protection of biodiversity that are important for the protection of biodiversity in the long term. These include the establishment of an Institute for Research on River Ecology, establishment of a Watershed Management Program, and actions and measures that the Governments can take to protect and enhance the biodiversity in the Kunhar Basin.

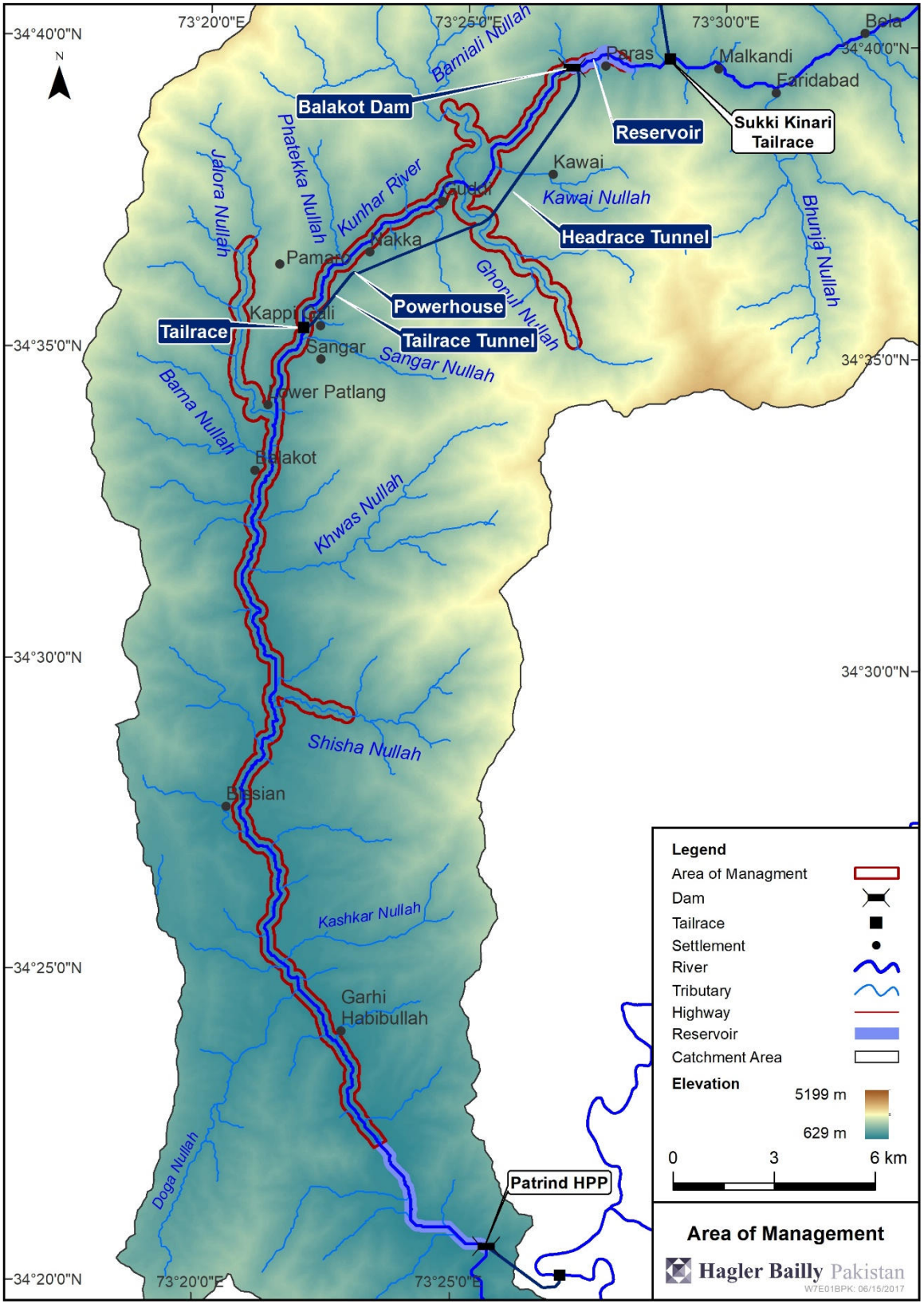
Spatial and Temporal Scope of the Biodiversity Management Plan

The selection of geographic scope of the BAP has been defined to incorporate an area where biodiversity will be directly impacted by the Project. This area is defined as the Area of Management, and includes an impact zone of about 45 km length of river. The Area of Management includes the reservoir of the Project, 4 km upstream of where the Project dam will be constructed, and extends to 5 km upstream of the Patrind dam but excluding the reservoir of Patrind HPP. The Area of Management also includes segments

of the Barniali, Ghonul, Jalora, and Shisha Nullahs. **Exhibit XII** illustrates a map showing the Area of Management.

Protection of the terrestrial ecological resources in the Area of Management has not been included in the BAP. This is because Project construction and operation impacts on terrestrial flora and fauna are not likely to be significant. In addition, there are no Protected Areas near the Area of Management. Any potential impacts on the terrestrial biodiversity will be mitigated and managed through the implementation of the Environment Management Plan.

Exhibit XII: Spatial and Temporal Scope of BMP



Proposed Conservation Measures

The strategy and approach used for protecting the biodiversity includes the following:

- Setting up an effective and efficient watch and ward system that will help to reduce the existing anthropogenic pressures in the Area of Management which is central to keeping the integrity of the Area of Management of the BAP intact. This will:
  - curtail illegal fishing including non-selective fishing, fishing in breeding season of fish, fishing in river tributaries.
  - regulate sediment mining to maintain it at sustainable levels and prevent sediment mining from ecologically sensitive locations.
- Promote environmental awareness among the local communities and engage them in protecting the ecological resources
- Institutional strengthening of custodian government departments

Control of Illegal Fishing

The following measures will be implemented by the Fisheries Department, KP and Wildlife Department, KP (referred to as Departments) with support from Project for conserving the fish populations of the Kunhar River.

- Non-selective fishing using fine mesh gill nets, poisons and dynamites will be completely controlled in the entire stretch of the Kunhar River.
- Fishing in the tributaries that are breeding grounds of fish will be banned.
- Fishing during the breeding season of the fish (May – August) will be banned.
- Fishing in habitats identified as sensitive particularly for the fish species of conservation importance will be restricted or banned, with special attention to sections of tributaries that are breeding grounds of fish.
- Commercial fishing will not be allowed either in the river and its tributaries or in the reservoir.
- The above rules and regulations will be strictly implemented with an efficient and effective watch and ward system.
- Subsistence fishing using rods and cast nets with limited weights will be allowed through a permitting system in the reservoir created upstream of the dam, and downstream of the dam when the KP Fisheries Department considers the fish populations to have recovered.
- Angling will be allowed to attract visitors and develop the educational and recreational value of the river when the KP Fisheries considers the fish populations to have recovered.

Fish Passage

In the absence of tested and proven techniques for automatic transportation of fish upstream of the dam to a height of more than 35 m which is the case with the Project, physical transport of fingerlings of migratory fish captured downstream of the river to

upstream of the dam is recommended. This will help in maintaining the diversity in the gene pool if the monitoring program indicates a need for this action. Experimentation with emerging methods and techniques to transport fish upstream of the dam will be conducted by the proposed Institute for Research on River Ecology (IRRE).

Regulation of Sand and Gravel Mining

Sediment mining will only be allowed in designated areas and banned from ecologically sensitive areas such as habitat of fish of conservation importance, and fish breeding locations in tributaries. An Outline for Sediment Mining Management Guidelines is provided in the BAP**.** The Sediment Mining Guidelines will ensure that a balance is achieved between meeting community needs for sand and gravel as well as the integrity of aquatic habitat in the Area of Management such that the habitat is not excessively damaged due to uncontrolled mining activities on the river bed.

Awareness among Local Communities

An Awareness and Education Program will be initiated to inform and educate the local communities about the importance of the biological resources of the area and actions required for their protection.

Human Resources for Management of Aquatic Biodiversity

As part of the BAP, PEDO will provide funds to support an improved watch and ward system within the Area of Management. This will include construction of field offices, hiring of additional staff members (watchers), and necessary equipment and facilities. Mining inspectors will be hired to prevent sand and gravel extraction from ecologically sensitive locations. Social mobilizers will be hired for education and awareness-raising of the local communities.

Establishment of an Institute for Research on River Ecology (IRRE)

The IRRE is proposed as a basin wide institution in which all the developers of HPPs in the Jhelum Poonch and Kunhar basin contribute to establishment and operation of the institute, and jointly benefit from the research outputs. The initiative is the outcome of the International Finance Corporation of the World Bank (IFC) initiative to set up a Hydropower Working Group for the basin, through which the project owners can cooperate and collaborate to collectively manage the basin in a sustainable manner. The proposed institute will help the project owners in maintaining ecological databases and research and analysis capabilities that will benefit them individually by lowering their environmental management costs. PEDO will contribute to the establishment and operation of an Institute for Research on River Ecology (IRRE), subject to approval of associated costs in the tariff by the National Electric Power Regulatory Authority (NEPRA).

Establishment of Watershed Management Program (WMP)

The Watershed Management Program (WMP) will primarily focus on improvement of water quality in the Kunhar basin that is critical for protection of biodiversity in the long term. The institutional and financial model for setting up watershed management institutions will be similar to that proposed for the IRRE but will be restricted to the Kunhar basin. The support provided by PEDO and project owners in this case, however,

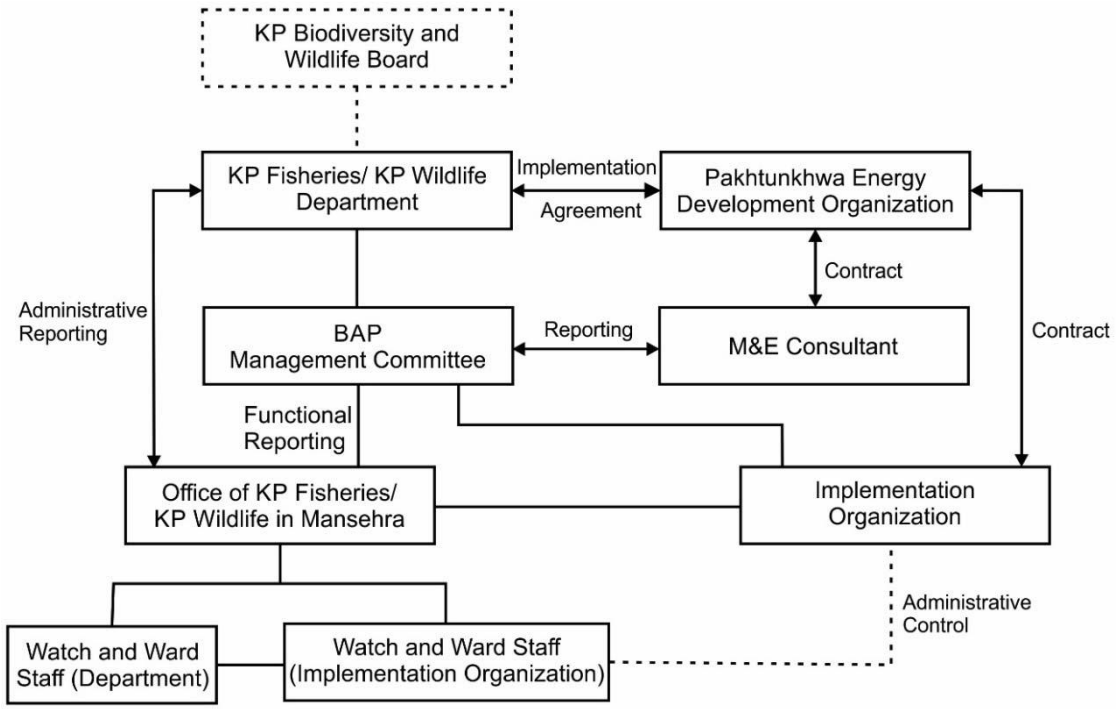
will be limited, as additional support and resources will be mobilized from the participating government departments which will include forests, wildlife, agriculture, and irrigation. Action areas may include, but not be limited to, land use management and reforestation to reduce erosion and risk of landslides and to meet community needs for fuel wood and timber, management of water use, and control of water quality. As in the case of the IRRE, PEDO will contribute to the establishment and operation of a WMP subject to approval of associated costs in the tariff by the NEPRA.

Institutional Arrangements for Implementation of BMP

Exhibit XIII illustrates the institutional and contractual arrangements for implementation of the BAP. In Khyber Pakhtunkhwa (KP), the responsibility for watch and ward of the terrestrial and aquatic ecological resources lies with the Wildlife Department, while the Fisheries Department regulates recreational fishing and is also responsible for management of water quality of the river. It is therefore not clear which department will take the lead in supporting implementation of the BAP. For the purpose of this Draft BAP, both organizations have been proposed and a decision can be taken by the KP Government about which department will finally be designated.

PEDO will support an Implementing Organization which will implement the actions outlined in the BAP with support from KP Fisheries/Wildlife Department. A BAP Management Committee in KP will be established, which will be responsible for reviewing the reports submitted by the Implementation Organization and the M&E Consultant, reporting to on an annual basis and coordination with a high level oversight body such as KP Wildlife Management Board, and providing directions to the staff of the Department, Implementation Organization, and the M&E Consultant for improving the effectiveness of the implementation of the BAP.

Exhibit XIII: Institutional Arrangements for Implementation of BMP in KP



Monitoring and Evaluation Framework and Adaptive Management

A Pressure-State-Response (PSR) framework will be used for monitoring of effectiveness of implementation on the BAP. The type of indicators proposed for monitoring the pressures are:

1. The total amount of fish by species being harvested in a year, for subsistence and recreational purposes, through legal as well as illegal means.
2. Total amount of sand and gravel extracted from the river and tributaries, separately reported or estimated for extraction through legal means (with permits at designated mining sites) and through illegal means (without permits).

Indicators of state will include hydrology, water quality, catchment, and fish. The method of data collection, frequency and timing of collection as well as data analysis is included in a detailed Monitoring and Evaluation Plan prepared for the BAP. The methodologies will be adjusted and adapted over time where required to facilitate assessment. Indicators of response will include institutional capacity, awareness among stakeholders and their concerns. A combination of qualitative and quantitative techniques will be employed. Reports will be prepared and discussed with the key stakeholders once every year.

The indicators and methodologies used for monitoring may need to be adjusted and adapted in line with the principles of adaptive management to respond to changing pressures, and unforeseen or unexpected outcomes of the mitigation measures applied.

Budget for Implementation

The BAP presents budgets for capital and one-time costs and for annual operating or recurring costs respectively for implementation of the BAP (**Exhibit XIV**). Implementation will be initiated following the financial close of the Project.

Exhibit XIV: Summary of the Budgetary Requirements for Implementation of the BAP

	Total Cost (USD)	*Share of PED (USD)*
Capital/One Time Cost		
Protection		114,238
Monitoring and Evaluation of Protection		125,000
Institute for Research on River Ecology @ 10% of Total Cost	217,921	21,792
Watershed Management @ 25% of Total Cost	509,252	127,313
Total Capital/One Time Cost		**388,343**
Annual Recurring Cost		
Protection		40,533
Monitoring and Evaluation of Protection		76,740
Institute for Research on River Ecology @ 10% of Total Cost	238,227	23,822
Watershed Management Program @ 25% of Total Cost	678,665	169,666
Monitoring and Evaluation of IRRE and WMP		30,000
Total Annual Recurring Cost		**340,761**

	Total Cost (USD)	*Share of PED (USD)*
Budget Estimate for Capitalization Purposes		
Capital/One Time Cost		**388,343**
Recurring Cost for 6.5 Years During Construction		2,214,947
Total Cost for Capitalization		**2,603,290**

Cost Estimate for Environmental Management

The total cost of Environmental Management has been estimated as USD 8,726,170/- for the construction phase and USD 782,281/- annually for the operation phase. In addition to this, estimated land acquisition and resettlement cost is USD13,514,184.