Hagler Bailly Pakistan

Arkari Gol Hydropower Project

Environmental and Social Impact Assessment

Volume 1 - Non-technical Summary

HBP Ref.: D8NS3AGH

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Master Hydro (Pvt.) Limited.

Islamabad

Contents

About the Project

Master Hydro Private Limited (MHL) intends to construct the 99.0 megawatt (MW) Arkari Gol Hydropower Project (the Arkari Gol HPP or the "Project") on the Arkari Gol (tributary). The dam and intake structure will be located 8 km upstream of the confluence of Arkari Gol and Lutkho River, near the village of Ucchatur in Chitral District, KP. The powerhouse will be located 7.5 km downstream of the dam on the right bank of Arkari Gol, near the village of Andakht. The Project area is accessible via road, at a distance of 460 km from Islamabad and 370 km from Peshawar, the capital of KP province.

This document introduces the Project and its environmental and social impacts in a non-technical language.

What is the Project?

The proposed Arkari Gol HPP is a run-of-river hydroelectric power project to produce electricity from the flow of water in Arkari Gol. The Project, once complete, will have two major components:

1. A concrete dam on Arkari Gol with a maximum height of 20 m from the bed of the river.
2. The Surface-type powerhouse to generate 99.0 MW of electric power.

How much water will be diverted?

The diversion of the water will depend on flow in the Arkari Gol. Running the Project as a true run of river hydropower project will minimize negative impacts on aquatic ecology downstream. However, as this is not economically feasible a modified form of peaking is recommended in which the peak is gradually ramped up and then ramped down. This buffers the impact of a full peaking operation.

Cumec

Cumec is the short form of cubic meter per second. It is a unit of flow which equals 35.5 cubic foot per second (cusecs).

Where will the electricity go?

Electricity produced at the powerhouse will be transferred to NTDC, the national company for transmission of electric power, for onward transmission and distribution to consumers.

Who is developing the Project?

Under a contract with the Government of Pakistan, the Project is being developed by the Master Hydro Private Limited (MHL). MHL, a special purpose corporate vehicle established by Master Group of Industries, is responsible to implement the Project.

Exactly, where is the Project site?

Exhibit 1 shows the location of the Project. The dam intake structure will be located 8 km upstream of the confluence of Arkari Gol and Lutkho River, near the village of

Ucchatur in Chitral District, KP. The powerhouse will be located 7.5 km downstream of the dam on the right bank of Arkari Gol, near the village of Andakht.

What is this document?

Any development project—a power plant, a factory, a road, or a canal—requires land and modifies whatever is there on the land. Although the development project itself may be beneficial to the overall economy or the people, the modification of the land and what is on it, can have negative impact for some people, particularly those living on or near the land, and the ecology.

The Environmental and Social Impact Assessment (ESIA) is a predictive study undertaken prior to the development of the project. It has essentially two aims:

1. Identify the potential environmental and social impact of the proposed projects;
2. Design measures to minimize any anticipated adverse impact of the proposed Project and enhance the benefits for the environment and the people.

This document is a non-technical summary of the ESIA report of the Project. The ESIA report was prepared by Hagler Bailly Pakistan (Pvt.) Limited, a leading consultancy firm of the country.

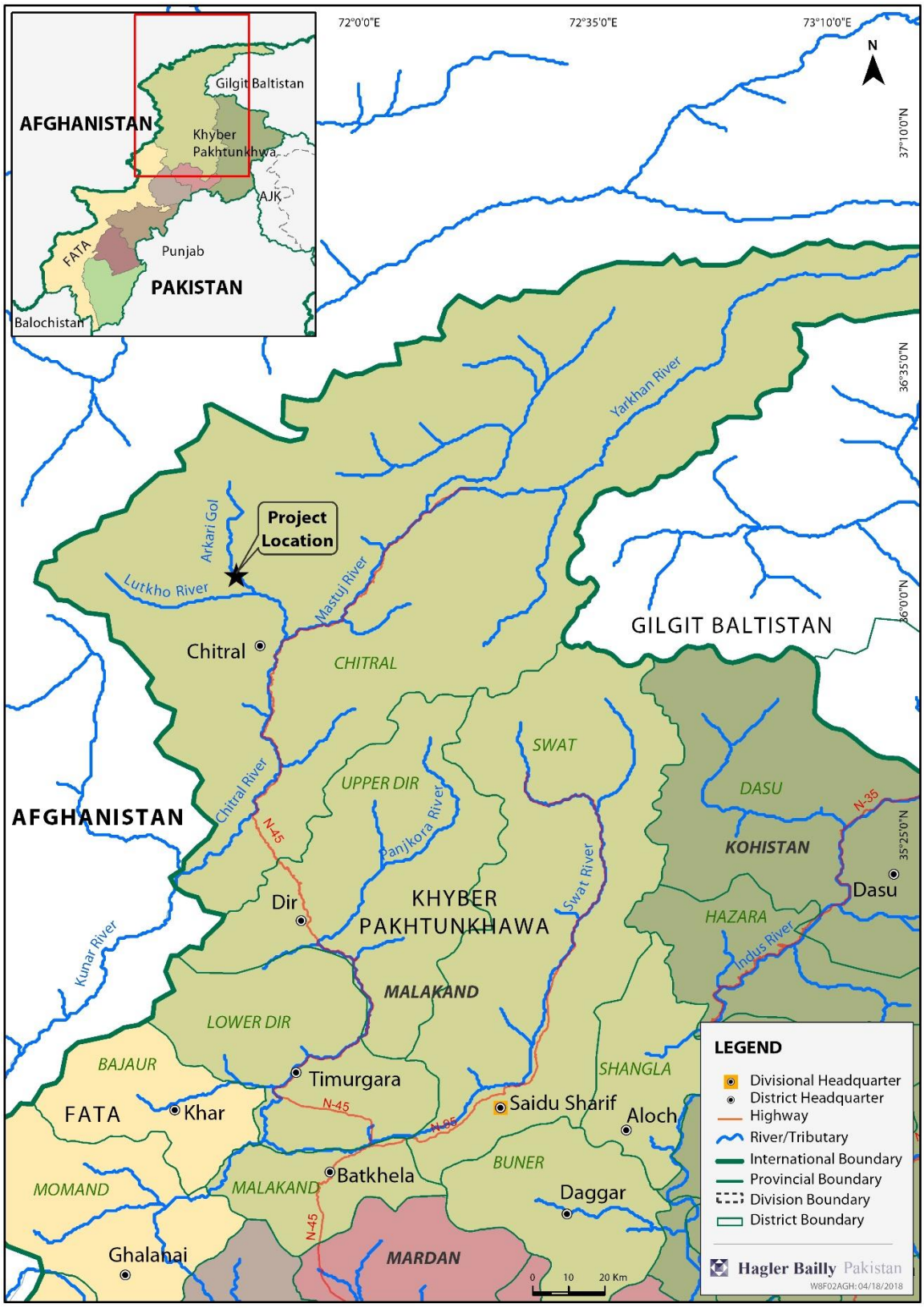
Who will approve the ESIA report?

Preparation of the ESIA report is a legal requirement in Pakistan and in KP. The law requires that all proponents of development projects must assess the anticipated environmental impact of their projects and submit and environmental assessment report to the Environmental Protection Agency (EPA) of KP.

The EPA will evaluate the ESIA against the environmental law and good environmental practices. They will determine whether the ESIA presents enough information to assure that the proposed project design complies with the environmental laws. They will review the potential air pollution, water pollution and noise from the proposed project and judge whether the health and well-being of the people will be protected. The EPA will also determine whether the ecology—the vegetation, fish in the water, the wild animals on the land and the birds—are not going to be destroyed.

A key requirement of ESIA is stakeholder consultation. In it the ESIA team talks to people who are likely to be affected by the Project, provides them with information regarding the Project and seeks their opinion on it. The EPA will also assess whether or not sufficient consultation has been undertaken.

Exhibit 1: Arkari Gol Hydropower Project Location



As part of the evaluation, the EPA will also conduct public hearings. This event will be open to all in which any person can go and express his or her opinion on the proposed Project. In the end, if the EPA is satisfied they will approve the Project. The construction of the Project will start only after the approval of the ESIA by the EPA.

The International Finance Corporation (IFC). IFC, a member of the World Bank Group, is the largest global development institution focused exclusively on the private sector in developing countries. The IFC is financing a number of HPPs in Pakistan. MHL is following IFC guidelines as best practices to guide its own ESIA.

The ESIA has been developed keeping in consideration the legal requirements as well as guidelines of the IFC.

What will it take to construct this Project?

Construction of the Project will require about 112.9 acres of land. The land will be utilized for construction of permanent facilities such as the dam, power house, and for temporary facilities required only during construction.

The Project will require aggregate and other construction material which will be obtained locally. The total construction period of the Project will be 4 years (48 months).

If consultation is mandatory, how many people were consulted?

Different types of consultation were undertaken for this project.

- More than 55 families from the land acquired for the Project (those who will be displaced due to the Project) were consulted;
- 8 communities along the Arkari Gol were consulted;
- 8 government and non-government organization (4 of each) were consulted.

Why this Project?

KP and Pakistan are going through an acute power shortage. The gap between supply and demand has crossed 7,000 MW. The proposed Project will supply the much needed power to reduce the current gap without relying on import of fuels at the cost of foreign exchange to the country.

The alternatives to the proposed hydropower project include power generation from LNG/imported natural gas based plants, coal fired steam plants, and fuel oil based diesel engines. Cost of power generation for the proposed hydropower project is comparable to that for LNG and coal based options, and lower than that for wind energy and solar PV projects where power generation is intermittent and weather dependent.

The Arkari Gol Hydropower Project can be completed in four years and is an attractive option amongst currently available alternatives for power generation.

About the Environment

A key component of any ESIA is the environmental and social baseline. This is a description of the environment of the area and includes the land, the people living on it—their social, environmental and cultural conditions—the vegetation and wildlife, and the water resources, the air quality, noise, and the traffic. A comprehensive description of the environmental conditions is presented in the ESIA report grouped in three chapters, the physical, social and the ecological baseline. A brief description of the environment follows.

The area over which the description is provided is called the Study Area. The Study for the Project is shown in **Exhibit 2**.

How is the air quality and water resources in the area?

Air quality in the Project area complies with international guideline limits at all locations as well as National Environmental Quality Standards (NEQS) with the exception of fine particulate matter ($PM_{2.5}$) concentrations that exceed NEQS at two of the three locations tested.

There are low levels of human sources of noise in the area, and very low levels of traffic.

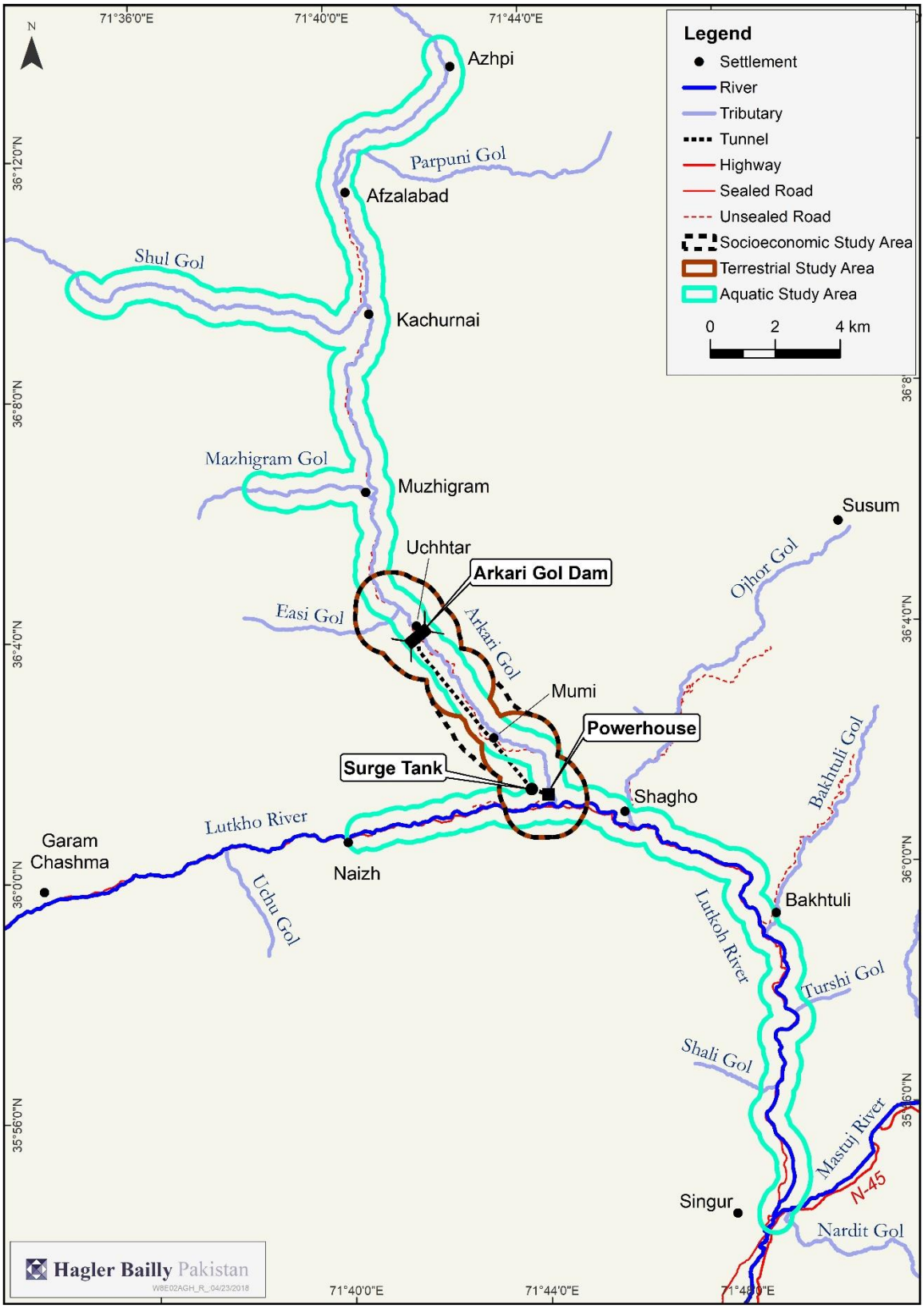
Water resources in the area consist of surface water including rivers and nullahs and groundwater including springs. A census was carried out to map the community water resources for villages near Project facilities. Water quality samples from the Arkari Gol and community springs were collected and analyzed. All parameters are within permissible levels of NEQS for drinking water and the spring water tested excellent for drinking as there was no bacterial contamination.

What wildlife is found in the area?

The main aspects of the aquatic biodiversity in the Aquatic Study Area include the fish fauna, macro-invertebrates, periphyton biomass, and riparian vegetation. A total of three fish species are reported in the Aquatic Study Area (area of impact of the Project). Amongst them the Snow Trout is of conservation importance as it is listed as Vulnerable on the IUCN Red List.

Highest number of species were observed in Lutkho River where a total three fish species were captured. The only fish species of commercial importance found in the area is the Snow Trout.

Exhibit 2: Study Areas



The land area is not too disturbed because of low human population, low grazing of livestock and low levels of extraction of forest resources. The diversity of terrestrial wildlife species is generally low but is of conservation importance. A total of five mammal species were observed during the surveys carried out as part of the ESIA, namely Snow Leopard, Grey Wolf, Asiatic Jackal, Red Fox and Flare-horned Markhor. The Snow Leopard is listed as Vulnerable while the Flare-horned Markhor is listed as Near Threatened on the IUCN Red List. Based on the survey a total of 19 species of birds and four species of herpetofauna were observed during the surveys. Of the bird species reported from the area, only Ferruginous Pochard and Lammergeier are listed as Near Threatened in the IUCN Red List.

What about the people?

Rural settlement surveys were undertaken in all the settlements with river dependence or within 1 km of Project facilities. Interviews were conducted with key informants to gather information on settlement's social and economic setup, with focus on infrastructure and livelihoods. Key physical and socioeconomic features of the Study Area are illustrated in the photographs shown in **Exhibit 3**.

Exhibit 3: Photographs of the Study Area

Scattered houses in affected settlement Uchhtar

Mumi settlement

Semi Pucca house at Uchhtar

Katcha house at Andahti

Government primary school at Uchhtar settlement

University of Chitral

Unsealed road in the Study Area

Bridge for vehicles in the Study Area

Small shop in the Study Area

Water channel supplied from Arkari Gol

The settlements situated on both sides of Arkari Gol in the Socioeconomic Study Area are connected to main towns and cities through Arkari road which links settlements to Chitral Garam Chashma road on one side and to Arkari town on other side. Arkari road is an unsealed road in poor condition. It is a landslide-prone area and occasionally land sliding damages the road. A traffic survey was undertaken to evaluate the current traffic conditions on routes that could be used for the transportation of equipment, material, and staff to the Project site during construction and operation.

All 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. Distances of the settlements to sources of water ranges from 1 km to 4 km. Almost all surveyed settlements reported having access to spring water at relatively short distances.

None of the settlements 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 Arkari Gol, resulting in a deterioration of water quality. The problem is more severe during the winter when river flow is reduced and does not flush contaminants out as effectively.

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.

All settlements in the Socioeconomic Study Area are connected to the local micro hydro power project located at settlement Mumi provided by Aga Khan Rural Support Programme. Electricity is mainly used for lighting purposes and running household electrical appliances. For cooking, water and space heating purposes, fuelwood is used in almost all the households. Communities source fuelwood from privately-owned lands, government-owned land and communal forests, paying only for the transportation cost.

The main river-dependent socioeconomic activity is the irrigation of agricultural lands. As reported by the local communities and observed by the survey team more than 150 acres of land is being irrigated by Arkari Gol in the Socioeconomic Study Area. Moreover, four water flour mills and one micro hydro power plant at settlement Mumi are also working using water channels from the river.

The major sources of income are private jobs (23%), agriculture (22%) government services (21%) and labor (19%). For women major sources of income are private jobs (33%), government services (33%), agriculture (24%) and livestock (10%) Moreover, amongst males average income is highest in the business sector followed by private sector and government services sector. Amongst women average income is highest in the private services sector followed by government services and agriculture.

The Socioeconomic Study Area and surroundings are generally peaceful, and there are no major law and order problems are reported. Most of the Socioeconomic Study Area has police presence in the form of police stations or check posts on major roads.

There is limited fishing activity in the Socioeconomic Study Area. Some of the fish caught is self-consumed. The fishing season lasts around five months through the year, depending on the fish species caught. Most of fishing is practiced without permits from government departments.

Hunting of migratory birds is quite common throughout the entire stretch of the Socioeconomic Study Area. The hunting season lasts around five months through the year. Large-sized artificial ponds have been constructed near the banks of the river and decoy ducks are used to attract migratory ducks. A small hunting hide, built from large stones, is used for hunting purposes.

No Indigenous Peoples reside in the Socioeconomic Study Area. More than 90% of the population of the Socioeconomic Study Area belongs to the Ismaili sect of Islam and others belong to the Ahl-e-Sunat sect.

The Environmental and Social Impacts

What environmental issues were studied?

The ESIA team undertook an extensive assessment exercise to identify and evaluate various environmental issues. The issues that were evaluated included:

- Aquatic ecology—loss of riverine ecosystem due to inundation by Arkari Gol reservoir; degradation of the river ecosystem in the low flow segment
- Terrestrial ecology—terrestrial habitat loss and impacts of on biodiversity due to construction and operation activities
- Ambient air quality—degradation of air quality due to emission of dust and other gases from construction activities
- Water availability and quality—water resource depletion; changes to groundwater patterns; contamination of water resources; Alterations of natural passage of springs due to tunnel construction may disrupt the water availability at mountain springs for local community.
- Noise and vibration—construction equipment noise and vibration from blasting
- Soil, topography, land stability—impact on soil quality and soil erosion
- Livelihood and well-being—employment; training and skill development; enhancement of subsistence and recreational fishing; sand and gravel mining; and land acquisition
- Socio-cultural impacts—pressure on social infrastructure and services; conflicts due to provision of employment to outsiders; conflicting socio-cultural norms; and graveyard management
- Aesthetics and tourism—degradation of aesthetic value of the area due to construction activities; and permanent change in visual character during plant operations
- Traffic and road—impact on highway and community roads
- Climate change—greenhouse gas emissions and climate risk
- Cumulative impact assessment—cumulative impact of the all the hydropower project under construction or planned in the District Chitral

The study of these issues resulted in a series of mitigation measures that are now incorporated in the design and operation plan of the Project to ensure that the project impacts are within acceptable limits.

What are the key issues?

The purpose of the ESIA is to identify *all* potential environmental impacts and to propose a comprehensive set of measures to address the concerns associated with them.

Nevertheless the two issues are considered as sensitive requiring particular attention to avert any potential adverse impact.

The cumulative impact of hydropower projects in District Chitral: Cumulative impacts are those that result from the incremental impact of a project or developments when assessed in combination with other existing or planned projects. The study area selected for this assessment includes the rivers on which hydropower projects are panned in the Chitral Valley including mainly the Mastuj River, Lutkho River, Arkari Gol and other tributaries of the Mastuj River on which hydropower projects are planned. A total of ten hydropower projects were considered.

Basin-wide hydropower development will impact migratory fish species, in this case the Snow Trout. Loss of connectivity will confine the population of this fish mainly to reaches in tributaries of the main stem Mastuj/Chitral River where dams are not constructed. Isolation will increase in-breeding. Other non-migratory fish species adapted to life in riverine conditions will be impacted due to conversion of part of the river into a lentic or lake habitat. Peaking flows from power houses will substantially reduce the extent of riverbed and will result in loss of habitat for the loaches that survive in cobbles and boulders in shallow waters.

Environmental Flow (EFlow)

Environmental flows describe the quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems

Unlike other basins such as those in Jhelum and Poonch, impacts on socioeconomic aspects are limited in the Chitral Basin as river-dependent socioeconomic activities are limited. The Project is expected to improve infrastructure and employment conditions in the area.

This CIA recommends good practice measures that are important for the protection of biodiversity in the long term. These include assessing the feasibility of fish ladders on a case by case basis, release from other dams at levels higher than that for Arkari Gol HPP to account for habitats that are more productive as compared to that in Arkari Gol, avoiding overlapping peaking from multiple hydropower projects, and holistic environmental flow assessments based on World Bank Guidelines.

The CIA also recommends basin-wide management. This includes standardization of assessment methods using World Bank Guidelines, active regulation by the KP EPA using World Bank Guidelines, increased support to the government departments involved in protection of biodiversity and habitat, greater coordination between developers for achieving synergistic benefits and a balance between environmental and energy requirements in the basin, and support to research for understanding of river ecology and improvement of management practices.

Land Acquisition: Construction of the Project will require about 45.7 hectares (112.9 acres) of land. This land will be permanently acquired for the project by the government. Acquisition of the land will affect 48 families. Part of the land is cropped. There around 1,800 fruit trees and more than 5,300 non-fruit trees on the private land. The land acquisition will also affect roads, bridges, schools, and mosques.

A resettlement action plan (RAP) has been prepared as a tool to acquire the land and resettle the families living on it in a socially responsible manner. The main objective of the RAP is to identify social impacts of the project and to plan measures to mitigate adverse social impacts resulting from loss of assets due to construction of the several project facilities as reservoir, powerhouse, construction camp and offices, access roads etc. The RAP is based on the findings of the census survey, field visits, meetings and consultations with various project-affected persons in the Project area. Compensation for all land, houses, and other assets will be made by the relevant government authorities keeping in view market prices and other considerations in accordance with applicable laws.

How it will be ensured that all mitigation measures are implemented?

An Environmental Management Plan has been prepared which details the measures that are required to implement the mitigation measures. Responsibilities have been defined for implementation and for monitoring the implementation. Specialized tools such as Site-Specific Environmental Management Plan will be developed to ensure that no all measures are implemented at the project level.

Hagler Bailly Pakistan

Arkari Gol Hydropower Project

Environmental and Social Impact Assessment

Volume 2 – Executive Summary

HBP Ref.: D8ES3AGH

June 11, 2018

Master Hydro (Pvt.) Ltd. (MHL)

Lahore

Executive Summary

Master Hydro (Pvt.) Ltd. (MHL or Company) intends to develop the 99 megawatt (MW) Arkari Gol Hydropower Project (the Arkari HPP or the "Project") on the Arkari Gol, about 8 kilometer (km) upstream of the confluence of Arkari Gol with Lutkho River in the Chitral District of Khyber Pakhtunkhwa (KP). The dam is located 370 km from Peshawar. The location of the Project is shown in **Exhibit I**.

Project Background

The Government of Khyber Pakhtunkhwa (KP), through the Pakhtunkhwa Energy Development Organization (PEDO) is involved in development of hydropower projects in KP. Within the inventory of hydropower projects of the Chitral District of KP a project site was identified on Arkari Gol, a tributary of the Lutkho River. The site is located 37 km from Chitral Town. A Feasibility Study for a hydropower project at this site was carried out in 2013-2014 and released in 2014. As part of this the most favorable design solution was established.

The Company contracted the services of Hagler Bailly Pakistan (Pvt.) Ltd. (HBP) to prepare an Environmental and Social Impact Assessment (ESIA) required in line with the applicable national and international laws. HBP was also asked to prepare a new Resettlement Action Plan (RAP) for the land required for the Project. It was required that both the ESIA and the RAP shall be prepared in accordance with a) the national legal environmental requirements including that of the KP; and b) International Finance Corporation's (IFC) Environmental and Social Performance Standards on Social and Environmental Sustainability (PS) as required by the Overseas Private Investment Corporation (OPIC).

Study Area

The selection of the Study Area for the ESIA took into account 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 IFC's Performance Standards and guidelines.

Exhibit I: Arkari Gol Hydropower Project Location

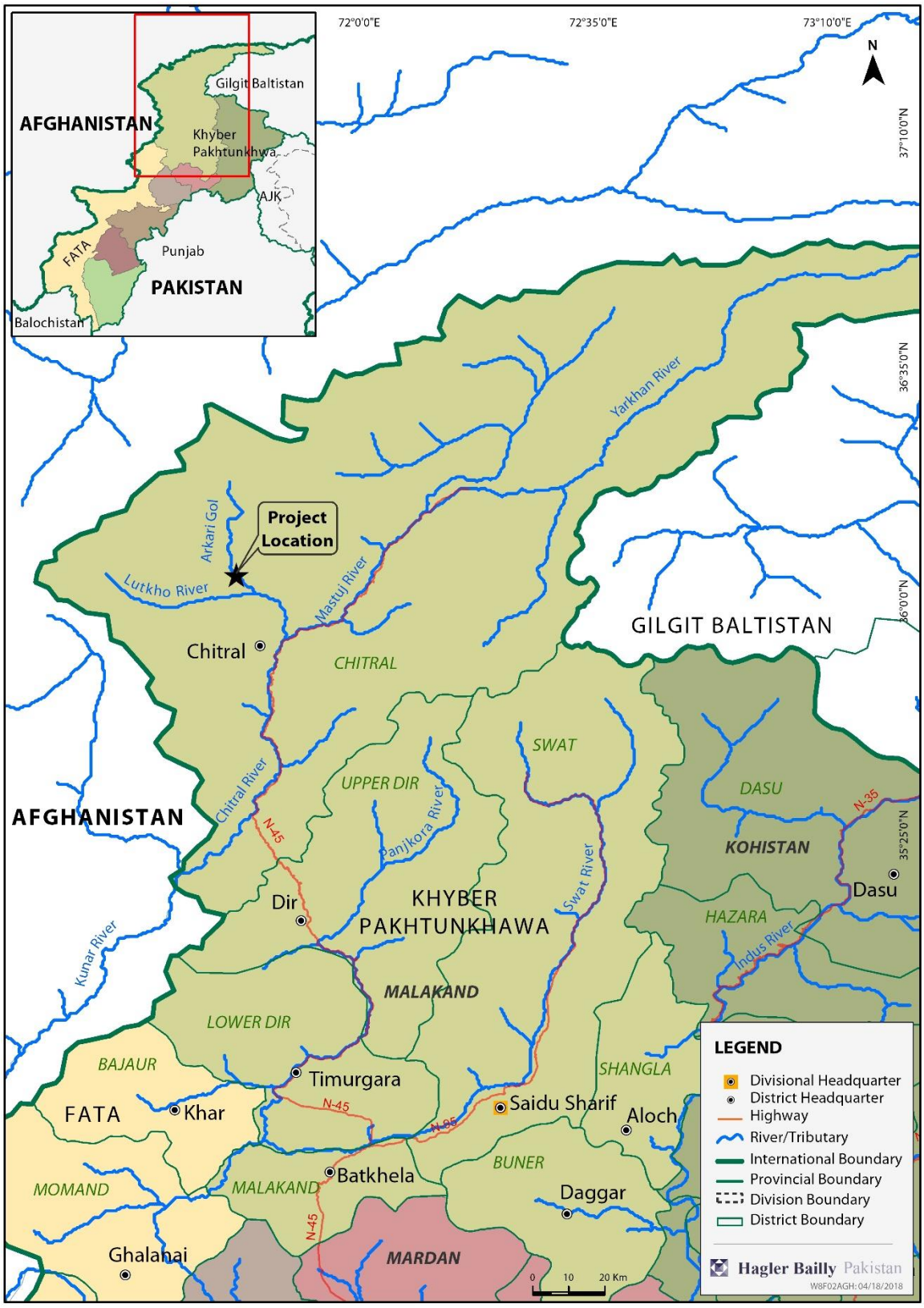
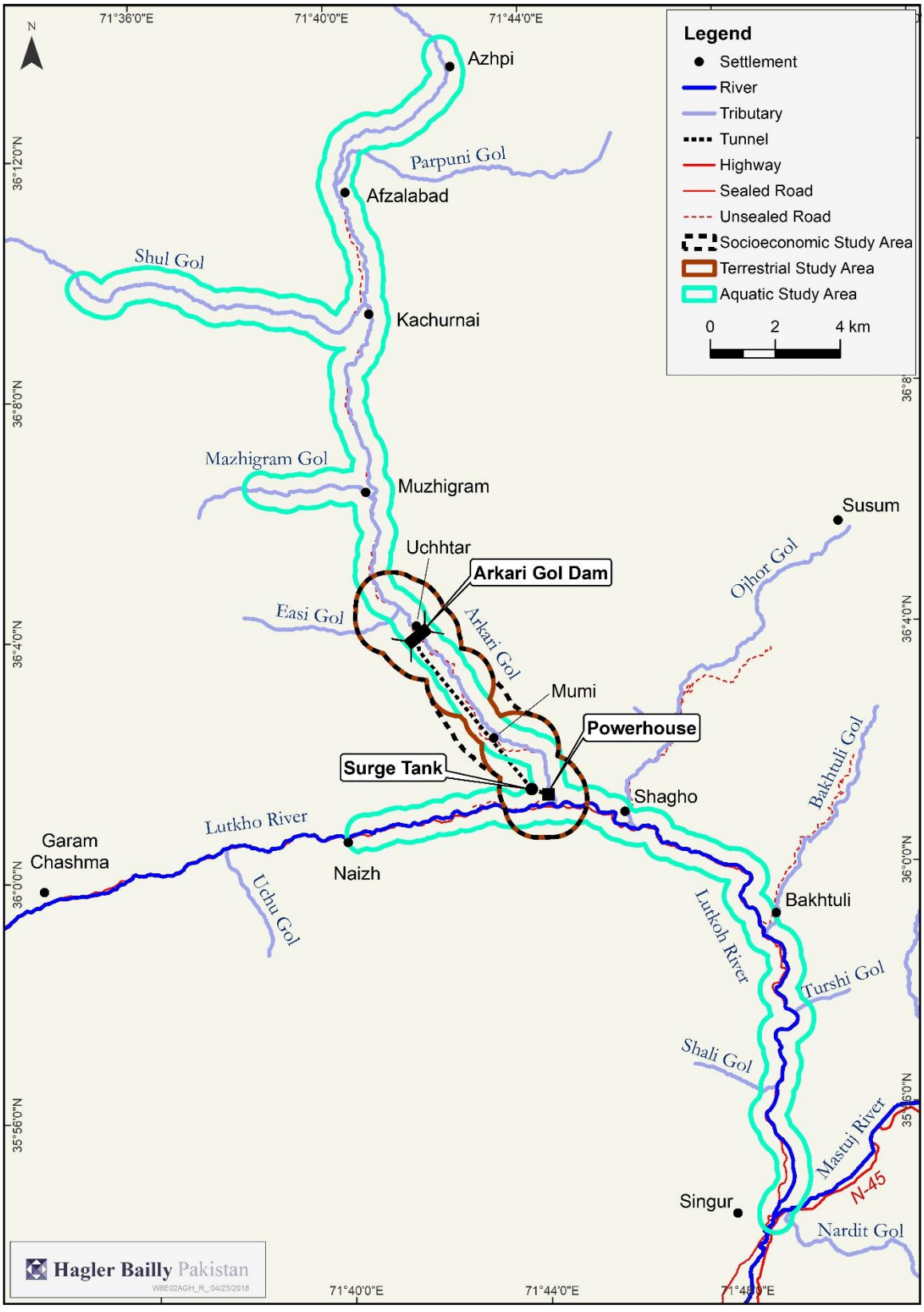


Exhibit II: Study Areas



KP Environmental Laws

The KP Environmental Protection Agency was established in 1989. The KP Environmental Protection Act 2014 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.

OPIC Guidelines and IFC's PS on Social and Environmental Sustainability

The IFC's PSs are applied to manage social and environmental risks and impacts and to enhance development opportunities in private sector financing in IFC member countries eligible for financing. OPIC uses IFC Guidelines as a standard for environmental and social sustainability. Together, the eight PSs establish standards that the client is required to meet throughout the project life by IFC or other relevant financial institution. Master Hydro (Pvt.) Ltd. will follow PSs of IFC for this project and will ensure that the contractors/ subcontracts (subcontractors of the contracts) appointed by it follow the IFC's PS on environmental and social sustainability.

Project Description

The Arkari Gol HPP is a run-of-the-river hydropower project to be constructed on the Arkari Gol, a tributary of the Lutkho River. The catchment area of Arkari Gol at the proposed dam site is 1,036 square kilometer (km^2). Arkari Gol HPP Dam is located near the village of Ucchatur and the Powerhouse is located near the village of Andakht.

Power Generation Capacity

The proposed Project is designed to operate with the reservoir at Full Supply Level (FSL) of 2,190 m above mean sea level (amsl) with a reservoir capacity of 1.06 million m^3. At these conditions, the total installed capacity of the hydropower station will be 99 MW.

Land Requirement

The Project will involve acquisition of land for various components. A total of 140.0 acres of land will be required of which 26.5 acres is cultivated land, 4.0 acres is residential land and 109.5 acres is barren land or river bed. This will include 19.0 acres for Powerhouse, 5.6 acres for Surge tank, 5.4 acres for Warehouse, 45.15 acres for Dam and Intake structure, 25.9 acres for Reservoir and 38.96 acres for Temporary facilities.

Main Components of the Project

Dam and Reservoir

The dam will be a concrete-faced, rock-filled structure with a height of 20 m. The small live operating storage will be 0.489 million m^3. The reservoir will have a length of approximately 1.3 km[1] and an area of 0.101 km^2 (10.143 hectare).

[1] Pakhtunkhwa Hydel Development Organization (PHYDO), Government of Khyber Pakhtunkhwa, not dated, Feasibility Study for the Arkari Gol Hydropower Project, District Chitral, (Lower), Khyber Pakhtunkhwa, Volume 1, Main Report

Reservoir Sediment Flushing

Mean annual suspended sediment load at the weir site is about 0.259 million m^3. Mean annual bed load at the weir site is about 0.039 million m^3. Mean annual total sediment inflow to the Arkari reservoir is about 0.297 million m^3.

Based on information from the developers the reservoir will reach equilibrium seven years after construction. Flushing will be carried out annually over a period of 3-7 days during July (high flow season) depending on the sediment inflow.

Intake Structure

The intake structure will comprise two bays fitted with vertical gates to regulate inflow from the reservoir. On each bay a trash rack will be provided upstream of the gates to check the entry of floating debris into the power waterway. The intake structure is proposed along the right bank of the river as close to the embankment of the dam as possible. This will facilitate flushing of sediment and maintenance of maximum submergence. A lateral structure is proposed to minimize head losses and accelerate flow uniformly for the trash rack to the gate downstream. The intake structure is designed to be capable of discharging the total design discharge for the turbines plus 20% of the design discharge for flushing of the sediments settled in the de-sanding chambers. Total design discharge of the intakes will be about 36 m^3/s.

Headrace Tunnel from Intake to Surge Tank

The headrace tunnel will run from the intake to the surge structure. The optimal internal tunnel diameter is 4.4 m to give a rated discharge of 36 m^3/s for the Pelton turbines. The resulting flow will be approximately 3 m/s which is within the range allowed for concrete-lined tunnels.

Pressure Shaft, Pressure Tunnel and Tailrace

The powerhouse and the pressure shaft will be connected by a pressure tunnel with a vertical length of 296 m. The total length of the pressure tunnel will be 700-900 m including a length of 300 m for the pressure shaft. The total length of the tailrace channel to the outlet structure will be 100 m.

Surge Tank

The surge structure branches at an elevation of 2,165.96 masl & 2,209.6 masl. The surge shaft is of an internal diameter of 4.5 m and is of 71.18 m high. A three-chamber surge tank has been selected. The final dimensioning of the surge structures will need detail of basic requirements of the manufacturers for the hydro-mechanical equipment.

Powerhouse

Studies have shown a clear superiority of an external type powerhouse, located on the right bank of Arkari Gol near Andakht Village at the confluence of Arkari Gol and Lutkho River. The power station comprises following main structures:

- Turbine shaft for installation of three Pelton wheel turbines.
- Surface machine hall and operation building.
- Tailrace channel.

Three vertical shaft Pelton turbines are proposed. Each unit will be designed for a rated flow of 12 m^3/s producing a discharge of 36 m^3/s. This will result in a net head of 318 m and a rated mechanical turbine power of 33 MW. Therefore, total capacity will be 99 MW.

The gross head will be 335.33 m and net head 318 m. Maximum reservoir level will be 2,190 masl and tail water level will be 1,854.7 masl.

Construction Material and Waste

Material Requirement

The total amount of material for the main works and temporary construction of the project is about 240,000 tonnes of concrete, 27,500 tonnes of fill material and 8,000 tonnes of steel.

Spoils Disposal

Excavation of tunnels, desanders, and forebay will result in the production of huge quantities of muck comprising various rock types. In the weir area the rocks expected from the excavation of desanders and the portion of headrace tunnel comprise of granitic gneisses and amphibolites. Based on the indicative bill of quantities it is assumed that the total quantity of spoil material from dam site, tunnel and powerhouse will be between 300,000m^3 and 500,000m^3.

MHL have suggested that the material be used to provide terraces that can be used by the local population.

Construction Timeline

The construction will require 4 years (48 months).

Stakeholder Consultation

The consultation process was designed to be consistent with the relevant national legislation and the IFC's PS on social and environmental sustainability. Consultations with the Project stakeholders were undertaken in late April, 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 and institutions was recorded and detailed logs of consultations were prepared. A total number of 8 communities were consulted along the Arkari Gol. Local government and officials were also consulted.

Summary of Consultation

Following is a summary of concerns expressed by the communities:

- Project development will increase job availability which is a positive outcome.
- The Project should invest in improvements for the local communities including education, healthcare, safe drinking water.
- Land sliding is a serious risk in the area. The Project should invest in reducing the risk of land sliding and also in construction of new roads.

- The Project should supply LPG (Liquid Petroleum Gas) to the local communities at subsidized rates so that they no longer need to use forest wood for fuel.
- Priority in jobs should be given to those who are most affected.
- Electricity should be provided to the affectees free of cost.
- Irrigation systems depend on river water and the construction of a dam will result in interruption in this water supply. This will impact agriculture, and in turn, the livelihoods of the local communities.
- Increased traffic especially heavy traffic will result in an increase in air and noise pollution as well as increase in traffic.
- If any graveyards and places of worship are affected, the Project should provide them with newly constructed places of worship.
- People's homes are very important to them and hold value in terms of family ties. Affected households should be properly compensated for the loss of land and property. The government should build homes for them.
- Land acquisition should be minimized. Those affected should be properly compensated. This should be done for all assets, not just land.
- Project developers should build a colony for affectees and provide alternative land.
- Springs may dry up due to construction activities
- Construction of the tunnel may result in instability and an increase in landslides.
- Due to influx of outsiders mobility of women will be affected.

The following is a summary of concerns expressed by the institutional stakeholders:

- Job opportunities will increase and infrastructure will improve.
- Electricity should be provided free of cost.
- Springs may become dry due to construction activities.
- Land sliding is a major issue in the area.
- Fish may be affected and their populations may decrease due to dam construction.
- River as well as the major tributaries which support breeding of fish will be impacted due to dam construction

Overview of the Physical Environment

The physical baseline includes a description of the topography, land use, geomorphology, visual character, climate, air quality, water resources, noise levels, and traffic.

Topography

The area in the catchment of the Arkari Gol, upstream of the Project ranges between 1,830 m and 6,956 m. The majority (~90%) of this catchment is below 5,000 m amsl, resulting in limited permanent snow and glacial cover within the catchment, relative to

other catchments of the higher Himalaya and Karakorum in Pakistan to the east and north east of the Arkari Gol catchment respectively.

Land Use and Cover

Based on the land cover and land use classification in the GlobalLand30 dataset, the land cover upstream of the Project includes only minor forest (0.9%) and agricultural land (0.7%). The majority of land cover is barren land (63.1%), followed by shrub land (16.8%), snow and ice (9.8%), and grassland (8.8%). The western side of the Arkari Gol contains most of the shrub land while grasses are mostly found in eastern side. Most of the available snow and ice fraction has been found above 4500 m elevation.

Geology, Soils and Hazards

Tectonics

The Project area is part of the continental collision zones between Eurasian and Indian plates. The intercontinental collision between the Eurasian and Indian plates has resulted in intense deformation with complex folding accompanied by a continental subduction process. The Indian plate is under thrusted and the Eurasian plate is upper thrusted. Both the plates are separated by the Main Karakoram Thrust (MKT) which trends in NE-SW direction, through Shishi valley, Rizhun Gol and passes through Harchin from Chitral district.

The Chitral district has three main mountain ranges, known as Hindu Kush, Karakoram and Kohistan. The Hindu Kush and Karakoram ranges are located on the Eurasian plate while the Kohistan range is part of Indian plate.

Seismic Hazard

The Northern Areas of Pakistan are extensive zones of high seismicity and contain several seismo-tectonic features generated by an integrated network of active faults. A telemeter seismic network which operated from 1973 to 1977 has recorded data from approximately 10,000 earthquakes covering the area between longitudes 69º and 75º and latitudes 30º and 35º.

Seismic Hazard Analysis in the Feasibility Study

Seismic hazards may be analyzed deterministically, as when a particular earthquake scenario is assumed, or probabilistically in which uncertainties in earthquakes size, location and time of occurrence are explicitly considered. Both approaches were adopted in the Feasibility Study for the Project. A summary of the results of these studies, together with a brief description is provided below:

A summary of the results calculated for the Feasibility Study, together with a brief description of is provided below:

- The Maximum Credible Earthquake (MCE) is the largest reasonably conceivable earthquake that appears possible along a recognized fault or within a geographically defined tectonic province, under the specific tectonic framework governing the region of interest. The value for Peak Ground Acceleration (PGA) for MCE was calculated to be 0.61 g.

- The Maximum Design Earthquake (MDE) is the maximum level of ground motion for which a structure is designed. The MDE value recommended in the Feasibility study is 0.305 g based on a reduction factor of 2 with respect to MCE.
- The Operation Basis Earthquake (OBE) is the level of ground motion the dam shall be capable of resisting, remain operational, and not require extensive repairs. All structural components, which are part of or built within the main dam body, are designed to remain functional during and after an OBE event. For OBE; a value of 0.305 g was recommended. The OBE has probability of 10% of being exceeded in 50 years. However, as the Building Code of Pakistan prescribes a value of 0.34 g the OBE was increased to 0.34g to comply with the building code.

The peak ground acceleration (PGA) with 10% probability of exceedance in 50 years (475 year average return interval) by the Global Seismic Hazard Assessment Project, is reported and is between 4.01 meter per second squared (m/s^2) and 4.80 m/s^2 (0.41g to 0.49 g) at the Project site.

Lithology

The rocks at Power house area are gneissic type and phyllite, well bedded, medium to thick bedded, medium to hard, and splintery. As powerhouse is located at confluence of Arkari Gol and Lutkho river the quaternary deposits like scree and alluvium are present. The whole terrace is covered by cultivated land. The bed rock is covered under these deposits.

The dam is located in a granitic outcrop. The granite body intrudes along the strike of the Wakhan formation which consists of slate, gneiss and quartzite. Tirich Mir granite also has similar origin and may have normal igneous contact with the Wakhan formation in the Project area.

From dam to the powerhouse, the tunnel crosses metamorphic and igneous rocks including phyllite, schist, gneisses, quartzite, and granite.

Climate

The Chitral weather station, 27 km southeast of the Dam site was used to categorize the climate of the area. The climate analysis of Study Area was carried out by classifying it into different seasons as follows:

- Spring (mid-March to mid-June): characterized by high temperatures, and high rainfall with moderate humidity and high speed-winds. Summer (mid-June to mid-September)
- Summer (Mid-June – mid-September): hot and dry weather, with temperatures reaching highs of 35 C in July and average precipitation of 6-7mm per month.
- Autumn (mid-September to mid-November): characterized by moderate temperatures and low rainfalls. Daily minimum reaches 5 C in November with moderate humidity, as the humidity again reduces after monsoon and low speed-winds.

- Winter (mid-November to mid-March):characterized by very low temperatures, with an average daily maximum of 10 C, moderate rainfalls, with an increasing amount of rainfall at the end of the winter.

Most of the stations operated by the Pakistan Meteorological Department (PMD) in high altitudes are not representative of the Project catchment, as these are located in the valleys. Therefore, the spatial WorldClim 2.0 dataset is also presented in the main report. The WorldClim 2.0 dataset shows a good match with the data at the Chitral Station and can therefore be used to gauge the climate patterns at the Project site.

Ambient Air Quality

The Ambient Air Quality was measured for respirable particulate matter (PM) including both PM_{10} and $PM_{2.5}$. The air quality was tested at 3 locations and found to be within IFC EHS interim target 1 values at all locations of measurement.

Noise Levels

The noise levels were measured at three locations for 24 hours each, using portable Cirrus Research plc.'s sound level meter, Model CR:1720. Noise levels were within NEQS at all three locations during the daytime. During the night they exceeded NEQS at 2 of the 3 locations. Low levels of anthropogenic noise sources were observed as low levels of fluctuation were observed during the night and day and the current noise levels are likely all from natural sources.

Traffic

Traffic counts were conducted at two locations on the transport route, T1 near the Powerhouse site and T2 closer to Chitral. The key findings are:

- Almost all traffic consisted of light transport vehicles (94%).The remaining 6 % traffic was heavy transport vehicles which consists of buses and two axle trucks.
- At T-2, an early morning traffic peak was observed from Garam Chashma to Chitral, whereas an afternoon peak was observed in the opposite direction. This may indicate that people travel into Chitral for work in the morning and return in the afternoon.
- At T-1 the Arkari to Chitral and Garam Chashma to Chitral routes show similar early morning peaks as observed at T2. The remaining routes have minimal traffic on them.

Visual Character

The mountainous landscape, deep gorges restricts visibility to a maximum of 0.5 to 1.5 km at receptor locations. However, the lack of vegetation and distance between mountains allows for clear visibility within the valley.

Water Resources and Sediment

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

The Project reservoir and dam are located on the Arkari Gol, a left bank tributary of the Lutkho River. The Lutkho River drains into the Mastuj River. The Arkari Gol flows at a

much higher elevation than both the Lutkho and Mastuj rivers. After passing Chitral, the Mastuj River is known as the Chitral River, which on entering Afghanistan is known as the Kunar River, a left bank tributary of the Kabul River. The Kabul River reenters Pakistan near Peshawar, where it combines with the Swat River, and then flows into the Indus River downstream of the Tarbela Dam near Attock City.

The hydrology at the dam site is characterized by:

- Peak flows in the month of July and August associated with melting of snow and ice at higher elevations in the catchment
- Dry or low flow winter season typically extends from December through March when the flows are reduced to the order of one sixth of peak in the month of August.

May, June, July, August and September are months of significant amounts of suspended sediment in the Arkari Gol. In August suspended sediment at the site peaks at 81,605 tons, whereas January has the lowest suspended sediment load at 791 tons. There is little vegetation cover in the watershed as it remains covered with glaciers and snow during the winter. Consequently, the river is fed mostly by snow and glacial melt and flows steadily throughout the year. On an annual basis the Chitral River carries 435 times more sediment but only 17 times more water than the Arkari Gol. The high value of suspended sediment at low elevation (Chitral) is mainly owing to high rainfall runoff erosion and increased sediment transport.

Community Water Resources

A census was carried out to map the community water resources for villages near Project facilities. A 500 m buffer around the Project facilities that may need excavation (including the dam and underground tunnels) was demarcated for the survey to account for the distance to which the impact on ground water might possibly extend.

A total of 13 water resource infrastructure points (9 mountain springs and 4 water supply schemes) were identified and characterized within the hydrocensus area. 74 households depend on the springs, whereas 487 households depend on the water supply schemes in the area covered by the hydro-census. Mountain springs in the area are largely undeveloped and have no associated infrastructure. These springs are a major sole potable water supply for the majority of households. 90% of active water sources are used to supply drinking water to humans and all water sources are used for livestock drinking as well. Residents of the area also use the Arkari Gol for drinking, other uses, and for their livestock. The physical and chemical parameters are within standards and no bacterial contamination was found in the mountain spring water that was tested and was classified as excellent for drinking based on its microbiology.

There are four main water channels that are diverting river water for irrigation from near the dam site. These channels have been constructed by the community using locally quarried stone and materials**.** Approximately 202 acres of land is irrigated from water diverted by these channels.

Water Quality

Water quality samples from Arkari Gol, Luktho River, and community springs were collected and analyzed for establishing baseline conditions for surface and groundwater. The key results are discussed below:

- No bacterial contamination was found in the mountain spring water that was tested and was classified as excellent for drinking based on its microbiology.
- All parameters tested were below the NEQS limits and the water quality is uncontaminated in the area.
- The Lutkho River has lower conductivity and higher pH than the Arkari Gol and the mountain spring water in the Arkari Gol catchment.

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 Chitral River

The Chitral River, which is the principal river of the Chitral Valley, is formed by the union of two sub rivers, the Lutkho River from the north-west and the Mastuj River from the north-east. Summer temperature range between 14 to 19°C, while winter temperature range between 2 to 6°C. Tributaries of Chitral River include the Barum Gol, Turikho Gol, Yarkhun Gol, Arkari Gol, Lutkho Gol, Bomboret Gol, Rambur Gol, Birir Gol, Shishi Gol and Ayun Gol. A total of six species of fish have been reported from Chitral River and its tributaries, including Snow Trout *Schizothorax plagiostmous (richadsonii)*, Kunar Snow Trout *Schizothorax labiatus*, Chirruh Snow Trout *Schizopyge esocinus*, Chitral Loach *Triplophysa choprai*, Himalayan Catfish *Glyptosternum reticulatum* and Khyber Loach *Schistura prashari*. Chirruh Snow Trout is very rare, and only one or two specimens have been reported from the lower reaches of the river.[2]

The Arkari Gol, where the Project is located, mainly originates from the Arkari Glacier at an altitude of 5,065 m. Many smaller tributaries connect with the Arkari Gol including Parpuni Gol, Shul Gol, Mazhigram Gol, and Easi Gol. A total of four fish species have been reported from the Arkari Gol i.e. Snow Trout, Himalayan Catfish, Chitral Loach and Khyber Loach.

The main Chitral River in some upstream area is flat and open, dividing into many channels with plenty of vegetation on the banks. The river in this stretch provides ideal breeding habitats for fish, especially for Snow Trout, Chitral Loach and Himalayan Catfish. In the summer season, Chitral River is very turbid and torrential during due to rainfall and rapid melting of snow. The summer season is also the breeding period for the fish. However, due the high turbidity and torrential flows, it becomes difficult for the fish to breed in the main river. In contrast, the tributaries have physical conditions favorable

[2] Hora, S. L., (1934). The fish of Chitral. Rec. Ind. Mus., (36): 279-320.

for fish (turbidity, flow, food availably), therefore, many species depend mainly on the tributaries for breeding and feeding.

During the March 2018 surveys a total of three fish species Snow Trout, Chitral Loach and Himalayan Catfish were recorded from the Aquatic Study Area. The most abundant and widely distribution fish species was Chitral Loach followed by Snow Trout and Himalayan Catfish.

Migratory Fish Species

Based on the surveys carried out in March 2018, the Aquatic Study Area contains only one long distance migratory species, the Snow Trout. The Snow Trout is of conservation importance based on the IUCN Red List 2018 as it is listed as Vulnerable.[3]

In order to avoid the low temperature during winter in the upper section of the Aquatic Study Area, the Snow Trout migrates to lower parts of the Chitral River during the winter period. At the start of the spring season (mid of April) the Snow Trout migrates back to the upper reaches of Lutkho River and Arkaro Gol. In the Arkari Gol the Snow Trout migrates upstream 5.2 km of the confluence. At this point the elevation of the river increases. Also there is a waterfall of about 5 feet (2.5 km downstream of the proposed dam site) which restricts the fish from upstream migration. No fish specimen of any species was captured at any location upstream of this waterfall. Locals of the area also stated that the presence of the natural waterfall in the area restricts the Snow Trout from upstream migration.

A total of 25 specimens of the Snow Trout were observed during the March 2018 surveys in the Aquatic Study Area.

Macro-invertebrates

Based on surveys carried out for the ESIA the most abundant macro-invertebrate taxa reported include *Baetis* sp. followed by *Chironomidae* Most of pollution intolerant genera of macro-invertebrates were observed indicating good water quality. One moderately pollution tolerant genus i.e. *Hydropsyche sp* was also observed.

Riparian Vegetation

The dominant species included *Salix viminalis*, *Artemisia maritima*. *Robinia pseudoacacia*, *Salix acmophylla* and *Rumex hastatus.* Vegetation cover was reported as ranging between 1.36% and 2.60%, average plant count was 15 and floral diversity was reported as 4 species per Sampling Location.

Periphyton Biomass

Periphyton is attached algae on the sediment deposited on stones. It is a source of food for benthos and small fish species. During the March 2018 survey, sampling for periphyton biomass was carried out at a total 3 sampling locations but no periphyton biomass was collected from any sampling location. This is because of the fast flow of the

[3] Vishwanath, W. 2010. *Schizothorax richardsonii*. The IUCN Red List of Threatened Species 2010: e.T166525A6228314. http://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T166525A6228314.en. Downloaded on **18 April 2018**.

river in the surveys season, which erodes and washes out periphyton biomass from the cobble stones.

Terrestrial Biodiversity

Terrestrial Flora

A total of 14 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. The locals are dependent on the plants for numerous uses, some of which include food sources, medicinal products, fodder and fuel.

Mammals

A number of mammal species have been reported within the wider area of the Project. These include the Common Leopard *Panthera pardus*, Snow Leopard Panthera uncia, Pallas Cat *Otocolobus manul*, Leopard Cat *Prionailurus bergalensis*, Grey Wolf *Canis lupus*, Red Fox *Vulpes vulpes*, Asiatic Jackal *Canis aureus*, Himalayan Brown Bear *Ursus arctos*, Asiatic Black Bear *Ursus thibetanus*, Stone Marten *Martes foina*, Yellow Throated Marten *Martes flavigula*, Flare-horned Markhor *Capra falconeri*, Himalayan Ibex *Capra ibex*, Long Tailed Marmot *Marmota caudata*.

During the March 2018 Survey only Snow Leopard and Flare-horned Markhor observed in the Study Area are of conservation importance as these species are listed as Vulnerable and Near Threatened respectively in the IUCN Red List.

Avifauna

A total of 19 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 Vegetation Cluster habitat type. Abundant bird species include the Mallard *Anas platyrhynchos*, Ferruginous Pochard *Aythya nyroca*, Black-billed Magpie *Pica hudsonia*, and White Wagtail *Motacilla alba*.

Ferruginous Pochard and Lammergeier *Gypaetus barbatus* are listed as Near Threatened in the IUCN Red List of Species.

Herpetofauna

A total of four species of herpetofauna were observed during the surveys carried out as part of the ESIA. The highest reptile abundance and density was observed in Barren Land habitat type, while diversity in the Vegetation Cluster habitat was higher than that of Barren Land. None of the herpetofauna species observed are of conservation importance based on the IUCN Red List of Species.

Overview of Socioeconomic Environment

Rural settlement surveys were undertaken in all 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 III**.

Exhibit III: Physical and Socioeconomic Features of the Study Area

Near the Location of Project Facilities

Community consultation at Uchhtar settlement

Unsealed road in Socioeconomic Study Area

Wheat crop in Mumi settlement

Female consultation at Mumyun settlement

Artificial pond for migratory birds and ducks hunting near Uchhtar

There are a total of 8 settlements in the Socioeconomic Study Area. All the settlements in the area are located along the river within a radius of 300 meter from the center of the river. All the settlements are small in terms of number of households (HHs) raining from 5 to 70 HHs. The average household size in the Socioeconomic Study Area is 6.67 individuals, with a minimum average of 5.63 individuals at settlement Raughnik and a maximum average of 7.5 individuals at settlement Mumyun.

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. Very little out migration was recorded, whereas no in-migration was recorded in any settlement.

Main castes in the Socioeconomic Study Area are Zondray, Khuja Alanjas and Raees. The predominant language in the Socioeconomic Study Area is Khowar (100%), with Urdu as the main secondary language.

School enrolment for both boys and girls was found to be comparable at all levels.

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 both side of Arkari Gol in the Socioeconomic Study Area are connected to main towns and cities through Arkari Road which links settlements to Chitral Garam Chashma road on one side and to Arkari town to other side. Arkari Road is an unsealed road in poor condition moreover, it is a landslide area and occasionally land sliding also damages the road.

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 Arkari Gol River. Most settlements surveyed reported access to pit latrines of some type, although a significant number of households are still using open latrines.

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.

All settlements of the Socioeconomic Study Area are connected to the local micro hydro power project located at settlement Mumi provided by a NGO working in the area known as Aga Khan Rural Support Programme (AKRSP).

The Socioeconomic Study Area and surroundings are generally peaceful, and there are no major law and order problems reported. Police presence in the entire area is quite low.

There are no banks or markets within the Study Area. For major purchases the surveyed settlements depend on nearby towns and cities, which include Shaghor, Garam Chashma and Chitral city.

The major sources of income are private jobs (23%), agriculture (22%) government services (21%) and labor (19%). For women major sources of income are private jobs (33%), government services (33%), agriculture (24%) and livestock (10%). A significant

portion (30%) of households in the Socioeconomic Study Area earn less than PKR 20,000, and can therefore be considered impoverished.

The average landholding in all settlements ranges from 2 to 7 kanals (0.101 to 0.354 hectares) per household. The main winter crop in all settlements is wheat and the main summer crop is maize, vegetables are also grown in the Socioeconomic Study Area. Although the area is mountainous and land holdings are small, people have made water channels up to a length of 3-4 km to irrigate their lands. Therefore, crop yields are good in the Socioeconomic Study Area. Due to small land holdings quantity of crop production is limited and not even sufficient for the households themselves and no crops are sold in the market.

People keep cows and goats for milk production and chicken for eggs and meat. A small number of buffalos and sheep were also reported in the Socioeconomic Study Area. Trends in livestock rearing were found to be consistent across the settlements, and animals commonly owned include bullocks/buffalos, cows, goats. Livestock owners often engage herders to rear goats, whereas poultry, cows and buffalo are reared at home.

The socioeconomic activities investigated in detail included sediment mining from the river, irrigation, migratory birds hunting, fishing and recreation and tourism. River dependent socioeconomic activities in the Socioeconomic Study Area were found to be limited.

As observed during the field survey and consultation with the local communities, sediment mining and fishing in the Socioeconomic Study Area is limited and insignificant. There is very little tourism in the Socioeconomic Study Area and recreational dependence on the river was reportedly low in all the settlements.

Main river dependent socioeconomic activity is the irrigation of agricultural lands. As reported by the local communities and observed by the survey team more than 150 acres of land is being irrigated by the Arkari Gol in Socioeconomic Study Area. Moreover, four water flour mills and one micro hydro power plant at settlement Mumi are also operating on these water channels.

Hunting of migratory birds is quite common throughout the entire stretch of the Socioeconomic Study Area. Large size artificial ponds have been constructed near the bank of the river in the Socioeconomic Study Area and decoys ducks are used to attract migratory ducks.

No Indigenous Peoples reside in the Socioeconomic Study Area. More than 90% of the population of the Socioeconomic Study Area belongs to the Ismaili sect of Islam and others belong to the Ahl-e-Sunat sect.

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 related change in flow conditions in the Arkari Gol and Lutkho River.

There is no trans-basin diversion, and ecosystems other than river such as estuaries and wetlands are not affected. There is no significant dependence on the river ecosystem, and the Project is not located in Critical Habitat as per IFC PS6. It is, however, located in

Natural Habitat (not Modified Habitat) therefore a 'Medium Resolution' EFlow assessment would suffice. Connectivity assessment is not considered as important as the natural steep gradient of the Arkari Gol and the resultant waterfalls provide a natural barrier to connectivity. The Snow Trout is not found upstream of a waterfall located 2.5 km downstream of the dam. The dam therefore does not present a barrier to fish migration.

The requirement for 'Medium Resolution' notwithstanding, holistic high resolution models developed for similar rivers in the region with comparable biodiversity including presence of the migratory Snow Trout were adapted for use in the EFlow assessment for the Project. Results of EFlow assessments conducted for hydropower projects located in the Jhelum Basin and for Trishuli River in Nepal using the Downstream Response to Instream Flow Transformations (DRIFT) model were used.

Predictions for impact on fish populations and macroinvertebrates, which are part of the food chain of the fish found in Arkari Gol, the Snow Trout, the Himalayan Catfish, and the Chitral Loach.

Environmental Flow Release and Peaking Scenario

Environmental flow (EFlow), or flow that must be released from the dam to meet the requirements of the aquatic ecosystem, is of concern in the 7.3 km stretch of the river downstream of the dam before the confluence with the Lutkho River EFlow defined in the Feasibility Study was modelled which ranges from 0.8 m^3/s in the dry season to 2 m^3/s in the flood season.

Three peaking scenarios were considered for this study as described below:

- Scenario A: Four hours of peaking at 36 m^3/s corresponding to design capacity of powerhouse,
- Scenario B: Four hours of peaking at moderated peak of 24 m^3/s with two hours of ramp up and ramp down to peak discharge, and
- Scenario C: Baseload or true Run of River operation.

Results and Conclusions

The environmental flow release proposed in the Project Feasibility Study can be justified as the diversity and abundance of fish in the section of the Arkari Gol subjected to low flow is low. The Vulnerable and long distance migratory Snow Trout is either not present in this section, or its abundance is relatively low compared to that in the Lutkho River in the sub-basin.

A fish ladder is not required as fish were not observed upstream of the natural fall in the river located about 2.5 km downstream of the dam.

Downstream of the tailrace the impacts on aquatic ecology depend on the operational scenario selected (see **Exhibit IV**). Under true run of river conditions (Scenario C) where no peaking is carried out populations of the Snow Trout and Chitral Loach will not decline due to the Project. However, under peaking conditions (Scenario A) their populations will decline to 40% and 50% of present day baseline levels, respectively, over a period of 31 years. A modified peaking scenario (Scenario B) is an option in

which the operational peak is reduced to 24 m^3/s and flow is gradually ramped up to peak level and is then ramped down towards the end of the peaking period. This will buffer the impact of a peaking operation. Under this operational scenario the Snow Trout will decline to 70% of baseline while the Chitral Loach will not be significantly impacted. An approach to power generation that provides a balance between economic value of peaking power and impacts of the Project on river ecology and can be justified to result in "No Net Loss Where Feasible" in a Natural Habitat as defined in PS6 will be selected in consultation with the power purchaser.

Exhibit IV: Predicted Populations in 31 Years as Percentage of 2018 Baseline Population

Indicator	*Low Flow Section*	*Downstream of Tailrace Subjected to Peaking Flows*		
	Feasibility EFlow Scenario	*Scenario A*	*Scenario B*	*Scenario C*
EPT Abundance	56%	NA	NA	NA
Snow Trout	58%	40%	70%	100%
Chitral Loach	20%	50%	Negligible change, less than 5% decline	100%

Note: NA – Not Assessed

Study of Alternatives

No Project Option

Pakistan is going through an acute power shortage. The gap between supply and demand has crossed 7,000 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 Chitral Valley, especially fish species of conservation importance. The Project will support government departments in providing protection to fish habitat more effectively.

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 V.**

Exhibit V: Summary of Significant Impacts

ID	*Aspect*	*Impact*	*Phase*	*Stage*	*Magnitude*	*Timeframe*	*Spatial Scale*	*Consequence*	*Probability*	*Significance*	*+/-*
1	Aquatic Ecology	Loss of Aquatic Biodiversity due to Creation of a Low Flow Section Downstream of the Dam	C, O	Init	Moderate	Long Term	Small	Moderate	Definite	Medium	-
				Res	Moderate	Long Term	Small	Moderate	Definite	Medium	-
2	Aquatic Ecology	Loss of Aquatic Biodiversity due to Changes in Ecological Conditions Downstream of the Powerhouse as a Result of Release of Water	C, O	Init	Moderate	Long Term	Small	Moderate	Definite	Medium	-
				Res	Moderate	Long Term	Small	Moderate	Definite	Medium	-
5	Terrestrial Ecology	Project operation leading to animal disturbance, displacement and decline.	O	Init	Minor	Long Term	Small	Medium	Possible	Medium	-
				Res	Minor	Long Term	Small	Low	Possible	Low	-
6	Ambient Air Quality	Increase in ambient concentration of air pollutants from construction activities and vehicular movement may cause health impacts on the community.	C	Init	Moderate	Short Term	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Short Term	Intermediate	Low	Possible	Low	-
8	Hazards of Fly Rock from Blasting	Blasting may pose a safety hazard due to flying debris	C	Init	Moderate	Short Term	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
9	Construction Nosie	Increase in ambient noise levels due to the operation of construction equipment, movement of construction traffic and blasting may create a nuisance for nearby communities and visiting tourists.	C	Init	Moderate	Short Term	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
10	Water Availability and Quality	Alterations of natural passage of springs due to tunnel construction may disrupt the water availability at mountain springs for local community.	C	Init	Major	Long Term	Intermediate	High	Possible	High	-
				Res	Minor	Medium Term	Intermediate	Low	Possible	Low	-
11	Water Availability and Quality	Damage to community irrigation channels may occur during construction especially during blasting of the headrace tunnel	C	Init	Major	Long Term	Intermediate	High	Possible	High	-
				Res	Minor	Medium Term	Intermediate	Low	Possible	Low	-

ID	*Aspect*	*Impact*	*Phase*	*Stage*	*Magnitude*	*Timeframe*	*Spatial Scale*	*Consequence*	*Probability*	*Significance*	*+/-*
12	Water Availability and 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	-
14	Soil, Topography and Land Stability	Contamination of soil as a result of accidental release of solvents, oils, and lubricants can degrade soil fertility and agricultural productivity.	C	Init	Moderate	Medium	Small	Medium	Possible	Medium	-
				Res	Minor	Medium	Small	Low	Unlikely	Low	-
15	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	Init	Moderate	Medium Term	Intermediate	Medium	Definite	Medium	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
16	Soil, Topography and Land Stability	Increased erosion and sediment load entering the river from bunds and sediment ponds during the construction phase and as a consequence of the failure of spoil dumping sites.	C, O	Init	Moderate	Long Term	Intermediate	High	Possible	High	-
				Res	Moderate	Medium Term	Intermediate	Medium	Unlikely	Low	-
21	Traffic and Road	Increased risk to community safety due to increased traffic during the construction phase near communities.	C	Init	Major	Short Term	Small	Medium	Possible	Medium	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
23	Seismic and Flood Hazard	A potential flood and seismic hazard under natural extreme conditions for which the dam is not designed, albeit very unlikely, has potential to cause loss of life and damage to property.	C	Init	Major	Short Term f	Extensive	High	Unlikely	Medium	-
				Res	Moderate	Short Term	Extensive	Medium	Unlikely	Low	-
25	Livelihood and Well-being	Direct, indirect and induced employment at the local level, resulting in increased prosperity and wellbeing due to higher and more stable incomes of people.	C, O	Init	Minor	Long term	Extensive	Medium	Possible	Medium	+
				Res	Moderate	Long term	Extensive	High	Definite	High	+

ID	Aspect	Impact	Phase	Stage	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance	+/-
26	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 local labor.	C, O	Init	Minor	Long term	Intermediate	Medium	Possible	Medium	+
				Res	Moderate	Long term	Extensive	High	Possible	High	+
27	Livelihood and Well-being	Decrease in productivity of agricultural fields due to unavailability of water for irrigation	O	Init	Major	Long term	Extensive	High	Definite	High	-
				Res	Minor	Short	Small	Low	Definite	Low	-
28	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	-
29	Livelihood and Well-being	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	-
30	Livelihood and Well-being	Disputes over the 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	Medium	Intermediate	Medium	Possible	Medium	-
31	Livelihood and Well-being	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	-
32	Livelihood and Well-being	Religious conflicts due to different religious beliefs of workers and locals.	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)

Cumulative Impact Assessment

The methodology used for the CIA of Arkari Gol HPP has been adapted from the guidelines of the International Finance Corporation. The study area selected for the CIA (CIA Study Area) includes the rivers in the Chitral Valley on which hydropower projects are planned mainly the Mastuj River, Lutkho River, Arkari Gol and other tributaries on which hydropower projects are planned. The temporal scope of the CIA spans a period of 31 years up till the year 2050.

Unlike in other basins such as those in Jhelum and Poonch, impacts on socioeconomic aspects are limited in the Chitral Basin as river-dependent socioeconomic activities are limited. The Project is expected to improve infrastructure and employment conditions in the area.

Impact on Fish Fauna

Basin-wide hydropower development will impact migratory fish species, in this case the Snow Trout. Loss of connectivity will confine the population of this fish mainly to reaches in tributaries of the main stem Mastuj/Chitral River where dams are not constructed. The fragmented populations will be under stress due to their inability to migrate downstream in winters to avoid colder waters upstream in the basin. Isolation will also increase in-breeding. Other non-migratory fish species adapted to life in riverine conditions will be impacted due to conversion of part of the river into a lentic or lake habitat. Peaking flows from power houses will substantially reduce the extent of riverbed and will result in loss of habitat for the loaches that survive in cobbles and boulders in shallow waters.

Management Strategy and Measures

This CIA recommends good practice measures that are important for the protection of biodiversity in the long term. These include:

- Assessing the feasibility of fish ladders on a case by case basis
- Release from other dams at levels higher than that for Arkari Gol HPP to account for more productive habitats
- Avoiding overlapping peaking and
- Holistic environmental flow assessments based on World Bank Guidelines

The CIA also recommends basin-wide management. This includes the following actions:

- Standardization of assessment methods using IFC Guidelines,
- Active regulation by the KP EPA using World Bank Guidelines,
- Increased support to the government departments involved in protection of biodiversity and habitat,
- Greater coordination between developers for achieving synergistic benefits and a balance between environmental and energy requirements in the basin and
- Support to research in the basin for advances in understanding of river ecology

Cost Estimate for Environmental Management

The total cost for pre-construction phase is estimated as USD 5,715,686/. The total cost for Environmental Management has been estimated as USD 624,829/- for the construction phase and USD 127,457/- annually for the operation phase.

Conclusion

The Project will have impacts on the physical, socioeconomic and ecological environment. Aspects of the physical environment that will be most affected include water availability, water quality, soil, topography and land stability. Socioeconomically the most significant impact will be on those directly affected by the Project due to land acquisition. Ecologically the Project will have most impact on river biodiversity. The ESIA has taken fish species as the main indicator of aquatic biodiversity. In the Project-affected stretch of the river the fish species impacted will be the Snow Trout, Himalayan Catfish and Chitral Loach. The Snow Trout is listed as Vulnerable on the IUCN Red List and is a long-distance migratory species. As the Project is following the IFC's guidelines, biodiversity impacts were assessed using IFC PS6. Under this PS the Project is not located in Critical Habitat, therefore, it does not need to show Net Gain in Biodiversity Values. It is located in Natural Habitat, therefore, it needs to result in No Net Loss in biodiversity. Based on the EFlow Assessment, the Project is not causing a net loss in biodiversity. Overall, although the impacts on fish fauna are unavoidable, it is not impacting any Critically Endangered or Endangered fish species. The Project, on its own, has limited impacts on aquatic biodiversity, but with other developments in the basin, the cumulative impacts will mainly impact fish fauna, especially long-distance migratory species, namely the Snow Trout.

The ESIA recommends mitigation measures to reduce the impacts of the Project to within acceptable levels. These mitigation measures are consolidated in the environmental management plan (EMP). The EMP provides details of implementation, monitoring and reporting responsibilities for all mitigation measures. In addition a resettlement action plan (RAP) has been prepared in accordance with IFC guidelines, specifically IFC PS5, which provides details of the compensation methods for the affected households.

Hagler Bailly Pakistan

Arkari Gol Hydropower Project

Environmental and Social Impact Assessment

Volume 3 - Draft Report

HBP Ref.: D8E03AGH

June 11, 2018

Master Hydro (Pvt.) Ltd. (MHL)

Lahore

Contents

Exhibits

1. Introduction

Master Hydro (Pvt.) Ltd. (MHL) intends to develop the 99 megawatt (MW) Arkari Gol Hydropower Project (the Arkari HPP or the Project) on the Arkari Gol, about 8 kilometer (km) upstream of the confluence of Arkari Gol with Lutkho River in the Chitral District of Khyber Pakhtunkhwa (KP). The dam is located 370 km from Peshawar. The location of the Project is shown in **Exhibit 1.1**. The dam and powerhouse are at a distance of 7.5 km. The Project is required to comply with the laws of KP.

The environmental and social safeguard documents that are prepared for the Project are as follows:

1. Environment and Social Impact Assessment (ESIA) including the Environmental Management Plan (EMP), Environmental Flow (EFlow) Assessment, and Cumulative Impact Assessment (CIA)
2. Resettlement Action Plan (RAP)

A Feasibility Study of the Project (FS) was released in March 2014. MHL has acquired the services of Hagler Bailly Pakistan (Pvt.) Ltd. (HBP) to prepare the environmental and social safeguard documents for the Project that meet the requirements of the Overseas Private Investment Corporation (OPIC) and conform to environmental legislation of KP and of Pakistan.

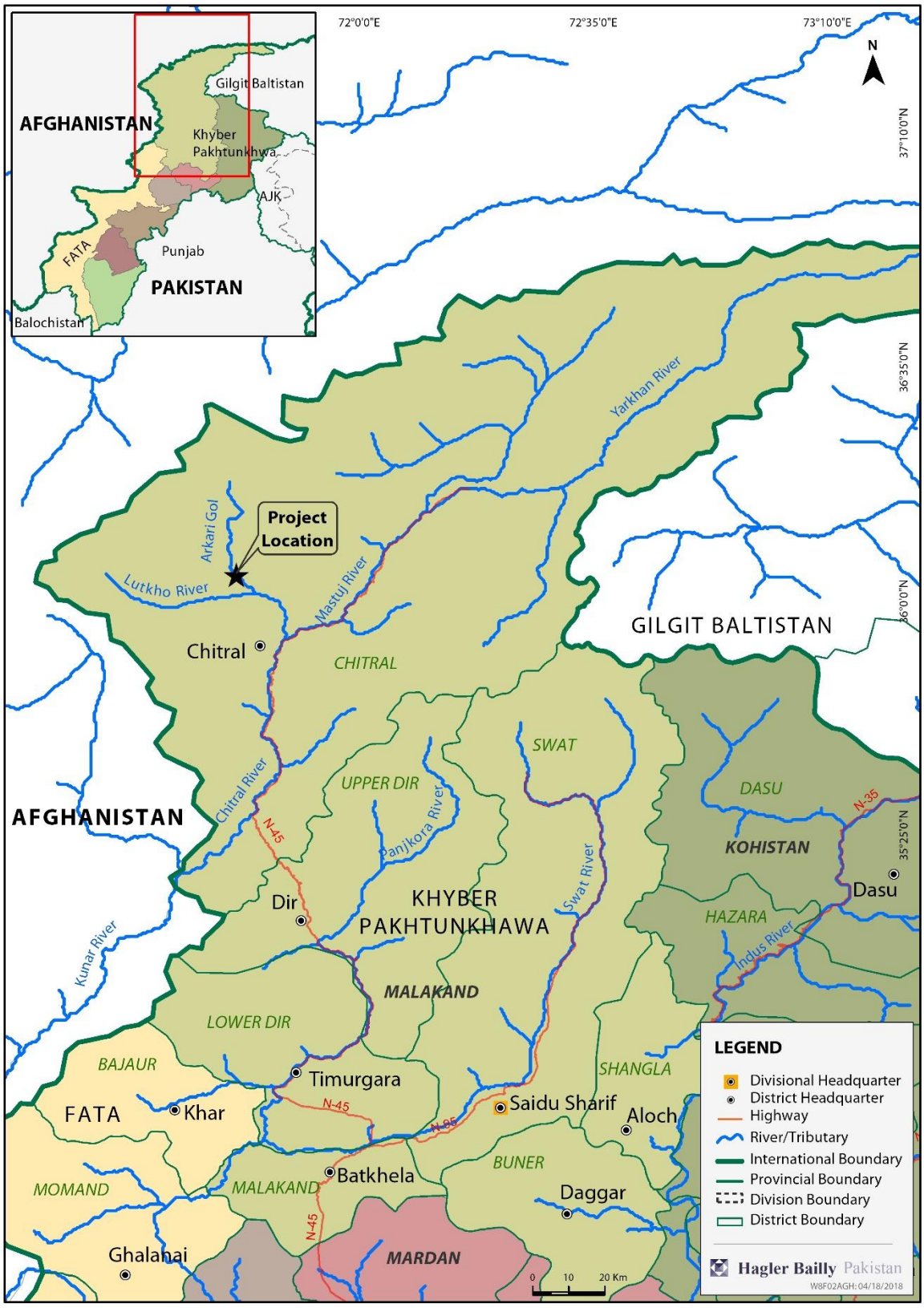
This document is the ESIA of the proposed Project.

1.1 Project Proponents

Master Hydro (Pvt.) Limited is a special purpose corporate vehicle established under the laws of Pakistan, to develop, construct, own and operate the Arkari Gol HPP. Master Hydro (Pvt.) Limited is owned by Master Group of Industries.

Master Group of Industries is a diverse business that started its operations in the mattress industry in 1963 as a licensee of Bayer A.G (Germany). Since then the group has expanded into textile, automobile, engineering and energy sectors. In the renewable energy sector Master Group of Industries established the Master Wind Energy Limited which operates a 52.8 MW wind power project. The wind energy project successfully came into operation in October 2016. The group is looking to increase its investments in the power sector.

Exhibit 1.1: Arkari Gol Hydropower Project Location



1.2 Project Overview

The Project is a run of the river hydropower project with daily peaking in winter, to be constructed on the Arakri Gol (**Exhibit 1.2**). The Project site is located 40.5 km upstream of the Chitral main town, about 370 km by road from Peshawar, near the Ucchatur village, Chitral District, KP. The geographical coordinates of the proposed dam site are 36° 4'3.49"N, 71°41'33.99"Eand of the proposed powerhouse site are36° 1'15.32"N, 71°44'13.07"E. The Project site is about 495 km by road from Islamabad.

The total installed capacity of the Project will be 99 MW. The average annual energy generation will be 378 Gigawatt-hour (GWh).

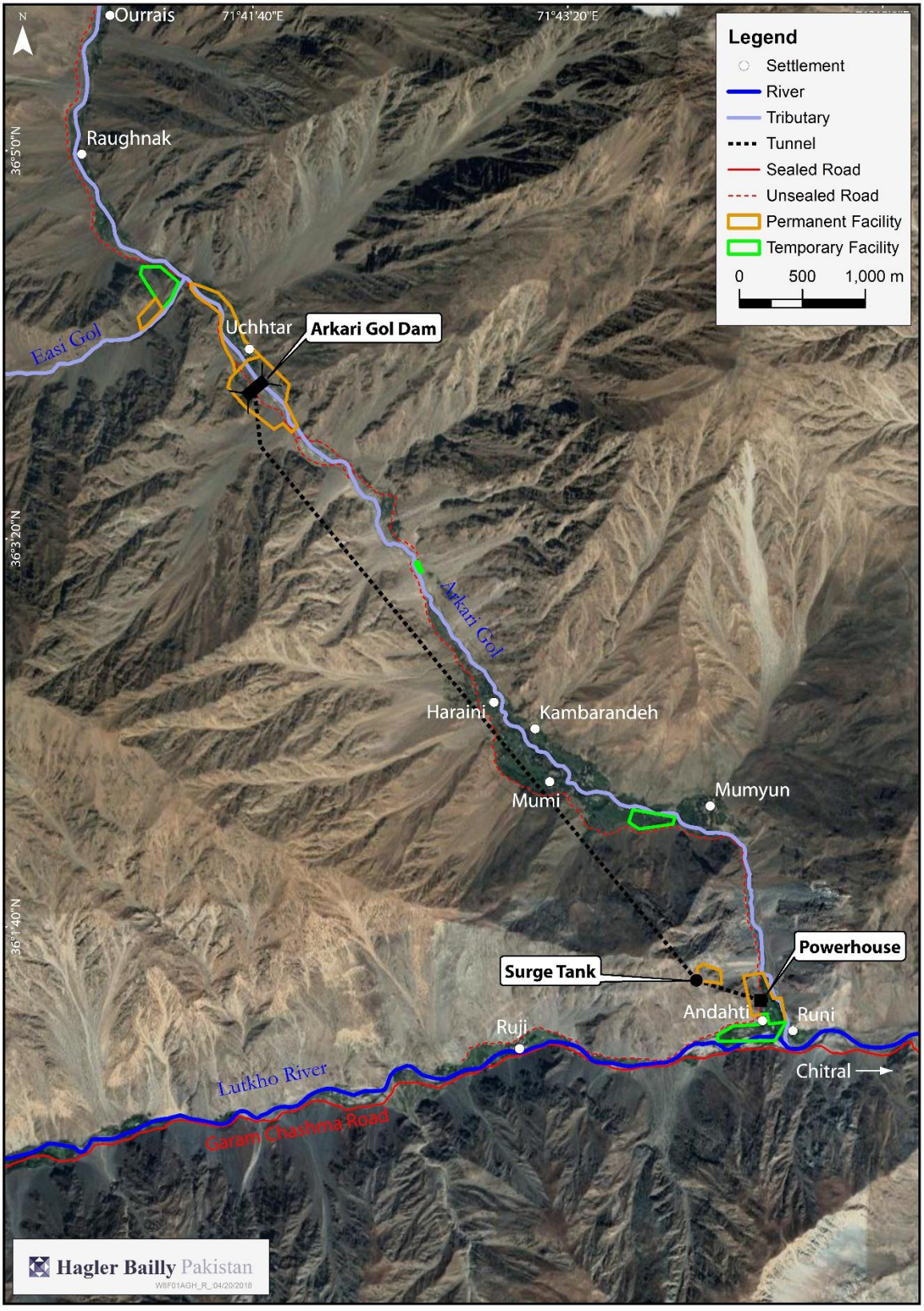
The main dam will be a concrete structure with a height of 20 m from the foundation level and dam crest width of 6 m. The reservoir capacity at full supply level (FSL) of 2,190 m above mean sea level (amsl) will be 1.06 million cubic meters (MCM) of which live storage will be 0.489 MCM. The surface area of the reservoir will extend to approximately 0.121 km upstream of the dam and will cover an area of 0.101 km^2 (10.143 hectares).

The average annual discharge at the proposed dam site is 17 m^3/s. The design discharge is 36 m^3/s. There will be a headrace tunnel with a length of 5.9 km.

The powerhouse will be a surface-type powerhouse with an open 132 kilovolt (kV) switchyard.

There will also be permanent and temporary camp facilities, a workshop area and offices. As the Project is following IFC guidelines these facilities will be established in compliance with IFC standards.

Exhibit 1.2: Arkari Gol Hydropower Project Layout



1.3 Objectives and Scope of the ESIA

The overall purpose of the ESIA is to identify the potential environmental and social impacts of the proposed Project and evaluate them following the process which is acceptable to regulatory authorities in Pakistan, and the Project developers. In this process, the ESIA identified measures to minimize any anticipated adverse impact of the proposed Project as far as possible but at least to a level that meets the national standards and good international industry practice (GIIP) criteria for evaluation of environmental and social impacts.

The specific objectives of this ESIA were to:

- Assess the existing environmental conditions in the Project area, including the identification of environmentally sensitive areas.
- Assess the proposed activities to identify their potential impacts, evaluate the impacts, and determine their significance.
- Assess cumulative impacts of proposed hydropower projects on in the basin.
- Propose appropriate mitigation and monitoring measures that can be incorporated into the design of the proposed activities to minimize any damaging effects or any lasting negative consequences identified by the assessment.
- Assess the proposed activities and determine whether they comply with the relevant environmental regulations in Pakistan as well as the requirements of Project developers.
- Prepare an ESIA report for submittal to the Environmental Protection Agency of KP.

The scope of the ESIA includes the environmental and social impacts of all activities proposed by MHL in the immediate vicinity of the proposed Project site during construction and operation stages of the Project. The scope does not include the transportation of equipment and supplies through ships on international waters and the unloading of the same at the Karachi ports.

To evacuate power from the proposed Project, a 132 kV transmission line is to be constructed by National Transmission and Despatch Company (NTDC), which falls in the category of associated project.[1] The length of the transmission line is not known at this stage as the interconnection point is not yet finalized. To achieve environmental or social outcomes consistent with the national regulatory requirements and the IFC guidelines, it is essential that NTDC undertake the ESIA of the transmission line following the requirements stated in **Section 2** of this report and develop a sound environmental Management Plan (EMP). The scope of this ESIA does not include the design, construction, and operation of the transmission line, however, recognizing the potential impacts and risks associated with the transmission line, measures to ensure that a full EIA of the transmission line is undertaken, the EMP identifies and defines a set of management measures to be taken in the contractual arrangement with NTDC.

[1] IFC defines associated facilities as “facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable”

1.4 Study Areas

The spatial boundaries of the Study Areas for the ESIA were selected to cover all areas where any measureable change to any component of the environment is likely to take place, directly or indirectly, due to any activity directly associated with the proposed Project. The selection of the Study Areas took into account the environmentally sensitive receptors[2] that are most likely to be impacted by the Project's development activities. It also took into account the different stages of the Project specifically construction and operation. To ensure assessment of cumulative impacts, the Study Areas were selected to be large enough to allow the assessment of the Valued Ecosystem Components (VECs) that may be affected by the Project activities.

The permanent footprint of the proposed Project includes the area that will be acquired for the dam, reservoir, powerhouse, roads and some other facilities.

The Study Areas are considerably larger than the Project footprint. The proposed Project has different types of impacts spread over a relatively large area; therefore a single study area for all types of impacts is difficult to define.

The ecological Study Area was defined as follows:

- **Aquatic Study Area**: The part of the Arkari Gol starting from Azhpi upstream of the Project to Mastuj River downstream of the powerhouse. It includes tributaries in this stretch but only those with a significant perennial flow that support breeding of fish.
- **Terrestrial Study Area**: This was defined as a 1 km buffer around locations where Project-related facilities are to be located as well as the reservoir.

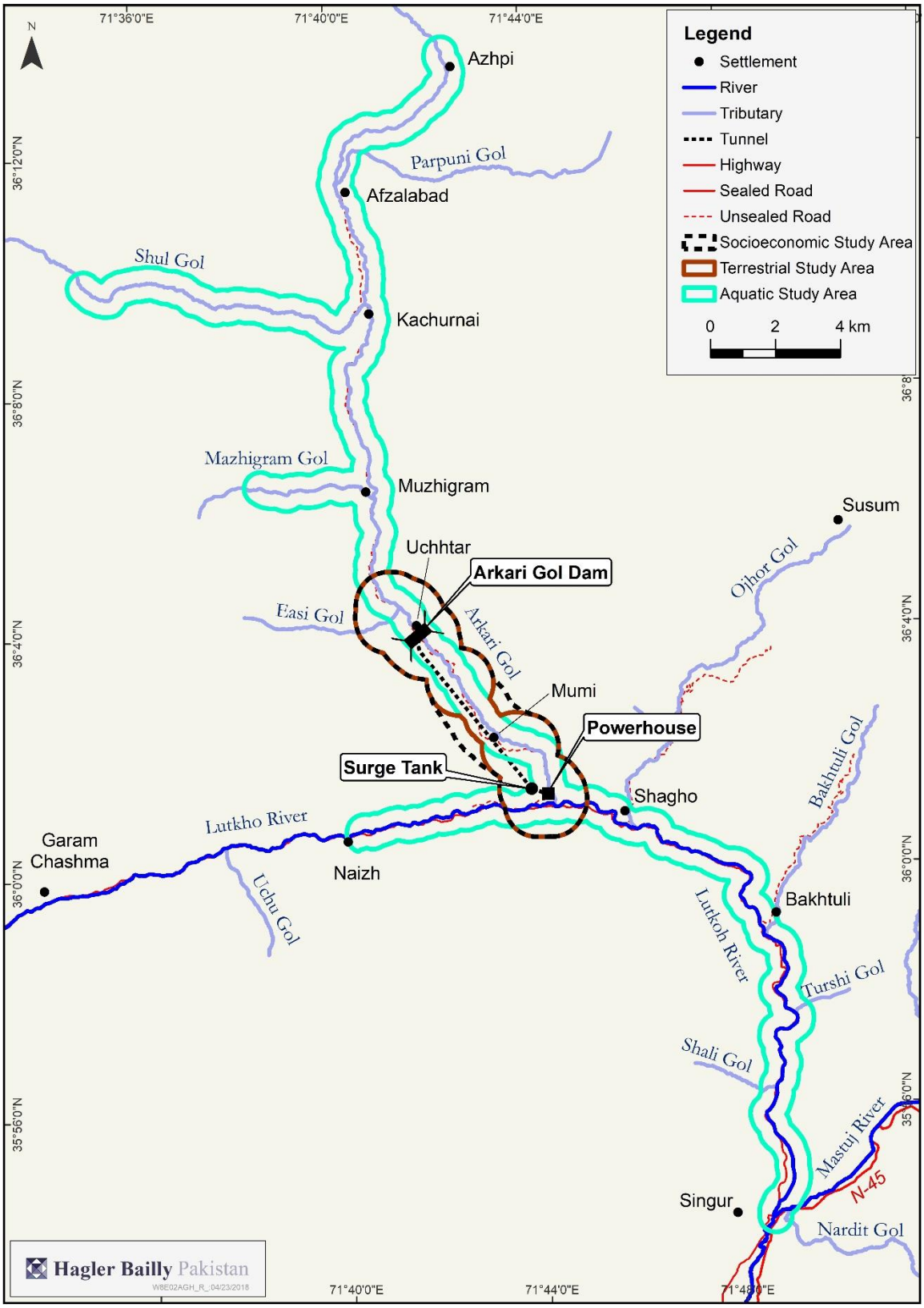
The Socioeconomic Study Area was defined as follows:

- **1 km buffer around Reservoir**: along reaches that may be impacted due to the Project, and the zone where there is river dependence (either through use of drift wood, use of sand and gravel as building materials, fishing, etc.).
  - All settlements with a center within the 1 km buffer are included.
  - All settlements with more than 50% of their land area within the 1 km buffer are also included.
- **1 km buffer around Project facilities:** For coverage of communities that will be directly impacted through either resettlement, or construction related impacts. This includes the low flow section.
- **Upstream Extent:** Selected as the top end of the reservoir, upstream of the dam.
- **Downstream Extent:** The downstream extent of the Socioeconomic Study Area is the confluence of Lutkho River and Arkari GolGol.

The Study Areas defined for this baseline study are shown in **Exhibit 1.3**.

[2] Sensitive receptors include, for example, residential areas, schools, places of worship, habitat of threatened or vulnerable flora and fauna species, drinking water sources, wetlands, and cultural heritage sites.

Exhibit 1.3: Study Areas



1.5 Study Team

The ESIA has been conducted by a team of HBP professionals who are the leading experts in their respective fields in the country. The names of the study team members and their roles are shown in **Exhibit 1.4**.

Exhibit 1.4: Study Team

Name	*Education and Experience*	*Role and Main Activities*
HBP		
Vaqar Zakaria	▶ BS and MS in Chemical Engineering, MIT, USA 26 years of experience in environmental assessment and monitoring	▶ Project Team Leader ▶ EFlow Assessment Expert ▶ Supervision of the Biodiversity Management Plan ▶ Supervision of the Cumulative Impact Assessment
Anwar Fazal Ahmed	▶ MSc (Hons) Rural Development ▶ MA Economics 16 years of experience in resettlement planning and implementation	▶ Land Acquisition and Resettlement Expert ▶ Household socioeconomic data collection, analysis and reporting
Aziz Karim	▶ MSc Biochemistry ▶ BSc Biochemistry, Microbiology, Chemistry Over 10 years of experience in environmental assessment	▶ Physical Environment Expert ▶ Supervision of physical data collection (noise, air quality, traffic and visual) ▶ Water quality, visual and traffic analysis and reporting
Fareeha Irfan Ovais	▶ MSc – Environmental Change and Management ▶ MSc – Zoology ▶ BSc – Botany, Zoology, Chemistry Over 10 years of experience in ecology and climate change	▶ Development of the Biodiversity Management Plan ▶ Reviews for ecology baseline and impact assessment
Hassan Bukhari	▶ MS Natural Resources and Environment ▶ BS Physics 2 years of experience in environmental assessment	▶ Coordination of Physical Environment field teams ▶ Water quality, noise, traffic and air quality data analysis and reporting ▶ Physical impact assessment
Saeed Nawaz	▶ BA Journalism and Education ▶ FSc Physics, Chemistry, Biology 19 years of experience in water, wastewater and soil sample analysis	▶ Hydrocensus and water sample data collection ▶ Water physical parameters laboratory analysis

Name	*Education and Experience*	*Role and Main Activities*
Sadia Asghar	▶ BSc Environmental Engineering ▶ FSc Pre-Engineering 2 years of experience in environmental assessment	▶ Climate data review, analysis and reporting ▶ Physical baseline reporting ▶ Air quality, traffic and visual impact assessment
Kamran Minai	▶ MSc Environmental Science and Management ▶ BSc Biology 4 years of experience in environmental assessments	▶ Project management support ▶ Compilation and standardization of the Project reports ▶ Quality assurance checks ▶ Coordination of Terrestrial Ecology field teams ▶ Compilation of Ecological Baseline ▶ Terrestrial ecology desktop research, data collection, analysis and reporting ▶ Terrestrial ecology impact assessment ▶ Aquatic ecology impact assessment
Shakeel Ahmad	▶ MPhil. Wildlife and Ecology ▶ BS (Hons.) Zoology 3 years of experience in ecology data collection, analysis, reporting and assessments	▶ Project management activities ▶ Ecology surveys ▶ Ecology baseline preparation
Ahmad Shoaib	▶ MPhil. Fisheries and Aquaculture ▶ BS (Hons.) Applied Zoology ▶ BS (Hons.) Fisheries and Aquaculture 3 years of experience in aquaculture and 1 year of experience in fish surveys for environmental assessments	▶ Aquatic ecology field investigation, data analysis and reporting
Muhammad Usman Berches Niazi	▶ MSc. Geography ▶ BA. Geography and Economics 4 years of experience in Geographic Information Systems (GIS)	▶ Socioeconomic, physical and ecological report mapping
Jan Muhammad	▶ MS Economics 8 years of experience in social development	▶ Socioeconomic field data collection
Ghulam Murtaza	▶ MSc Sociology ▶ BA Sociology ▶ FSc Pre-Engineering 7 years of experience in geographic information systems (GIS) and 8 years of experience in ecology field surveys	▶ Socioeconomic, physical and ecological report mapping

Name	*Education and Experience*	*Role and Main Activities*
Naseer ud din Ahmad	▶ MA Economics and Statistics 50 years of experience in project management and administration	▶ Administrative and logistic support
Imran Khalid	▶ Certification in MS Office and Hardware ▶ Graduation 12 years of experience in formatting and designing of technical documents	▶ Document formatting services
Umer Jehangir	▶ Graduation 7 years of experience in formatting and designing of technical documents	▶ Document formatting services
HBP Associates		
Dr Mohammad Rafique	▶ PhD Zoology ▶ MPhil Genetics ▶ MSc Zoology ▶ BSc 27 years of experience in fisheries assessments	▶ Biodiversity expert and lead aquatic ecologist ▶ Aquatic ecology field investigation, data analysis and reporting
Mishkatullah	▶ MSc (Hons) Agriculture and Entomology ▶ BSc (Hons) Agricultural Entomology ▶ FSc Pre-Engineering 12 years of experience in entomological studies	▶ Aquatic ecology field investigation (macroinvertebrates), data analysis and reporting
Rafaqat Masroor	▶ PhD Zoology (Herpetology) ▶ MSc Zoology ▶ BSc Zoology, Botany, Geography 14 years of experience in wildlife studies and conservation assessments	▶ Terrestrial ecology field investigation and data collection
Muhammad Yasir Asad	▶ MS Sociology 7 years of experience in social development	▶ Household socioeconomic data collection
HBP Consultants		
Bilal Khan	▶ BSc Geology ▶ BEng Environmental Engineering Over 10 years of experience in hydrology, geology and environmental impact assessment	▶ Climate Change Risk Assessment

1.6 Organization of the Report

The ESIA is organized in 10 sections. Following this section, **Section 1** (*Introduction*), there are two sections that provide the information that put the Project into context. These are:

- **Section 2** (*Policy Legal and Administrative Framework*) describes the legal, policy, and regulatory requirements applicable to the ESIA process and the project design.
- **Section 3** (*Description of the Project*) describes the Project facilities, its main components, the construction activities, land requirement and the technical design summary.

The environmental baseline, or current status of environmental conditions, is discussed in the following three sections:

- **Section 4** (Description of the Environment) is divided into three parts:
  - **Section 4.1** (Physical Baseline) describes the geology, soils, hazards, topography, land use, climate, air quality, sound levels, visual character, and the water resources of the Study Area.
  - **Section 4.2** (Ecology Baseline) describes the fish, macro-invertebrates, riparian vegetation, terrestrial flora, mammals, avifauna, and herpetofauna of the Study Area.
  - **Section 4.3** (Socioeconomic Baseline) provides a narrative description of the socioeconomic zones, a description of the demographics, ethnicity, religion, governance, and administrative setup, social service infrastructure, physical infrastructure, local economy household socioeconomic conditions, indigenous people, and cultural heritage of the Study Area.
- **Section 5** (*Analysis of Alternatives*) identifies and analyzes various alternatives to the Project and its design. This includes a 'no project' option, alternative technology and scale of power generation, alternative Project location and layout, peaking and non-peaking operation, environmental flow and management option, and options for equipment and supplies transportation.
- **Section 6** (*Information Disclosure, Consultation, and Participation*) describes the scoping consultations undertaken for the Project and the results of consultations.

The impact assessment is organized in three sections:

- **Section 7** (*Anticipated Environmental Impacts and Mitigation Measures*) is the main assessment chapter that assesses the impact of the proposed Project design, construction and operation on the physical, ecological and socioeconomic environment of the area. The aspects that are covered include aquatic ecology, terrestrial ecology, air quality, hydrology and water quality, noise, soil, topography, land stability, land acquisition, livelihood and well-being, macroeconomic impacts, aesthetics and tourism, climate change, cumulative impacts, traffic and road.

- **Section 8** (*Grievance Redress Mechanism*) provides the framework for reporting, recording, and taking actions on complaints of the community.
- **Section 9** (*Environmental Management Plan*) provides details on management and mitigation measures to be carried out during the design, construction and operation phases of the Project. It also categorizes these measures based on the responsibilities of various members of the Project execution team and lays out the main aspects for monitoring of the implementation of management and mitigation measures.

Finally the outcome of the impact assessment is combined to produce the following sections:

- **Section 10** (*Conclusions and Recommendations*). It brings together the salient findings of the assessment and highlights the key applicable standards and guidelines. It also briefly describes the main measures recommended if the Project is to be executed.

2. Policy, Legal, and Administrative Framework

This section provides a summary of the national and international legislation and guidelines that are relevant to the assessment of the Project's environmental components. The review of the legal and institutional framework and relevant laws help identify the policy directives and required procedures to investigate social responsibility, environmental accountability and financial soundness of the Project.

2.1 Provincial Legislative and Regulatory Framework

The development of statutory and other instruments for environmental protection and management has steadily gained priority in Pakistan since the late 1970s. The Pakistan Environmental Protection Ordinance 1983 was the first piece of legislation designed specifically for protection of the environment. The promulgation of this ordinance was followed in 1984 by the establishment of the Pakistan Environmental Protection Agency, the primary government institution dealing with environmental issues. Significant work on developing environmental policy was carried out in the late 1980s, which culminated in the drafting of the Pakistan National Conservation Strategy. Provincial environmental protection agencies were also established at about the same time. The National Environmental Quality Standards (NEQS) (**Appendix A**) were established in 1993. The enactment of the Pakistan Environmental Protection Act 1997 (PEPA 1997) conferred broad-based enforcement powers to the environmental protection agencies. Publication of the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations 2000 (IEE-EIA Regulations 2000) provided the necessary details on the preparation, submission, and review of an IEE and EIA. In addition to the PEPA 1997, Pakistan's statute books contain a number of other laws that have clauses concerning regulation and protection of the environment.

One of the key components of the 18th Amendment to the Constitution, passed by the parliament in 2010, was devolution of power from the federal to provincial governments. Through this amendment, the concurrent legislative list of the constitution was abolished, and all legislative powers on subjects included in the concurrent legislative list, which included environmental protection, were transferred to the provinces. Thus, after the passage of the 18th amendment, the federal government lost its power to legislate on environmental protection, and only provincial governments could make laws regarding protection of the environment.

2.1.1 Statutory Framework for Environment

The key national environmental legislation was the Pakistan Environmental Protection Act (PEPA 1997). After devolution through the 18th Constitutional Amendment 2010 the provinces have sole authority and responsibility to legislate on 'environment and ecology'. In this respect Khyber Pakhtunkhwa Environmental Protection Act 2014 (KP Act 2014), promulgated in 2014, is the relevant environmental act that will apply to this Project. This Act is largely based on PEPA 1997, with minor changes. Under the Act, all

decisions made under PEPA 1997 are protected and applicable (Section 40(2)). Hence the environmental approval and conditions of approval, which were conferred before the enforcement of this act, are fully valid and applicable.

2.1.2 Khyber Pakhtunkhwa Environmental Protection Act 2014

The KP Environmental Protection Act 2014 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 articles of KP Act 2014 that have a direct bearing on the proposed Project are listed below.

The details are discussed in the following sections:

- Article 11 that deals with the KP environmental quality standards (KPEQS) and its application.
- Article 12 that deals with discharges, emissions and waste disposal.
- Article 13 that deals with IEE and EIA with review and approval process.
- Article 14 that prohibits import of hazardous waste.
- Article 15 that provides rules on handling of hazardous substances.
- Article 16 that provides regulations on motor vehicles.
- Article 17 that prohibits various acts detrimental to the environment.

The main features of the KP Act 2014 are discussed in **Exhibit 2.1**.

Exhibit 2.1: Khyber Pakhtunkhwa Environmental Protection Act 2014

Purpose	To provide for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution, and promotion of sustainable development
Definition of *Adverse Environmental Effect*	pollution or impairment of, or damage to, the environment, and includes,--- i. impairment of, or damage to, human health and safety or to property or biodiversity; ii. pollution to physical, biological, social, economic environment or to geological, hydrological resources or various land forms; iii. damage to public comfort, aesthetic conditions, ecological balance and meteorological conditions; iv. damage to aquifers, vegetal canopy, cultural heritage or archeological sites; and v. any other adverse environmental effect as may be specified in the rules
Definition of *Air Pollutant*	Any substance that causes pollution of air and includes soot, smoke, dust particles, odor, light, electro-magnetic radiation, heat, fumes, combustion exhaust, exhaust gases, noxious gases, hazardous substances and radioactive substances;
Definition of *Biodiversity or Biological Diversity*	The variability among living organisms from all sources, including inter-alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part, includes diversity within species, between species and of eco-systems;
Definition of *Environment*	i. air, water and land; ii. all layers of the atmosphere; iii. all organic and inorganic matter and living organisms; iv. the ecosystem or flora and fauna, and ecological relationships; v. buildings, structure's, roads, facilities, installations and works; vi. all social or cultural and economic conditions and activities affecting community life; and vii. the inter-relationships between any of the factors specified in sub-clauses (i) to (vi)
Definition of *Hazardous Waste*	The waste which contains hazardous substances or as may be prescribed and includes healthcare risk wastes and radioactive waste
Definition of *Hazardous Substance*	i. a substance or mixture of substances, except the pesticide as defined in the Agricultural Pesticides Ordinance, 1971 (II of 1971), which, by reason of its physical, chemical or biological properties or toxic, explosive, flammable, corrosive, infectious, radioactive, persistent or having any other characteristics as may be prescribed, or is likely to cause, directly or in combination with other substances, an adverse environmental effect; and ii. any substance which may be prescribed as a hazardous substance;

Definition of *Discharge*	Spilling, leaking, pumping, depositing, seeping, releasing, flowing out, pouring, emitting, emptying or dumping;
Definition of *Ecosystem*	A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit;
Definition of *Effluent*	Any material in solid, liquid or gaseous form or combination thereof being discharged from industrial activity or any other source and includes a slurry, suspension or vapour;
Definition of *Industrial Activity*	Any operation or process for manufacturing, making, formulating, synthesizing, altering, repairing, crushing, grinding, cleaning ornamenting, finishing, packing or otherwise treating any article or substance with a view to its use, sale, transport, delivery or disposal, or for mining, for oil and gas exploration and development, or for pumping water or sewage, or for generating, transforming or transmitting power or for any other industrial or commercial purposes;
Definition of *Industrial Waste*	Waste resulting from an industrial activity;
Definition of *Pollution*	The contamination of air, land or water by the discharge of emission of effluent or wastes or air pollutants or noise or other matter which either directly or indirectly or in combination with other discharges or substances alters unfavorably the chemical, physical, biological, radiational, thermal or radiological or aesthetic properties of the air, land or water or which may, or is likely to make the air, land or water unclean, noxious or impure or injurious, disagreeable or detrimental to the health, safety, welfare or property of persons or harmful to biodiversity;
Definition of *Noise*	The intensity, duration and character of sound from all sources, and includes vibration;
Definition of *Sewage*	Liquid or semi-solid wastes and sludge from sanitary conveniences, kitchens, laundries, washing and similar activities and from any sewerage system or sewage disposal works;
Definition of *Waste*	Substance or object or material which has been, is being or is intended to be, discarded or disposed of, and includes liquid waste, solid waste, waste gases, suspended waste, industrial waste, agricultural waste, radioactive and nuclear waste, mist, animal waste, electronic waste, municipal waste, hospital waste, pharmaceutical waste, plastic and polythene waste and residues from the incineration of all types of waste.
Definition of *Climate Change*	A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods;
Definition of *Emission*	The extent of pollutant's discharges per unit time or the extent of pollutant per unit volume of gas, liquid or vapor emitted
Definition of *Factory*	Any premises in which industrial activity is being undertaken;
Functions of the Agency	Administer and implement the provisions of this Act and the rules made there under;
	Prepare, in coordination with the appropriate Government Agency or local council and in consultation with the concerned sectoral Advisory Committees where established, environmental policies for the approval of the Council

	Prepare, revise and establish the Khyber Pakhtunkhwa Environmental Quality Standards with the approval of the Council: Provided that before seeking approval of the Council, the Agency shall publish the proposed Khyber Pakhtunkhwa Environmental Quality Standards for public opinion in accordance with the prescribed procedure;
	Ensure enforcement of the Khyber Pakhtunkhwa Environmental Quality Standards; resources, solid waste management and water sanitation
	Establish standards for the quality of the ambient air, water and land, by notification establish different standards for discharge or emission from different sources and for different areas and conditions as may be necessary: Provided that- (a) where these standards are less stringent than the Khyber Pakhtunkhwa Environmental Quality Standards prior approval of the Council shall be obtained; and (b) list of areas, with the approval of the Council, in which any class of activities or projects shall not be carried out or shall only be carried out subject to certain specified safeguards;
	Co-ordinate with other Provinces, Federal Government, National and International Organizations for the implementation of environmental policies, issues concerns and programs as may be prescribed
	Co-ordinate and facilitate the Government departments, agencies, organizations and institutions in the Khyber Pakhtunkhwa in adaptation to address the impacts of climate change;
	Establish systems and procedures for surveys, surveillance, monitoring, measurement, examination, investigation, research, inspection and audit to prevent and control pollution, and to estimate the costs of cleaning up pollution and rehabilitating the environment in various sectors
	Carry out and conduct environmental monitoring and implementation of environmental approvals provided in this Act;
	Carry out and conduct environmental audits of old industrial units in accordance with rules(Old industrial units means those established before the commencement of this Act)
	Issue licenses for the consignment, handling, transport, treatment, disposal, storage, handling or otherwise dealing with hazardous substances;
	Assist Government Agencies, local councils, local authorities and other persons to implement schemes for the proper disposal of wastes so as to ensure compliance with the Khyber Pakhtunkhwa Environmental Quality Standards
	Provide information and guidance to the public on environmental matters
	Specify safeguards for the prevention of accidents and disasters which may cause pollution, collaborate with the concerned

	persons in the preparation of contingency plans for control of such accidents and disasters, and co-ordinate implementation of such plans;
	Review and approve mitigation plans and give guidance and directions, where necessary, for cleanup operations ordered under this Act
Prohibition of certain discharges or emissions	(1) Subject to the provisions of this Act, rules, notifications and guidelines made thereunder i. no person shall discharge or emit or allow the discharge or emission of any effluent or wastes or air pollutant or noise, load, concentration or level which is in excess of the Khyber Pakhtunkhwa Environmental Quality Standards or, where applicable, the standards established under sub clause (vii) and (viii) of sub-section (1) of section 6; and ii. No person shall discharge effluents, emissions or wastes in excess of load permitted in the conditions of environmental permit or environmental approval or license. (2) The Agency, with the approval of Government, may levy a pollution charge on any person who contravenes or fails to comply with the provisions of sub-section (1), to be calculated at such rate, and collected in accordance with such procedure as may be prescribed. (3) Any person who pays the pollution charge levied under sub-section (2), shall not be charged with an offence with respect to that contravention or failure.
Initial Environmental Examination and Environmental Impact Assessment	1) No proponent of a project shall commence construction and operation unless he has filed with the Agency an initial environmental examination or where the project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained from the Agency, environmental approval in respect thereof. (2) The Agency shall (a) review the initial environmental examination and accord its approval or require submission of an environmental impact assessment by the proponent; or (b) review the environmental impact assessment and accord its approval subject to such conditions as it may deem fit to impose, require that the environmental impact assessment be resubmitted after such modifications as may be stipulated, or reject the project as being contrary to environmental objectives. (3) Every review of an environmental impact assessment shall be carried out with public participation and no information will be disclosed during the course of such public participation which relates to: (a) trade, manufacturing or business activities, processes or techniques of a proprietary nature, or financial, commercial, scientific or technical matters which the proponent has requested should remain confidential, unless for reasons to be recorded in writing, the Director-General of the Agency is of the opinion that the request for confidentiality is not well-founded or the public interest in the disclosure outweighs the possible prejudice to the competitive position of the project or its proponent; or (b) International relations, national security or maintenance of law and order, except with the consent of Government; or

	(c) Matters covered by legal professional privilege. (4) The Agency shall communicate its approval or otherwise within a period of four months from the date of the initial environmental examination or environmental impact assessment is filed complete in all respects in accordance with the prescribed procedure, failing which the initial environmental examination or, as the case may be, the environmental impact assessment shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules, provided that delay is not on part of the proponent for the provision of additional information asked for during the review process or conductance of public hearing of the project. (5) Subject to sub-section (4), Government may in a particular case extend the aforementioned period of four months if the nature of the project so warrants. (6) The provisions of sub-sections (1), (2), (3), (4) and (5) shall apply to such categories of projects and in such manner as may be prescribed. (7) The projects or any activity of a proponent not covered under sub-section (6), specified in guidelines shall obtain a general environmental approval in a manner prescribed in guidelines in respect thereof. (8) The Agency shall maintain separate Registers for initial environmental examination and environmental impact assessment projects, which shall contain brief particulars of each project and a summary of decisions taken thereon, and which shall be open to inspection by the public at all reasonable hours and the disclosure of information in such Registers shall be subject to the restrictions specified in sub-section (3).
Handling of Hazardous Substances	Subject to the provisions of this Act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle, deal in and use or import any hazardous substance except--- (a) under a license issued by the Agency and in such manner as may be prescribed; or (b) in accordance with the provisions of any other law for the time being in force, or of any International Treaty, Convention, Protocol, Code, Standard, Agreement or other instrument to which Pakistan or the Province of the Khyber Pakhtunkhwa is a party.
Regulation of motor vehicles	(1) Subject to the provisions of this Act, and the rules, notification and guidelines made thereunder, no person shall operate a motor vehicle from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the Khyber Pakhtunkhwa Environmental Quality Standards or where applicable the standards established under clauses (vii) and (viii) of sub-section (1) of section 6. (2) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any motor vehicle or class of vehicles or locomotive shall install such pollution control devices or other equipment or use such fuels or undergo such maintenance or testing as may be prescribed. (3) Where a direction has been issued by the Agency under sub-section (2) in respect of any motor vehicles or class of motor vehicles, or locomotives, no person shall operate any such vehicle till such direction has been complied with.

2.1.3 Preparation and Submission of EIA

Article 13 of KP Act states that "No proponent of a project shall commence construction and operation unless he has filed with the Agency an initial environmental examination (IEE) or where the project is likely to cause an adverse environmental effect, an environmental impact assessment (EIA), and has obtained from the Agency, environmental approval in respect thereof".

Hydroelectric power generation projects with capacities greater than 50 MW require an EIA as per the categorization of the IEE-EIA Regulations 2000. The law requires that the EIA must be submitted and approved by the provincial EPA before any construction activities can commence.

2.2 Environmental Standards

2.2.1 National Environmental Quality Standards

KP EPA is yet to formulate the *Khyber Pakhtunkhwa Environmental* Quality Standards (KPEQS) as per Article 6 (v) of the KP Act 2014. So, the National Environmental Quality Standards (NEQS) will be applicable to the Project. Article 11(1) of the PEPA 1997 states that
"Subject to the provisions of this Act and the rules and regulations made thereunder no person shall discharge or emit or allow the discharge or emission of any effluent or waste or air pollutant or noise in an amount, concentration or level which is in excess of the National Environmental Quality Standards."

NEQS have been established for gaseous emission, liquid effluent, ambient air quality, noise and drinking water. From the date of enforcement of the NEQS, all projects, whether in operation on the date or constructed later, are required to comply with these standards.

The Project needs to comply with all applicable standards, and Project proponents and contractors should ensure that no activity will result in the emission of pollutants and effluents exceeding limits as prescribed in the NEQS. The applicability of the NEQS to the Project is described in **Exhibit 2.2**. The complete set of NEQS are included in **Appendix A**.

Exhibit 2.2: NEQS Applicable to the Project

NEQS	*Applicability During Construction*	*Applicability During Operation*
Gaseous Emission	All power generators	Any back-up generator
Noise emission	All noise sources	Not applicable
Emission from motor vehicles	All project vehicles	All project vehicles
Noise from motor vehicles	All project vehicles	All project vehicles

NEQS	*Applicability During Construction*	*Applicability During Operation*
Ambient air quality	Changes in air quality of the surrounding area due to construction activities	Not applicable
Liquid effluent	Sanitary waste and other liquid waste discharged to the environment	Sanitary waste and other liquid waste discharged to the environment
Drinking water	Water supplied by the owners and contractors to staff	Water supplied by the owners and contractors to staff

2.3 Other Environmental Laws

2.3.1 Land Acquisition Act 1894

The national law governing land acquisition is the Land Acquisition Act 1894 (LAA 1894) and successive amendments to it. The LAA 1894 regulates the land acquisition process and enables the government to acquire private land for public purposes through the exercise of the right of eminent domain. Land acquisition is a provincial responsibility in Pakistan and provinces also have their own province-specific implementation rules.

The LAA 1894 and its implementation rules require that, following an impact identification and valuation exercise, land and crops are compensated in cash at the current market rate to titled landowners. In past practice land acquisition was usually based on the last 3 to 5 years average registered land–sale rates. However, in several recent cases like Faisalabad Khanewal motorway project and the Expressway 35 project, the median rate over the past 1 year, or even the current rates have been applied. Under section 23 of LAA 1894 and its amendments, in addition to the market–value of the land a sum of 15% of the amount as compulsory acquisition surcharge is also paid to the affected persons (APs), if the acquisition has been made for public purpose and a sum of 25% on such market–value if the acquisition has been made for a Company. The APs, if not satisfied, can go to the Court of Law to contest the compensation award of the LAC.

The various sections relating to the land acquisition are briefly discussed below and summarized in **Exhibit 2.3**.

Exhibit 2.3: Key Feature of the LAA 1894

Section	*Actions [Person Responsible]*	*Purpose and Effect*
4	▶ Publication in the official gazette of a notification that a "land in any locality is needed or is likely to be needed for any public purpose or for a Company" [Collector] ▶ Public notice of the substance of such notification at convenient places in the said locality [Collector]	Allows preliminary investigation. In affect it demonstrates the interest of the government that the "land in any locality is needed or is likely to be needed for any public purpose or for a Company" Allows the Collector to authorize persons to enter, and where necessary, clear the land to: survey the land; undertake soil and other studies for determining the suitability of the land; measure land and demarcate boundaries by placing markers.
5 and 5A	▶ Publication in the official gazette by the government a) the intention of the government that any particular land included in Section 4 notification is needed for public purposes or for a Company, b) the administrative location of the land, c) the purpose of land acquisition, d) its approximate area, and e) location where the development plan for the land, if required, is available for public inspection, if required, [DC, if land required for public purposes or the provincial government if land required for a Company] ▶ Public notice of the substance of such notification at convenient places in the said locality Collector	Notifies the intention of the government to acquire land for the particular purpose in order to give opportunity to the interested persons (persons who would be entitled to claim an interest in compensation if the land were acquired) to file an objection to the land acquisition. The objection can be filed within 30 days.
6	▶ The Collector, if satisfied after reviewing the report made under section 5–A, subsection (2), will make a declaration in the official Gazette with conclusive evidence, stating that particular land is required for public/private purpose. The declaration will include the location of the land, the purpose and its approximate area. ▶ The declaration shall be made only after ensuring that the compensation is to be paid by the company.	Provides the declaration from the collector for the purchase of required land. Declaration is published and communicated to the public in large to notify the acquisition of land including its location, area and purpose.
7	▶ After declaration under Section 6 Collector, to take order for the acquisition of the land.	Official orders are given by the [Executive District Officer (Revenue)], directing the Collector, to initiate the formal land acquisition process.
8	▶ If the required land is not demarcated under section 4, the Collector, will give orders to mark, measure and plan out the required land.	Demarcation of required land as per the exact requirement of the project.

Section	*Actions [Person Responsible]*	*Purpose and Effect*
9	▶ The Collector to issue public notice at convenient places on or near the land to show intentions for acquiring required land and inviting to file claims for compensation, objections to measurements etc., indicating date, time and place for all the land owners, indicating such date not earlier than 15 days. ▶ The Collector also to serve notice, by post, to the occupier or to the known land owners (if any), residing within the revenue district or elsewhere. ▶ The Collector shall also serve notice, not less than 15 days prior to the date fixed under sub–section (2) of section 9, to the land owners about the inquiry to be held under section 11 for determination of claims and objections.	To inform the land owners and public at large, well ahead the time, about the acquisition of the demarcated land to ensure that interested persons are given sufficient time to object or claim.
10	▶ The collector will also require and send a notice to any other interested person (co–proprietor, sub–proprietor, mortgagee, tenant or otherwise) with interest/claim pertaining to the required land. ▶ Any person claiming any interest under this section or section 9 will be bound to do so within the meaning of section 175 and 176 of Pakistan Penal Code.	To ensure that there are no financial discrepancies left unaddressed during the process of land acquisition and every person associated with the land is duly informed and their objection/claims are appropriately addressed.
11	▶ On the fixed date, the Collector to enquire into the claims and objections of interested persons with regard to measurements made under section 8, value of the land (at the date of the publication of the notification under section 4, sub–section (1) and respective claims. The Collector can make an award (under his jurisdictions) of true area of the land, compensation which in his opinion should be allowed for the land and the distribution of the compensation among all the known or believed to be interested in the land, whether they have appeared before him or not.	To determine the actual land owners and precise measurements of the required land. This section also ensures that the compensation paid is true representation of the value of land. To ensure that the compensation is fairly distributed among all the owners of the land.

Section	*Actions [Person Responsible]*	*Purpose and Effect*
12	▶ The award filed in the Collector's office shall be deemed conclusive, whether the interested persons have appeared before the Collector or not. ▶ The Collector shall issue immediate notice of the award to the land owners whether they have appeared personally or by their representatives when the award is made.	To avoid potential future conflicts between the government and the owners of the land. This ensures that the decision made by the collector is final. To convey complete information in a timely manner to the land owners. This section ensures that the land owners have complete information on the award irrespective of their presence in Collector's office.
12 –A	▶ The Collector can rectify any mistake (typographical, arithmetical errors) in the award by his own motion or on the application of any of the parties.	To ensure that there are no errors or mistakes in the award or the assessment of the land. This ensures that the measurement and valuation of the land is done justly.
13	▶ The Collector may conduct or discontinue and reschedule the enquiry for any reason, any day/time fixed by him.	To implement check and balance on the system. This ensures sense of responsibility on the government officers.
14	▶ The Collector is empowered by this section to call, and enforce the attendance of witnesses, including the interested parties or any of them to produce the documents by the same means, and in the same manner as provided the case of a Civil Court under the Code of Civil Procedures.	To avoid future conflicts and increase transparency in the land acquisition process. To ensure that only the rightful legal owners who have proper documents are paid the award and no illegal claims are entertained.
15	▶ The Collector shall be guided by section 23 and 24 in determining compensation.	
16	▶ Under this section, the collector may take possession of the land, after the compensation paid to the owner of the land or deposited in the Civil Court in his name by the acquisitioning authority and the required land, shall then be granted to the government without any further claim.	To ensure smooth transfer of land rights from the owner to the acquisitioning authority. This gives security to the acquiring authority that once the award is paid in full, the Collector will take the possession of the land.

2.3.2 Key Biodiversity Laws

There are a number of other laws in the statute books of Pakistan which have a bearing on the environmental performance of the Project. The three primary laws are described in **Exhibit 2.4**.

Exhibit 2.4: Three Key Laws Relevant to the Project

Law	*Description*	*Applicability to the Project*
The Khyber Pakhtunkhwa Forest Ordinance, 2002	This Act authorizes provincial forest departments to establish forest reserves and protected forests. The Act prohibits any person from: setting fires in the forest; quarrying stone; removal of any forest produce; or causing any damage to the forest by cutting trees or clearing areas for cultivation or any other purpose without express permission of the relevant provincial forest department.	Based on a discussion with locals the Project area does not include any land owned by the Forest Department, KP.
The Khyber Pakhtunkhwa Wildlife and Biodiversity (Protection, Preservation, Conservation and Management) Act, 2015	This law was enacted to protect the province's wildlife resources directly and other natural resources indirectly. It classifies wildlife by degree of protection, i.e., animals that may be hunted on a permit or special license, and species that are protected and cannot be hunted under any circumstances. The Act specifies restrictions on hunting and trade in animals, trophies, or meat. The Act also defines various categories of wildlife-protected areas, i.e., National Parks, Wildlife Sanctuaries, and Game Reserves.	Based on a discussion with staff from the Fisheries Department, KP the Arkari Gol does not include any Protected Areas.
NWFP Fisheries Rules 1976	This law prohibits destruction of fish by explosives, poisoning water and the hunting of protected fish species. The law also forbids the use of net or fixed engine traps without a permit or license. The law grants power to the Director General (DG) Fisheries to issue permits to catch fish. It protects fish against 1) Destruction of fish by explosives, and 2) Destruction of fish by poisoning water.	This law is applicable to the Project as there is a possibility of catching fish as sustenance by the Project staff and also makes it obligatory to obtain a license from the fisheries department before commencing any fishing activities.

2.3.3 Other Laws

In addition to the laws cited above, a number of other laws were reviewed for provisions that can affect the environmental and social performance of this Project. A list is provided in **Exhibit 2.5**. These were reviewed and the results of the review are provided in this section, in particular information about their potential to impact the Project.

Exhibit 2.5: Other Laws Reviewed

Antiquities Act, 2016	Industrial Relations Act, 2010
Delimitation of Local Councils Act, 2015	Forestry Commission Act, 1999
Environmental Protection Act, 2014	Irrigation and Drainage Authority Act, 1997
Factories Act, 2013	Minimum Wages Act, 2013
Forest Ordinance, 2002	Payment of Wages Act, 2013
Industrial and Commercial Employment (Standing Orders) Act, 2013	Rivers Protection Ordinance, 2002
Energy Development Organization Act, 1993	Worker's Compensation Act, 2013
Integrated Water Resources Management Board Ordinance, 2002	The Khyber Pakhtunkhwa Local Government Act, 2013
Prohibition of Employment of Children Act, 2015	The West Pakistan Firewood and Charcoal (Restriction) Act, 1964
Protection of Trees and Brushwood Act, 1949	Wildlife and Biodiversity (Protection, Preservation, Conservation and Management) Act, 2015
Rural Drinking Water Supply Scheme Act, 1985.	
The Khyber Pakhtunkhwa Right to Information Act,2013	

Energy Development Organization Act, 1993

The Pakhtunkhwa Energy Development Organization (PEDO) is granted authority by this Act to develop the energy resources in KP. Under this Act, development of hydropower is transferred to PEDO.

Forest Ordinance, 2002

The Forest Ordinance, 2002 has been instated to protect, conserve, manage and sustainably develop forests and other renewable natural resources. The ordinance empowers the government to declare any forest land as reserved or no longer reserved, designate reserve forests for village communities to use, declare forest land or wasteland as Protected Forests or remove protected status, control Guzara Forests, Mazri and Mazri produce, as well as timber and timber produce. Under the ordinance the government is granted powers of forest management, with authority given to forest officers. The government, through its officers, has the right to exercise penalties on violations on prohibitions as laid out in the ordinance.

Certain plant species are protected under the Act when found in reserved forests, protected forests and protected wastelands. A list of these species is provided in Schedule I of the Act.

The Project will not impact Reserve Forests, Protected Forests, Village Forests or Guzara Forests. It is important to ensure that Project-related activities do not encroach on any of

the above-mentioned types of forests. It is also important that Project staff not engage in the collection or trade of forest produce. The area has very limited forest cover, therefore, this unlikely to be a concern.

Forest Development Corporation Ordinance, 1980

The Forest Development Corporation has been established under this ordinance. The corporation functions to "make suitable arrangements for the

(i) economic and scientific exploitation of forests;

(ii) sale of forest produce;

(iii) establishment of primary wood-processing units;

(iv) regeneration in areas to be specified by Government; and

(v) performance of such other functions as may be assigned to it by Government."

The Project will not be impacted by this ordinance. It should be ensured that Project staff do not engage in activities that are under the jurisdiction of this corporation for example in the trade of forest products.

Forestry Commission Act, 1999

The Act is aimed at establishing a Forestry Commission to improve the protection, management sustainable development of forests in KP. Under this Act the Commission established is empowered and entrusted to further this aim by taking steps such as giving vision and a framework for the sustainable development of forests in KP, guiding and overseeing the process of institutional and legislative reforms in the Department, advocating policies for sustainable development of forests etc. The Project will not be impacted by this Act, however, any initiatives undertaken by the Commission may be of interest to the Project for biodiversity management and mitigation.

Protection of Trees and Brushwood Act, 1949

The Act provides protection for trees and brushwood. Under this Act it is illegal to clear trees and brushwood belonging to the local government. Project-related activities should only be undertaken on land acquired for the Project. They should not clear trees or brushwood outside the acquired area.

Wildlife and Biodiversity (Protection, Preservation, Conservation and Management) Act, 2015

The Act has been instated to consolidate the laws relating to protection, preservation, conservation and management of wildlife in KP. Its aims include the following:

"(a) strengthening the administration of the organization[1] to effectively manage wild animals and their habitats;

(b) to holistically manage Protected Areas in a sustainable manners for the best interest of the indigenous communities and local stakeholders;

[1] Wildlife Department, KP

(c) securing appropriately the goods and services produced from wild animals and their habitats at the level of local communities;

(d) fulfilling the obligations envisaged under the biodiversity related multilateral environmental agreements ratified by the Government of Pakistan;

(e) promotion of public awareness and capacity building for proper appreciation of the environmental significance and socio-economic values of wildlife; and

(f) conservation of biological diversity and realization of its intrinsic and extrinsic values through sustainable use and community participation."

The Act empowers Wildlife Officers to enforce the laws relating to wildlife conservation and management and to use reasonable force to do so, if necessary. It places restrictions on hunting, possession and display of wildlife, trade and trafficking of wildlife or wildlife products, and protected areas. Wildlife offences and penalties for those offences are provided in the Act.

The Project and Project-related activities will be affected by the Act if there is violation of the rules pertaining to wildlife. This will be the case if staff engage in activities prohibited under the Act such as hunting, possession and display of wildlife, trade in wildlife and wildlife products, introduction of alien invasive species and so on. To ensure compliance with law, staff should report any wildlife sightings to the concerned government department.

Rivers Protection Ordinance, 2002

The ordinance has been instated to provide for the protection of aquatic ecology, water quality, economic and environmental value of rivers and their tributaries in KP. The ordinance has been instated keeping in view the increasing developments along rivers in KP and the need to maintain the quality of the rivers for public use. The rules set out will be applicable on any length of a particular river or stream or any part of a river or its tributary that has been specified by the Government. The Project is a hydropower project being developed on the main Arkari Gol. If the Government of KP designates the Arkari Gol or specifically a stretch of the Arkari Gol which includes the stretch to be used by the Project, then the rules set out in this ordinance will be applicable.

The rules laid out in the ordinance relate mainly to encroachment onto the river and pollution of the river. It is important that Project-related activities do not pollute the river and that all construction activities along the river banks be carried out within the area designated for them.

Integrated Water Resources Management Board Ordinance, 2002

The Integrated Water Resources Management Board has been established to devise and oversee the implementation of an integrated water resources management strategy aimed at sustainable economic, social and environmental returns on water resource development. Under the ordinance a Board has been established, the functions of which include conducting studies to accurately assess the various demands of water for consumptive or non-consumptive use. This includes the use of water resources for hydropower itself, as well as areas that will potentially be affected by the Project such as

fisheries, water-related sports, environmental sustainability, forestry, lakes and water bodies etc.

The Project will be affected by this ordinance as it is impacting the flow of the Arkari Gol. Any policies, rules and procedures put in place by the Board need to be complied with. In addition to this studies conducted as part of this assessment should be shared with the Board.

Rural Drinking Water Supply Scheme Act, 1985

The Act has been instated to facilitate the execution of schemes for supply of drinking water in rural areas. Project-related activities should not disrupt any schemes established under this Act. As long as Project-related activities take place within the land acquired for the Project, this law will not affect the Project.

Irrigation and Drainage Authority Act, 1997

The Act addresses the irrigation and drainage system in KP by requiring the adoption of a strategy for streamlining it. It includes the implementation of policies in the water resources sector to improve and sustainably develop supply for irrigated agriculture along with operating and maintaining irrigation, drainage, storage reservoirs and flood control infrastructure in KP. The Project will not be affected by the Act if it does not affect the irrigation system in KP. Irrigation is not expected to be impacted by the Project.

The West Pakistan Firewood and Charcoal (Restriction) Act, 1964

The Act prohibits the burning of firewood and charcoal in factories, brick-kilns, limekilns and other specified places. The Project can be considered a factory under the definition provided in the Act. The Project owner and developer should ensure that no burning of firewood and charcoal is carried out in premises under its control.

Antiquities Act, 2016

The Antiquities Act, 2016 is applicable to the Project. Chapter IV, Clause 56 ‘Execution of mega project’ requires a clearance to be obtained from the Director (as defined in the Act) before construction of a dam. Chapter VI, Clause 70, ‘Regulation of mining, quarrying, etc.’ gives the Director authority to prohibit mining, quarrying, excavation, blasting and movement of heavy vehicles for the purpose of protecting or preserving any immovable antiquity.

Factories Act, 2013

The Factories Act, 2013 provides for the regulation of labor in KP. A factory is defined as “…any premises, including the precincts thereof, whereon ten or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on or is ordinarily carried on with or without the aid of power, but does not include a mine, subject to the operation of the Mines Act, 1923 (Act No. IV of 1923);” Based on this definition, the Act is applicable to the Project.

The Act regulates a range of conditions relating to labor. These include health and safety, restrictions on working hours of adults, holiday with pay, and special provisions for adolescents with children. It also provides for government inspection staff to function as directed by the government, penalties and procedures relating to violations of the Act as

well as supplemental information for staff (such as display of factory notices, removal of difficulties, protection against discrimination etc.). The Project needs to comply with the requirements under these regulations.

Industrial and Commercial Employment (Standing Orders) Act, 2013

The Industrial and Commercial Employment (Standing Orders) Act, 2013 provides for the regulation of industrial and commercial employment in KP. It provides a list of standing orders for workers in the province. These include classification of workers based on types of contracts, identification of workers, the requirement for documenting terms and conditions, publications of working times, publication of wage rates, shift working, payment of wages, incentive schemes, insurance, bonuses, stoppage of work, closure of establishment, termination of employment, punishments, liability of the employer, amongst others.

The Project is required to comply with the clauses in this Act. The terms and conditions for the workers need to be published and all matters related to agreements between workers and the developer, outlined in the Act, need to be documented and adhered to.

Prohibition of Employment of Children Act, 2015

The Act has been instated to prohibit the employment of children and to regulate the employment of adolescents in KP. The Project will be impacted by the Act only if it employs children under the age of 14. The Project should not employ children or adolescents for any Project-related activities. Under the Act, staff designated by the government, can inspect the Project facilities to ensure compliance with its rules. The inspector may require the establishment to provide evidence of age of staff in case of dispute over age.

Industrial Relations Act, 2010

The Act has been instated to regulate relationships between workers and employers. It outlines the rights and responsibilities of the workers and the employer. For example, workers and employers can, without distinction, establish and join associations of their own choice. Every trade union and employer's association shall frame its own constitution and rules to elect its representatives.

The owners and developers of the Project need to ensure that no unfair conditions are placed on labor in terms of employment practices. The workers also must not partake in any unfair labor practices. Furthermore, under the Act, participation of workers in management is important. Under the Act the government can appoint an inspector to ensure compliance with provisions of the Act. The Act also provides for penalties in case of violations of provisions in the Act.

Minimum Wages Act, 2013

The Act provides for the regulation of minimum rates of wages and various allowances for different categories of workers employed in certain industrial and commercial undertakings and establishments. The Project needs to ensure that all workers are paid at least minimum wages. If this is ensured, the Act will not affect the Project.

Payment of Wages Act, 2013

The Act regulates the payment of wages to persons employed in factories, industrial establishments and commercial establishment in KP. The Project can be considered a factory under the definition in the Act. Therefore, it needs to comply with the provisions of the Act by ensuring payment of wages by all responsible people.

Worker's Compensation Act, 2013

The Act provides for workers or their legal heirs compensation for injury or death by accident. The Project owner will be liable to provide compensation if personal injury is caused to a worker by accident during the course of his employment.

The Khyber Pakhtunkhwa Local Government Act, 2013

The Act has been instated to construct and regulate local government institutions in KP and to consolidate laws relating to these institutions. The Act defines the functions and powers of various heads of local government such as District Councils, Villages, City Districts etc.

The local government is a stakeholder with whom the Project needs to coordinate. Any changes in the organization, powers and functions of the local government, directed by the Act, can affect the Project.

Delimitation of Local Councils Act, 2015

The Act mainly concerns the defining of local councils by providing for the delimitation of village councils, neighborhood councils and territorial wards for general seats to tehsil councils, and district councils, for elections to local councils in KP. The Act may affect the Project if there is a change in the delimitation of local councils.

The Khyber Pakhtunkhwa Right to Information Act, 2013

The Act provides for ensuring transparency and access to information in KP. The Project is a public sector Project, therefore, it needs to provide information to the public and not compromise transparency under this Act.

2.4 Federal and Provincial Conservation Strategies

Pakistan National Conservation Strategy (PNCS) [2] was prepared jointly by the then federal Ministry of Environment with assistance from the International Union for the Conservation of Nature (IUCN). It was approved by the federal cabinet in 1992 as the basic policy document on environmental sustainability.

The Sarhad Provincial Conservation Strategy (SPCS)[3] was prepared by the Government of KP with assistance from IUCN. It was approved by the provincial cabinet in 1996 and was considered a sustainable development action plan for the KP.

Both these documents are no longer used for planning purposes and as such are obsolete as a policy document. However, they can be used where relevant as a guideline.

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[2] The Pakistan National Conservation Strategy, 1992.

[3] The Sarhad Provincial Conservation Strategy, 1996, Government of North West Frontier Province in collaboration with IUCN–The World Conservation Union.

National Sustainable Development Strategy, 2012 (NSDS): The NSDS envisions the evolution of a just and harmonious society via the promotion of vibrant and equitable economic growth without the over-exploitation of natural resources and the fair distribution of development dividends to all, in particular marginalized, poor, and vulnerable in society and to future generations. The strategy is aligned with the emerging concept of 'green economy' as an alternate to the Framework for Economic Growth (2011), prepared by the Planning Commission of Pakistan.

National Climate Change Policy (2012): The National Climate Change Policy, approved by the Government in 2012 has the overall goal 'to ensure that climate change is mainstreamed in the economically and socially vulnerable sectors of the economy and to steer Pakistan towards climate resilient development'. One of the major objectives of this policy is conservation of natural resources and long term sustainability further elaborated through specific measures under forestry, biodiversity, and other vulnerable ecosystems. With respect to forestry, the National Climate Change Policy (NCCP) outlines the need to restore and enhance Pakistan's forest cover under sustainable forest management to 'withstand present and probable future impacts of climate change.' Biodiversity-related policy measures include setting national biodiversity indicators and provision of requisite financial resources for implementation of the BAP (2000).

To support the Climate Change Policy, in 2013 the Government prepared a Framework for Implementation of the Climate Change Policy (2014-2030) which lists priority, short-term, medium-term and long-term actions to be implemented in various sectors including forestry.

2.5 Institutional Framework

The success of environmental assessments as a means of ensuring that development projects are environmentally sound and sustainable depends in large measure on the capability of regulatory institutions for environmental management. The institutional framework for decision-making and policy formulation in environmental and conservation issues is briefly described below.

The Khyber Pakhtunkhwa Environmental Protection Agency (KP EPA) is primarily responsible for administering the provisions of the KP Environmental Protection Act, 2014. The institutional framework for decision-making and policy formulation in environmental and conservation issues is summarized in **Exhibit 2.6.**

Exhibit 2.6: Institutional Responsibilities

Agency	*Law*	*Functions*	*Relevance to the Project*
KP Environmental Protection Agency and KP Environmental Protection Council	KP Environmental Protection Act 2014	Enforcement of provisions of the KP Environmental Protection Act 2014 in KP	KP-EPA has the key jurisdiction in the context of environmental protection over the Project
National Electric Power Regulatory Authority (NEPRA)	Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997	Regulating the provision of electric power services, specifically grant licenses for generation, transmission and distribution of electric power. The Act requires the licensee to follow performance standards laid down by the Authority for distribution and transmission of electric power, including safety, health and environmental protection instructions issued by the Authority or any Governmental agency, with the least environmentally harmful supply of electricity.	The Authority requires preparation and approval of EIA from the respective EPA as a condition of grant of generation license. Beyond this the authority has no direct role in environmental management as per current practice.
Provincial Disaster Management Authority KP	National Disaster Management Act (Amended) 2012	The Authority may: lay down policies on disaster management; lay down guidelines to be followed by government; and take such measures for the prevention of disaster or the mitigation or for preparedness and capacity building for dealing with disaster situation as it may consider necessary.	Will be the key agency in case of any natural or human-made emergency and disaster in the Project area.
Fisheries Department, KP	NWFP Fisheries Rules 1976	The Fisheries Department has the authority to enforce the laws and regulations provided in the Fisheries Rules, 1976. This includes regulation of fishing methods using permits and licenses, the species that can be caught and associated penalties for violation of regulations pertaining to wild fish.	All wild fish fauna is under the jurisdiction of the Fisheries Department, therefore, they need to be informed about any impacts on fish fauna and related mitigation measures need to be agreed with them.
Forest Department, KP	The Khyber Pakhtunkhwa Forest Ordinance, 2002. Khyber Pakhtunkhwa Ordinance No. XIX of 2002.	The Forest Department enforces the provisions of the Forest Ordinance, 2002 to meet its objectives which include protection, conservation, management and sustainable development of forests by engaging the community and defining the role of the government.	All forest areas including reserved forests, village forests, protected forests, guzara forests and wastelands, and produce from forests is under the jurisdiction of this department. They need to be

Agency	*Law*	*Functions*	*Relevance to the Project*
			informed about impacts on forests and they need to agree with related mitigation measures.
Wildlife Department, KP	The Khyber Pakhtunkhwa Wildlife and Biodiversity (Protection, Preservation, Conservation and Management) Act, 2015	The Wildlife Department enforces the provisions of the Khyber Pakhtunkhwa Wildlife and Biodiversity Act, 2015 to meet its objectives which include strengthening the administration of the organization to effectively manage wild animals and their habitats, to fulfil the obligations of the government under its commitments to managing biodiversity, and promoting public awareness for the value of wildlife and conservation.	All wildlife is under the jurisdiction of this department. The department needs to be informed of impacts on wildlife and they need to agree to related mitigation measures.
Local Governments	The Khyber Pakhtunkhwa Local Government Act, 2013 Act No. XXVIII	Under this Act the local governments are established and function within the provincial framework. Local areas for local government include villages, neighborhoods, tehsils, towns, districts, and city districts. The Act foresees a role for the district government in environmental management.	The District Administration, if it has enacted any of the procedures for environmental management, will be involved in certain aspects of environmental management of the Project.

2.5.1 Environmental Protection Agency

The KP EPA was established in 1989. It is a monitoring and regulating agency with the following main functions:

- Administer and implement the KP Environmental Protection Act 2014, its rules and regulations,
- Review the IEE-EIA, including preparation of procedures and guidelines,
- Preparation, revision and enforcement of NEQS (industries, municipalities and vehicular emissions),
- Establish and maintain laboratories, certification of laboratories, for conducting tests and analysis,
- Assist local councils/authorities and government agencies in execution of projects,
- Establish a system for surveys, monitoring, examination and inspection to combat pollution,
- Conduct training for government functionaries and industrial management,
- Provide information and education to the public on environmental issues,
- Publish an annual state of the environment report. Survey qualitative and quantitative data on air, soil, water, industrial/municipal and traffic emissions,
- Take measures to promote environment related research and development activities.

2.5.2 Environmental Protection Council

The Pakistan Environmental Protection Council established in 1984 does not have regulatory power over KP. The KP environmental protection Act 2014 allows for a provincial level environmental protection council which has yet to be established. It will be the highest inter-ministerial statutory body in the province and will be responsible for:

- Formulating environmental policies.
- Overseeing enforcement of environmental law.
- Approval of the NEQS.
- Incorporation of environmental considerations into development plans and policies.

2.5.3 Pakistan Environmental Protection Agency

Regulation 7 of the IEE-EIA Regulations 2000 pertains to the guidelines. It states that: ‘(1) The Agency may issue guidelines for preparation of an IEE or EIA or an environmental checklist, including guidelines of general applicability and sectoral guidelines indicating specific assessment requirements for planning, construction and operation of projects relating to a particular sector. (2) where guidelines have been issued under sub-regulation (1), an IEE or EIA shall be prepared, to the extent practicable, in

accordance therewith and the proponent shall justify in the IEE or EIA or in environmental checklist any departure therefrom.'

The relevant guidelines are the follows:

- *Policy and Procedures for Filing, Review and Approval of Environmental Assessments*, Pakistan Environmental Protection Agency, September 1997

  These guidelines define the policy context and the administrative procedures that will govern the environmental assessment process, from the project pre-feasibility stage, to the approval of the environmental report. The section on administrative procedures has been superseded by the IEE-EIA Regulations, 2000.

- *Guidelines for the Preparation and Review of Environmental Reports*, Pakistan Environmental Protection Agency, 1997

  These guidelines target the project proponents and specify:

  - The nature of the information to be included in environmental reports
  - The minimum qualifications of the EIA conductors appointed
  - The need to incorporate suitable mitigation measures at every stage of project implementation
  - The need to specify monitoring procedures.

  The terms of reference for the reports are to be prepared by the project proponents themselves. The report must contain baseline data on the project area, detailed assessment thereof, and mitigation measures.

- *Guidelines for Public Consultation*, Pakistan Environmental Protection Agency, May, 1997

  These guidelines support the two guidelines mentioned earlier. It deals with possible approaches to public consultation and techniques for designing an effective program of consultation that reaches out to all major stakeholders and ensures the incorporation of their concerns in any impact assessment study.

- *Guidelines for Sensitive and Critical Areas*, Pakistan Environmental Protection Agency, October, 1997

  The guidelines on sensitive areas are more specific in that they identify the officially notified protected areas in Pakistan, including critical ecosystems, archeological sites, etc., and present checklists for environmental assessment procedures to be carried out inside or in the vicinity of such sites. Environmentally sensitive areas include, among others, archeological sites, biosphere reserves and natural parks, and wildlife sanctuaries and preserves. The guidelines state that the approach recommended in the document should extend to areas in the vicinity of such sensitive and critical sites, although the term 'vicinity' is not explicitly defined.

2.6 Guidelines and Standards of International Financial Institutions

The environmental assessment of the Project and all documents produced as part of it are required to comply with the guidelines and standards of international financial institutions including the Overseas Private Investment Corporation (OPIC). OPIC, in its guidelines on projects funded by it, refers to compliance of projects with the guidelines of the International Finance Corporation (IFC). Therefore, the requirements of OPIC are briefly described in this section followed by a more detailed discussion of IFC's Performance Standards (PSs) and guidelines which are applicable to the Project.

2.6.1 Overseas Private Investment Corporation (OPIC) Guidelines

The Overseas Private Investment Corporation (OPIC) is the United States Government's development finance institution. Its role is to mobilize private capital to help address critical development challenges.

OPIC has an Environmental and Social Policy Statement (ESPS) which details the organization's policy and guidelines on environmental and social issues including environmental and social impacts of development projects and their management. The ESPS provides those applying for OPIC's support ('Applicant') with notice of the general environmental and social requirements that OPIC applies in evaluating prospective projects and monitoring on-going OPIC-supported projects. These environmental and social requirements apply to all projects supported through OPIC insurance, reinsurance, direct loans, or investment guaranties, including support through Financial Intermediaries.

OPIC's ESPS adopts as a standard for the environmental and social review process, the IFC's Performance Standards (PSs) on Social and Environmental Sustainability and Industry Sector Guidelines and any subsequent revisions to those standards (see **Section 2.6.4**). At a minimum, OPIC requires that all projects must meet the PSs, applicable Industry Sector Guidelines, including any revisions issued by IFC, Internationally Recognized Worker Rights, and host country laws, regulations and standards related to environmental and social performance, including host country obligations under international law. OPIC has released an environmental guidance note on hydro-electric projects.[4] The guidelines within it draw on the IFC's PSs and other guidelines that are applicable to hydropower development.

Applicants seeking OPIC support must demonstrate compliance with host country environmental, health, safety and social requirements. Where host country requirements differ from the PSs, Industry Sector Guidelines, and Internationally Recognized Worker Rights, the project is expected to meet whichever is more stringent.

Projects are required to develop and implement a Stakeholder Engagement Plan (SEP) tailored to Project risks and impacts in accordance with the requirements of PS 1. The SEP is required to be included as part of the document(s) submitted to OPIC for disclosure.

[4] Overseas Private Investment Corporation, September 2012, Environmental Guidance Renewable Energy – Hydro Projects,

As part of stakeholder engagement under OPIC's guidelines, applicants are required to provide periodic reports (at a frequency of not less than annually) to Project Affected People on (1) implementation of any ESAP and Remediation Plan and (2) issues that have been identified as of concern to those Project Affected People. Any material changes to the project design, management systems or mitigation measures will also be communicated to Project Affected People. All reports must be in a language and format accessible to the Project Affected People. Applicants investing in Category A projects are required to conduct additional certified third-party audits.

All OPIC-supported projects that have been operational for at least 12 months are required to submit an Annual Self-Monitoring Questionnaire. The questionnaire is one of the tools used by OPIC to indicate compliance with OPIC's policy requirements, including environmental and social requirements. Category A projects also require annual environmental and social reports. Annual environmental and social reports enable OPIC to monitor the performance of the project with respect to environmental, occupational and community health, safety and social issues. At a minimum, the reports include information on the following:

- Results of environmental and social monitoring or sampling activity.
- Compliance with all conditions and covenants in OPIC Agreements.
- Project-related accidents impacting the environment or Project Affected People or resulting in a disability or loss of life.
- Summary of training provided on environment, health, and safety issues.
- Environmental and safety deficiencies identified by the local regulatory authorities as well as any remedial actions taken.
- Community engagement activities.
- Complaints or grievances received from Project Affected People or Stakeholders and actions taken to resolve the issues.

Screening and Categorization

Environmental screening is the process of identifying, at the earliest stage possible, the potential adverse environmental impacts of a proposed project that could preclude OPIC support on categorical grounds. If a project is determined to be categorically prohibited, OPIC will promptly notify the investor that the application cannot be considered for environmental clearance and ultimate project approval.

For projects involving the construction and operation of large dams, OPIC applies screening and environmental assessment criteria that incorporates core values and strategic priorities identified in the November 16, 2000 Report of the World Commission on Dams (WCD). Although there is a lack of consensus on the advisability of adopting all of the guidelines and recommendations contained within the WCD Report, OPIC has adopted and implemented those elements of the WCD policy that inform good public policy and that are within OPIC's capacity to implement.

The Arkari Gol Hydropower Project will have significant adverse environmental impacts that are sensitive (e.g., irreversible, affect sensitive ecosystems, involve involuntary

resettlement, etc.), and diverse. Therefore, it is categorized as a Category A Project and will require a full scale EIA.

EIAs prepared for hydroelectric and irrigation projects should, at a minimum, address issues cited in the IFC's Application of Environmental Assessment to Large Dam and Reservoir Projects (IFC Procedure for Environmental and Social Review of Projects). OPIC's assessment also includes at least an evaluation of the following factors:

- Hydrological and Limnological Impacts. Impacts on water resources due to impoundments include effects on stream flow; groundwater; surface water quality; potential for increased floods; and potential for alteration of sediment deposition patterns. Additional guidance may be found in WCD Strategic Priority4 (Sustaining Rivers and Livelihoods).
- Catchment Area Impacts. Impacts on terrestrial environments surrounding impoundments include induced seismic and geologic events, impacts on terrestrial wildlife and impacts on downstream aquatic life. Additional guidance may be found in WCD Strategic Priority 4 (Sustaining Rivers and Livelihoods).
- Construction Impacts. Impacts resulting from land use requirements in excess of the dam/reservoir footprint include supportive power structures, worker housing, borrow areas, access roads, power transmission corridors and waste disposal units.
- Air Quality and Global Climate Change Impacts. Impacts evaluated include decomposition of submerged biomass; vehicle and machinery emissions; and potential impacts associated with deforestation and elimination of potential carbon sinks. Additional guidance may be found in WCD Strategic Priority 2 (Comprehensive Options Assessment) and Guideline 8 (Greenhouse Gas Emissions).
- Resettlement. Factors evaluated include public consultation and disclosure procedures; community development planning; livelihoods assessment; potential for income restoration; compensation; and dispute resolution mechanisms. Additional guidance may be found in WCD Guideline 18 (Impoverishment Risk Assessment) and Guideline 19 (Mitigation, Resettlement and Development Action Plan).
- Safety. Factors include structural stability of the dam and the capacity of the spillway(s) to pass flood flows. In the case of high hazard potential dams the analysis must examine the capacity to pass the probable maximum flood and the adequacy of monitoring and warning devices and downstream warning and evacuation procedures. Additional guidance may be found in WCD Strategic Priority 2 (Comprehensive Options Assessment), Strategic Priority 3 (Addressing Existing Dams) and Guideline 11 (Economic Risk Assessment).
- Project Acceptability. Factors include an evaluation of consultation and disclosure procedures; land acquisition process; stakeholder identification; and compliance with local laws and regulations. Additional guidance may be found in WCD Strategic Priority 1 (Gaining Public Acceptance), Strategic Priority 5 (Recognizing Entitlements and Sharing Benefits) and Guidelines 17 (Baseline

Social Conditions), 19 (Mitigation, Resettlement and Development Action Plan) and 20 (Project Benefit-Sharing Mechanisms).

The ESIA must adequately describe potential risks and proposed mitigation measures and include a draft ESAP, draft Remediation Plan (if required) and Stakeholder engagement plan. At a minimum, the Applicant is required to provide a local language translation of the executive summary of the ESIA and make the summary available to Project Affected People in a format that is readily understandable and tailored to meet the information needs of Project Affected People. The translated summary should be distributed by means that take into account the ability of Project Affected People to receive, address and effectively comment on the content. OPIC also discloses this summary on its web site.

2.6.2 International Finance Corporation's (IFC) Environmental and Social Performance Standards on Sustainability

IFC's Environmental and Social Performance Standards are part of the IFC's Sustainability Framework. It applies to all projects financed by IFC and defines the responsibility of project proponents for managing their environmental and social risks. There are eight PS, last released in 2012. Together, they establish standards that the IFC's client are required to meet throughout the project life.

The applicability of these PS is established during the Social and Environmental Impact Assessment process, while implementation of the actions is necessary to meet the requirements of IFC, the PS are managed through the owner's ESMS.

PS 1 Social and Environmental Assessment and Management System

It establishes the importance of integrated assessment to identify the social and environmental impacts, risks, and opportunities in the Project's area of influence. PS 1 requires Social and Environmental Assessment and Management Systems for managing social and environmental performance throughout the life cycle of this Project and runs through all subsequent PSs. The main elements of PS 1 includes the following elements: (i) Social and Environmental Assessment; (ii) Management program; (iii) organizational capacity; (iv) training; (v) community engagement; (vi) monitoring; and (vii) reporting.

The ESIA will be based on the guidelines described in PS 1.

PS 2 Labor and working conditions

This standard requires that worker-management relationship is established and maintained and, compliance with national labor and employment laws and safe and healthy working conditions are ensured for the workers.

The Project will have to adhere to the regulations laid down in the standard for hiring workers during construction and operation, along with performing due diligence for workers in the supply chain for Project materials.

PS 3 Pollution Prevention and Abatement

This standard outlines the approach to pollution prevention and abatement in line with internationally disseminated technologies and practices with objectives to (a) avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from activities; and (b) promote the reduction of emissions that

contribute to climate change. It requires a project to avoid, minimize, or reduce adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.

This PS is applicable to the emissions and effluents resulting from Project activities.

PS 4 Community Health, Safety and Security

PS 4 concentrates on the responsibility that must be undertaken by the client to avoid or minimize the risks and impacts to the community's health, safety and security that may arise from Project activities. This PS is applicable to the Project.

PS 5 Land Acquisition and Involuntary Resettlement

This standard requires that Project does not result in involuntary resettlement or at least if unavoidable it is minimized by exploring alternative Project designs. In addition, the Project will ensure that social and economic impacts from land acquisition or restrictions on affected persons' use of land are mitigated.

The Project includes the acquisition of land which will result in resettlement and loss of livelihood. The associated RAP will conform to the guidelines of IFC PS 5.

PS 6 Biodiversity Conservation and Sustainable Natural Resource Management

This standard aims at protecting and conserving biodiversity, the variety of life in all its forms, including genetic, species and ecosystem diversity and its ability to change and evolve, is fundamental to sustainable development. This PS addresses how clients can avoid or mitigate threats to biodiversity arising from their operations as well as incorporate sustainable management of renewable natural resources. The PS6 defines a Critical Habitat as outlined below.

Critical Habitat is designated by the IFC PS 6[5] and is described as having a high biodiversity value, as defined by:

- Habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) species;
- Habitat of significant importance to endemic and/or restricted-range species;
- Habitat supporting globally significant concentrations of migratory species and/or congregatory species;
- Highly threatened and/or unique ecosystems; and/or
- Areas associated with key evolutionary processes.

PS 7 Indigenous Peoples

PS 7 acknowledges the possibility of vulnerability of indigenous people owing to their culture, beliefs, institutions and living standards and that it may further get compromised by one or other project activity throughout the life cycle of the project. The PS underlines the requirement of minimizing adverse impacts an indigenous people in the Project area,

[5] Policy on Social and Environmental Sustainability, January 2012. Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, International Finance Corporation. The World Bank Group.

respecting the local culture and customs, fostering good relationship and ensuring that development benefits are provided to improve their standard of living and livelihoods.

The Project area is not used by Indigenous Peoples as defined by IFC PS 7.

PS 8 Cultural Heritage

This standard aims to protect the irreplaceable cultural heritage and to guide clients on protecting cultural heritage in the course of their business operations.

The Project area does not contain any cultural heritage as defined by PS 8.

2.6.3 Other IFC Guidelines

Other guidelines developed by IFC include general Environmental Health Safety (EHS) guidelines along with content specific guidelines for cumulative impact assessment, and land acquisition.

EHS General Guidelines

The EHS Guidelines are technical reference documents with general and industry-specific examples of GIIP. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project based on the results of an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account. The General EHS Guidelines consist of the following components:

Environmental: This guideline applies to facilities or projects that generate emissions to air at any stage of the project life cycle. They also look into aspects of energy conservation, wastewater and ambient water quality, water conservation, hazardous materials management, waste management, noise and contaminated land.

Occupational Health and Safety: This section provides guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety. Although the focus is placed on the operational phase of projects, much of the guidance also applies to construction and decommissioning activities. This incorporates general facility design and operation, communication and training, physical hazards, chemical hazards, biological hazards, radioactive hazards, Personal Protective Equipment (PPE), special hazard environment and monitoring.

Community Health and Safety: This guidance complements the above two guidelines by specifically addressing aspects of project activities which fall outside the traditional project boundaries but which are related to the project operations as and when they occur.

Construction and Decommissioning: This section provides an additional and specific guidance to the prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life cycle or due to expansion or modification of existing project facilities.

These guidelines present ambient air quality and noise level standards against which the baseline conditions and Project Impacts are compared. It also provides good practices which will be adopted in the ESIA.

IFC's EHS Guidelines for Electric Power Transmission and Distribution

The EHS Guidelines for Electric Power Transmission and Distribution include information relevant to power transmission between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas. The various aspects comprising this guidance are industry specific impacts and management and performance indicators and monitoring.

***Applicability*:** The transmission lines will be developed by NTDC as a separate project.

Land Acquisition Handbook

Involuntary resettlement may entail both the physical displacement of people and the disruption of their livelihoods. The purpose of the IFC Handbook for Preparing a RAP is to provide guidance in the planning and execution of involuntary resettlement associated with IFC investment projects. IFC's policy on involuntary resettlement applies to any project that may result in the loss of assets, the impairment of livelihood, or the physical relocation of an individual, household, or community.

The associated Resettlement Action Plan (RAP) to be developed as part of Phase 2 will follow the guidelines detailed in this handbook.

Cumulative Impact Assessment Guidelines

IFC's Good Practice Handbook of Cumulative Impact Assessment (CIA) and Management: Guidance for the Private Sector in Emerging Markets, describes the need and presents guidelines for an effective CIA. It builds upon the requirements set in PS 1, which recognizes that in some instances, private sector developers need to consider cumulative effects in their identification and management of environmental and social impacts and risks. Although the total cumulative impacts due to multiple projects typically should be identified in government-sponsored assessments and regional planning efforts, according to PS 1, IFC clients are expected to ensure that their own assessment determines the degree to which each project under review is contributing to the cumulative effects. Under the IFC guidelines, if a project is the first hydropower project in the basin, a CIA is recommended. This is the case for the Arkari Gol HPP.

2.6.4 World Bank Group

OPIC recognizes the environmental safeguards documents of the World Bank Group, of which the IFC is a part, as an example of good international industry practice.

The specific requirements are as follows:

Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines. …. [Page 16 of SPS 2009]

During the design, construction, and operation of the project the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards

contain performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from these levels and measures, the borrower/client will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the borrower/client will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in this document. [Page 36 of SPS 2009]

The borrower/client will provide workers with a safe and healthy working environment, taking into account risks inherent to the particular sector and specific classes of hazards in the borrower's/client's work areas, including physical, chemical, biological, and radiological hazards. The borrower/client will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work by (i) identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; (ii) providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) providing appropriate equipment to minimize risks and requiring and enforcing its use; (iv) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment; (v) documenting and reporting occupational accidents, diseases, and incidents; and (vi) having emergency prevention, preparedness, and response arrangements in place. The borrower/client will apply preventive and protective measures consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. [Page 38 of SPS 2009]

The IFC has guidelines on Environmental Health and Safety (EHS) for emission and effluent.[6] It also has guidelines in the form of Performance Standards such as the IFC's Performance Standard 3: Resource Efficiency and Pollution Prevention, for assessment and compliance with greenhouse gas emission standards.[7] There are a total of eight IFC Performance Standards which were published in April 2006 and revised in 2012. In addition to this, the World Bank Group's Environmental and Social Framework includes ten Environmental and Social Standards (ESS). ESS4. Community Health and Safety addresses the health, safety, and security risks and impacts on project-affected communities. Annex 1 of ESS4 "Safety of Dams" applies to new, existing and under-construction dams.[8] For large dams the World Bank requires:

- reviews by an independent panel of experts (the Panel) of the investigation, design, and construction of the dam and the start of operations;
- preparation and implementation of detailed plans: a plan for construction supervision and quality assurance, an instrumentation plan, an operation and maintenance plan, and an emergency preparedness plan;

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6 The International Finance Corporation, Environmental, Health, and Safety General Guidelines, The World Bank Group, April 2007.

7 Asian Development Bank (ADB), Environmental Safeguards: A Good Practice Sourcebook Draft Working Document, December 2012.

8 The World Bank Group, The Environmental and Social Framework, March 30, 2017, < http://www.worldbank.org/en/programs/environmental-and-social-policies-for-projects/brief/the-environmental-and-social-framework-esf>, accessed May 1, 2017

- prequalification of bidders during procurement and bid tendering,
- periodic safety inspections of the dam after completion.

2.6.5 World Commission on Dams 2000

The World Commission on Dams (WCD) established the most comprehensive guidelines for dam building. It describes an innovative framework for planning water and energy projects that is intended to protect dam-affected people and the environment, and ensure that the benefits from dams are more equitably distributed. The WCD framework covers key areas for improved planning of dams, including the need to fully assess all available options for meeting water and energy needs; addressing outstanding social issues from existing dams before building new ones, gaining public acceptance for key decisions, and the importance of protecting healthy rivers.[9] The Project is being constructed in an area with natural resources of value both in terms of ecology and socioeconomics. It is being financed by an international funding body, therefore, international standards, guidelines and best practices need to be considered.

2.7 International Treaties and Agreements

Important international environmental treaties that have been signed by Pakistan and may have relevance to the Project are listed in **Exhibit 2.7**. They concern climate change and depletion of the ozone layer; biological diversity and trade in wild flora and fauna; desertification; waste and pollution; and cultural heritage.

[9] International Rivers, The World Commission on Dams, Available at <https://www.internationalrivers.org/campaigns/the-world-commission-on-dams>, accessed April 18, 2017

Exhibit 2.7: International Environmental Treaties Endorsed by Pakistan

Topic	*Convention*	*Date of Treaty*	*Entry into Force in Pakistan*
Climate change and the ozone layer	United Nations Framework Convention on Climate Change - the primary objective is the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.	1992	1994
	Kyoto Protocol to the United Nations Framework Convention on Climate Change - enabled by the above Convention on Climate Change. It has more powerful and legally binding measures. It sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas emissions.	1997	2005
	Vienna Convention for the Protection of the Ozone Layer - acts as a framework for the international efforts to protect the ozone layer with a primary objective to protect human health and the environment against adverse effects resulting from human activities that modify or are likely to modify the ozone layer.	1985	1993
	The Montreal Protocol on Substances that Deplete Ozone Layer and associated amendments - enabled by the Vienna Convention, it is designed to protect the ozone layer by phasing out the production and consumption of a number of substances believed to be responsible for ozone depletion.	1987	1993
Waste and pollution	Basel Convention on the Control of Trans Boundary Movements of Hazardous Wastes and their Disposal - regulates the trans boundary movement of hazardous waste and other waste with a stated purpose to protect human health and the environment against the adverse effects from generation and management of hazardous waste and other waste. The Convention provides for three sets of measures with binding obligations. These are: Strict control of trans boundary movement of hazardous waste; Environmentally sound management of hazardous waste; and Enforcement and implementation of the provisions of the convention at international and national levels.	1989	1994
	International Convention on Oil Pollution Preparedness, Response and Co-operation	1990	1995
	Stockholm Convention on Persistent Organic Pollutants - seeks to protect human health and the environment from Persistent Organic Pollutants, which are chemicals that remain intact in the environment for long periods, become widely distributed geographically and accumulate in the fatty tissue of humans and wildlife.	2001	2008

Topic	*Convention*	*Date of Treaty*	*Entry into Force in Pakistan*
	International Convention for the Prevention of Pollution from Ships (MARPOL) – is the main international convention that's covers prevention of pollution of the marine environment by ships from operational or accidental causes. The Convention includes regulations aimed at preventing and minimizing pollution from ships, both accidental pollution and that from routine operations, and currently includes six technical Annexes.	1983	
Desertification	International Convention to Combat Desertification – with an objective to combat desertification and mitigate the effects of drought. It is supported by international cooperation and partnership arrangements, with the aim of achieving sustainable use of land and water resources and sustainable development in affected areas.	1994	1997
Biodiversity and the protection of plants and animals	Convention on Biological Diversity – covering ecosystems, species, and genetic resources and also the field of biotechnology. The objectives are: ► conserve of biological diversity; ► sustainable use of its components; and ► fair and equitable sharing of benefits arising from genetic resources.	1992	1994
	Cartagena Protocol on Biosafety to the Convention on Biological Diversity - addresses potential risks posed by living modified organisms resulting from modern biotechnology.	2000	2009
	Bonn Convention on the Conservation of Migratory Species of Wild Animals - aims to conserve terrestrial, marine and avian migratory species throughout their range. It is concerned with the conservation of wildlife and habitats on a global scale.	1979	1987
	Memorandum of Understanding concerning Conservation Measures for the Siberian Crane - parties undertakes to provide strict protection to Siberian Cranes, and identify and conserve wetland habitats essential for their survival.	1998	1999
	Convention on International Trade in Endangered Species of Wild Fauna and Flora - to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	1973	1976

Topic	*Convention*	*Date of Treaty*	*Entry into Force in Pakistan*
	International Plant Protection Convention (1997 Revised Text) - to prevent the international spread of pests and plant diseases. It requires maintenance of lists of plant pests, tracking of pest outbreaks, and coordination of technical assistance between member nations.	1951/52	1954
	Agreement for the Establishment of the Near East Plant Protection Organization - to establish the Near East Plant Protection Organization (NEPPO), which promotes international co-operation with a view to implementing International Plant Protection Convention.	1993	2009
	Plant Protection Agreement for the Asia and Pacific Region and amendments – establishes the Asia and Pacific Plant Protection Commission to review and promote the region's progress in the implementation of the Agreement. Trade in plants and plant products are regulated by certification, prohibition, inspection, disinfection, quarantine, destruction, etc., as necessary.	1955 (amendment 1967)	1958 (amendment 1969)
	Convention on Wetlands of International Importance especially as Waterfowl Habitat and associated protocols and amendments - to promote conservation and sustainable use of wetlands. The Ramsar List of Wetlands of International Importance now includes almost 1,800 sites (known as Ramsar Sites). There are currently 19 Ramsar sites in Pakistan.	1971 (amended 1987)	1976 (amended 1994)
Cultural heritage	Convention concerning the Protection of the World Cultural and Natural Heritage - requires parties to adapt a general policy on the protection of the natural and cultural heritage, to set up services for such protection, to develop scientific and technical studies, to take appropriate legal, technical, scientific and administrative measures and to foster training and education for such protection.	1972	1976

Pakistan is a party to a number of conventions in relation to biodiversity, including the Convention on the Conservation of Migratory Species of Wild Animals (CMS), the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES), the Convention on Wetlands of International Importance (Ramsar Convention) and the United Nations Convention on Biological Diversity (CBD).

The CBD defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems". As a signatory country, Pakistan has a responsibility to:

- Safeguard its biodiversity.
- Introduce procedures requiring environmental impact assessment (EIA) for projects likely to have significant impacts on biological diversity.
- Introduce legislative provisions that ensure environmental policies and procedures are duly taken into account.

There are no direct bearing of these treaties on the Project. Wherever required, the federal or provincial governments have enacted laws to comply with the provisions of the treaties listed in this section. Thus the obligations of the Project are to comply with pertinent laws only.

3. Project Description

This section provides a brief description of the Project. The description is based on the FS carried out for the Project, released in March 2014.[2]

The Arkari Gol HPP is a run-of-river hydropower project with daily peaking throughout the year, to be constructed on the Arkari Gol. The Arkari Gol is a left tributary of Lutkho River. It joins Lutkho River about 1 km upstream Shoghore Village. The Arkari Gol is called Arkari Gol ('Gol' being tributary in local language). The drainage area of Arkari Gol up to the proposed dam site is about 1,036 km^2.

The dam and intake structure will be located 8 km upstream of the confluence of Arkari Gol and Lutkho River, near the village of Ucchatur in Chitral District, KP. The powerhouse will be located 7.5 km downstream of the dam on the right bank of Arkari Gol, near the village of Andakht.

The Project area is accessible via road, at a distance of 460 km from Islamabad and 370 km from Peshawar, the capital of KP province.

Chitral is situated in the extreme northern part of Pakistan. It is about 14,850 km^2 and is bordered for about 480 km along Afghanistan. The area is sandwiched between Hindu Kush Range in the north and the Hindu Raj Range in the south and has an approximate NE-SE trend. Located further east are the Great Himalayas. The entire Chitral Valley is a mountainous region cut into deep and steep sided valleys by Chitral River and its numerous tributaries. The mountain elevations range from 3,500 m to 7700 m. The latter is the elevation of Terchmir, the highest peak in the region. Several streams drain into Arkari Gol upstream of the proposed site and contribute appreciable amount of water for hydropower. The valley of Arkari Gol descends from an elevation of 6,952 meters above mean sea level (masl) and at Uchhatur up to 2,169.8 masl at the proposed weir site. On the basis of the 100 m Digital Elevation Model (DEM), the elevation in the watershed varies from 2,172 masl to 6,732 masl.

A map showing the Project setting is provided in **Exhibit 3.1**. The general layout of the Project facilities is shown in **Exhibit 3.2**.

3.1 Main Components

The main permanent structures to be designed are as follows:

- Concrete gravity dam.
- Roller-compacted concrete (RCC) spillway.
- Bottom outlets for sediment flushing.

[2] Pakhtunkhwa Hydel Development Organization (PHYDO), Government of Khyber Pakhtunkhwa, March 2014, Feasibility Study for the Arkari Gol Hydropower Project, District Chitral, (Lower), Khyber Pakhtunkhwa, Volume 1, Main Report

- Intake structure.
- Headrace tunnel.
- Pressure shaft and pressure tunnel.
- Surface-type powerhouse.
- Tailrace channel.

Temporary works comprise the diversion structures including the cofferdams and a diversion tunnel. The main structures are described below.

3.1.1 The Main Dam

The main dam will be a concrete structure, with a height of 20 m above the riverbed. The soil investigations of the dam site show that the rock is about 100 m deep. Therefore a rock-fill type dam was recommended. Axis of the weir and diversion embankment has been selected on the basis of prevailing hydrological, topographical, geological and environmental conditions.

There spillway will comprise four units having four vertical roller gates with stoplog arrangements.

Exhibit 3.1: Project Location

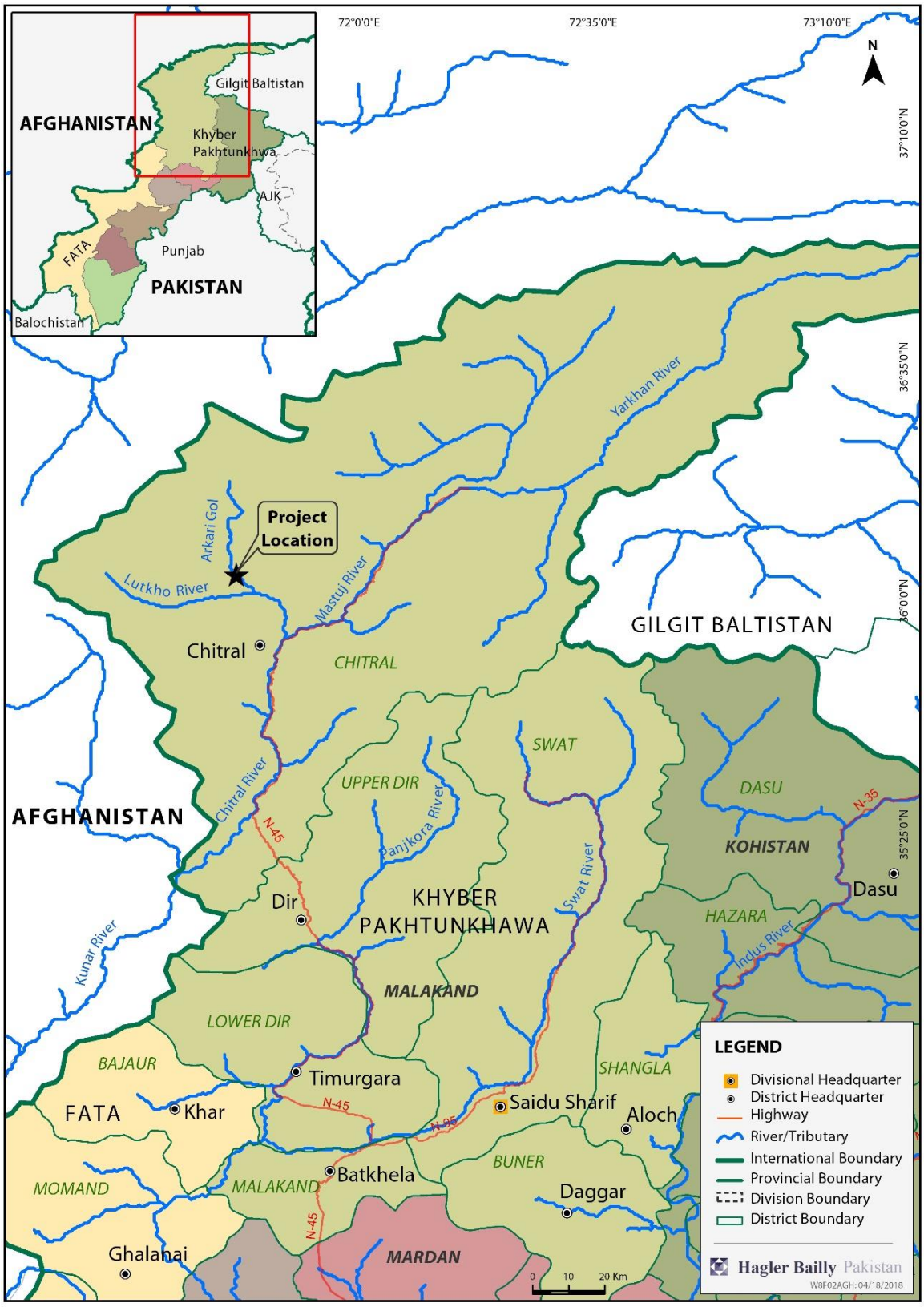
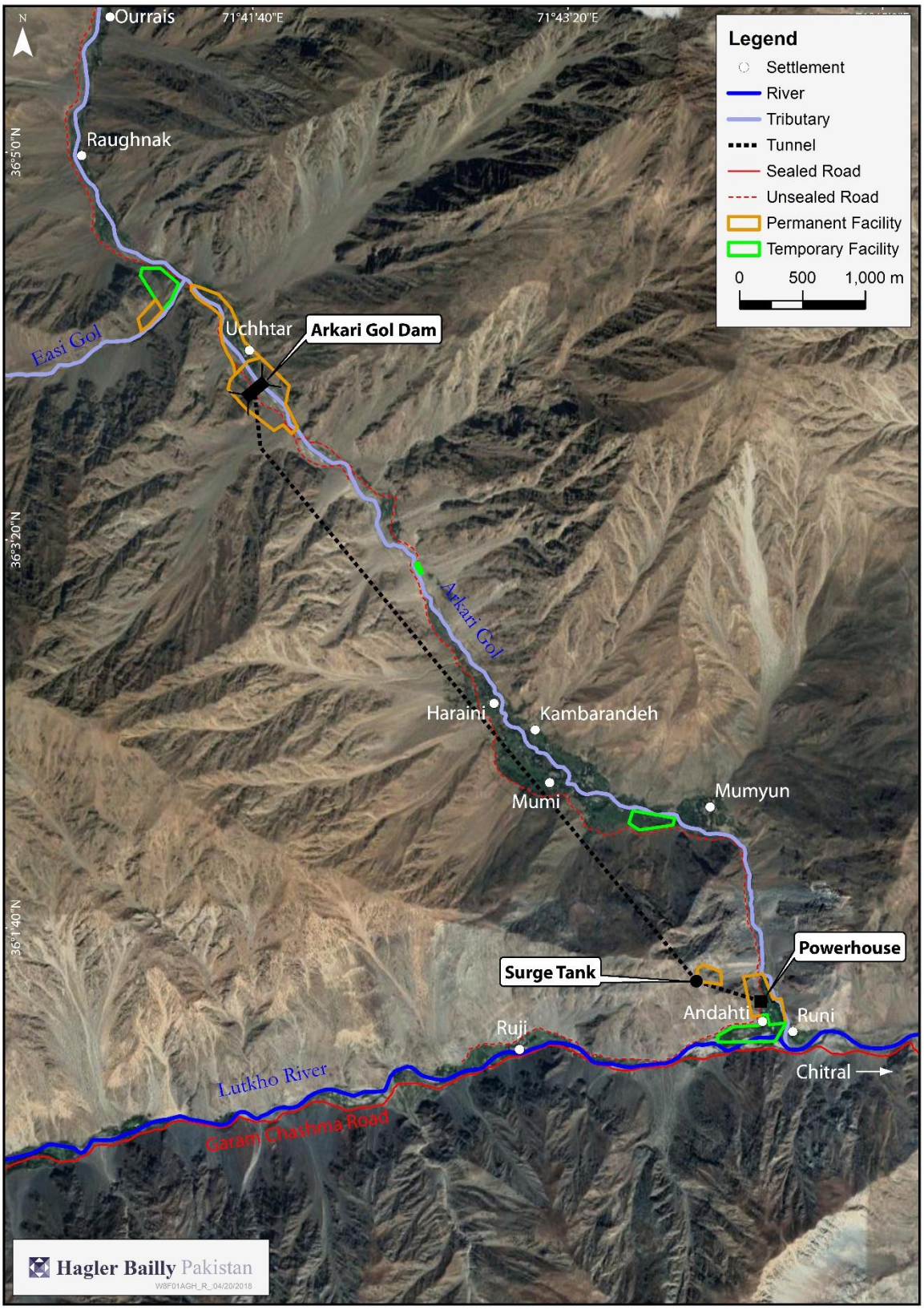


Exhibit 3.2: Project Layout



3.1.2 Powerhouse

Studies have shown a clear superiority of an external type powerhouse, located on the right bank of Arkari Gol near Andahti Village at the confluence of Arkari Gol and Lutkho River. The power station comprises following main structures:

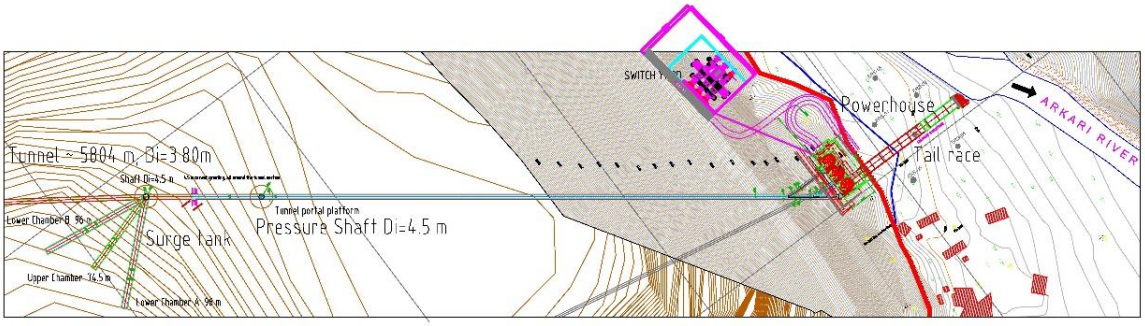
- Turbine shaft for installation of three Pelton wheel turbines.
- Surface machine hall and operation building.
- Tailrace channel.

Three vertical shaft Pelton turbines are proposed. Each unit will be designed for a rated flow of 12 m^3/s producing a discharge of 36 m^3/s. This will result in a net head of 318 m and a rated mechanical turbine power of 33 MW. Therefore, total capacity will be 99 MW.

The gross head will be 335.33 m and net head 318 m. Maximum reservoir level will be 2,190 masl and tail water level will be 1,854.7 masl.

A schematic showing the powerhouse, surge tank and switch yard is provided in **Exhibit 3.3.**

Exhibit 3.3: Schematic



Source: Pakhtunkhwa Hydel Development Organization (PHYDO), Government of Khyber Pakhtunkhwa, not dated, Feasibility Study for the Arkari Gol Hydropower Project, District Chitral, (Lower), Khyber Pakhtunkhwa, Volume 1, Main Report

3.1.3 Intake Structure

The intake structure will comprise two bays fitted with vertical gates to regulate inflow from the reservoir. On each bay a trash rack will be provided upstream of the gates to check the entry of floating debris into the power waterway. The intake structure is proposed along the right bank of the river as close to the embankment of the dam as possible. This will facilitate flushing of sediment and maintenance of maximum submergence. A lateral structure is proposed to minimize head losses and accelerate flow uniformly for the trash rack to the gate downstream. The intake structure is designed to be capable of discharging the total design discharge for the turbines plus 20% of the design discharge for flushing of the sediments settled in the de-sanding chambers. Total design discharge of the intakes will be about 36 m^3/s.

3.1.4 Headrace Tunnel from Intake to Surge Tank

The headrace tunnel will run from the intake to the surge structure. The optimal internal tunnel diameter will be 4.4 m to give a rated discharge of 36 m^3/s for the Pelton turbines. The resulting flow will be approximately 3 m/s which is within the range allowed for concrete-lined tunnels.

Based on the feasibility study the headrace channel will be concrete lined throughout its length. In case the geotechnical conditions allow, Powerchina has mentioned that they see the possibility for unlined sections with increased tunnel diameter to account for the hydraulic higher hydraulic losses.

3.1.5 Surge Tank

The surge structure branches at an elevation of 2,165.96 masl & 2,209.6 masl. The surge shaft is of an internal diameter of 4.5 m and is of 71.18 m high. A three-chamber surge tank has been selected.

- The Lower Chamber-A has a horseshoe section and a length of 96 m.
- The Lower Chamber-B has a horse shoe section and a length of 96 m.
- The end of the lower chambers will be connected again over a horizontal/vertical connection tunnel with the headrace tunnel.
- The upper chamber will be excavated from the working platform at an elevation of 74.5 m. The chamber has to be closed by a concrete wall with sufficient freeboard to the maximum surge level.
- Ventilation for the surge tank is proposed by an opening at the portal top.

The final dimensioning of the surge structures will need detail of basic requirements of the manufacturers for the hydro-mechanical equipment.

3.1.6 Pressure Shaft, Pressure Tunnel and Tailrace

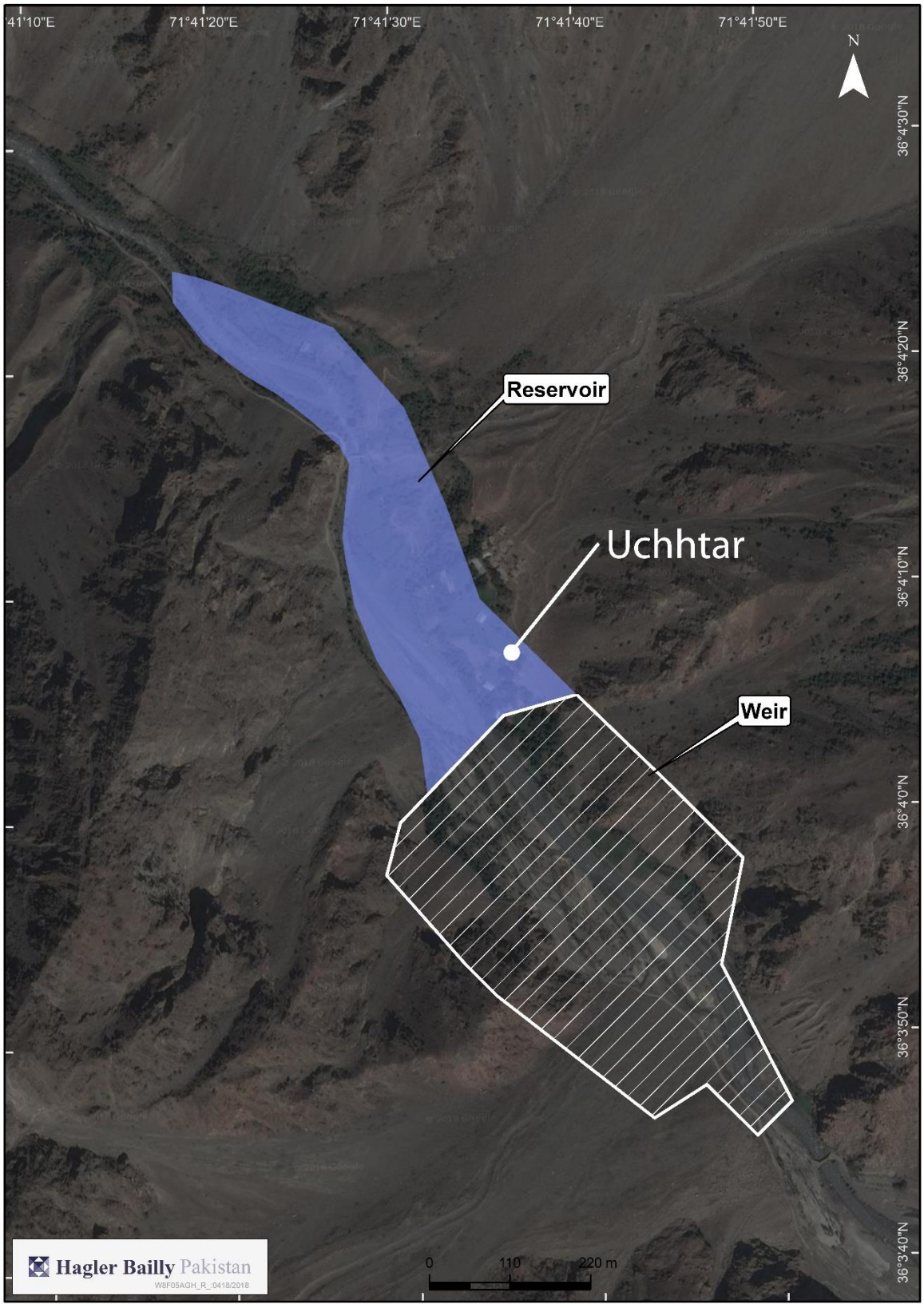
The powerhouse and the pressure shaft will be connected by a pressure tunnel with a vertical length of 296 m. The total length of the pressure tunnel will be 700-900 m including a length of 300 m for the pressure shaft. The total length of the tailrace channel to the outlet structure will be 100 m.

3.1.7 Reservoir

The Project is designed for a full supply level (FSL) at 2,190 masl creating a reservoir of volume of approximately 1.06 million m^3. The live operating storage is 0.489 million m^3. The reservoir will have a length of 1.3 km and an area of 0.101 km^2 (10.1423 hectares).

The extent of the reservoir is shown in **Exhibit 3.4**.

Exhibit 3.4: Reservoir Extent



3.1.8 Sediment Flushing

Mean annual suspended sediment load at the weir site is about 0.259 million m^3. Mean annual bed load at the weir site is about 0.039 million m^3. Mean annual total sediment inflow to the Arkari reservoir is about 0.297 million m^3.

Based on information from the developers the reservoir will reach equilibrium seven years after construction. Flushing will be carried out annually over a period of 3-7 days during July (high flow season) depending on the sediment inflow.

3.1.9 Associated Facilities

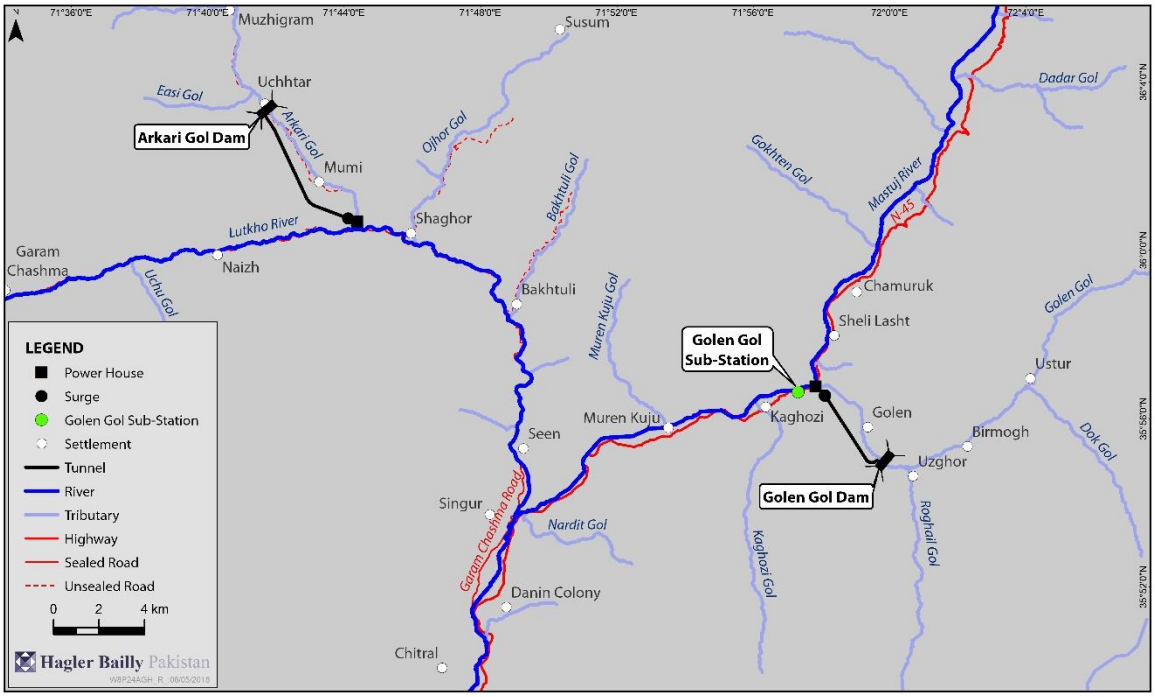
To evacuate power from the proposed Project, the transmission line to be constructed by NTDC falls in the category of an associated project.[3] NTDC will be responsible for the design and construction, as well as the EIA, of these facilities.[4] To achieve environmental or social outcomes consistent with the IFC guidelines, which are being followed by OPIC, it is essential that NTDC undertake the environmental assessment of the transmission line and develop a sound ESMS consistent with the national and provincial legal environmental requirements as well as that of the IFC PSs. The scope of Consultant's assignment does not include the evaluation of the design, construction, and operation of the transmission line for evacuation of the power produced by the Project.

Based on currently available information the sub-station at Golen Gol, located about 20 km from the powerhouse will be used to transmit power from the Project. A 132 kV line will be used to carry power from the Project to the sub-station and another 132 kV line will be used to transmit it onwards from the sub-station. The location of the sub-station at Golen Gol is shown in **Exhibit 3.5** along with the location of the Project.

[3] The associated facility is defined as "facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable"

[4] Specific details on the transmission lines are not yet available, as these will be commissioned by NTDC two years before commissioning of the Project.

Exhibit 3.5: Locations of Interconnection Points for Transmission of Power



3.1.10 Camps and Offices

Camps and offices will be required during the construction phase for the contractors' staff and engineers as well as for the clients engineering staff. As is the case with other hydropower projects, it is anticipated that low density housing and amenities will be provided. In addition, there will likely be a large labor workforce which will require accommodation. This may be a combination of married and single quarters.

3.1.11 Technical Design Summary

Exhibit 3.6 provides the technical design summary of the Project.

Exhibit 3.6: Salient Features of the Project Design

River	Arkari Gol, left side tributary to Lutkho River	
	Catchment Area at dam site (km²)	1,036
	Mean Annual Discharge (m³/s)	17.00
	Total annual flow (Mm³)	536
Reservoir	Total Storage Capacity (Mm³)	1.06
	Live Storage Capacity (Mm³)	0.489
	Dead Storage Capacity (Mm³)	0.656
	Surface Area (km²)	0.121
	Length of Reservoir (km)	1.3
	Full Reservoir Level (masl)	2,190

Dam Structure	Dam Type	Concrete gravity dam
	Catchment Area at dam location (km^2)	1,036
	Dam Top Elevation (masl)	2,192
	Foundation Level (masl)	2,168
	Height above Riverbed (m)	20
	Crest Length (m)	150
	Crest Width (m)	6
Spillway Gates	Type of Gate	Roller
	Number of Gates	4
	Rated discharge of gates (m3/s) – total for all	1,436
	Type of low level outlet	Roller
	Number of low level outlets	4 undersluices
Stilling Basin	Length (m)	90
Flood Control	Design Flood (Return Period 1000a) (m^3/s)	562
	4 Vertical Gates	6 m x 6 m each
	4 Bottom Outlets	6 m x 6 m each
River Diversion	Diversion Flood (Construction Phase Return Period = 10 a) (m^3/s)	162
	1 Diversion Tunnel (Horse Shoe) (Protected by upstream & downstream cofferdams) Cross Sectional Area (m^2)	50
Intake Components	2 Stoplogs	3 m x 4 m each
	2 Trashracks	5.89 x 7.63 m each
	Rack Cleaning Machine	
	Velocity of lifting (m/s)	0.3
	2 Intake gates	3 m x 4m each
Headrace Tunnel		
	Number	1
	Length (km)	6.25
	Excavation Diameter (TBM) (m)	4.4
	Adit 1	
Tailrace	Type	Open Channel
	Length (m)	100
Surge Tank	Surge Shaft Internal Diameter (m)	4.5
	Height (m)	71.2
	Length (m)	75

Lower Chambers	Units	2
	Length of each (m)	96
	Cross Section of each (m²)	21.9
Upper Chamber	Length (m)	74.5
	Cross Section (m²)	33.5
Pressure Shaft	Vertical Shaft, Steel Lined	
	Internal Diameter (m)	3.0 to 3.2
	Difference in Height (m)	296
Pressure Tunnel	Horizontal Tunnel, Steel Lined	
	Length from Pressure Shaft to Power House (m)	494
	Internal Diameter (m)	3.0
Powerhouse	External powerhouse	
	Turbine Shaft depth below machine hall floor (m)	15
Turbines	Type of Turbine	Pelton
	Capacity of each Turbine (MW)	33
	Total Capacity (MW)	99
	Rated unit discharge of each turbine (m^3/s)	12
	Number of Turbines	3
	Maximum water head (m)	335 m gross head, 17 m losses
	Minimum water head (m)	331 m gross head, 17 m losses
	Weighted average water head	334 m gross head
	Power coefficient (MW/m3/s)	99 MW / 36m3/s = 2,75 MW/(m3/s)
	Flow release required or planned (m^3/s)	0.8 m^3/s in winter and 2.0 m^3/s in summer
Machine Hall	Length (m)	46.7
	Width (m)	24.2
	Height (m)	13.5

Source: Pakhtunkhwa Hydel Development Organization (PHYDO), Government of Khyber Pakhtunkhwa, March 2014, Feasibility Study for the Arkari Gol Hydropower Project, District Chitral, (Lower), Khyber Pakhtunkhwa, Volume 1, Main Report

3.2 Project Preparation and Construction

This section describes the following aspects related to Project construction:

- River Diversion
- Construction Timeline and Materials
- Spoil Disposal

- Quarry Areas

3.2.1 Main Construction Activities

River Diversion

River diversion facilities have been designed for a to 10-years return period of 284 m^3/s. The diversion facilities will be in service for approximately three years during construction. In case of floods with higher frequency the cofferdams would be over spilled and flushed downstream. The safety of completed concrete blocks in such an event depends on the stage of actual construction progress (bottom outlets). Design floods of higher frequency results in increasing cost for the temporary river diversion.

Construction Timeline

Based on the FS the Project will take 4 years (48 months) to construct. The construction will follow the following sequence:

- Mobilization
- Pre-construction works
- Diversion tunnel
- Dam
- Spillway
- Power canal from Intake structure
- Headrace tunnel
- Surge chambers
- Pressure shaft and pressure tunnel
- Tailrace canal

In parallel construction will be carried out on the powerhouse, switchyard and erection of equipment. Following this testing and commission will be done.

3.2.2 Construction Material

Materials required to carry out the construction of civil works include concrete, various types of fill materials and steel products.

Estimates of quantities are provided in **Exhibit 3.7**.

Exhibit 3.7: Estimates of Quantities

Material Type	*Tonnes*
Concrete	240,000
Fill Material	27,500
Steel	8,000
Total	**275,500**

3.2.3 Spoil Disposal

Excavation of tunnels, desanders, and fore bay will result in the production of huge quantities of muck comprising various rock types. In the weir area the rocks expected from the excavation of desanders and the portion of headrace tunnel comprise of granitic gneisses and amphibolites. Based on the indicative bill of quantities it is assumed that the total quantity of spoil material from dam site, tunnel and powerhouse will be between 300,000 m^3 and 500,000 m^3.

MHL have suggested that the material be used to provide terraces that can be used by the local population.

3.2.4 Quarry Areas

Two huge deposits of crushed aggregate exist in the vicinity of Aawi village and are about 2 km from Shoghore. Coarse aggregates of this area are being extensively used in construction of road building and concrete production.

3.3 Transport Corridor

The Arkari Gol HPP will entail procurement, transportation and installation of heavy and large sized construction and powerhouse equipment such as cranes, turbines, generators, transformers etc. Most of the equipment will be imported from foreign countries and will land at Karachi Port before being transported to the Project site.

The road infrastructure beyond Chakdara will need rehabilitation/upgradation at certain sections. This will entail upgradation/maintenance of roads, bridges, culverts, tunnels etc. and improvements in their existing design parameters such as widths, clear heights, profiles, cross-sections, curves, slopes, loading class etc.

A final decision with regard to the route and mode of transport will however be taken after sufficient data is available for making a comparative analysis of the competing options. **Exhibit 3.8** the road to be built as part of the Project based on currently available information.

The transport route is shown in **Exhibit 3.9**.

Exhibit 3.8: Road construction as part of the Project

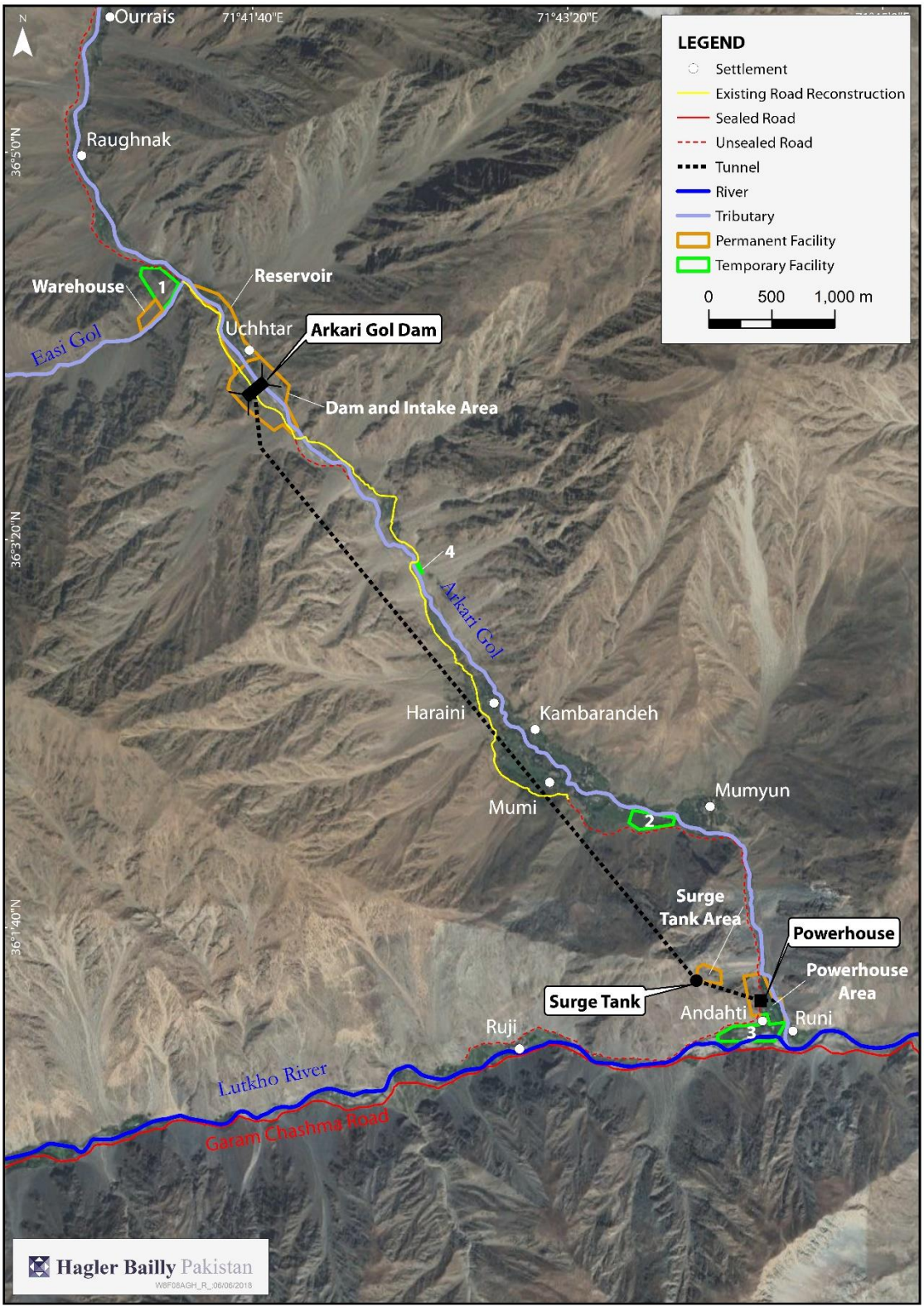
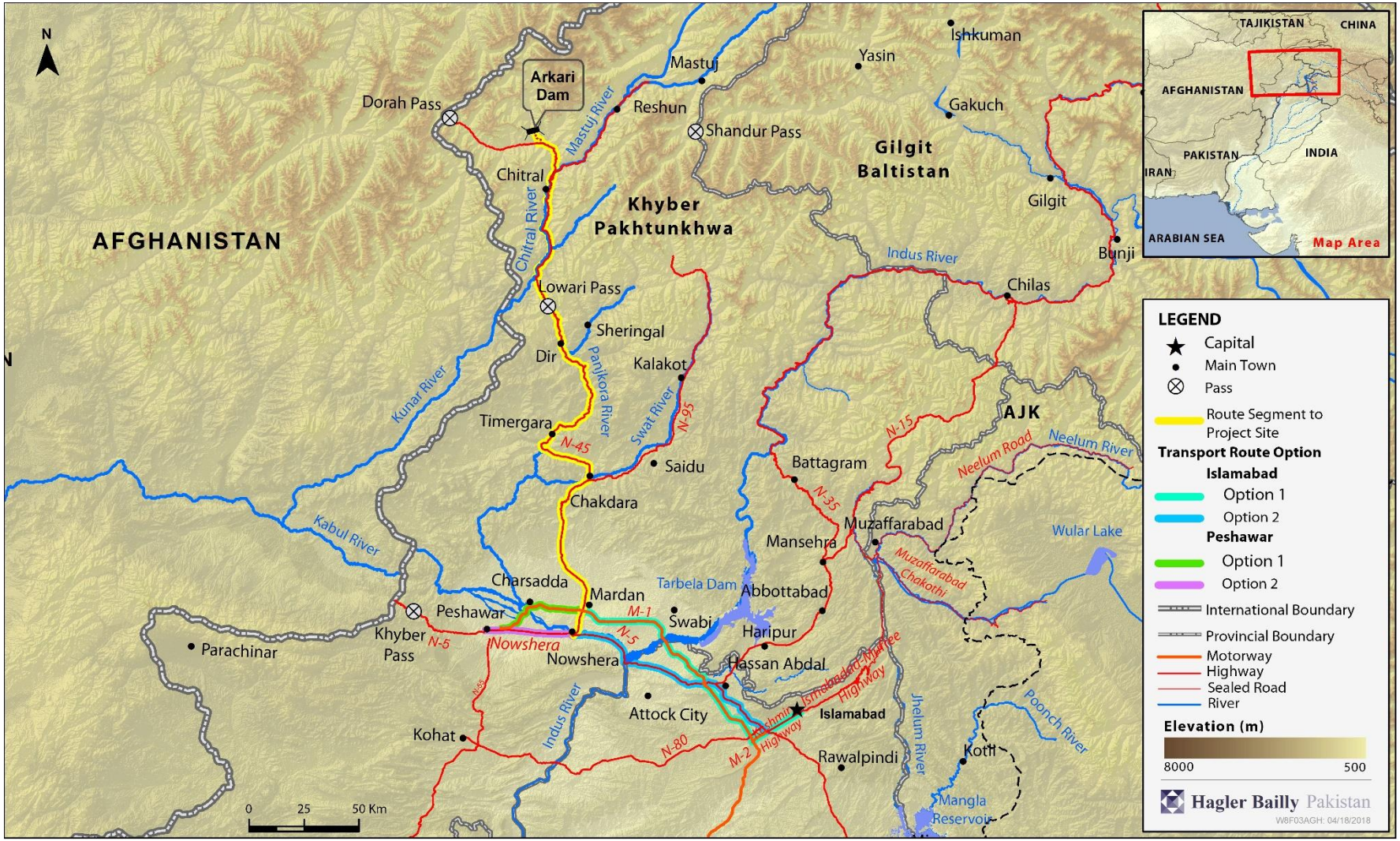


Exhibit 3.9: Transport Route



3.4 Land Requirement

The Project will involve acquisition of land for various components. Some of the land will be occupied permanently and some temporarily during the construction phase. The Project will involve acquisition of land for various components. A total of 140.0 acres of land will be required of which 26.5 acres is cultivated land, 4.0 acres is residential land and 109.5 acres is barren land or river bed. This will include 19.0 acres for Powerhouse, 5.6 acres for Surge tank, 5.4 acres for Warehouse, 45.15 acres for Dam and Intake structure, 25.9 acres for Reservoir and 38.96 acres for Temporary facilities.

3.5 Regional Hydropower Developments

A number of hydropower projects have been planned or are under construction in District Chitral, of which one is located on the Arkari Gol. Of these projects only Golen Gol is currently operational. A list of these hydropower projects is provided in **Exhibit 3.10**. The cascade of projects is shown in **Exhibit 3.11**.

Exhibit 3.10: Hydropower Projects Planned or Under Construction in District Chitral

No	*Project Name*	*Capacity (MW)*	*Tunnel Length (km)*	*Planned/Under Construction*
1	Golen Gol	108	3.8	Completed
2	Arkari Gol	99	6.25	Feasibility Stage
3	Mujigram-Shoghor	64.26	13.75	Feasibility Stage
4	Shushgai-Zhendoli	144	8.5	Feasibility Stage
5	Turen More Kari	350	14.1	Feasibility Study Completed
6	Jamshil More Lasht	260	13.6	Feasibility Study Completed
7	Ayun Gol	15.17	5.4	Pre-Feasibility Study Completed
8	Barum Gol	24.93	4.4	Pre-Feasibility Study Completed
9	Turen More Kari	350	NA	Pre-Feasibility Study Completed
10	Laspur-Miragram	230	32.40	Prefeasibility of Conceptual Stage
11	Istaru Booni	72	4.024	Proposed
12	Ghrait- Swir Lasht	377	14.50	Proposed
	Total	**2094.36**		

Notes: 1. Only developments within District Chitral are listed. 2. NA = Not Available

Exhibit 3.11: Hydropower Projects Planned or Under Construction in Distric Chitral

4. Description of the Environment

4.1 Ecology Baseline

The ecology baseline has been prepared to provide an overview of the ecological conditions in the Study Area and surroundings.

Sources of information for preparation of this baseline included published literature and reports, scientific journals as well as ESIA reports of other projects in the vicinity of the Study Area including the Rapid Environmental Analysis of 108 MW Golen Gol Hydroelectric Power Project.[1] In addition, a field survey was carried out between March 28, 2018 and April 3, 2018 (March 2018 Surveys) to collect field data and information about the aquatic and terrestrial ecological resources in the Study Area in the spring season.

4.1.1 Objectives and Scope

The baseline was prepared with the following objectives:

- A review of the available literature on the biodiversity of the Ecological Study Area.
- Field surveys including:
  - Qualitative and quantitative assessment of flora, mammals, reptiles, birds and invertebrates.
  - Identification of key species, their population and their conservation status in the country and worldwide.
  - Reports of wildlife sightings in the Ecological Study Area by the resident communities.
- Analysis of ecological interaction of selected species with the environment.
- Analysis was also carried out to further develop the basis for evaluating the potential impacts of Project related activities on the biodiversity, specifically seeking any potential critical habitat and ecosystem services in the Ecological Study Area.

4.1.2 Study Areas

There are two types of ecological resources that are of concern, aquatic and terrestrial. Therefore, two types of Study Areas were defined, an Aquatic Study Area and a Terrestrial Study Area.

The Aquatic Study Area was selected taking into consideration the maximum extent of impacts of the Project both upstream and downstream of the dam. It includes the stretch

[1] Hagler Bailly Pakistan, December 2016, Rapid Environmental Analysis of 108 MW Golen Gol Hydroelectric Power Project for Water and Power Development Authority (WAPDA)

of the Arkari Gol from upstream Azhpi Village to confluence of Arkari Gol and Lutkho River (29 Km), including all major tributaries in this stretch.[2] The reservoir is expected to form on the Arkari Gol stretch 1.3 km upstream of the dam as a result of which the Riverne habitat will be changed to a lake–like habitat and the Study Area includes this entire stretch. Moreover, since the dam on the Arkari Gol will create a barrier to migration for the fish species of concern, a stretch of 21 km of Arkari Gol upstream of the dam has been included in the Aquatic Study Area. The stretch of Lutkho River from Naizh Village to confluence of Mastuj River (Chitral River) is also included in the Aquatic Study Area. A small stretch (1 km) of Chitral River, downstream of the confluence of Lutkho and Chitral Rivers is also included in the Aquatic Study Area. The Aquatic Study Area is shown in **Exhibit 4.1**.

The Terrestrial Study Area comprises the Project facilities as well as a 1 km buffer around Project–related facilities which are likely to be impacted by Project–related activities. **Exhibit 4.2** shows the Terrestrial Study Area.

[2] Only those tributaries with a significant perennial flow that have the potential to support breeding of fish are included`

Exhibit 4.1: Aquatic Study Area

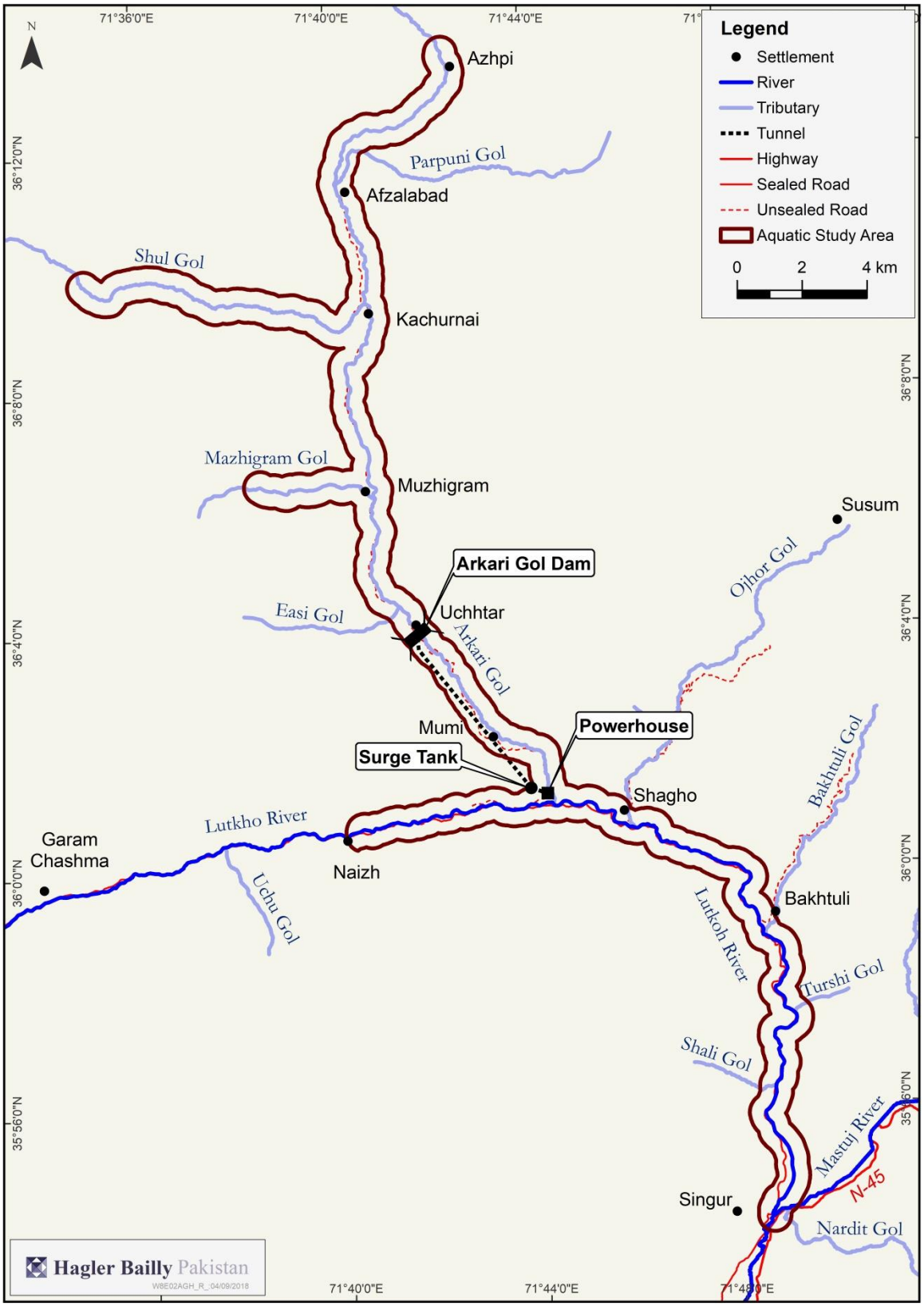
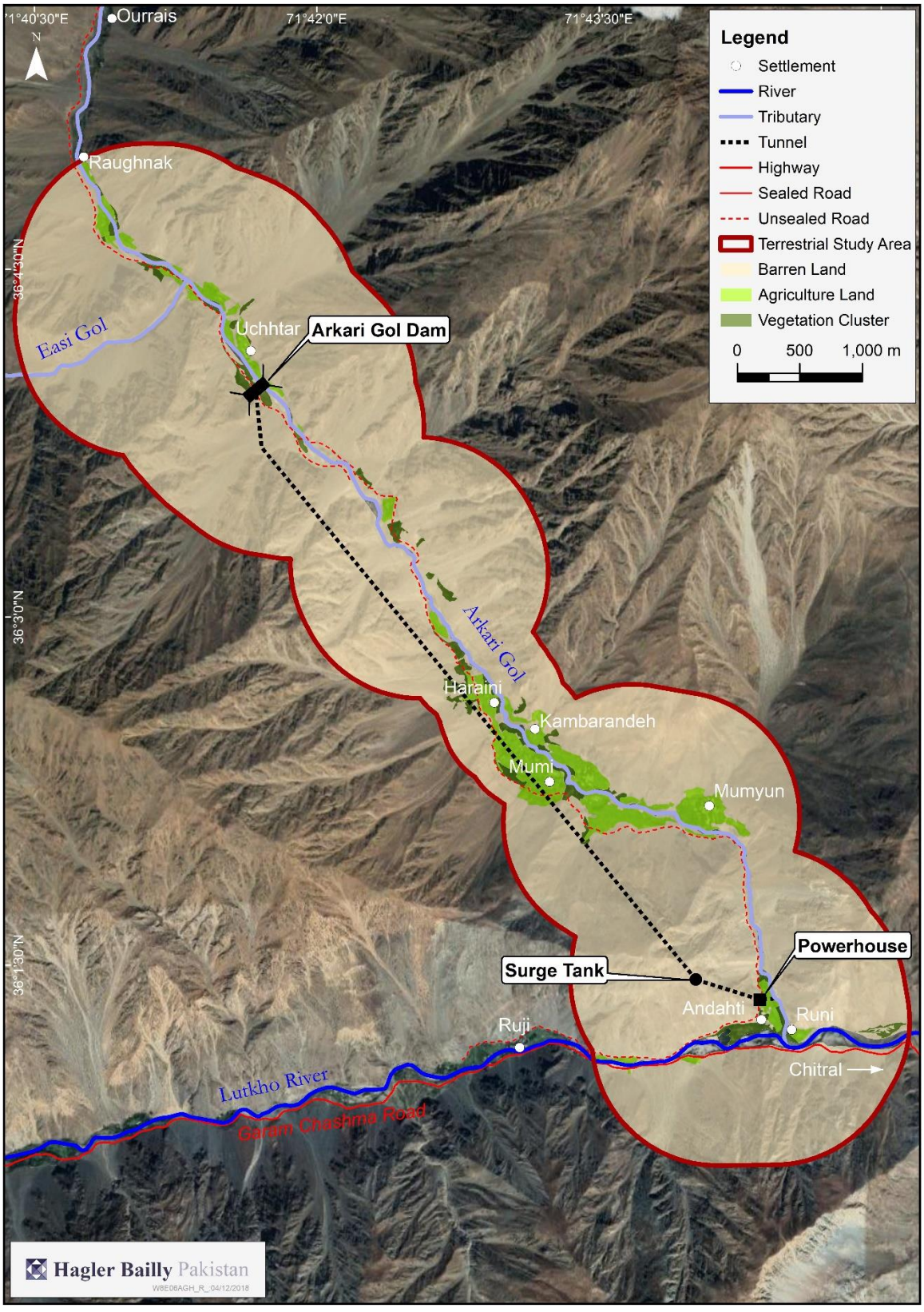


Exhibit 4.2: Terrestrial Study Area



4.1.3 Field Survey

The field surveys were carried out between March 28, 2018 and April 3, 2018 (March 2018 Surveys).

Sampling Locations

Sampling locations for aquatic ecological resources including fish fauna, macro–invertebrates, periphyton and riparian vegetation are shown in **Exhibit 4.3.** The justification for the selection of these sampling locations is provided in **Exhibit 4.4.** The list of sampling locations in the tributaries is provided in **Exhibit 4.5.**

Sampling locations for terrestrial ecology are provided in **Exhibit 4.6.** The locations were selected taking into account three main habitat types identified using ***Google Earth™*** satellite imagery. These include Barren Land, Vegetation Cluster and Agricultural Land. The number of sampling locations was based on percentage representation of the habitats in the Terrestrial Study Area. Four sampling locations were selected in the Barren Land and two sampling locations in the Vegetation Cluster Habitat. No sampling was carried out in the Agriculture Land habitat because most of this habitat was located very close to the homes of the local community members and was private property. The habitat type at each sampling location is listed in **Exhibit 4.7.**

Methodology

The methodology used to collect data on each biological resource is summarized below. The field survey plan for data collection is provided in **Appendix B**.

Aquatic Ecological Resources

Fish

Fish sampling was conducted using electrofishing and cast nets mainly in Arkari Gol, Lutkho River and its main tributaries with appropriate depth and flow of water. The method used at each location depended on the morphology of the river or tributary, accessibility, the target fish species, and the possibility of finding the fish in a particular habitat in view of temperatures and fish activity at the time of sampling.

Fish fauna were collected using cast nets at selected sampling sites. Two types of cast nets were used. Mesh sizes of 25 mm and 30 mm were used. A total of 30 castings were carried out – 15 castings per mesh size, spread over a distance of about 90 m, depending on site conditions.

Electrofishing was employed for sampling where water levels were low and wading was possible. The LR–24 was used for electrofishing.[3] Electrofishing was carried out in a 150 m^2 area.

Macro–invertebrates

Macro–invertebrates were sampled by adopting the standardized rapid biological assessment sampling techniques (using multi–habitat approach) developed by Barbour et

[3] Available at Smith Root, http://www.smith–root.com/electrofishers/lr–24/

al 1999.[4] A Surber Sampler or D frame kick net was used for sampling. Twenty efforts were taken at each sampling site based on percent availability of each biotope. For example if a sampling site comprises of 80% riffle and 20% pool habitat, then 16 efforts of the Surber Sampler was conducted in the riffles and 4 efforts in pool (ratio of 80% to 20%). At each sampling site, the collected materials were rinsed using running clean stream water through the net two to three times. The materials were transferred into a large (white) tray or a bucket. The samples were then transferred to a container and covered with 10% formalin.

Periphyton

Periphyton sampling was carried out at a total three sampling location of the Arkari Gol but no periphyton biomass was observed at any location.

Riparian Vegetation

The usual means of sampling vegetation for floristic composition is the quadrat. The vegetation in the marginal zone and flood plain in the Study Area were sampled by the quadrate method, taking 3 quadrates of 5m x 5m at each sampling site. The first quadrat was taken at the beginning of the transect, the second at 250 meters and the third at 500 m. Plants from each quadrate was noted. Additional plant species in the area adjacent to the quadrate was also noted down. Cover, relative cover, density, relative density, frequency, relative frequency percentages and Importance Value Index (IVI) for each species from the study were calculated.

Terrestrial Ecological Resources

Terrestrial Flora

The usual means of sampling vegetation for floristic composition is the quadrat. The vegetation in the terrestrial Study Area were sampled by the quadrate method, taking 3 quadrates of 5m x 5m at each sampling site. The first quadrat was taken at the beginning of the transect, the second at 250 meters and the third at 500 m. Plants from each quadrate was noted. Additional plant species in the area adjacent to the quadrate was also noted down. Cover, relative cover, density, relative density, frequency, relative frequency percentages and Importance Value Index (IVI) for each species from the study were calculated.

Mammals

Line transects (500 m by 20 m) was placed at each sampling site to record all animals or their signs detected. All the animals sighted, or their signs (foot marks, droppings, dens) were recorded. GPS coordinates of the location and habitat type were also documented. Transects were walked as early as possible in the day and covered all possible habitat types in order to avoid bias of stratification. In addition, incidental sightings of all mammals were recorded; number of individuals, location and habitat type were recorded

[4] Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841–B–99–002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

for each sighting. Anecdotal information regarding specific mammals was collected from the local people and relevant literature was also consulted.

Birds

Line transects (500 m by 50 m) was used. Line transects were placed at each sampling site to record all birds observed. Transects was started as early as possible in the morning and in late afternoon and covered all possible habitats. The start time and coordinates of the starting point was recorded. The bird species were identified using the most recent keys available in literature.[5] Density and diversity of birds were calculated.

Herpeto–fauna

Line transects 500 m long and 20 m wide were placed systematically at each sampling site in the Study Area. The sampling sites were actively searched for all types of reptiles and amphibians along the line transects. Active searching was also carried out in sampling areas with a focus on suitable microhabitats. The species collected or observed during the survey were photographed with a digital camera and necessary field data was recorded. The coordinates and elevations were recorded using GPS, and other features of interest like habitat type was documented.

[5] Grimmett, R., Roberts, T., and Inskipp, T. 2008. Birds of Pakistan, Yale University Press.

Exhibit 4.3: Sampling Locations for Fish, Macro–invertebrates, Periphyton and Riparian Vegetation in the Aquatic Study Area, March 2018 Surveys

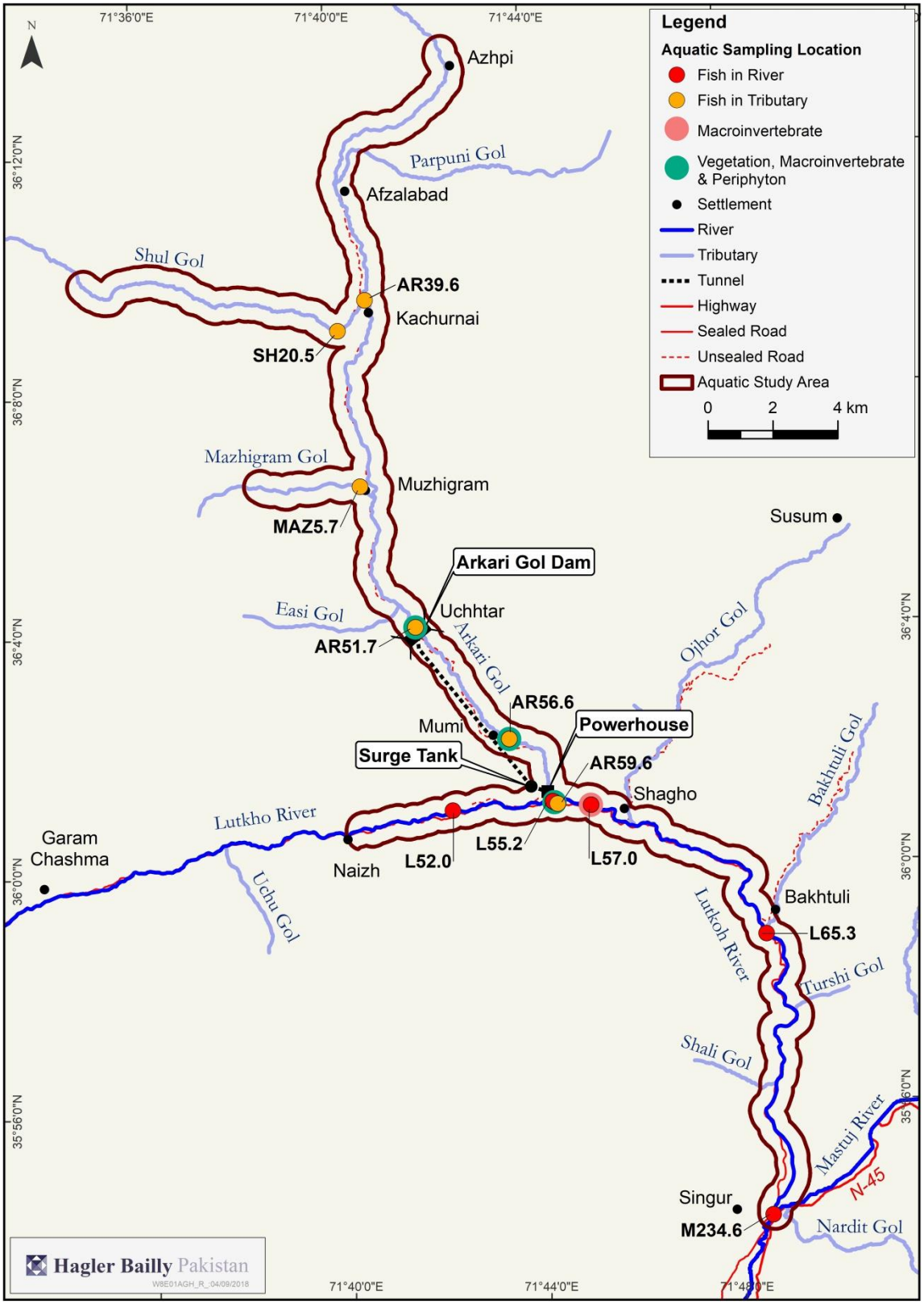


Exhibit 4.4: Justification for Selection of Sampling Locations on Main River

River Segment	*Sampling Site ID*	*Expected impacts from the Project*	*Expected variation in ecology triggered by variations in water temperature and flows*
Upstream of Dam	AR51.7 and AR39.6	The sites are located upstream of the reservoir of proposed dam and will be impacted by the barrier created by the dam	Variations mainly in fish fauna especially migratory fish species due to the barrier created by the dam. Inundation at the reservoir will result in impacts on riparian vegetation
Downstream of Dam	AR56.6	The site will be impacted by the lower flows due to the diversion of the river flow into the power generation tunnel	Variations in macro–invertebrates, periphyton and fish fauna due to changes in flows caused by diversion tunnel that will result in changes in the temperature of the water
Downstream of Powerhouse	AR59.6, L57.0, L65.3, and M234.6	Both temperature and flow of water in this segment will be impacted by variations in flow due to peaking of dam	Variations in macro–invertebrates, periphyton, riparian vegetation and fish fauna mainly due to changes in the temperature and flow of the water in the River

Exhibit 4.5: List of Sampling Sites for the Tributaries

Tributary (Local Name)	*Sampling Site ID*
Mazhigram Gol	MAZ5.7
Shul Gol	SH20.5

Exhibit 4.6: Sampling Locations for Terrestrial Flora and Fauna

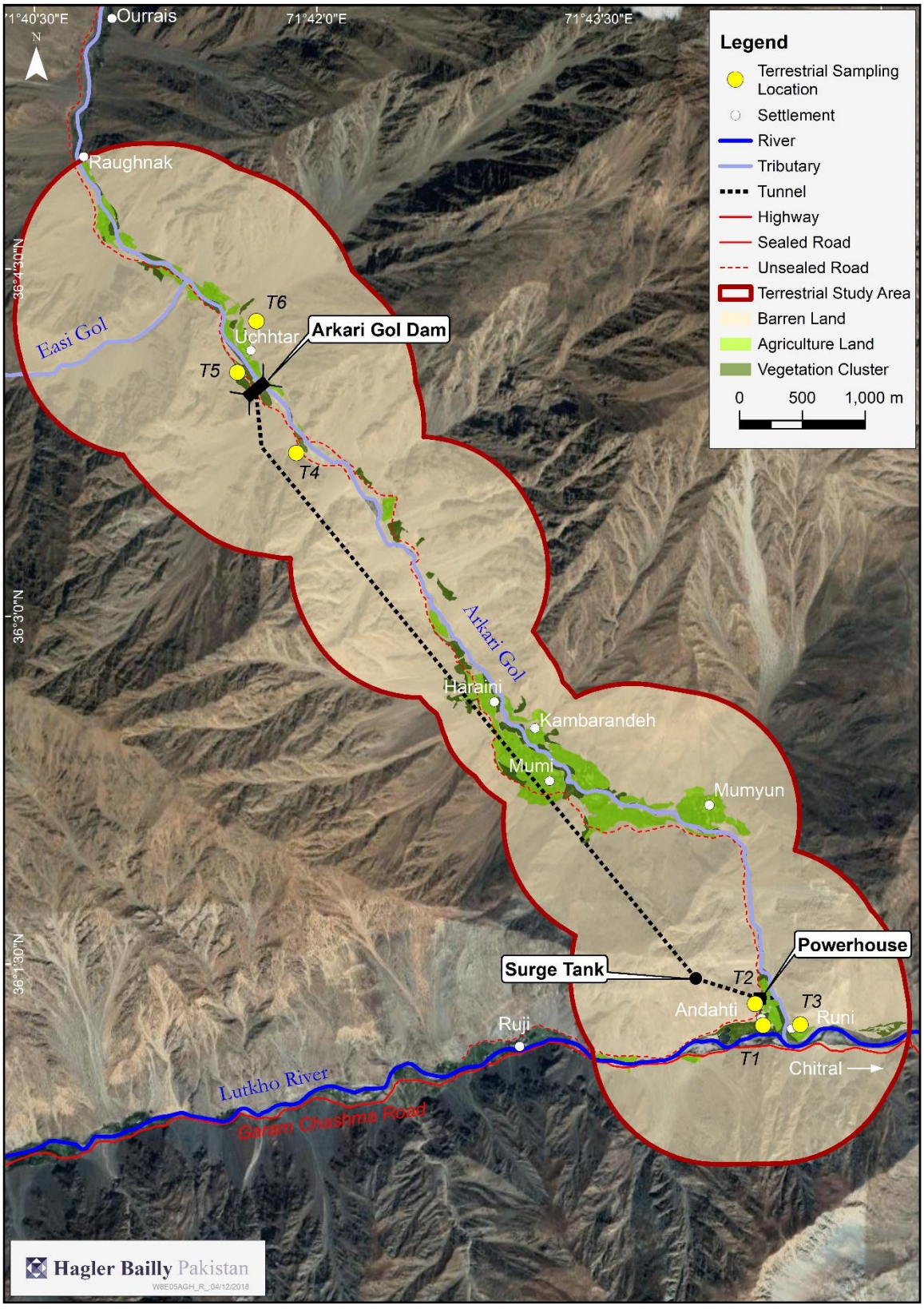


Exhibit 4.7: Habitat Types for the Terrestrial Sampling Locations

Habitat Type of Sampling Locations	*Sampling Locations*
Barren Land	T2, T3, T4, and T6
Vegetation Cluster	T1 and T5

4.1.4 Aquatic Ecology

This section presents an overview of the aquatic ecological resources in the Aquatic Study Area based on a review of available literature as well as field survey assessment carried out in March 2018. Ecological resources assessed include fish fauna, macro–invertebrates, periphyton and riparian vegetation.

Fish

This section provides an overview of the fish fauna in the Aquatic Study Area.

Overview of Fish Fauna

The Chitral River, which is the principal river of the Chitral Valley, is formed by the union of two sub rivers, the Lutkho River from the north–west and the Mastuj River from the north–east. These two rivers join about four miles above the town of Chitral. In its lower reaches, the river is called the Kunar River and joins the Kabul River near Jallalabad. Summer temperatures range between 14 to 19°C, while winter temperature range between 2 to 6°C. Tributaries of Chitral River include the Barum Gol, Turikho Gol, Yarkhun Gol, Arkari Gol, Lutkho Gol, Bomboret Gol, Rambur Gol, Birir Gol, Shishi Gol and Ayun Gol. The Project is located on the Arkari Gol.

Fish fauna of the Chitral River has ichthyological affinities with the Kabul River. A total of six species of fish have been reported from Chitral River and its tributaries, including Snow Trout *Schizothorax plagiostmous (richadsonii)*, Kunar Snow Trout *Schizothorax labiatus*, Chirruh Snow Trout *Schizopyge esocinus*, Chitral Loach *Triplophysa choprai*, Himalayan Catfish *Glyptosternum reticulatum* and Khyber Loach *Schistura prashari*. Chirruh Snow Trout is very rare, and only one or two specimens have been reported from the lower reaches of the river.[6]

The main Chitral River, upstream area, is flat and open, dividing into many channels with plenty of vegetation on the banks. The river in this stretch provides ideal breeding habitats for fish, especially for Snow Trout, Chitral Loach and Himalayan Catfish. The abundance of these species in this stretch of the river is higher compared to the downstream reaches. In the summer season, Chitral River is very turbid and torrential during due to rainfall and rapid melting of snow. The summer season is also the breeding period for the fish. However, due the high turbidity and torrential flows, it becomes difficult for the fish to breed in the main river. In contrast, the tributaries have physical conditions favorable for fish (turbidity, flow, food availably). Therefore, many species depend mainly on the tributaries for breeding and feeding. Most of the tributaries have crystal clear waters as well as shallow depths and a bed of gravel and cobbles which

[6] Hora, S. L., (1934). The fish of Chitral. Rec. Ind. Mus., (36): 279–320.

provide ideal breeding grounds for the fish. Fish species, particularly the Snow Trout, Kunar Snow Trout, Chitral Loach and Himalayan Catfish use these tributaries as breeding grounds.

A complete list of fish species reported from the Chitral River and surrounding tributaries is given in **Exhibit 4.8**. Information is also provided about their IUCN Red List status, commercial importance, endemism and migratory behavior. Of the six fish species reported from the Study Area, only the Snow Trout is a fish species of concern as it is a long distance migratory species and listed as Vulnerable in the IUCN Red List.[7] It also has high commercial importance.

Exhibit 4.8: List of Species Reported from Chitral River and its Tributaries

No	*Scientific Name*	*Common Name*	*IUCN Status*	*Commercial Importance*	*Migratory*	*Endemism*
1.	*Schizothorax richadsonii*	Snow Trout	Vulnerable	High	✓	–
2.	*Schizothorax labiatus*	Kunar Snow Trout	Not assessed	Low	–	–
3.	*Schizopyge esocinus*	Chirruh Snow Trout	Not Assessed	Low	–	–
4.	*Triplophysa choprai*	Chitral Loach	Not Assessed	Low	–	–
5.	*Glyptosternum reticulatum*	Himalayan Catfish	Least Concern	Low	–	–
6.	*Schistura prashari*	Khyber Loach	Not Assessed	Low	–	–

The Arkari Gol where the Project is located mainly originates from the Arkari Glacier at an altitude of 5,065 m. Many smaller tributaries connect with the Arkari Gol including Parpuni Gol, Shul Gol, Mazhigram Gol, and Easi Gol. A total of four fish species have been reported from the Arkari Gol i.e. Snow Trout, Himalayan Catfish, Chitral Loach and Khyber Loach.

Lutkho River and Arkari Gol are the main tributaries in the vicinity of project where fish species migrate for breeding. During the low flow season (December to February), the main water channel contracts, but the flow in the river remains swift due to the steep river gradient. Thus the oxygen concentration is high in winter and not a limiting factor. However the combination of low water temperature and the fast current make the river almost unfit for the survival of most of the fish species. This forces them to migrate and the species adopt different modes of migration to cope with the severe winters in the mountainous areas.

Three types of migration take place at the onset of winter season, longitudinal, lateral and local migration. Longitudinal migration is long distance migration, shown by fish which have strong pectoral fins and streamlined bodies such as Snow Trout *Schizothorax richardsonii*. Lateral and local migration is demonstrated by fish which do not have

[7] The IUCN Red List of Threatened Species. Version 2017–3. <www.iucnredlist.org>. Downloaded on **16 April 2018**.

strong pectoral fins and their bodies are also not streamlined enough to cope with the flow of the river. Thus the species of the genera *Schistura* and *Glyptosternum* show lateral migration as they move from the main river channel and tributaries to side streams having comparatively higher temperature and slower water currents. They also occupy the crevices, boulder areas and trenches along the river bed.

During winter, the Snow Trout migrates to lower parts of the Chitral River to avoid the low water temperature. During the spring season (middle of April) the Snow Trout migrates back to the upper reaches of Lutkho River and Arkari Gol. In the Arkari Gol the Snow Trout can only migrate upstream up to a distance of 5.2 km from the Lutkho River. At this point the elevation of the river increases. Also there is a waterfall of about 5 feet (2.5 km downstream of the proposed dam site) which restricts the fish from upstream migration. No fish specimen of any species was captured at any location upstream of this waterfall. Locals of the area were consulted about distribution of the Snow Trout in the Arkari Gol and they confirmed that fish cannot migrate upstream of the waterfall.

Survey Results

A total of 11 locations in the Aquatic Study Area were sampled for fish (**Exhibit 4.3**). Four of these locations were in the Arkari Gol, two were located in the tributaries of Arkari Gol, four were located in the Lutkho River and one was located in Chitral River.

Exhibit 4.9 shows photographs of field activities during the March 2018 Surveys.

Exhibit 4.9: Photographs of Field Activities (March 2018 Survey)

a) Electrofishing

b) Electrofishing

c) Cast netting

d) Measuring Fish Length

Key Observations

A total of 159 specimens of 3 species were collected from the Aquatic Study Area. These included 25 Snow Trout specimens which were all captured from Lutkho River

Main Arkari Gol

Cast netting and electrofishing was the sampling methods used in the main Arkari Gol as it was not possible to apply other sampling methods (gill nets) due to the fast river flow at the time of sampling.

- Water temperature in Arkari Gol was 12°C
- A total of 32 specimens of 2 fish species were collected from the main Arkari Gol.
- Maximum relative abundance (26 specimens) was observed at Sampling Location AR59.6, near the confluence of Arkari Gol and Lutkho River.
- The most abundant fish species observed during the surveys in the Arkari Gol was Chitral Loach. A total of 30 specimens were collected.
- The second most abundant fish species was the Himalayan Catfish with two specimens collected. All the specimens were collected from four sampling locations in the Arkari Gol. Two of these sampling locations were located upstream of proposed dam.

Main Lutkho River

Cast netting and electrofishing was the sampling methods used in the main Lutkho River as it was not possible to apply other sampling methods (Gill Nets) due to the fast river flow at the time of sampling.

- Water Temperature in Lutkho River was between 12 to 13°C.
- A total of 112 specimens of 3 fish species were collected from the main Lutkho River.
- Maximum relative abundance (51 specimens) was observed at Sampling Location L55.2, near the confluence of Lutkho River and Arkari Gol.

- The most abundant fish species observed during the surveys in the Lutkho River was Chitral Loach. A total of 77 specimens were collected.
- The second most abundant fish species was Snow Trout, with 25 specimens collected and this was followed by Himalayan Catfish with 10 specimens collected. All the specimens were collected from four sampling locations in the Lutkho River. Two of these sampling locations were located downstream of proposed powerhouse.

Main Chitral River

Cast netting and electrofishing was the sampling methods used in the main Chitral River as it was not possible to apply other sampling methods (Gill Nets) due to the fast river flow at the time of sampling.

- Water Temperature in Lutkho River was between 13 to 14°C.
- A total of 15 specimens of 2 fish species were collected from the main Chitral River.
- The most abundant fish species observed during the surveys in the Chitral River was Chitral Loach. A total of 14 specimens were collected.

Tributaries of Arkari Gol

Only electrofishing was conducted in the tributaries due to low flow in these tributaries.

- Sampling was carried out at one location each, in two tributaries (SH20.5 and MAZ5.7) of Arkari Gol
- Although extensive electrofishing was carried out, no specimen of any fish species was captured
- The water temperature in both tributaries was 9°C which is lower than the water temperature recorded from Arkari Gol (12°C)
- Low temperature restricts fish activity and this may be the reason that no fish were recorded from the tributaries

Relative abundance of fish observed during March 2018 surveys is provided in **Exhibit 4.10** while species richness observed in the Aquatic Study Area is provided in **Exhibit 4.11.**

Exhibit 4.10: Relative Abundance Observed in the Aquatic Study Area, March 2018 Survey

Sampling Location		*Arkari Gol*				*Total*	*Lutkho River*				*Total*	*Chitral River*	*Total*	*Tributaries*		*Total*	*Grand Total*
Scientific Name	*Common Name*	*AR39.6*	*AR51.7*	*AR56.6*	*AR59.6*		*L52.0*	*L55.2*	*L57*	*L65.3*		*M234.6*		*SH20.5*	*MAZ5.7*		
Glyptosternum reticulatum	Himalayan Catfish	–	–	1	1	2	6	–	–	4	10	1	1	–	–	–	13
Schizothorax richardsonii	Snow Trout	–	–	–	–	–	–	7	12	6	25	–	–	–	–	–	25
Triplophysa choprai	Chitral Loach	–	–	5	25	30	6	44	20	7	77	14	14	–	–	–	121
Relative Abundance		–	–	6	26	32	12	51	32	17	112	15	15	–	–	–	159

Exhibit 4.11: Species Richness Observed at different Sampling Location, March 2018 Survey

Sampling Location		*Arkari Gol*				*Total*	*Lutkho River*				*Total*	*Chitral River*	*Total*	*Tributaries*		*Total*	*Grand Total*
Scientific Name	*Common Name*	*AR39.6*	*AR51.7*	*AR56.6*	*AR59.6*		*L52.0*	*L55.2*	*L57*	*L65.3*		*M234.6*		*SH20.5*	*MAZ5.7*		
Glyptosternum reticulatum	*Himalayan Catfish*	–	–	✓	✓	✓	✓	–	–	✓	✓	✓	✓	–	–	–	✓
Schizothorax richardsonii	*Snow Trout*	–	–	–	–	–	–	✓	✓	✓	✓	–	–	–	–	–	✓
Triplophysa choprai	*Chitral Loach*	–	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	–	–	✓
Richness (Cast Net)		–	–	–	1	1	–	1	–	1	2	1	1	–	–	–	2
Richness (Electrofishing)		–	–	2	2	2	2	2	3	3	3	2	1	–	–	–	3
Species Richness (Overall)		–	–	2	2	2	2	3	3	3	3	2	2	–	–	–	3

Summary

Most Abundant Species	Chitral Loach	**Highest Abundance Location**	L55.2	**Highest Richness**	L55.2, L57 and L65.3
2nd Most Abundant Species	Snow Trout	**2nd Highest Abundance Location**	L57	**2nd Highest Richness**	AR56.6, AR59.6, L52 and M234.6

A list of the fish species captured during the March 2018 surveys is given in **Exhibit 4.12**, along with information on their IUCN status, endemism[8] and migratory status. None of these fish species are restricted range species or endemic to the area. Of the species reported from the Study Area, only one species, the Snow Trout is listed as Vulnerable in the IUCN Red List 2018.

Exhibit 4.13 shows photographs of some of the fish species observed during the March 2018 survey surveys. A map of the relative abundance and richness observed during the surveys is given in **Exhibit 4.14.**

A summary table for the results and findings of March 2018 surveys is given in **Appendix C.** The summary table indicates different sampling methods applied, relative abundance, species richness and topography at each sampling location.

Catch per unit effort is number of specimens captured with a particular sampling method applied in a given time or sampling unit at a particular location. **Exhibit 4.15** shows the catch per unit effort for various capture techniques used. The effort in case of cast nets includes 20 castings, 10 each of two mesh sizes spread over a defined stretch of about 100 – 200 m. Electrofishing was applied to an area of 150 m^2.

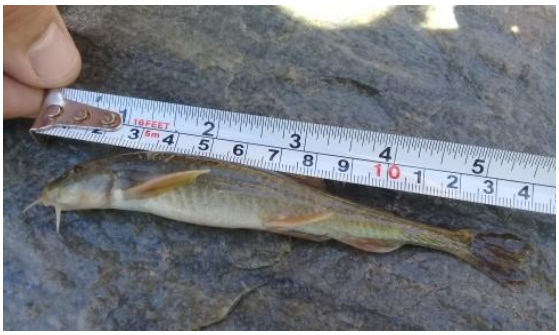
Exhibit 4.12: Fish Fauna Recorded from Aquatic Study Area, March 2018 Survey

No	*Scientific Name*	*Common Name*	*IUCN Status*	*Commercial Importance*	*Migratory*	*Endemism*
1.	*Schizothorax richardsonii*	Snow Trout	Vulnerable	High	✓	–
2.	*Glyptosternum reticulatum*	Himalayan Catfish	Not Assessed	Low	–	–
3.	*Triplophysa choprai*	Chitral Loach	Not Assessed	Low	–	–

[8] Endemic species refers to species that are endemic to the Chitral River basin.

Exhibit 4.13: Photographs of Fish Fauna Recorded from Aquatic Study Area, March 2018 Survey

a) Snow Trout



b) Chitral Loach

c) Himalayan Catfish

d) Snow Trout

Exhibit 4.14: Fish Relative Abundance and Richness, March 2018 Survey

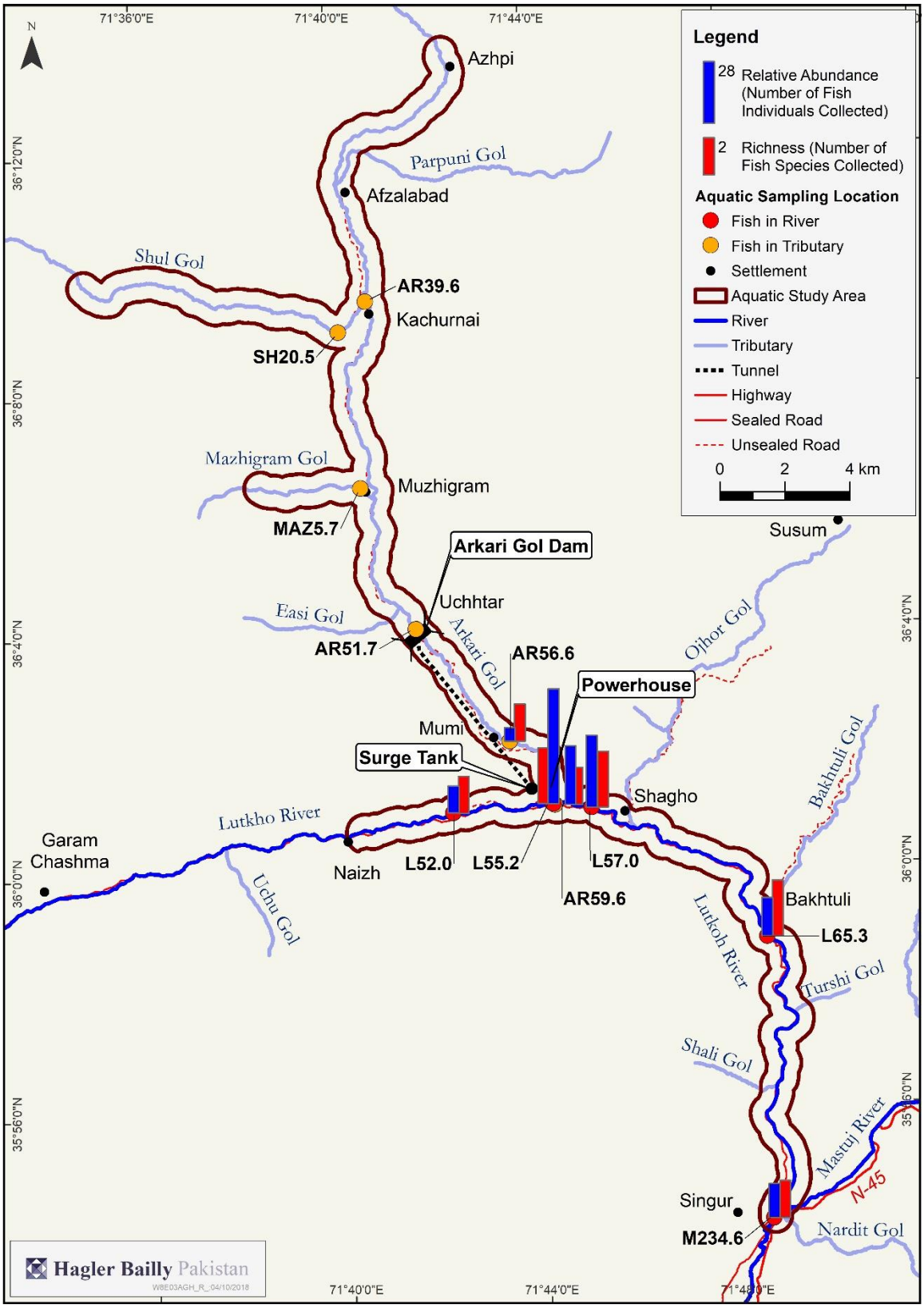


Exhibit 4.15: Catch per Unit Effort, March 2018 Surveys

River/Tributary	*Sampling ID*	*Location*	*Cast Net*	*Electro Fishing*	*Total*
			Fish Captured/ 20 castings	*Fish Captured/ 150 sq. m*	
Chitral River	M234.6	Downstraem of the conflence of Lutkho and Chitral River	4	11	15
Arkari Gol	AR51.7	Arkari Gol near Dam site	–	–	0
Lutkho River	L52.0	Lutkho River near Ruji Village	–	12	12
Arkari Gol	AR59.6	Arkari Gol near to Powerhouse	7	19	26
Lutkho River	L55.2	Lutkho River near to Powerhouse	14	37	51
Lutkho River	L57	Lutkho River, Downstream of Powerhouse	–	32	32
Arkari Gol	AR56.6	Arkari Gol near Momi Village	–	6	6
Arkari Gol	AR39.6	Arkari Gol near Kachurnai Village	–	–	–
Lutkho River	L65.3	Lutkho River near Bakhtoli Village	5	12	17
Shul Tributary	SH20.5	Near Kachurnai Village	–	–	–
Mazhigram Tributary	MAZ5.7	Near Dam site	–	–	–
Total			**30**	**129**	**159**

Threats to Fish Fauna

During the surveys carried out in March 2018, no major threats to fish fauna in the Aquatic Study Area were observed. In some parts of the Aquatic Study Area, locals were involved in fishing using rods and cast nets. However, fishing through illegal means like electrofishing, blasting and gill netting was not observed at any location in the Aquatic Study Area. Sand and gravel mining activity was also not observed at any location in the Arkari Gol or Lutkho River, although in lower part of the Lutkho River stone mining on a small scale was observed.

Conservation Status

The Snow Trout is listed as Vulnerable in the IUCN Red List 2018. It is also a long distance migratory fish with high commercial importance.

Fish Indicators and their Flow–related Needs

The following four species were selected as indicators for EFlow assessment using Downstream Response to Imposed Flow Transformations (DRIFT) model.

- Snow Trout
- Himalayan Catfish
- Khyber Loach

All species selected as indicators demonstrate a comparatively higher degree of specialization in habitat preference in the Aquatic Study Area. In other words, the habitat range of these species was observed to terminate either moving upstream or downstream within the Aquatic Study Area. Changes in flow regime are therefore likely to have a comparatively higher level of impact on these species.

Snow Trout

Preferences for flow dependent habitat, breeding, and migratory behavior of the Snow Trout are summarized in **Exhibit 4.16. Exhibit 4.17** summarizes the annual cycle of breeding and growth of the Snow Trout:

Exhibit 4.16: Preferences for Flow Dependent Habitat, Breeding, and Movement of the Snow Trout:

	Adults	*Juveniles*	*Spawning*
Depth	0.5–1.5 m	0.1–0.5m	0.1–0.3 m
Velocity	1–3 m/s	0–0.5 m/s	1–2 m/s
Habitat	Swift running water with rocky beds	Quiet parts of the streams or in the side branches of the main streams	Spawns on gravelly / stony ground or on fine pebbles with gravel size of 50-60 mm
Substrate	Rocky/Cobbly/Gravely	Cobble/Gravel	Gravel
Temperature	12–20 °C	12 –20 °C	18–22 °C
Dissolved O_2	6–8 mg/l and can survive 5-6 mg/l	6–8 mg/l	6–8 mg/l

	Adults	*Juveniles*	*Spawning*
Food	Insect larvae and eggs, Detritus	Micro-invertebrates	–
Breeding Period and Trigger	May-June in the Flood Season. Breeding is triggered by rise in temperature after the Dry Season. Spawning in side channels in shallow waters (10-30 cm) with boulders and low currents.		
Movement Pattern	Shows limited movement.		
Movement Timing	Limited movement to side channels for spawning.		
Movement Triggers	Availability of side pools with shallow waters, rise in temperature.		
Other Flow-related Needs	Is sensitive to pollution. Can tolerate turbidity.		

Exhibit 4.17: Annual Cycle of Breeding and Growth of the Snow Trout

Months	*Flow Conditions*	*Fish Behavior*
May–June	Flood Season	Breeding is triggered by snow melt and rise in turbidity. Fish move to breeding grounds in shallow side pools, and channels of the river with cobbles. Eggs hatch in this period, and fries and fingerlings remain in shallow waters in side channels under the cobbles.
July–October	Flood Season – Transition-2 and Dry Onset	Spent fish move to areas with boulders, cobbles in its general preferred habitat ranging from a depth of 0.5–1.0 m. Fries and fingerlings remain in the side channels. Both adult and young fish feed actively in this period to gain fat for wintering.
November – March	Dry Season	Fish move mainly to crevices under cobbles or in pools for overwintering. Food intake drops and also supplemented by fat reserves for survival.
April	Transition-1	Fish become active, takes maximum food and move to areas where it can get maximum food.

Himalayan Catfish

Preferences for flow dependent habitat, breeding, and migratory behavior of the Himalayan Catfish are summarized in **Exhibit 4.18**, Annual cycle of breeding and growth of the Himalayan Catfish is shown in the **Exhibit 4.19.**

Exhibit 4.18: Preferences for Flow Dependent Habitat, Breeding, and Movement of the Himalayan Catfish

	Adults	*Juveniles*	*Spawning*
Depth	Shallow (<1.0 m), can withstand both stagnant and fast flowing water. Avoids deep pools. Can survive low flows in Dry Season by taking shelter under boulders.	Shallow (<0.75 m)	Shallow (<0.75 m)
Velocity	Slow (0-2 m/s), can tolerate floods by taking shelter under boulders	Slow (0-2 m/s)	Slow (0-2 m/s)
Habitat	Underneath stone piles	Underneath stone piles	Riffles, shallow pools, with stony beds
Substrate	Rocky	Cobble	Cobble
Temperature	10–20 °C	10–20 °C	10–14 °C
Dissolved O_2	6–8 mg/l and can survive 5–6 mg/l	6–8 mg/l	6–8 mg/l
Food	Insect larvae, micro-invertebrate	Micro-invertebrates	–
Breeding Period and Trigger	May-June in the Flood Season. Breeding is triggered by rise in temperature after the Dry Season. Spawning in side channels in shallow waters (10-20 cm) with boulders and low currents.		
Movement Pattern	Shows limited movement.		
Movement Timing	Limited movement to side channels for spawning.		
Movement Triggers	Availability of side pools with shallow waters, rise in temperature.		
Other Flow-related Needs	Is sensitive to pollution. Can tolerate turbidity.		

Exhibit 4.19: Annual Cycle of Breeding and Growth of the Himalayan Catfish

Months	*Flow Conditions*	*Fish Behavior*
May–June	Flood Season	Breeding is triggered by snow melt and rise in turbidity. Fish move to breeding grounds in shallow side pools, and channels of the river with cobbles. Eggs hatch in this period, and fries and fingerlings remain in shallow waters in side channels under the cobbles.
July–October	Flood Season – Transition-2 and Dry Onset	Spent fish move to areas with boulders avoiding fast flowing water. Fingerlings remain under the cobbles. Both adult and young fish feed actively in this period.
November–March	Dry Season	Fish move mainly to crevices under cobbles for overwintering. Avoid pools. Food intake drops and also supplemented by fat reserves for survival.

Months	*Flow Conditions*	*Fish Behavior*
April	Transition-1	Fish emerge and move to areas with boulders, avoiding fast flows, in search of food to get ready for the breeding season.

Chitral Loach

Preferences for flow dependent habitat, breeding, and migratory behavior of the Chitral Loach are summarized in **Exhibit 4.20**, Annual cycle of breeding and growth of the Chitral Loach is shown in the **Exhibit 4.21.**

Exhibit 4.20: Preferences for Flow Dependent Habitat, Breeding, and Movement of the Chitral Loach

	Adults	*Juveniles*	*Spawning*
Depth	Banks, shallow riffles (<0.75 m)	Shallow side pools (<0.75 m)	Shallow side channels and pools (<0.30 m)
Velocity	Low to moderate (0–2 m/s)	Low to moderate (0–2 m/s)	Low to moderate (0–2 m/s)
Habitat	Pools, riffles, glides	Banks	Pools, riffles
Substrate	Rocky, stony	Cobbles	Stones, cobbles
Temperature	6–14 °C	6–14 °C	10–14 °C
Dissolved O_2	6–8 mg/l	6–8 mg/l	6–8 mg/l
Food	Insect larvae, micro-invertebrate	Micro-invertebrates	–
Breeding Period and Trigger	May–August in the Flood Season. Breeding is triggered by rise in temperature after the Dry Season. Breeds both in river as well as in tributaries in suitable habitat.		
Movement Pattern	Does not show any significant movement except for breeding, when it moves to shallow side pools.		
Movement Timing	Limited movement to side channels for spawning.		
Movement Triggers	Availability of side pools with shallow waters, rise in temperature.		
Other Flow-related Needs	Is sensitive to pollution.		

Exhibit 4.21: Annual Cycle of Breeding and Growth of the Chitral Loach

Months	*Flow Conditions*	*Fish Behavior*
June – August	Flood Season	Breeding is triggered by snow melt and rise in turbidity. Fish move to breeding grounds in shallow side pools, and channels of the river with cobbles and gravely beds. Eggs hatch in this season, and fries and fingerlings remain in shallow waters in side channels.

Months	*Flow Conditions*	*Fish Behavior*
September–October	Flood Season – Transition-2 and Dry Onset	Spent fish move to banks of the mainstream. Fingerlings remain in shallow side channels. Both adult and young fish feed actively in this period.
November–March	Dry Season	Fish move mainly to crevices for overwintering. Food intake drops significantly as fish is inactive and also utilizes fat reserves for survival.
April-May	Transition-1 and Flood Season	Fish emerge and move to banks, avoiding fast flows, in search of food to get ready for the breeding season.

Macro–Invertebrates

Overview

Benthic macro–invertebrates are an important part of the food chain in aquatic ecosystems, especially for fish. Many invertebrates feed on algae and bacteria, which are at the lower end of the food chain. Some shred and eat leaves and other organic matter that enters or is produced in the water. Because of their abundance and position as 'intermediaries' in the aquatic food chain, benthos plays a critical role in the natural flow of energy and nutrients.[9]

Stream regulation by damming of rivers and ensuing impoundment are one of the most frequent causes of depletion of biological diversity of aquatic ecosystems resulting in interference with the natural process of dispersal.[10,11] Some authors have described several beneficial aspects of water regulation and impoundment, but the loss of aquatic habitat and the associated species and populations cannot be underestimated. Any variation in community structure of primary producers is reflected in subsequent changes in higher components of food chain e.g., benthic macro–invertebrates and fish fauna.[12]

The composition of invertebrate communities varies along and between rivers, with the main influences on distribution and abundance being current velocity, water temperature, substratum type, stability of both aquatic and riparian vegetation, dissolved substances, competition, and human practices. Large, stable substrata–such as boulders and cobbles–support larger, more productive invertebrate populations than do unstable gravels and sand. On mobile bottoms, such as gravel and sand, invertebrates are readily displaced and may be at risk through mechanical damage. A decrease in substratum size results in lower macro–invertebrate diversities and production.

Aubert, 1959[13] reported twenty species of stoneflies (extremely pollution intolerant organisms) belonging to seven genera from Pakistan (Hindukush including Gilgit–Baltistan and Chitral; Karakorum including Neelum valley, Kaghan valley; Rawalpindi including Murree). He reported six species of stoneflies species from Neelum Jhelum

[9] Williams D. D. and Feltmate, B. W. 1992. Aquatic Insects. CAB International Wallingford, Oxon. 360 pp.

[10] Richter, B.D., Braun, D.P., Mendelson, M.A., Master, L. L. 1997. Threats to imperiled freshwater fauna. Conservation Biology. 11, 1081–1093.

[11] Zalewski, M., Janauer, G. A., Jolankai, G., 1997. Ecohydrology. IHP–V, UNESCO. 7, 7–18.

[12] Ibid

[13] Aubert, J. 1959: Plécoptères du Pakistan. Memoires de la Societe vaudoise des Sciences naturelles, 75, Vol. 12, fasc. 3:65–91.

area which include *Nemoura* (*Amphinemura*) *mirabilis* (Muzaffarabad after the confluence of the Neelum and Jhelum Rivers), *Nemoura* (*Amphinemura*) *schmidi* (Kel, Neelum Valley), *Nemoura* (*Amphinemura*) *skardui* (Rampur Neelum Valley), *Nemoura* s. s. *lilami* (Kel, Neelum Valley), *Nemoura* s. s. *polystigma* (Lilam, Neelum Valley) and *Cholroperla kishanganga* (Kel, Neelum Valley). Organism's pollution tolerance was taken from HKH bios scoring list (Hindukush Himalayan Score Bio–assessment) (Hartmann *et al.*, Deliverable 10). [14]

Survey Results

During the March 2018 Survey, a total of four locations were sampled to determine the abundance and diversity of macro–invertebrate fauna in the Aquatic Study Area. Three of these sampling locations were located along the Arkari Gol while one location was located downstream of the powerhouse in the Lotkoh River. The sampling locations for macro–invertebrates are shown in **Exhibit 4.3**. The abundance, species diversity and HKH Bios Score[15] of macro–invertebrate recorded during the March 2018 Survey is shown in **Exhibit 4.22**. Photographs of field activities are given in **Exhibit 4.23.** A map showing the relative abundance and species diversity of macro–invertebrate taxa is shown in **Exhibit 4.24.**

[14] Hartmann, A., O. Moog, T. Ofenböck, T. Korte, S. Sharma and D. Hering. Deliverable No. 10. ASSESS–HKH Methodology Manual describing fundamentals a application of three approaches to evaluate river quality based on benthic macroinvertebrates: HKH screening, HKH score bioassessment & HKH multimatric bioassessment. 80pp. www.assess–hkh.at

[15] It is a biotic score that determines the tolerance level of biota i.e. macro–invertebrates. A lower HKH Bios Score of an organism means higher pollution tolerance of that particular organism while the higher the Bios Score the lower its pollution tolerance level.

Exhibit 4.22: Macro–invertebrate Abundance and Richness, March 2018 Survey

Sample ID					*AR51.7*	*AR56.6*	*AR59.6*	*L57.0*	***Total***	*HKH Bio Score*
No	*Order*	*Sub–Family*	*Genus*	*Feeding Habit*						
1	Ephemeroptera	Heptageniidae	Rhithrogena sp.	Scraper	–	–	2	1	**3**	9
2	Ephemeroptera	Heptageniidae		Scraper	–	–	–	1	**1**	8
3	Ephemeroptera	Baetidae	Acentrella sp.	Collector gatherer	1	–	3	–	**4**	8
4	Ephemeroptera	Baetidae	Baetis sp.	Collector gatherer	75	74	18	45	**212**	–
5	Plecoptera	Chloroperlidae		Unknown	1	–	–	–	**1**	9
6	Trichoptera	Hydropsychidae	Hydropsyche sp.	Collector filterer	–	1	2	2	**5**	7
7	Trichoptera	Rhyacophilidae	Rhyacophila sp.	Predator	1		1		**2**	8
8	Diptera	Simuliidae		Collector filterer	1	–	–	–	**1**	7
9	Diptera	Chironomidae		Unkonwn	–	10	–	–	**10**	–
10	Diptera	Tipulidae		Unknown	–	–	2	–	**2**	7
				Abundance (Order/ Family/ Genus)	**79**	**85**	**28**	**49**	**241**	**–**
				Richness	**5**	**3**	**6**	**4**	**7**	**–**

Exhibit 4.23: Photographs of Field Activities, March 2018 Survey

Collection of Macro–Invertebrates

Key Observations

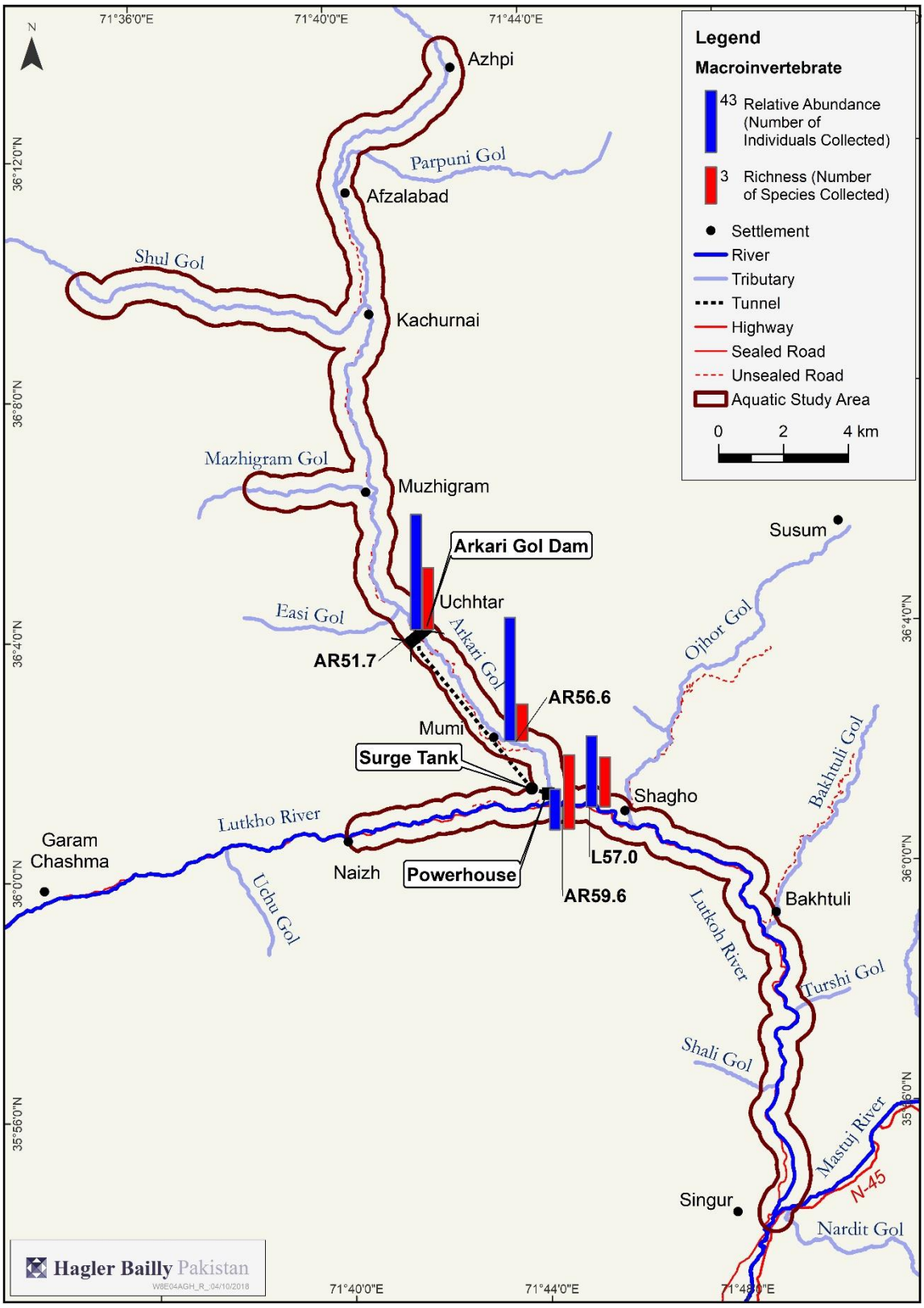
Key observations during the March 2018 Survey are summarized below.

1. A total of 10 macro–invertebrate taxa were identified. Identification was at the order/family/genus level.
2. Abundance was highest at Sampling Location AR56.6, main Arkari Gol near Momi village.
3. The most abundant macro–invertebrate taxa observed was *Baetis* sp. followed by Chironomidae.
4. Most of pollution intolerant genera of macro–invertebrates were observed indicating good water quality. One moderately pollution tolerant genus i.e. *Hydropsyche sp* was also observed.
5. Maximum richness was seen at Sampling Location AR59.6.

Conservation and Protection Status

None of the macro-invertebrate taxa reported from the Study Area are identified as threatened or included in the IUCN Red List 2018.

Exhibit 4.24: Macro–invertebrate Abundance and Richness
March 2018 Survey



Riparian Vegetation

Overview

Riparian vegetation is the plant community sustained by river flow, groundwater or generally moist conditions along river margins, and is typically distinct in species composition from adjacent terrestrial communities.[16]

Riparian vegetation plays a central role in the functioning of Riverne ecosystems: bank erosion is reduced through armoring; water quality is maintained through trapping of sediment, nutrients and other contaminants, and shading regulates river water temperature and thus primary productivity; food is provided for riparian animals in the form of fruits, nuts and leaves, and for aquatic macro-invertebrates in the form of leaf litter; the plants themselves offer a diverse array of habitats as well as a corridor for the movement of migratory terrestrial and semi-aquatic animals.[17]

Survey Results

The range of vegetation cover observed in the riparian areas in the Aquatic Study Area during the March 2018 survey was between 1.36% and 2.60%. The average plant count was 15 per sampling location. Floral diversity in this habitat type was 4.0 species per sampling location. The dominant species included *Salix viminalis*, *Artemisia maritima*. *Robinia pseudoacacia*, *Salix acmophylla* and *Rumex hastatus.*

The vegetation cover, plant count and diversity by habitat type are provided in **Exhibit 4.25**. The phyto–sociological attributes are provided in **Exhibit 4.26**. Photographs of riparian habitat are shown in **Exhibit 4.27**. Average and maximum vegetation cover in the riparian habitats was relatively low compared to that observed for terrestrial habitat types (Vegetation Cluster).

Exhibit 4.25: Vegetation Cover, Plant Count and Diversity in Riparian Habitat Type, March 2018 Survey

Habitat Types	*Plant Cover (%)*			*Plant Count (No. of Plants per Sampling Location)*			*Diversity (Average no of species per Sampling Location)*
	Avg	*Max*	*Min*	*Avg*	*Max*	*Min*	
Riparian	1.86%	2.60%	1.36%	15	21	11	4.0

[16] Parkyn, Stephanie. (2004). *Review of Riparian Buffer Zone Effectiveness*. Ministry of Agriculture and Forestry (New Zealand), www.maf.govt.nz/publications.

[17] PROSSER, I.P. 1999. Identifying priorities for riparian restoration aimed at sediment control. Second Australian stream management conference, 8-11 February. Adelaide, South Australia. Pg 511-516.

Exhibit 4.26: Phyto–sociological Attributes of Plant Species in Habitats
March 2018 Survey

Species Name	*D1, Density*	*D3, Relative Density*	*C1, Average Cover*	*C3, Relative Cover*	*F1, Frequency*	*F3, Relative Frequency*	*IVI, Importance Value Index*
Salix viminalis	0.67	13.33	0.85	13.36	0.11	8.33	11.68
Ailanthus altissima	0.44	8.89	53.41	0.14	0.11	8.33	5.79
Artemisia maritima	0.33	6.67	41.9	0.14	0.11	8.33	5.05
Ficus carica	0.11	2.22	1.15	1.65	0.11	8.33	4.07
Juniper spp	0.33	6.67	1.17	4.88	0.22	16.67	9.4
Platanus orientalis	0.11	2.22	0.12	15.6	0.11	8.33	8.72
Populus ciliata	0.22	4.44	1.38	2.75	0.22	16.67	7.95
Robinia pseudoacacia	0.33	6.67	0.5	11.38	0.22	16.67	11.57
Rubus ellipticus	0.11	2.22	7.79	0.24	0.11	8.33	3.6
Rumex hastatus	0.44	8.89	172.28	0.04	0.11	8.33	5.76
Salix acmophylla	1.11	22.22	0.4	47.53	0.56	41.67	37.14
Sisymbrium irio	0.78	15.56	5.81	2.29	0.22	16.67	11.5
Total	**5**	**100**	**286.76**	**100**	**2.22**	**166.67**	**122.22**

D1: Density
The number of individuals of a species counted on a unit area.

C1: Average cover in sq m for a single species

C3: Relative cover
The proportion of the total cover of a species to sum of the cover of all the species in area.

F3: Relative frequency
The proportion of the total frequency of a species to the sum of the frequency of all the plants of all species in the area.

D3: Relative density
The proportion of a density of a species to that of a stand as a whole.

F1: Frequency
Percentage of sampling plots in which a given species occurs.

IVI: Importance value index
It can be obtained by adding the values of relative density, relative cover and relative frequency and dividing it by three will give the importance value IVI of the species

Exhibit 4.27: Riparian Habitat (March 2018 Survey)

Riparian Habitat near Sampling Location AR59.6

Riparian Habitat near Sampling Location AR51.7

Riparian Habitat near Sampling Location AR59.6

Juniper spp. in Riparian Habitat

Conservation Status

None of the terrestrial vegetation species reported from the Study Area are identified as threatened or included in the IUCN Red List 2018.

Periphyton Biomass

The term periphyton refers to the film of living matter coating almost all surfaces in streams. It is usually dominated by benthic algae, but also includes diatoms, bacteria, fungi and other organic matter. Benthic algae are the primary producers in rivers, providing food for macro-invertebrates and fish. They respond rapidly to changing conditions, and they are often the first organisms to respond to and to recover from stress.

Periphyton is attached algae on the sediment deposited on stones. During the March 2018 survey, sampling for periphyton biomass was carried out at a total 3 sampling locations (**Exhibit 4.3)** but no periphyton biomass was collected from any sampling location. This is because of the fast flow of the river in the survey season, which erodes and washes out periphyton biomass from the cobble stones.

4.1.5 Terrestrial Ecology

This section provides an overview of terrestrial ecology in the Terrestrial Study Area and surroundings based on a review of available literature and field surveys conducted in March 2018. Terrestrial sampling locations are shown in **Exhibit 4.6**. List of the terrestrial species found in the area are provided in **Appendix D**, while Field Data is provided in **Appendix E.**

Terrestrial Flora

Overview

Approximately 6000 plant species often of medicinal and/or commercial importance have been reported from Pakistan.[18] However, the floral diversity is subjected to progressive loss, owing to fragmentation and degradation of natural habitats that is leading to the disappearance of countless species.[19] Pakistan has five significant mountain systems, i.e. Western Himalayas, Karakoram, Hindukush, Suleiman and Khirthar range. Chitral the high mountainous dry temperate area of the Northern Pakistan lies in Hindukush range which is one of the oldest mountain ranges in the world.

There is very little information available in literature about the terrestrial flora of the Arkari valley. A total of 571 plant species belonging to 334 different genera have been reported from the wider area around the Terrestrial Study Area. Most of the plant species belong to Family Asteraceae (16%), Poaceae (10.16%), Papilionaceae (6.65 %), Lamiaceae (4.55%), Rosaceae (4.55%), Boraginaceae (3.50%), Brassicaceae (3.50%).[20] Most of these plant families are common and have a wide distribution range.

Habitat Types in the Terrestrial Study Area

Habitat classification approaches are subjective in nature, devised to assist in the understanding of ecological systems, the functions of those systems, and the interrelationship with species. Classically, wildlife habitat is described as containing three basic components: cover, food, and water (Morrison et al 2006)[21] with vegetation as the core descriptive component.

Habitats in the Terrestrial Study Area were classified relying primarily upon vegetation type. Following this classification approach, three types of habitats were defined: Barren Land, Agricultural Fields and Vegetation Cluster. Satellite imagery from ***Google Earth™*** was used to initially delineate spatial distribution of habitat types within the Terrestrial Study Area and this habitat characterization was confirmed during the field surveys. Most of the Terrestrial Study Area classified as Barren Land having no or very little vegetation.

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[18] Nasir E and Ali, S.I. (1972). Flora of West Pakistan. Published under P. L. 480, Research project of U.S.A.D., with coordination of A.R.C. Pakistan.

[19] Perveen, A. and Hussain, M.I. (2007). Plant Biodiversity and Phytosociological attributes of Gorakh hill (Khirthar range) Pak. J. Bot. 39(3): 691–698.

[20] Hussain, Farrukh, S. Mukaram Shah, Lal Badshah, and Mufakhira Jan Durrani. "Diversity and ecological characteristics of flora of Mastuj valley, district Chitral, Hindukush range, Pakistan." *Pak. J. Bot* 47, no. 2 (2015): 495–510.

[21] Morrison, M.L, Marcot, B., Mannan, W. 2006. Wildlife–Habitat Relationships: Concepts and Applications. Island Press, Washington, D.C.

The relative percentages of each habitat type in the Terrestrial Study Area is provided in **Exhibit 4.28**. Photographs of different habitat types in the Terrestrial Study Area are shown in **Exhibit 4.29**.

Exhibit 4.28: Habitat Types for the Terrestrial Sampling Locations

Habitat Type	*Area (km^2)*	*Percentage*
Barren Land	18.29	92.1
Vegetation Cluster	0.31	1.6
Agricultural Land	0.83	4.2
River	0.42	2.1
Total	**19.8**	**100**

Exhibit 4.29: Photographs of Different Habitat types in the Terrestrial Study Area, March 2018 Survey

Vegetation Cluster

Barren Land

Barren Land

Survey Results

During the March 2018 survey, a total of 14 species of plants were observed in the Terrestrial Study Area. The indicators, including plant cover, plant count and diversity per sampling location describe the floral conditions within each habitat type. The Agricultural Fields could not be sampled as these were located very close to, and sometimes within, the households of the local communities.

Barren Land is dominated by small size plants species such as *Sisymbrium irio, Artemisia maritima* and *Rumex hastatus* and large sized trees are largely absent. Therefore, low plant cover was observed in Barren Land. Vegetation Cluster habitat is dominated by large size tree species. The vegetation cover, plant count and diversity by habitat type are provided in **Exhibit 4.30.** The phyto–sociological attributes for the species in the two habitat types for the March 2018 Survey are provided in **Exhibit 4.31.**

Exhibit 4.30: Vegetation Cover, Plant Count and Diversity by Habitat type, March 2018 Survey

No.	*Habitat Types*	*Plant Cover (%)*			*Plant Count*			*Diversity (Average no of species per Sampling Location)*
		Average	*Maximum*	*Minimum*	*Average*	*Maximum*	*Minimum*	
1.	Barren Land	2.01%	3.34%	0.99%	16.25	27	8	1.75
2.	Vegetation Cluster	2.29%	2.35%	2.23%	18.5	19	18	5.5

Exhibit 4.31: Phyto–sociological Attributes of Plant Species in Habitats, March 2018 Survey

Habitat	*Species Name*	*D1, Density*	*D3, Relative Density*	*C1, Average Cover*	*C3, Relative Cover*	*F1, Frequency*	*F3, Relative Frequency*	*IVI, Importance Value Index*
Barren Land	*Ailanthus altissima*	0.11	3.08	5.79	8.11	0.06	14.29	8.49
	Artemisia maritima	1.78	49.23	43.84	17.13	0.56	142.86	69.74
	Juniper spp	0.11	3.08	1.23	38.31	0.06	14.29	18.56
	Mentha longifolia	0.33	9.23	117.16	1.2	0.06	14.29	8.24
	Robinia pseudoacacia	0.11	3.08	1.73	27.17	0.06	14.29	14.85
	Rumex hastatus	0.67	18.46	71.9	3.92	0.28	71.43	31.27
	Sisymbrium irio	0.5	13.85	50.74	4.16	0.11	28.57	15.53
	Total	**3.61**	**100**	**292.39**	**100**	**1.17**	**300**	**166.67**
Vegetation Cluster	*Salix viminalis*	0.5	24.32	1.22	10.33	0.11	18.18	17.61
	Ailanthus altissima	0.17	8.11	0.49	8.53	0.11	18.18	11.61
	Artemisia maritima	0.11	5.41	11.98	0.23	0.06	9.09	4.91

Habitat	*Species Name*	*D1, Density*	*D3, Relative Density*	*C1, Average Cover*	*C3, Relative Cover*	*F1, Frequency*	*F3, Relative Frequency*	*IVI, Importance Value Index*
	Ficus carica	0.11	5.41	0.39	7.24	0.06	9.09	7.25
	Morus nigra	0.06	2.7	0.17	8.29	0.06	9.09	6.69
	Pistacia khinjuk	0.28	13.51	55.62	0.13	0.06	9.09	7.58
	Platanus orientalis	0.06	2.7	0.08	16.52	0.06	9.09	9.44
	Populus ciliata	0.11	5.41	0.52	5.37	0.06	9.09	6.62
	Robinia pseudoacacia	0.11	5.41	0.21	13.09	0.11	18.18	12.23
	Salix acmophylla	0.28	13.51	0.27	25.48	0.17	27.27	22.09
	Sisymbrium irio	0.28	13.51	1.46	4.78	0.11	18.18	12.16
	Total	**2.06**	**100**	**72.42**	**100**	**0.94**	**154.55**	**118.18**

D1: Density
The number of individuals of a species counted on a unit area.

C1: Average cover in sq m for a single species

C3: Relative cover
The proportion of the total cover of a species to sum of the cover of all the species in area.

F3: Relative frequency
The proportion of the total frequency of a species to the sum of the frequency of all the plants of all species in the area.

D3: Relative density
The proportion of a density of a species to that of a stand as a whole.

F1: Frequency
Percentage of sampling plots in which a given species occurs.

IVI: Importance value index
It can be obtained by adding the values of relative density, relative cover and relative frequency and dividing it by three will give the importance value IVI of the species

Barren Land

Barren Land habitat type constitutes 92.1% of the Terrestrial Study Area. The average vegetation cover is 2.01%. The average plant count is 16.25 and floral diversity is 1.75 species per sampling location. The dominant species include *Artemisia maritima, Rumex hastatus* and *Sisymbrium irio*. Photographs of some plant species found in this habitat type are shown in **Exhibit 4.32**.

Exhibit 4.32: Plant Species in Barren Land, March 2018 Survey

Artemisia maritima

Rumex hastatus

Juniper spps.

Vegetation Cluster

Vegetation Cluster habitat type constitutes about 1.6% of the total Terrestrial Study Area. The range of vegetation cover is between 2.23% and 2.35%. The average plant count is 18.5. The floral diversity is 5.5 species per sampling location. The dominant species include *Artemisia maritima*, *Salix acmophyla*, *Robinia pseudoacacia and Sisymbrium irio*. Photographs of some plant species found in this habitat type are shown in **Exhibit 4.33.**

Exhibit 4.33: Plant Species in Vegetation Cluster, March 2018 Survey

Salix acmophylla

Ailanthus altissima

Platanus orientalis

Artemisia maritima

Invasive Species

An alien or non–native plant or animal species is one that is introduced beyond its original range of distribution. Invasive alien species are non–native species that may become invasive or spread rapidly by outcompeting other native plants and animals when they are introduced into a new habitat that lacks their controlling factors as determined by natural evolution.[22]

Studies have indicated that 700 alien species are found in Pakistan. Of these six are considered to have extreme invasive nature including Paper Mulberry *Broussonetia papyrifera*, Mesquite *Prosopis juliflora*, Common Water Hyacinth *Eichhornia crassipes*, Giant Salvinia *Salvinia molesta*, Parthenium Weed *Parthenium hystrophorus*, and Lantana *Lantana camara*.[23]

During the March 2018 surveys, no invasive plant species was observed in the Terrestrial Study Area. However, three invasive plant species Marijuana *Cannabis sativa*,

[22] International Finance Corporation, 2012, Guidance Note 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources

[23] Mohammad Niaz, May 4, 2009, Invasive alien species: A threat to biodiversity, Dawn News, accessed November 8, 2016

Strumarium *Xanthium strumarium* and Castor Oil Plant *Ricinus communis* were observed in the lower part of the Aquatic Study Area.

Cannabis sativa is distributed in northern Punjab and KP. It is not very aggressive with a medium degree of invasiveness. It invades waste areas and fence rows around farm building usually on bottomland soil. A very adaptable herb, it is found both in plains as well as at elevations up to 1000 feet.[24] *Xanthium strumarium* has been listed as a noxious weed and it is a major weed of crops such as soybeans, cotton, maize and groundnuts in many parts of the world. It produces large amounts of highly antigenic pollen and the glandular hairs on the leaves and stem secrete a substance which causes contact dermatitis in allergic individuals.[25] *Ricinus communis* is a fast–growing shrub or small tree which is a highly prolific and precocious producer of toxic seeds, very adaptable to different environments and has been widely distributed by man.[26]

Ethnobotany

Ethnobotany is the systematic study of the relationships between plants and people.[27] The popularity of herbal drugs is on the rise in many developed countries of the world, while in developing countries like Pakistan; medicinal plants contribute significantly to the income sources of people living in remote areas.[28]

Pakistan is among the top eight exporting countries of medicinal and aromatic plants in the world, exporting plants worth US$ 5.45 million per year. Over 60% of the total export originates from the Hindukush–Himalayas regions of the country.[29]

Previous studies on the ethnobotanical value of plant species in the wider area around the Project show that a number of plant species are used by the locals for treating diseases. Leaves of *Rumex hastatus* are eaten to increase appetite and also used as purgative, astringent and diuretic. Dried leaves of *Pistacia khinjuk* are burnt in smoke and are considering as devil repellent. *Sisymbrium irio* seeds are powdered and a paste is prepared, which is applied externally for pain. The paste is also used for clearing facial pimples and to prevent sunburn. The flowers of Artimisia species are dried, powdered and used as anthelmintic.[30]

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[24] Qaiser, M. 1973. Cannabaceae in S.I. Ali and E. Nasir (Eds) Flora of West Pakistan, No. 44, pp 5.

[25] Weaver SE, Lechowicz MJ (1982) The biology of Canadian weeds. Xanthium strumarium L. Can J plant sci 63(1): 211–225.

[26] Bridgemohan P, Bridgemohan RSH, 2014. Invasive weed risk assessment of three potential bioenergy fuel species. International Journal of Biodiversity and Conservation, 6(11):790–796. http://academicjournals.org/article/article1416497061_Bridgemohan%20and%20Bridgemohan.pdf

[27] New World Encyclopedia, http://www.newworldencyclopedia.org/entry/Ethnobotany, accessed April 13, 2017

[28] Hassan Sher, Haidar Ali And Shafiqur Rehman, Identification And Conservation of Important Plant Areas (IPAS) For The Distribution Of Medicinal, Aromatic And Economic Plants In The Hindukush–Himalaya Mountain Range, Pak. J. Bot., 44: 187–194, Special Issue May 2012

[29] Hassan Sher, Haidar Ali And Shafiqur Rehman, Identification And Conservation of Important Plant Areas (IPAS) For The Distribution Of Medicinal, Aromatic And Economic Plants In The Hindukush–Himalaya Mountain Range, Pak. J. Bot., 44: 187–194, Special Issue May 2012

[30] Ali, Haidar, and M. Qaiser. "The ethnobotany of Chitral valley, Pakistan with particular reference to medicinal plants." *Pak. J. Bot* 41, no. 4 (2009): 2009–2041.

Conservation and Protection Status

None of the species observed in the Study area or surroundings were found to be globally/nationally threatened species, endemic species or protected species.[31]

Mammals

Overview

Pakistan has rich diversity of mammalian fauna. About 195 mammalian species have been reported so far from different habitats in the country.[32] The diversity of large mammals in northern Pakistan is high compared to other parts of the country, yet majority of these species is either threatened or endangered.[33]

District Chitral provides habitat to a diverse group of threatened mammal species. Carnivores species reported from different areas of District Chitral include Common Leopard *Panthera pardus*, Snow Leopard *Panthera uncia,* Himalayan Lynx *Lynx lynx,* Pallas's Cat *Otocolobus manul*, Grey Wolf *Canis lupus*, Asiatic Jackal *Canis aureus*, Red Fox *Vulpes vulpes,* Stone Matin *Martes foina*, Yellow Throated Marten *Martes flavigula,* Himalayan Brown Bear *Ursus arctos,* Asiatic Black Bear *Ursus thibetanus*. Prey species found in different areas of district Chitral include Flare–horned Markhor *Capra falconeri*, Himalayan Ibex *Capra ibex,* Cape Hare *Lepus capensis,* Long Tail Marmot *Marmota caudata* etc. [343536]

Survey Results

Sampling was carried out at six sampling locations during the March 2018 Survey to study the mammalian species abundance and diversity within the Terrestrial Study Area. The locations of these are shown in **Exhibit 4.6**. The results of the surveys, based on the sightings or signs of the mammals observed are provided in **Exhibit 4.34**. Photographs of the mammalian signs and sightings observed are shown in **Exhibit 4.35**.

The locals were questioned about the sightings of wildlife species in the vicinity of the Terrestrial Study Area. They stated that the species Asiatic Jackal, Red Fox, Grey Wolf, Flare–horned Markhor and Himalayan Ibex are very common in the area. They also reported that Snow Leopard occasionally visits the area and kills their livestock.

The area around the Terrestrial Study Area provides habitat for Flare–horned Markhor and Himalayan Ibex which are animals for licensed trophy hunting. The income (80% amount) from trophy hunting is used for local community developments projects such as

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31 The IUCN Red List of Threatened Species. Version 2018.2. <http://www.iucnredlist.org>. Downloaded on 11 April 2018.

32 Molur, Sanjay. "Status and Red List of Pakistan's Mammals." (2003

33 Rao A, Marwat A (2003) NASSD background paper: Forestry. IUCN Pakistan, Northern Areas Progamme, Gilgit (Pakistan) 66p

34 Roberts, T.J. 1977. The Mammals of Pakistan. Ernest Benn, London and Tonbridge, pp 361.

35 Din, J. U., and M. A. Nawaz. "Status of the Himalayan lynx in district Chitral, NWFP, Pakistan." *Journal of Animal and Plant Sciences* 20 (2010): 17–22.

36 Din, J. U., S. Hameed, K. A. Shah, M. A. Khan, S. Khan, M. Ali, and M. A. Nawaz. "Assessment of Canid Abundance and Conflict with Humans in the Hindu Kush Mountain Range of Pakistan." *Wildlife Biology in Practice* 9, no. 2 (2013).

schools, bridges, medical units. The remaining 20% amount is used by the wildlife department for conservation purposes.

Conservation and Protection Status

Some of the species reported from the wider area around the Project are included in the IUCN Red List.[37] The Common Leopard, Snow Leopard, and Asiatic Black Bear are listed as Vulnerable, while Pallas's Cat and Flare–horned Markhor are listed as Near Threatened in the IUCN Red List.[38] In Pakistan National Red List, the Snow Leopard is listed as Critically Endangered, the Grey Wolf and Flare–horned Markhor are listed as Endangered while the Asiatic Jackal and Red Fox are listed as Near Threatened.

[37] The IUCN Red List of Threatened Species. Version 2018.2. <http://www.iucnredlist.org>. Downloaded on 11 April 2018.

[38] Ibid

Exhibit 4.34: Abundance of Mammal Signs and Sightings, March 2018 Survey

No	*Scientific Name*	*Common Name*	*IUCN Status*[39]	*Barren Land*		*Vegetation Cluster*	
				Sightings	*Signs*	*Sightings*	*Signs*
	Canidae						
1.	*Canis aureus*	Asiatic Jackal	Least Concern	1	2	–	4
2.	*Vulpes vulpes*	Common Red Fox	Least Concern	–	4	–	4
3.	*Canis lupus*	Grey Wolf	Least Concern		2		
	Felidae						
4.	*Panthera uncia*	Snow Leopard	Vulnerable	–	1	–	1
	Bovidae						
5.	*Capra falconeri*	Flare–horned Markhor	Near Threatened	55	–	–	–

[39] The IUCN Red List of Threatened Species. Version 2018.2. <http://www.iucnredlist.org>. Downloaded on 11 April 2018.

Exhibit 4.35: Signs of Mammals, March 2018 Survey

Scat of Red Fox

Scat of Snow Leopard

Scat of Grey Wolf

Flare–horned Markhors

Avifauna

Overview

Pakistan has a rich diversity of avian habitats, from the dry alpine and moist temperate forests of the western Himalayas to the deserts of Baluchistan and Sindh. These diverse habitats are of importance to some 669 recorded bird species.[40] Of these, 30% are long distance migratory birds, 43% are either Palearctic species visiting Pakistan only for breeding and 28% are regular winter visitors, which breed mainly in the northern trans–Himalayan regions.[41] The topographic variety of KP makes the province diverse in avifauna and the Himalayan forests provide habitat for a number of bird species. Of 669 bird species reported from Pakistan, 456 bird species are found in KP.[42]

The avifauna of District Chitral valley has not been studied in detail. However, a total 232 bird species, belonging to 58 different families, have been reported from Chitral

[40] Grimmett, Richard, Tom J. Roberts, Tim Inskipp, and Clive Byers. 2008. *Birds of Pakistan*. A&C Black.

[41] Grimmett, Richard, Tom J. Roberts, Tim Inskipp, and Clive Byers. *Birds of Pakistan*. A&C Black, 2008.

[42] Ahmad, D. (2012). Khyber Pakhtunkhwa State of the Environment. Peshawar: Environmental Protection Agency, Government of Khyber Pakhtunkhwa.

Valley. These include birds belonging to Family Anatidae, Phasianidae, Podicipedidae, Ciconiidae, Pelecanidae, Ardeidae, Pandionidae, Accipitridae, Otididae, Rallidae, Burhinidae, Charadriidae, Rostratulidae.[43] The bird fauna of Chitral valley is interesting in many ways. Its zoogeographical position is on the border between the Palearctic and Indo–Malayan regions, with the fauna being a mixture of both regions. In addition, Chitral is situated on one of the major bird migration routes of the world – the Indus Flyway – and a large number of migratory birds can be observed here practically during the entire year.[44]

Survey Results

Surveys for bird diversity and abundance were carried out in the Terrestrial Study Area in March 2018. A total of six locations were sampled with four in Barren Land and two in Vegetation Cluster habitat type. A summary of the results by habitat type including the bird abundance and diversity is provided in **Exhibit 4.36**.

Exhibit 4.36: Total Sightings, Density and Diversity by Habitat Type, March 2018 Survey

Habitat	*No. of Sampling Points*	*Total Sightings*	*Density (Average no of species per Sampling Location)*	*No. of Species*
Barren Land	4	47	11.75	13
Vegetation Cluster	2	88	44	16
Total	**6**	**135**	**22.5**	**19**

A total of 135 bird individuals belonging to 19 species were observed. Maximum abundance was observed at Sampling Location T1, located in Vegetation Cluster habitat. Abundant bird species observed at this Sampling Location included the Mallard *Anas platyrhynchos*, Ferruginous Pochard *Aythya nyroca*, Black–billed Magpie *Pica hudsonia*, and White Wagtail *Motacilla alba*. Maximum diversity was also observed at Sampling Location T1. A total of 16 bird species were observed at this Sampling Location.

Abundant bird species in the Terrestrial Study Area included the, Mallard, Ferruginous Pochard, White Wagtail, Black–billed Magpie, Jungle Crow *Corvus macrorhynchos*, Blue Whistling Thrush *Myophonus caeruleus* and Brown Dipper *Cinclus pallasii*.

Hunting of migratory birds is quite common throughout the entire stretch of the Aquatic Study Area. Photographs of some bird species which were hunted by the locals within the Terrestrial Study Area are shown in **Exhibit 4.37**. Large size artificial ponds have been constructed near the bank of the river in the Aquatic Study Area and decoys ducks are used to attract migratory ducks. A small hunting hide, built from large stones, was used for hunting purposes (**Exhibit 4.37**). Consultations with the wildlife department confirmed that permits are issued for hunting of migratory ducks. Permits are issued at

[43] Grimmett, Richard, Tom J. Roberts, Tim Inskipp, and Clive Byers. *Birds of Pakistan*. A&C Black, 2008.

[44] Kylanpaa, J. "Birds of Dera Ismail Khan District of North West Frontier Province in Pakistan". *Forktail* (2000): 15–28.

the rate of PKR 2,000 to each hunter for a specific period of the year. With one permit each hunter can kill 20 waterfowls per day.

Conservation and Protection Status

Of the bird species reported from the Study Area, none are Endangered or Critically Endangered based on the IUCN Red List of Threatened Species.[45] Only, two species, the Lammergeier or Bearded Vulture and Ferruginous Pochard are included in the IUCN Red List as Near Threatened species. Mallard is included in CITES Appendix I while Lammergeier is included in CITES Appendix II.

Exhibit 4.37: Migratory Birds Hunted by Local Hunters in the Terrestrial Study Area, March 2018 Survey

Mallard (Male)

Mallard (Female)

Ferruginous Pochard

Ferruginous Pochard (right) and Mallard (left)

[45] IUCN 2015. *The IUCN Red List of Threatened Species. Version 2015–4*. <http://www.iucnredlist.org>, accessed May 29, 2017.

Constructed Ponds and Hunting Hide (Circled)

Hunting Hide

Herpeto–fauna

Reptiles are highly habitat–specific, and therefore occupy small niches. Unlike birds and mammals that have very wide foraging ranges, reptiles have a restricted home range. Except for monitor lizards and large snakes, other species usually stay within an area of about a square kilometer for feeding and breeding.[46] Geckos or skinks may occupy microhabitats spread over even smaller areas. The breeding ground for a reptile species cannot be marked at one or two places; these are spread all over the area within suitable habitats at several scattered places, provided other climatic factors remain conducive.

Overview

The herpetofauna of Chitral Valley has not been studied in detail. However, the presence of about 41 herpeto–fauna species can be deduced from literature.[47] None of these species are of conservation importance based on the IUCN Red List. Five reported species are included in the CITES Appendices. These include the Bengal Monitor Lizard *Varanus bengalensis* (I), the Rope Snake *Ptyas mucosus mucosus* (II), Central Asian Cobra *Naja oxiana* (II), Common Sand Boa *Eryx johnii* (II) and the Checkered Keelback *Xenochrophis piscator piscator* (III).[48]

Survey Results

A total of six locations were sampled for herpeto–fauna during the March 2018 Survey. The locations of these are shown in **Exhibit 4.6**. A summary of the sampling locations by habitat type, number of sightings, density and number of species is provided in **Exhibit 4.38**.

[46] Mertens, R. 1969. “Die Amphibians und Reptilians West Pakistan”. Stutt. Beit. *Naturkunde*, 197, pp. 1–96.

[47] Khan, M.S., 2006. Amphibians and reptiles of Pakistan. Krieger Publishing Company, Malabar, Florida. pp 311.

[48] CITES. Checklist of CITES Species. Accessed on December 12, 2017. Available at http://checklist.cites.org/#/en

Exhibit 4.38: Herpetofauna Abundance and Diversity by Habitat Type, March 2018 Survey

Habitat	*No. of Sampling Locations*	*Total Signs/ Sightings*	*Average Signs/Sightings per Sampling Location (Density)*	*No. of Species*
Barren Land	4	52	13	2
Vegetation Cluster	2	12	6	3
Total	**6**	**64**	**10.67**	**4**

A total of 64 reptile and amphibian specimens belonging to four species were observed in the Terrestrial Study Area. These included Caucasian Agama *Paralaudakia Caucasia*, Swat Green Toad *Bufotes pseudoraddei*, Batura Glacier Toad *Bufotes baturae* and *Bufotes spps*.

The highest density of herpeto–fauna was observed in the Barren Land habitat (average of 13 sightings per sampling location). The greatest diversity was observed in the Vegetation Cluster habitat with a total of three species. The highest abundance was observed at Sampling Location T4 in Barren Land habitat with 30 individuals of Caucasian Agama sighted. The second highest abundance was observed at Sampling Location T2 in Barren Land habitat with ten individuals of Caucasian Agama sighted. Low diversity of the herpetofauna species observed in the Study Area was due to low temperatures at the time of sampling. Most herpetofauna species particularly reptiles hibernate in the cool months.

Conservation and Protection Status

Of the herpeto-fauna species reported from the Study Area, none are of conservation importance based on the IUCN Red List. None of the species observed are endemic. Photographs of some of reptile species observed during the March 2018 Survey are shown in **Exhibit 4.39**.

Exhibit 4.39: Herpetofauna Species, March 2018 Survey

Swat Green Toad *Bufotes pseudoraddei*

Batura Glacier Toad *Bufotes baturae*

Caucasian Agama *Paralaudakia caucasia*

Bufotes spps.

Caucasian Agama *Paralaudakia caucasia*

4.1.6 Protected Areas

A protected area is a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values. [49] In Pakistan a wildlife sanctuary is an area set aside for the protection of wildlife. Public access is prohibited or regulated and no exploitation of forest is allowed. Game reserves are areas, declared so by the government, where hunting of wild animals is not allowed, except under permit issued by the government. Other than this no other restriction applies in a game reserve. National Park is an area where the landscape, flora and fauna are protected and preserved in a natural state. Public access for recreation, education and research is provided for but hunting wild animals is prohibited.

Protected areas in the vicinity of the Arkari Gol Hydropower Project are shown in **Exhibit 4.40.** These include the Agram Basti Wildlife Sanctuary, Chitral Gol National Park, and Tooshi Game Reserve which are located 9 km, 14 km and 13 km from Project site respectively. The boundaries of Agram Basti Wildlife Sanctuary and Tooshi Game Reserve are not clearly demarcated in government documents. Therefore a circle corresponding to their area has been drawn in **Exhibit 4.40** to show the approximate area.

Agram Basti Wildlife Sanctuary is spread over an area of about 29,866 hectares and is located at a distance of about 9 km from the Project site. The important wildlife species

[49] IUCN Definition 2008, International Union for Conservation of Nature, Available at: https://www.iucn.org/theme/protected–areas/about;

reported from the sanctuary include Grey Wolf, Himalayan Brown Bear, Red Fox, Flare–horned Markhor and Himalayan Ibex.

The Chitral Gol National park is situated, about 3 km west of Chitral Town and about 14 km from the Project site. It is spread over an area of about 7,750 hectares. The elevation ranges from about 1,500 m to 4,979 m. It was declared a wildlife sanctuary on 23 December 1971 and as a national park in 1984.[50] The important wildlife species reported from the Chitral Gol National Park include Snow Leopard, Himalayan Lynx, Grey Wolf, Red Fox, Asiatic Black Bear, Yellow Throated Marten, Flare–horned Markhor, Himalayan Ibex, Lammergier, Himalayan Griffon Vulture *Gyps himalayensis*, Himalayan Snowcock *Tetraogallus himalayensis*, Himalayan Monal Pheasant *Lophophorus impejanus*. Major threats to the wildlife include livestock grazing, firewood collection and poaching.

Tooshi Game Reserve is located at a distance of about 13 km from the Project site. It is located along the paved road to Garam Chashma in Chitral's Lutkho district and covers an area of 1000 hectares. It is proposed to be reclassified as a wildlife sanctuary, as it has a large (about 160 individuals) and readily viewable Markhor population. The habitat is dominated by alpine meadows and dry temperate forest.[51] Key wildlife species reported from this game reserve include Snow Leopard, Himalayan Lynx, Red Fox, Grey Wolf, Flare–horned Markhor and Chukar Partridge *Alectoris chukar*.

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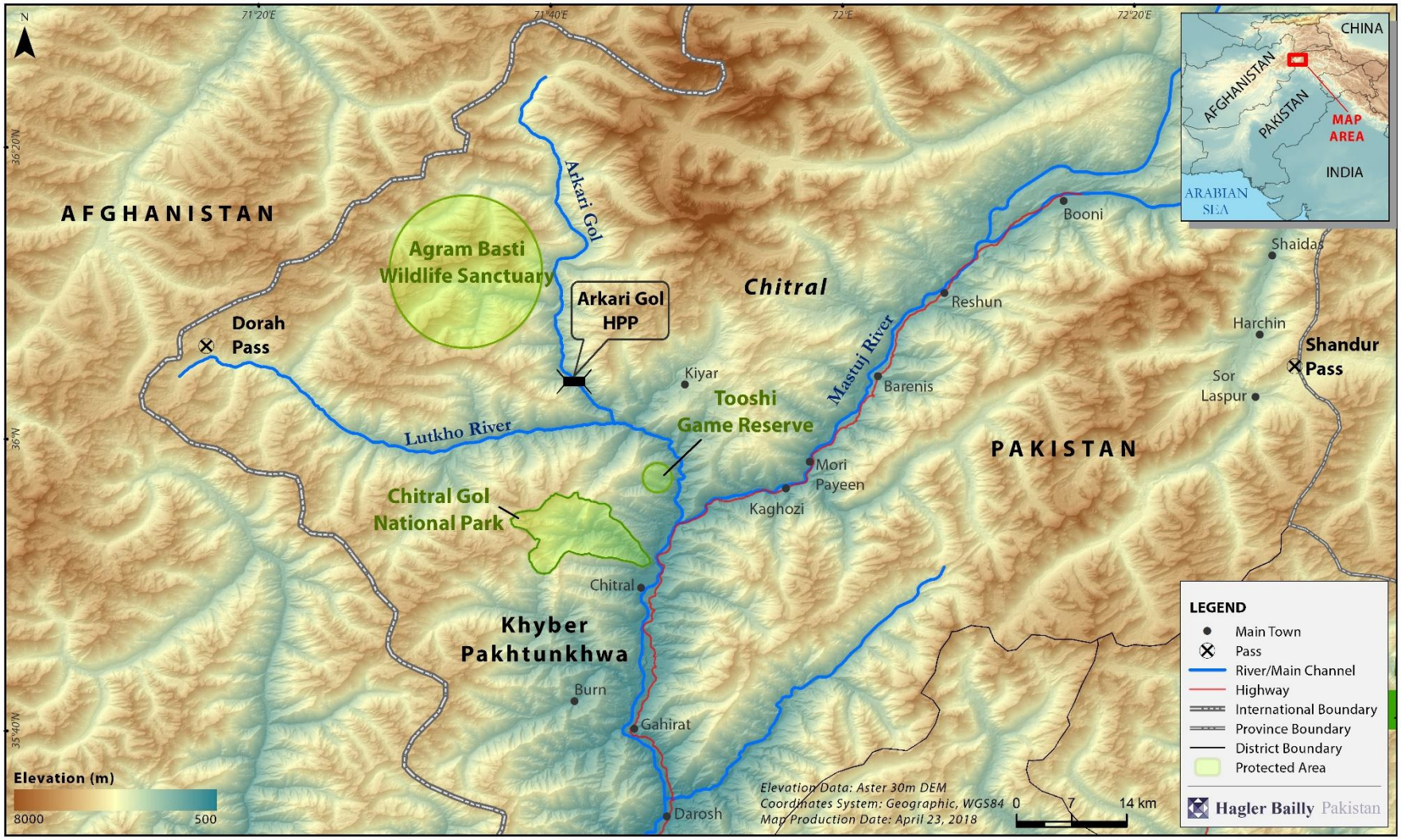
50 The Khyber Pakhtunkhwa Tribune, Articles, Wildlife Parks, http://ww.w.kpktribune.com/index.php/en/component/content/article/48–khyber–pakhtunkhwa/about–khyber–pakhtoonkhwa/1023–wildlife–parks, accessed on January 04, 2016

51 The Khyber Pakhtunkhwa Tribune, Game Reserves, <http://ww.w.kpktribune.com/index.php/en/divisions/malakand–division/districts/400–khyber–pakhtunkhwa/sports/1025–game–reserves>, accessed on December 29, 2016>, accessed on Dec 30, 2016

Exhibit 4.40: Protected Areas or Areas of Special Importance for Biodiversity



4.1.7 Habitat Assessment

Performance Standard 6 (PS6) "Biodiversity Conservation and Sustainable Management of Living Natural Resources" requires the categorization of habitats into modified, natural and critical. Critical Habitats are a subset of modified or natural habitats. They are habitats of high biodiversity value.[52]

Natural and Modified Habitats

Natural and Modified Habitats are defined and described in IFC PS6.[53] Their definitions, according to IFC PS6, are as follows:

Natural Habitat: Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition. Under IFC PS 6 No Net Loss is required in Natural Habitats.

Modified Habitat: Modified habitats are areas that may contain a large proportion of plant and/or animal species of non–native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.

Aquatic Study Area

The Aquatic Study Area is considered a Natural Habitat as the river water is not regulated by dams or barrages. In addition sediment extraction from river bed and banks is very limited, primarily because the Arkari Gol is difficult to access and also because demand for sediment in low.

Terrestrial Study Area

The Terrestrial Study Area is classified as Natural Habitat. Agricultural in the area is limited (4%). Most of the area is naturally Barren Land habitat type (92%). Population density is also low.

Critical Habitat

Critical Habitat is a requirement under the International Finance Corporation's (IFC) Performance Standards (PS).[54]

Critical habitat is an area that has high biodiversity value and may include sites that are legally protected or officially proposed for protection. These may include:

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[52] International Finance Corporation. January 2012. Policy on Social and Environmental Sustainability, Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, The World Bank Group.

[53] Ibid

[54] International Finance Corporation (IFC). January 2012. Policy on Social and Environmental Sustainability, Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, The World Bank Group.

- Areas protected by the International Union for Conservation of Nature (Categories I–VI) [55],
- wetlands of international importance (according to the Ramsar Convention);[56]
- important bird areas (defined by Birdlife International);[57] and
- biosphere reserves (under the UNESCO Man and the Biosphere Programme;[58]

The Project does not fulfill any of these characteristics.

Critical Habitat Assessment as per IFC PS6 requires the defining of a Discrete Management Unit (DMU). This is based on the following:

"*For Criteria 1 through 3, the project should determine a sensible boundary (ecological or political) which defines the area of habitat to be considered for the Critical Habitat Assessment. This is called the "discrete management unit," an area with a definable boundary within which the biological communities and/or management issues have more in common with each other than they do with those in adjacent areas (adapted from the definition of discreteness by the Alliance for Zero Extinction). A discrete management unit may or may not have an actual management boundary (e.g., legally protected areas, World Heritage sites, KBAs, IBAs, community reserves) but could also be defined by some other sensible ecologically definable boundary (e.g., watershed, interfluvial zone, intact forest patch within patchy modified habitat, seagrass habitat, coral reef, concentrated upwelling area, etc.). The delineation of the management unit will depend on the species (and, at times, subspecies) of concern*."[59]

DMUs has been defined for relevant species under consideration in Criteria 1 through 3.

The criteria for Critical Habitat Assessment[60] based on IFC's PS6 along with their application to the biodiversity within the Study Area is provided below.

1. *Habitat of significant importance to Critically Endangered and/or Endangered species:*

According to IFC's Guidance Note 6, Tier 1 sub–criteria for Criterion 1 are defined as follows[61]:

- *Habitat required to sustain ≥ 10 percent of the global population of an IUCN Red–listed Critically Endangered (CR) or Endangered (EN) species where these*

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55 IUCN. 1994. Guidelines for *Protected Areas* Management *Categories*. *IUCN*, Cambridge, UK.

56 Ramsar Convention, or Convention on the Wetlands of International Importance, Administered by the Ramsar Secretariat, Geneva, Switzerland

57 Birdlife International, UK

58 Administered by International Co–ordinating Council of the Man and the Biosphere (MAB), UNESCO.

59 Biodiversity Conservation and Sustainable Management of Living Natural Resources, Criterion 3, Guidance Note 6, International Finance Corporation, 1 January 2012

60 The determination of Critical Habitat, however, is not necessarily limited to these criteria. Other recognized high biodiversity values might also support a critical habitat designation, and the appropriateness of this decision would be evaluated on a case–by–case basis.

61 Ibid

are known, regular occurrences of the species and where the habitat could be considered a discrete management unit for that species.

- *Habitat with known, regular occurrences of CR or EN species where the habitat is one of 10 or fewer discrete management sites globally for that species.*

Tier 2 sub–criteria for Criterion 1 are defined as follows:

- *Habitat that supports the regular occurrence of a single individual of an IUCN Red–listed CR species and/or habitat containing regionally–important concentrations of an IUCN Red–listed EN species where the habitat could be considered a discrete management unit for that species.*
- *Habitat of significant importance to CR or EN species that are wide–ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long–term survivability of the species.*
- *As appropriate, habitat containing nationally/regionally–important concentrations of an EN, CR or equivalent national/regional listing.*

Based on information available from literature and March 2018 survey, there is no Endangered or Critically Endangered fish species reported from the Aquatic Study Area. Therefore the Aquatic Study Area is not a critical habitat for any of the residing fish species.

Similarly, species that are listed as Critically Endangered or Endangered have not been reported from the Terrestrial Study Area.

2. *Habitat of significant importance to endemic and/or restricted–range species:*

According to IFC's GN6, Tier 1 sub–criteria for Criterion 2 are defined as follows:

- *Habitats know to sustain ≥ 95 percent of the global population of an endemic or restricted–range species where that habitat could be considered a discrete management unit for that species (e.g. a single–site endemic[62]).*

Tier 2 sub–criteria for Criterion 2 are defined as follows:

- *Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted–range species where the habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement*

No restricted range species has been reported from the Aquatic Study Area. None of the fish are endemic to the Arkari or Lutkho River. Similarly, no endemic and/or restricted range species has been reported from the Terrestrial Study Area. Therefore Critical Habitat is not triggered for Criterion 2 for either Aquatic or Terrestrial Study Area.

3. *Habitat supporting globally significant concentrations of migratory species and/or congregatory species:*

[62] An endemic species is defined as "one that has ≥ 95 percent of its global range inside the country or region of analysis" as stated in GN79 of Guidance Note 6, Biodiversity Conservation and Sustainable Management of Living Natural Resources. International Finance Corporation, January 2012

According to IFC's GN6, Tier 1 sub–criteria for Criterion 3 are defined as follows:

- *Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 of the global population of a migratory or congregatory species at any point of the species lifecycle where that habitat could be considered a discrete management unit for that species.*

Tier 2 sub–criteria for Criterion 3 are defined as follows:

- *Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment.*
- *For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance.*
- *For species with large but clumped distributions, a provisional threshold is set at ≥5 percent of the global population for both terrestrial and marine species.*
- *Source sites that contribute ≥ 1 percent of the global population of recruits*

The Aquatic Study Area is home to the Snow Trout which is a long distance migratory fish. This fish species is distributed in India, Nepal, Bhutan, Pakistan and Afghanistan. [63] The DMU for the Snow Trout includes the Arkari Gol (stretch of 5 km) and parts of the Lutkho and Mastuj and Chitral Rivers between elevation range of 300 to 2810 m[64] as shown in **Exhibit 4.41**. The fish is widespread and found in rivers in India, Nepal, Bhutan, Pakistan and Afghanistan. Based on expert judgment, the habitat within the DMU does not provide habitat for more than 1 % of the global population of this species. Therefore Critical Habitat is not triggered for the Snow Trout. The DMU for Snow Trout is provided in **Exhibit 4.41**.

Within the Terrestrial Study Area, some migratory and congregatory bird species have been reported including the Northern Pintail, Northern Shoveler, Bar–headed Goose, Common Shelduck, and Gadwall. However, these bird species are widespread. According to expert judgment, the migratory bird populations are small and do not trigger Tier 1 or Tier 2 sub–criteria for Criterion 3 and the Terrestrial Study Area is not a Critical Habitat for migratory birds.

4. *Highly threatened and/or unique ecosystems*

---

[63] Vishwanath, W. 2010. *Schizothorax richardsonii*. The IUCN Red List of Threatened Species 2010: e.T166525A6228314. http://dx.doi.org/10.2305/IUCN.UK.2010–4.RLTS.T166525A6228314.en. Downloaded on **27 December 2017**

[64] As outlined in IUCN Red List. Vishwanath, W. 2010. *Schizothorax richardsonii*. The IUCN Red List of Threatened Species 2010: e.T166525A6228314. http://dx.doi.org/10.2305/IUCN.UK.2010–4.RLTS.T166525A6228314.en. Downloaded on **27 December 2017**

There is no information which indicates the Study Areas, or any part of them, are a highly threatened and/or unique ecosystem. Furthermore, there is no information which indicates the Study Areas are a part of a threatened or unique ecosystem.

5. *Areas with unique assemblages of species or which are associated with key evolutionary processes or provide key ecosystem services:*

There is no information which indicates the Study Areas, or any part of them, are associated with key evolutionary processes or provide key ecosystem services. While the species are functioning components of ecosystems, there are no unique assemblages of species or association of key evolutionary processes in the Study Areas.

ADB's Guideline for Critical Habitat Assessment not covered by IFC PS6

6. *Areas with biodiversity that has significant social, cultural or economic importance to local communities.*

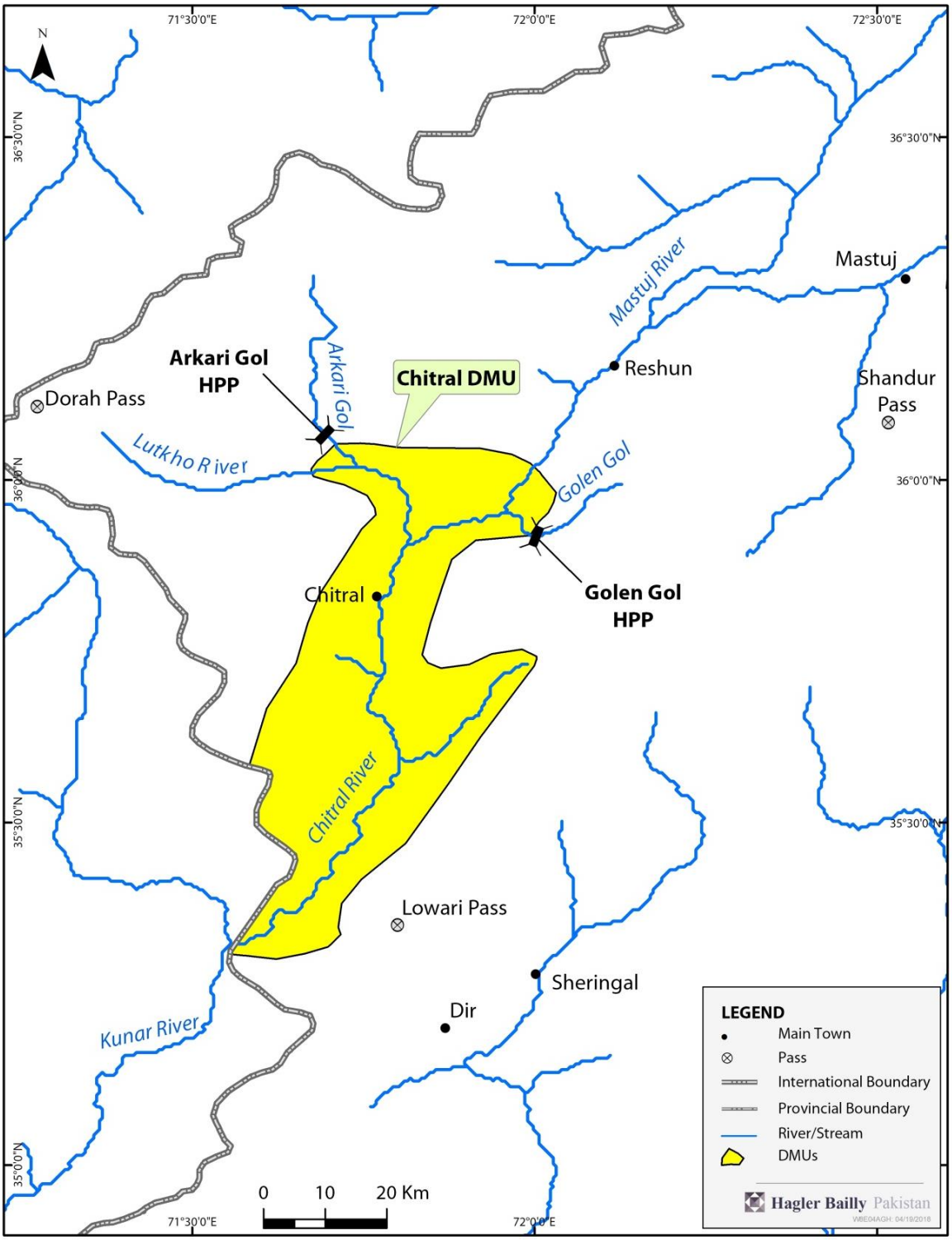
There is some recreational fishing in the Aquatic Study Area but livelihood dependence of the local communities on the fish for subsistence is low. The wider area around the Project provides habitat for Flare–horned Markhor and Himalayan Ibex which are animals for licensed trophy hunting. However, the communities do not depend on the income from trophy hunting for their livelihood and this income is used for developmental projects such as schools or medical units in the area. Project impacts are not likely to have significant impact on trophy hunting.

Therefore, neither the Aquatic Terrestrial Study Area nor the Terrestrial Study Area has biodiversity of significant social, cultural or economic importance for the local communities, and Critical Habitat is not triggered for this criterion.

Determination:

The Aquatic and Terrestrial Study Area do not lie in a Critical Habitat.

Exhibit 4.41: DMU of Snow Trout



4.1.8 Conclusions

This section provides a summary of the aquatic and terrestrial ecological resources in the Study Area which may be of concern from Project related impacts as outlined in **Section 7**, *Anticipated Environmental Impacts and Mitigation Measures*.

- A total of six fish species have been reported from the Aquatic Study Area including the Snow Trout, Kunar Snow Trout, Chirruh Snow Trout, Chitral Loach, Himalayan Catfish and Khyber Loach. None of these fish species are listed as Endangered or Critically Endangered in the IUCN Red List 2018. Of these, only the Snow Trout is a fish species of conservation importance since it is a long distance migratory fish, has high commercial importance and is listed as Vulnerable in the IUCN Red List. This fish is widespread and has been reported from India, Nepal, Bhutan, Pakistan and Afghanistan. In the Study Area, the Snow Trout is not found above an altitude of 2810 m[65] and in the Arkari Gol the presence of a natural water fall (2.5 km downstream of the proposed dam site) restricts its presence upstream of the waterfall.
- None of the terrestrial plant species reported from the Terrestrial Study Area or surroundings are globally/nationally threatened species, endemic species or protected species. There are some medicinal plants reported from the wider area around the Project such as *Rumex hastatus*, *Pistacia khinjuk*, *Sisymbrium irio* and Artimisia species.[66] No invasive plant species were observed in the terrestrial Study Area but few invasive plant species including Marijuana *Cannabis sativa*, Strumarium *Xanthium strumarium* and Castor Oil Plant *Ricinus communis* were observed in the Aquatic Study Area. It is important that Project activities take preventative measures to avoid spread of invasive species.
- A number of mammalian species of conservation importance have been reported from the wider area around the Project. The Common Leopard, Snow Leopard, and Asiatic Black Bear are listed as Vulnerable, while Pallas's Cat and Flare–horned Markhor are listed as Near Threatened in the IUCN Red List.[67] Both the Flare–horned Markhor and Himalayan Ibex are animals for licensed trophy hunting. Most of these mammals prefer higher altitudes and their occurrence at the Project site and vicinity is rare. Project related impacts are not expected to have a direct impact on these mammals. However, there may be an increase incidence of poaching as a result of influx of Project staff and contractors to the area.
- Of the bird species reported from the Study Area, none are Endangered or Critically Endangered based on the IUCN Red List of Threatened Species.[68] Only

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[65] As outlined in IUCN Red List. Vishwanath, W. 2010. *Schizothorax richardsonii*. The IUCN Red List of Threatened Species 2010: e.T166525A6228314. http://dx.doi.org/10.2305/IUCN.UK.2010–4.RLTS.T166525A6228314.en. Downloaded on **27 December 2017**

[66] Ali, Haidar, and M. Qaiser. "The ethnobotany of Chitral valley, Pakistan with particular reference to medicinal plants." *Pak. J. Bot* 41, no. 4 (2009): 2009–2041.

[67] Ibid

[68] IUCN 2015. *The IUCN Red List of Threatened Species. Version 2015–4*. <http://www.iucnredlist.org>, accessed May 29, 2017.

two species, the Lammergeier or Bearded Vulture and Ferruginous Pochard are included in the IUCN Red List as Near Threatened species. Mallard is included in CITES Appendix I while Lammergeier is included in CITES Appendix II. The waterbodies in the vicinity of the Project site provide habitat for a number of migratory birds which can be hunted by obtaining permits from the KP Wildlife Department. These birds are likely to face disturbances during the Project construction phase. During the operation phase, it is important to ensure that Project staff and consultants do not engage in illegal hunting of these birds.

- Of the herpeto-fauna species reported from the Study Area, none are endemic or included in the IUCN Red List. Project construction is likely to have a short-term impact on individual receptors but the basin wide impact or Project on herpeto-fauna is likely to be minor.
- There is no Critical Habitat (according to IFC's Performance Standard 6) in the Project site and vicinity though both the Aquatic and Terrestrial Study Area is considered a Natural Habitat.

4.2 Physical Environment

The physical baseline includes a description of the topography, land use, geomorphology, visual character, climate, air quality, water resources, noise levels, and traffic.

4.2.1 Scope and Methodology

The specific tasks covered under the physical baseline study included:

- Review of the available literature on the physical environment of the Study Area.
- Review of the feasibility study of the Project: Pakhtunkhwa Hydel Development Organization (PHYDO), Government of Khyber Pakhtunkhwa, March 2014, Feasibility Study for the Arkari Gol Hydropower Project, District Chitral, (Lower), Khyber Pakhtunkhwa, referred to as the "Feasibility Study" in this report.
- Analysis of secondary information to characterize baselines, particularly topography, land-use, geology, climate and water resources.
- Field surveys for characterization of Study Area, including:
  - Visual character
  - Ambient air quality
  - Water resources (water quality and domestic water supply and use)
  - Soil Quality
  - Noise levels
  - Traffic

Baseline data is compared to the National Environmental Quality Standards (NEQS), and where relevant, other standards, including the IFC-EHS Guidelines (2007), that are applicable to the Project.

The physical environment survey plan is included as **Appendix F**.

4.2.1 Topography and Land Cover

The Arkari Gol Hydropower Project; including a dam, power tunnel and powerhouse, is proposed along the Arkari Gol in Khyber Pakhtunkhwa, Pakistan. The Arkari Gol is a tributary of the Lutkho River which drains into the Mastuj River – a tributary of Chitral River.

The topography of the Arkari Gol catchment is shown in **Exhibit 4.42**. The area upstream of the Project ranges between 1,830 m and 6,956 m. The cumulative percentage of Project catchment area with elevation classes is shown in **Exhibit 4.43**. The majority (~90%) of the catchment upstream of the Project is below 5,000 m amsl. With the elevation largely below 5000 m, the permanent snow and glacial cover within the catchment is low, particularly relative to other catchments of the higher Himalaya and Karakorum in Pakistan to the east and north east of the Arkari Gol catchment respectively.

A classified land cover map, extracted from the GlobalLand30 dataset[69], is provided in **Exhibit 4.44**. The associated percent-land cover for areas upstream of the Project are provided in **Exhibit 4.45**. Based on the classification, the land cover upstream of the Project includes only minor forest (0.9%) and agricultural land (0.7%). The majority of land cover is barren land (63.1%), followed by shrub land (16.8%), snow and ice (9.8%), and grassland (8.8%). The western side of the Arkari Gol contains most of the shrub land while grasses are mostly found in eastern side. Most of the available snow and ice fraction has been found above 4500 m elevation.

[69] Developed by National Geomatics Center of China (NGCC) using multispectral images at 30 meters spatial resolution of Landsat TM/ETM+ and Chines Environmental Disaster Alleviation Satellite (HJ-1), with an accuracy range for classified land cover types varying between 72.5% and 92%.

Exhibit 4.42: Topography of the Arkari Gol Catchment

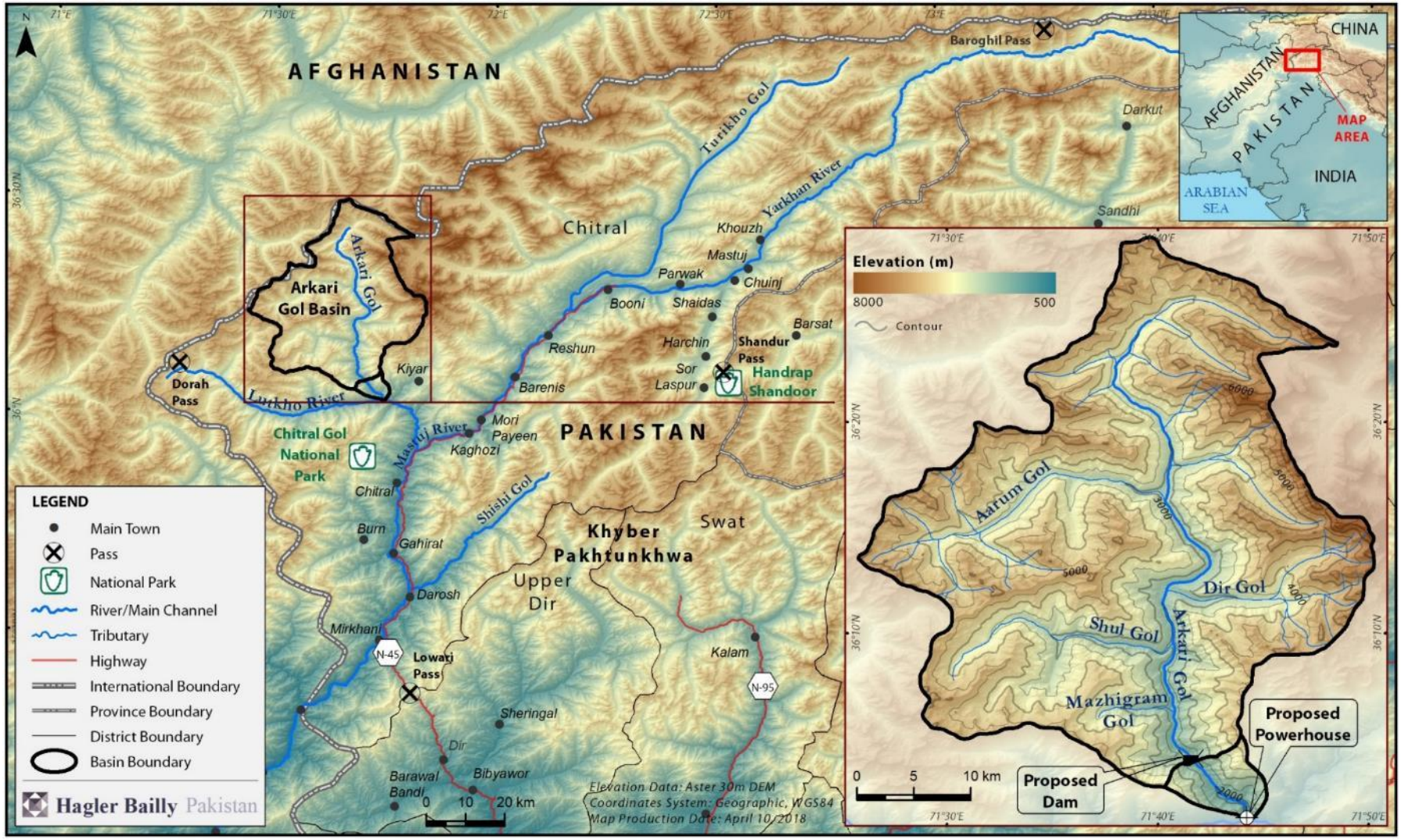


Exhibit 4.43: Catchment Elevations

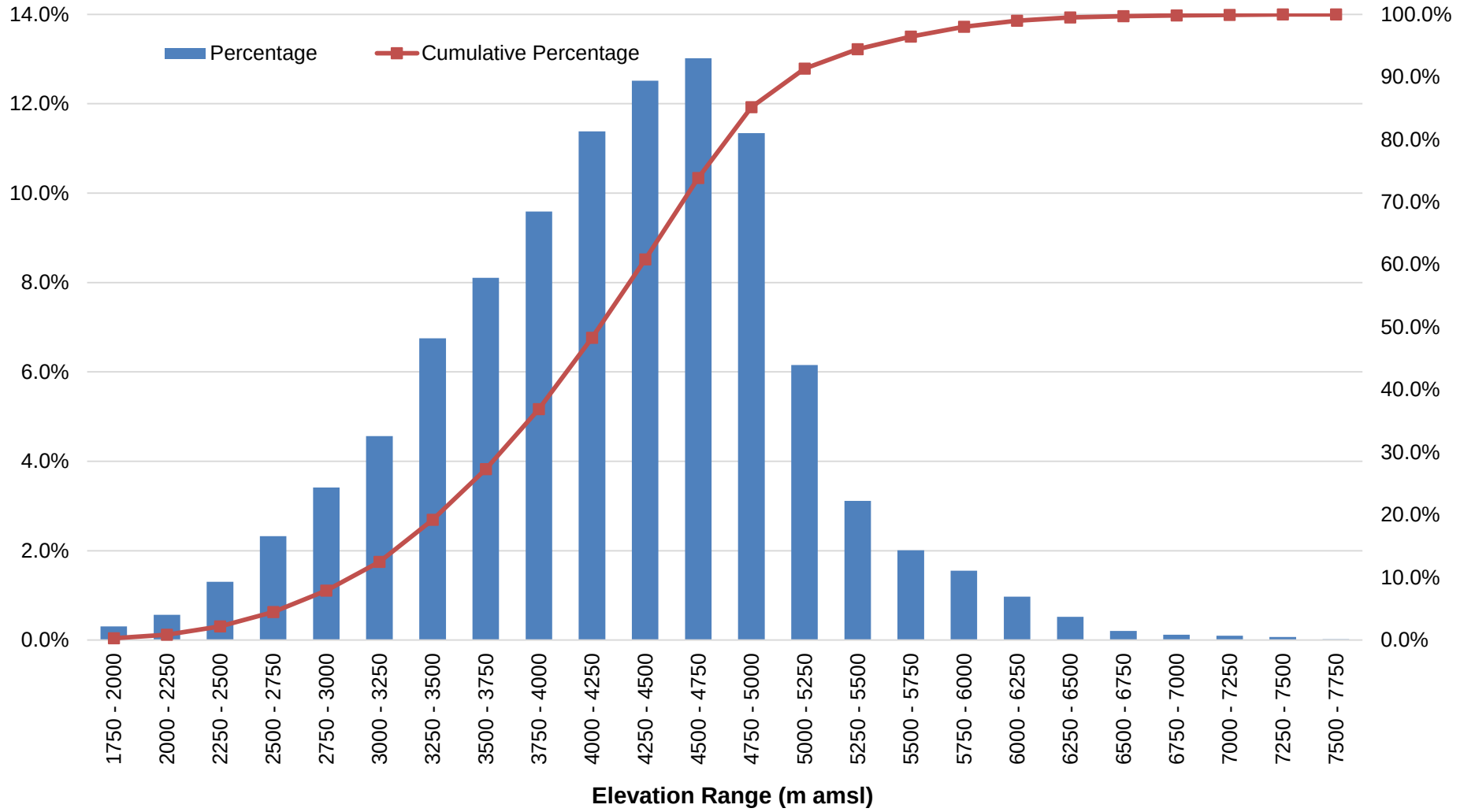


Exhibit 4.44: Land Cover of the Arkari Gol Catchment

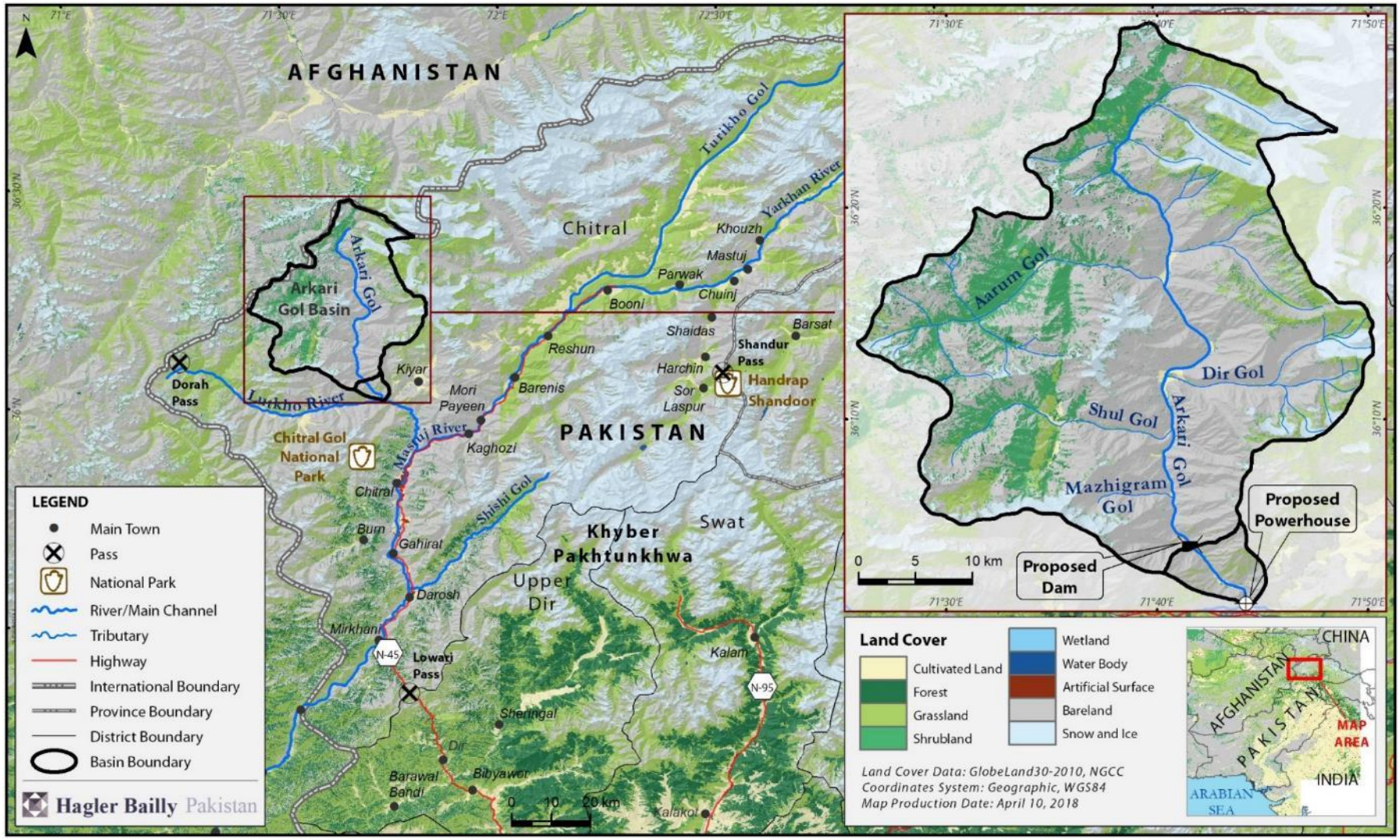
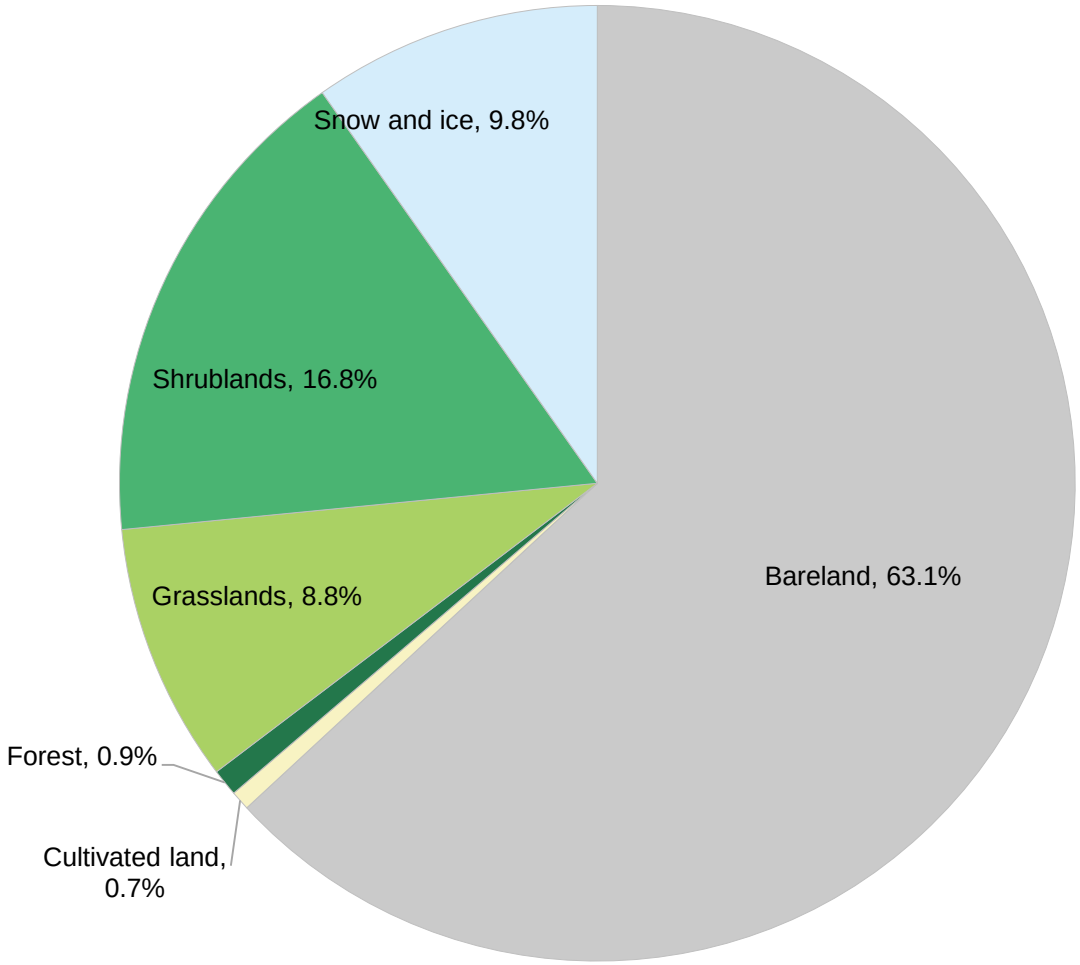


Exhibit 4.45: Land Cover Statistics (Upstream of Project)



4.2.2 Geology, Soils and Seismic Hazards

This section presents information on the geology, soils and seismic hazards within the Study Area. The information is obtained largely from the Feasibility Study and, where specified, other sources.

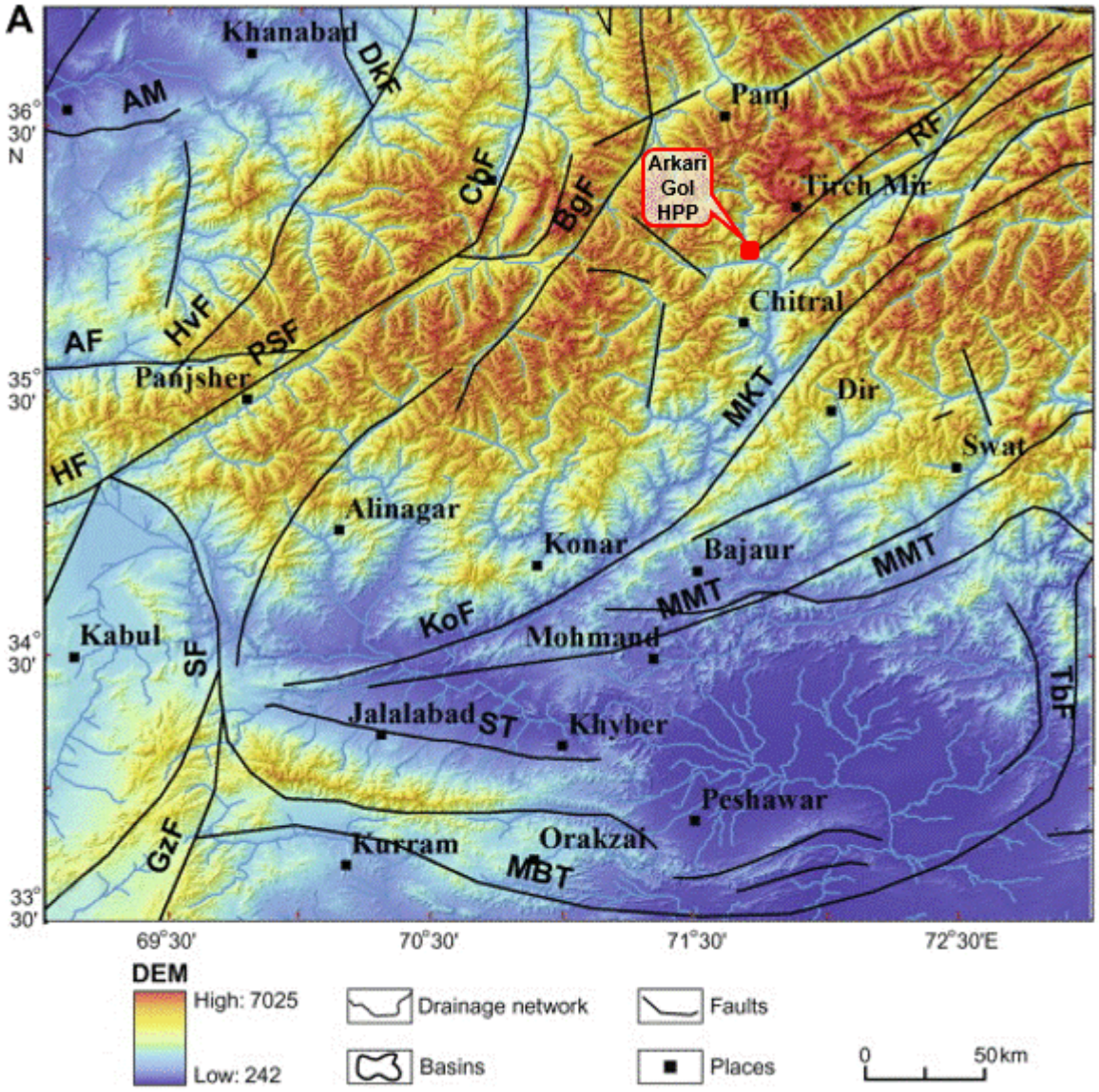
Tectonics

The Project area is part of the continental collision zones between Eurasian and Indian plates and the intervening Kohistan, Ladakh Arc. The intercontinental collision between the Eurasian and Indian plates has resulted in intense deformation with complex folding involving strike-slip and thrust faulting and crustal thickening expressed as a series of thrust faults accompanied by a continental subduction process.

The Chitral district has three main mountain ranges, known as Hindu Kush, Karakoram and Kohistan. The Hindu Kush and Karakoram ranges are located on the Eurasian plate while the Kohistan range is part of Indian plate. The Indian plate is under thrusted and the Eurasian plate is upper thrusted.

Both the plates are separated by the Main Karakoram Thrust (MKT) which trends in NE-SW direction (see **Exhibit 4.46**), through Shishi valley, Rizhun Gol and passes through Harchin from Chitral district. The crushing zone between the MKT and Kohistan is known as Northern Suture Mélange zone (NSM). Other faults shown in Exhibit X include: Reshen Fault (RF), Darvaz Karakul fault (DkF), Alburz Marmul (AM), Central Badakhshan fault (CbF), Henjvan fault (HvF), Herat fault (HF), Gardez fault (GzF), Konar fault (KoF), Main Boundary Thrust (MBT), Main Mantle Thrust (MMT), Sarobi fault (SF); Tarbella fault (TbF), and the Bazgir fault (BgF);

Exhibit 4.46: Major Faults in Relation to Dam Site



Sources: Lawrence et al., 1981; Wheeler et al., 2005; Doebrich and Wahl, 2006; Mahmood and Gloaguen, 2011.

Seismic Hazard

The Northern Areas of Pakistan and AJK are extensive zones of high seismicity and contain several seismo-tectonic features generated by an integrated network of active faults. A telemeter seismic network which operated from 1973 to 1977 has recorded data from approximately 10,000 earthquakes covering the area between longitudes 69º and 75º and latitudes 30º and 35º.

This section presents the calculated earthquake magnitudes to determine baseline conditions. The suitability of these criteria are discussed in the impact assessment presented in **Section 7** (*Anticipated Environmental Impacts and Mitigation Measures*).

Seismic Hazard Analysis in the Feasibility Study

Seismic hazards may be analyzed deterministically, as when a particular earthquake scenario is assumed, or probabilistically in which uncertainties in earthquakes size, location and time of occurrence are explicitly considered. Both approaches were adopted in the Geological Investigation Report for the Project and are summarized below.

The historical data for the Hindu Kush region was compiled by Amraseys and Biham (2003; 2009) which formed the basis for defining the historical seismicity of the Chitral Region.

The historical data suggests that Konar Fault (KoF in the figure above) and its NE splays like Upper Swat (Kalam) Fault Zone and the MKT have been a focus of several past earthquakes some approaching a magnitude of 7.5 on the Richter scale. There are historical records of extensive damage along the Kunar River as far as Drosh, suggesting that MKT did rupture in these earthquakes. In comparison, the Tirich Mir and Reshun Faults (RF in the above figure) have no historical earthquakes associated with them, except for one at 1842 centered on Chitral-Wakhan border. This apparently indicates lack of seismic activity associated with these faults. However, considering that continued convergence in the Hindu Kush is to the order of 5 cm/yr, the Tirich Mir and Reshun Faults may be more vulnerable in terms of seismic hazard potential as they must be storing strain for the past several hundred years.

Pakistan's PGA (g) contour map with 10% probability of exceeding in 50 years was utilized for the project where PGA contour level of 0.02g had been provided. However, because of lack of strong motion data, attenuation law could not be developed for the Project area. The analysis was based on identification of the nearest faults to the Project area/located within a radius of 100 km. The main tectonic features around the Project area which could be controlling the maximum earthquake are as follows:

a. Reshun Fault
b. Tirich Mir Fault
c. MKT
d. Chitral Fault
e. ShyokSture Zone, Bomb Barat Fault

A summary of the results calculated for the Feasibility Study, together with a brief description of is provided below:

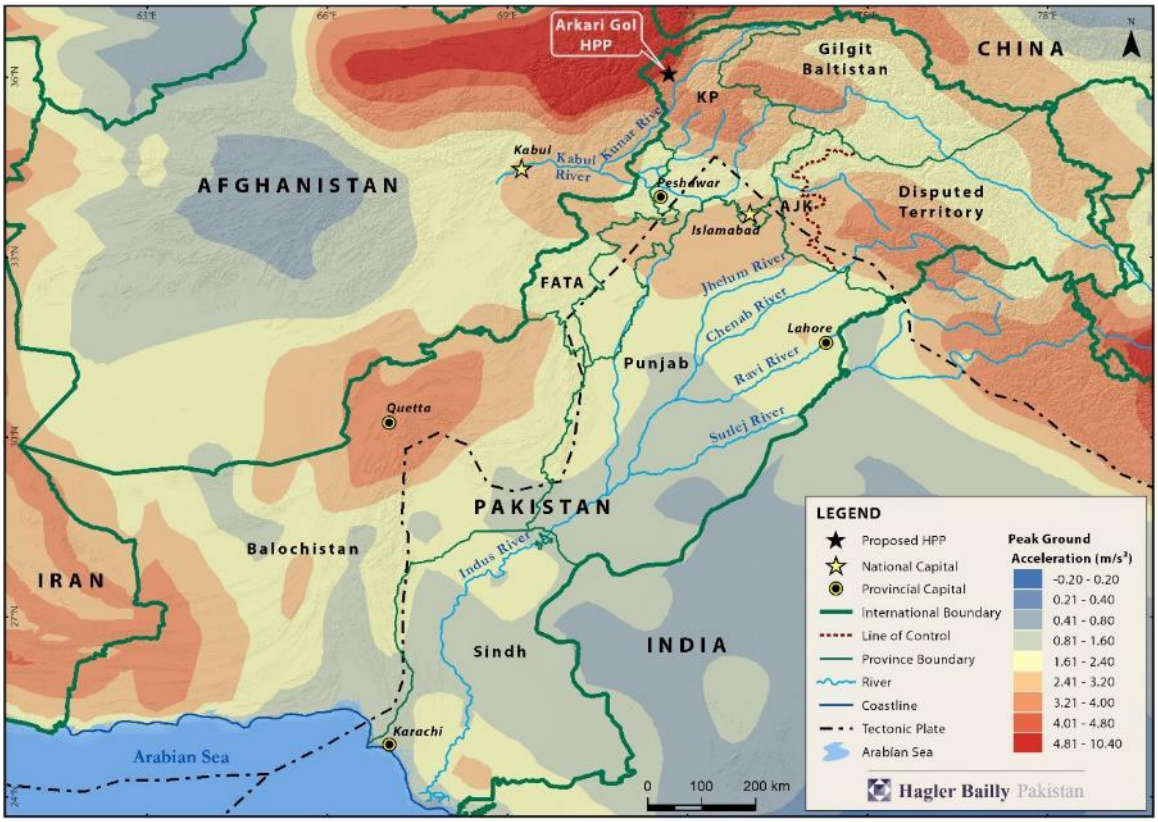
- The Maximum Credible Earthquake (MCE) is the largest reasonably conceivable earthquake that appears possible along a recognized fault or within a geographically defined tectonic province, under the specific tectonic framework governing the region of interest. The value for Peak Ground Acceleration (PGA) for MCE was calculated to be 0.61 g.
- The Maximum Design Earthquake (MDE) is the maximum level of ground motion for which a structure is designed. The MDE value recommended in the Feasibility study is 0.305 g based on a reduction factor of 2 with respect to MCE.

- The Operation Basis Earthquake (OBE) is the level of ground motion the dam shall be capable of resisting, remain operational, and not require extensive repairs. All structural components, which are part of or built within the main dam body, are designed to remain functional during and after an OBE event. For OBE; a value of 0.305 g was recommended. The OBE has probability of 10% of being exceeded in 50 years. However, as the Building Code of Pakistan prescribes a value of 0.34 g (discussed below) the OBE was increased to 0.34g to comply with the building code.

Global Seismic Hazard Assessment Project

The PGA calculated for Pakistan by the Global Seismic Hazard Assessment Project (GSHAP) is shown in **Exhibit 4.47**. The peak ground acceleration (PGA) with 10% probability of exceedance in 50 years (475 year average return interval) is reported and is between 4.01 meter per second squared (m/s^2) and 4.80 m/s^2 (0.41g to 0.49 g) at the Project site.

Exhibit 4.47: Seismic Hazard Map of Pakistan



Source: Adapted from Giardini, D., Grünthal, G., Shedlock, K. M. and Zhang, P.: The GSHAP Global Seismic Hazard Map. Annali di Geofisica 42 (6), 1225-1228, 1999.

Building Code of Pakistan

The revised Building code of Pakistan with Seismic Provision categorizes Pakistan into 5 seismic zones (see **Exhibit 4.48**). According to this classification the Project location

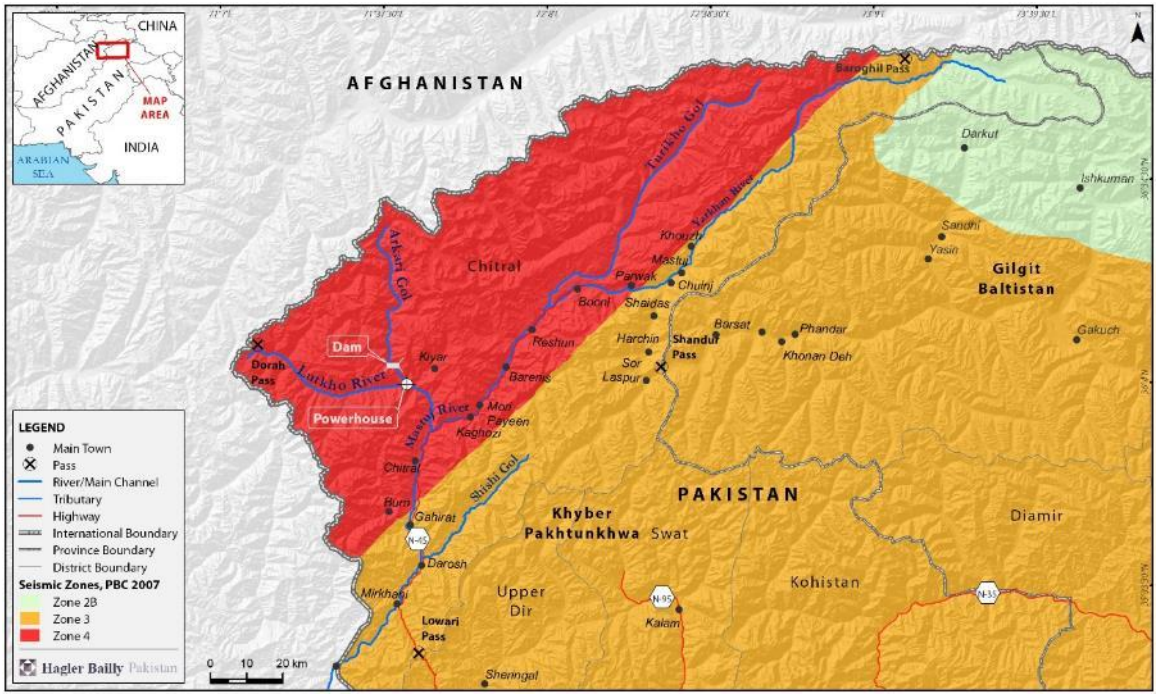
comes under seismic Zone 4 (see **Exhibit 4.49**) for which the Project is required to withstand a PGA greater than 0.32g (or 3.14 m/s^2).

Exhibit 4.48: Seismic Zone Categorization of the Pakistan Building Code

Seismic Zone	*Peak Horizontal Ground Acceleration*
1	0.05 to 0.08g
2A	0.08 to 0.16g
2B	0.16 to 0.24g
3	0.24 to 0.32g
4	> 0.32g

Source: Building code of Pakistan with Seismic Provision, 2007
Government of Pakistan Ministry of Housing and Works

Exhibit 4.49: Seismic Zones of the Pakistan Building Code



Source: Building code of Pakistan with Seismic Provision, 2007 Government of Pakistan Ministry of Housing and Works

Geology

The geology present at the Powerhouse, Damsite and the Headrace tunnel are described in this section.

Powerhouse Site

- The rocks at Power house area are gneissic type and phyllite, well bedded, medium to thick bedded, medium to hard, and splintery. The general strike is in the northeast to southwest direction and dipping toward northwest with 40° to 60° angle of dip. Large numbers of big rectangular blocks are lying at the site (see **Exhibit 4.50**) and others are inclined to fall from the ridge. As powerhouse is located at confluence of Arkari Gol and Lutkho river the quaternary deposits like scree and alluvium are present. The whole terrace is covered by cultivated land. The bed rock is covered under these deposits.

Dam Site

- The dam is located in a granitic outcrop. The granite body intrudes along the strike of the Wakhan formation which consists of slate, gneiss and quartzite (see **Exhibit 4.51**). The contact with granite is considered to be faulted but it could be a normal igneous contact as all the granite in Chitral has igneous normal contact in the Karakorum and Hindu Kush range. Tirich Mir granite also has similar origin and may have normal igneous contact with the Wakhan formation in the Project area.

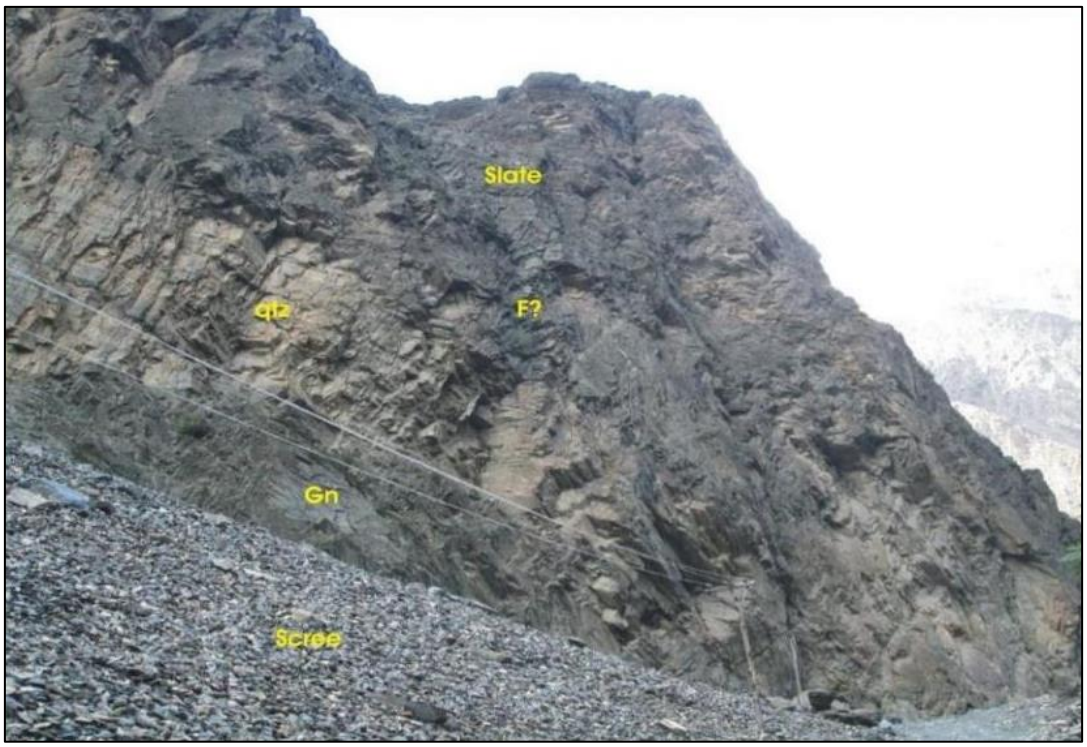
Headrace Tunnel

- From dam to the powerhouse, the tunnel crosses metamorphic and igneous rocks including phyllite, schist, gneisses, quartzite, and granite, which are described further below:
- **Gneiss** is a type of schist but the foliation is interrupted by the granular minerals like quartz, feldspar and garnet. These rocks are exposed in the area of Powerhouse, surge tank and tailrace area exhibiting breaking along the joint and foliation planes.
- **Phyllitic Slates** are dark, exceedingly fine grained, low grade metamorphic rocks. These rocks are exposed as a thick unit in the way of tunnel. The slate unit has white and grey color quartzite and two mapable beds of quartzite have been marked on the geological map. It is very hard, cliff forming, thin to thick bedded, fine to medium grained, well bedded, well jointed, and fractured.
- **Granite** is an acidic plutonic and light color rock. It occurs as major intrusive bodies such as batholiths and blocks. More than 50% of the tunnel length from the dam passes through granite body which the extension of Tirich Mir Granite. It is white color, very course grained and very phenocrystalline.

Exhibit 4.50: Fallen Blocks of Gneissic at the Powerhouse Site

Source: Feasibility Study for the Arkari Gol Hydropower Project, March 2014, PHYDO

Exhibit 4.51: Contact of three types of Rock i.e Gneiss (gn) Quartzite (qtz) and Slate



Source: Feasibility Study

Soil Quality

Soil was tested from the Study Area to document baseline conditions. A soil sample was collected from agricultural land near the Powerhouse site (36° 01' 11.9" N, 71° 44' 15.5" E). **Exhibit 4.52** presents photographs of the site and **Exhibit 4.53** shows the location. pH, EC, and organic parameters were tested at the HBP Lab, and the remaining parameters were tested at PINSTECH. Soil test results are summarized in **Exhibit 4.54** and lab reports are presented as **Appendix G**.

Exhibit 4.52: Soil Sampling Location and Method

Soil sample from agricultural field.

Soil sample collection.

Exhibit 4.53: Soil Sampling Location

Exhibit 4.54: Soil Quality at S-1

Parameter	*Analytical Method*	*Unit*	*LOR*	*Analysis Results*
pH	CSSS		0.1	7.08
EC	CSSS	µS/cm	1	343
Organic Matter	CSSS	%	0.1	2.57
Organic Carbon	CSSS	%	0.05	1.48
Silver	ICP-OES	µg/g	4.51	ND
Boron	ICP-OES	µg/g	1.79	5.05
Barium	ICP-OES	µg/g	1.02	90.00
Cadmium	ICP-OES	µg/g	0.24	ND
Chromium	ICP-OES	µg/g	0.44	30.98
Copper	ICP-OES	µg/g	1.02	27.91
Iron	ICP-OES	µg/g	1.70	41639.61
K	ICP-OES	µg/g	1.65	5861.25
Manganese	ICP-OES	µg/g	8.00	633.23
Nickel	ICP-OES	µg/g	0.19	33.24
Phosphate	ICP-OES	µg/g	0.39	2306.06
Lead	ICP-OES	µg/g	2.42	22.41
Zinc	ICP-OES	µg/g	1.31	93.48

CSSS: Canadian Society of the Soil Science
µS/cm: Microsiemens Per Centimeter
EC: Electrical Conductivity
LOR: Level of Reporting
ND: Not detected

4.2.3 Climate Baseline

The objective of the climate baseline is to characterize the climatic conditions in the Study Area. This includes characterization of the monthly trends in weather parameters (temperature, precipitation, relative humidity) and the extreme conditions that occur in the Study Area.

Data Sources

A regional climate overview was established using available data from Chitral weather station. This is the nearest Pakistan Meteorological Department (PMD) weather station to the Project. The description of weather station is presented in **Exhibit 4.55.**

Exhibit 4.55: Details of Chitral Weather Station

World Meteorological Organization (WMO) Identification Number	41506
Established	1964
Location	71° 50' E, 35° 50' N
Location with respect to dam site	27.5 km southeast
Location with respect to powerhouse site	21 km southeast
Elevation (m amsl)	1499
Data period used in the analysis	1964-1990 (27 Years)

Data Analysis

The climate analysis of Project area was carried out by classifying it into different seasons as below.

Spring (mid-March to mid-June)

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

Summer (mid-June to mid-September)

The summers are hotand dry, with temperatures reaching highs of 35ºC in July and average precipitation of 6-7mm per month..

Autumn (mid-September to mid-November)

Characterized by moderate temperatures and low rainfalls. Daily minimum reaches 5ºC in November with moderate humidity, as the humidity again reduces after monsoon and low speed-winds.

Winter (mid-November to mid-March)

Characterized by very low temperatures, with an average daily maximum of 10ºC, moderate rainfalls, with an increasing amount of rainfall at the end of the winter

The summary of climate analysis is presented in **Exhibit 4.56**. The parameters are tabulated in **Exhibit 4.57** and graphed in **Exhibit 4.58** to **Exhibit 4.60.**

Exhibit 4.56: Seasonal Variation

Season	*Temperature and Humidity*	*Rainfall*
Spring *(mid-March to mid-June)*	Daily maximum temperature averages between 15°C and 34°C. Daily minimum gradually increases from 9°C in March to 26°C in June. Morning humidity reduces from 67% in March to 47% in June. Same trend was observed in afternoon humidity that also reduces from 36% in March to 14% in June.	31% of total rainfall occur in summers with maximum amount of rainfall observed in April (208 mm). The mean number of rainy days during this period ranges from 0.5 to 7.7 per month.
Summer *(mid-June to mid-September)*	Daily maximum temperature increases by a few degrees and averages between 31°C and 36°C. Daily minimum temperatures gradually increases and varies between 13.3°C and 17.9°C. Morning humidity increases up to 76% in September. Afternoon humidity increases to 24% in August and then reduces to 21% in September.	Only 5% of total rainfall occur in this season with maximum amount of rainfall observed in September (67.8 mm). The mean number of rainy days during this period are between 0.5 to 0.9 per month.
Autumn *(mid-September to mid-November)*	Daily maximum temperature decreases by about 16°C in November. Daily minimum temperatures start decreasing and drops to 2.9°C by November. Morning humidity decreases to 60% in November. Afternoon humidity gets increased to 28% in November.	By the end of September, the rainfall starts increasing. About 8% of total rainfall occur in post-monsoon summer. Maximum rainfall of 83 mm has been observed in the month of November. The number of rainy days are less than 1.5 during these months.
Winter *(mid-November to mid-March)*	Daily maximum temperature averages between 9°C and 15°C. Daily minimum temperature averages between below 0°C and 4°C. Morning humidity again increases to 67% in March. Afternoon humidity remains almost same (36%) and it starts decreasing in march (36%).	The amount of rainfall starts increasing with the advent of winter. About 56% of the total rainfall occurs during this season with maximum amount in February (281 mm). The mean number of rainy days are between 3.6 and 7.7 per month.

Exhibit 4.57: Weather Parameters

Month	*Temperature (^{0}C)*			*Humidity (%)*		*Rainfall (mm)*	*Number of Rainy days*
	Mean	*Min*	*Max*	*5:00 AM*	*5:00 PM*		
Jan.	4.1	-0.7	8.8	64	38	36.8	3.6
Feb.	5.4	0.6	10.1	65	38	63.4	5.4
Mar.	9.6	4.2	15	67	36	106.7	7.7
Apr.	15.2	8.4	21.9	70	31	88.5	7.1
May.	20.2	12.5	27.8	62	23	44.6	3.5
Jun.	26.2	17.9	34.4	47	14	5.5	0.5
Jul.	28.1	20.2	36	62	19	6.2	0.7
Aug.	26.8	18.8	34.7	73	24	6.5	0.7
Sep.	22.3	13.3	31.2	76	21	7.7	0.9
Oct.	16.2	7.5	25	71	25	16.1	1.7
Nov.	10.7	2.9	18.5	60	28	19.5	1.9
Dec.	5.7	0	11.3	64	38	41.4	3.6

Exhibit 4.58: Mean Monthly Temperatures (°C)

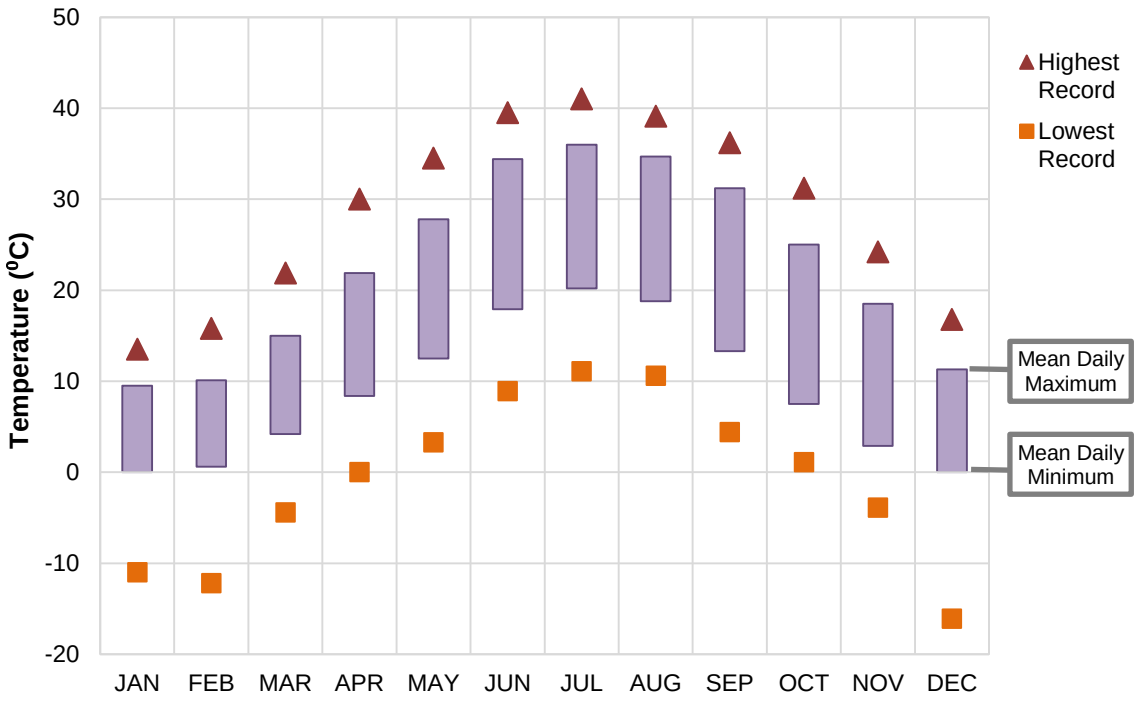


Exhibit 4.59: Mean Monthly Relative Humidity (%)

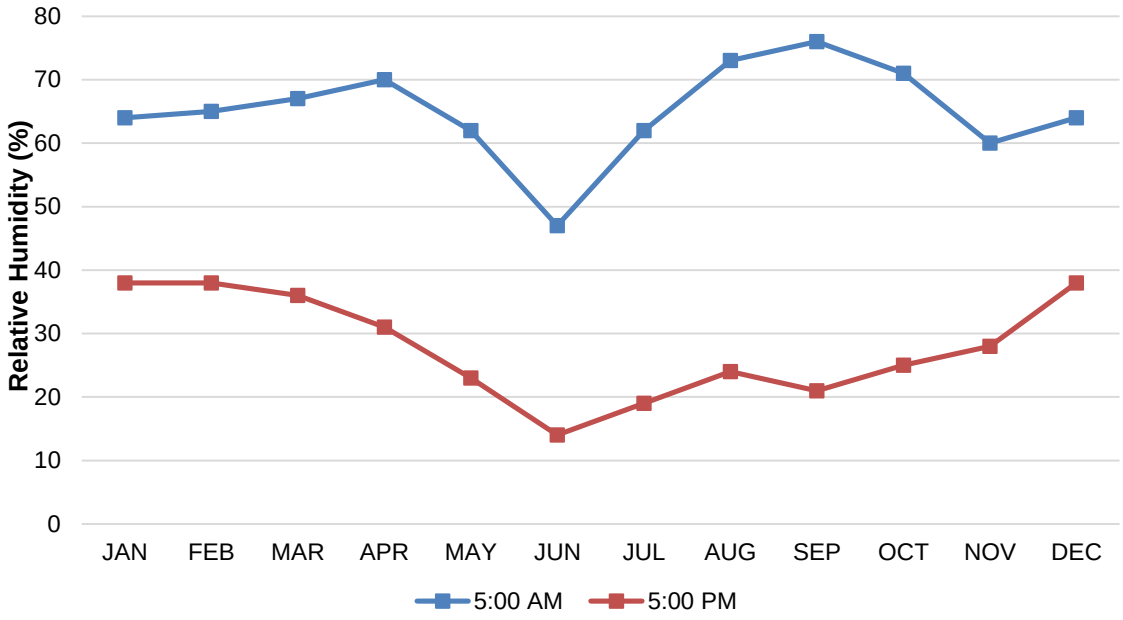
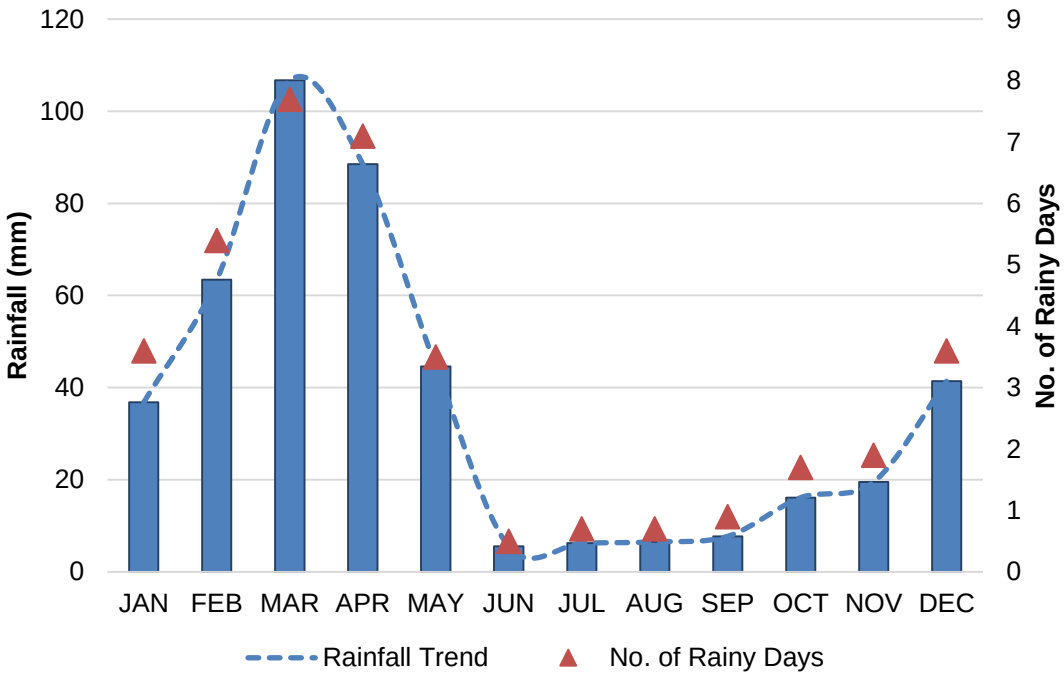


Exhibit 4.60: Mean Monthly Rainfall (mm)



Extreme Events

Weather extremes recorded at the Chitral weather station are given in **Exhibit 4.61** for temperature and in **Exhibit 4.62** for precipitation.

Exhibit 4.61: Temperature Extremes, 1961-1990 (°C)

	Highest Recorded	*Date*	*Lowest Recorded*	*Date*
January	17.2	14/1965	-11	29/1977
February	21	28/1985	-12.2	2/1969
March	28	22/1974	-4.4	18/1966
April	34.3	29/1988	0	7/1975
May	38.3	28/1971	3.3	22/1965
June	42.5	26/1984	8.9	2/1982
July	44.4	10/1971	11.1	6/1989
August	42.8	10/1970	10.6	31/1989
September	39.8	17/1990	4.4	18/1967
October	35	1/1970	1.1	31/1987
November	27.2	7/1970	-3.9	26/1970
December	20.7	4/1990	-16.1	27/1965
Year	44.4	July 10, 1971	-16.1	December 27, 1965

Exhibit 4.62: Extreme Precipitation Conditions, 1961-1990 (mm)

	Wettest Month		*Driest Month*		*Heaviest Rainfall in 24 hours*	
January	94.3	1977	0	1987	37.3	26/1974
February	123.2	1972	9.3	1978	61.7	23/1972
March	281.4	1966	7.4	1974	54.6	17/1966
April	208.3	1965	8.4	1982	64	18/1965
May	176.8	1972	0.3	1971	90.7	22/1965
June	64.5	1987	0	-9	35.4	3/1987
July	36.6	1966	0	-9	15.5	4/1965
August	28.7	1988	0	-6	16	27/1988
September	67.8	1972	0	1988	29.7	19/1972
October	62.5	1987	0.3	1982	44.2	2/1973
November	83.1	1982	0	-5	44	16/1982
December	119.3	1990	1.8	1966	80.5	30/1984
Year	779	1972	110.4	1964	90.7	22 May 1965

4.2.4 Climate Patterns in Arkari Gol Region

A number of different datasets to characterize the climate of the Project area are available. These include weather station data from weather stations operated by the Pakistan Meteorological Department (PMD) and Water and Power Development

Authority (WAPDA) as well as multiple gridded datasets. Chitral station is the nearest station located at a distance approximately of 26 km to the south of Project site. Other weather stations which have been considered are: Drosh station in south of proposed dam site with approximated distance of 56 km and Ashkasham station in Afghanistan at a distance ~ 71 km in north direction of Project site. Chitral and Drosh stations are located at downstream of Project. Precipitation observations are available for all three stations while temperature observations are available for Chitral and Drosh stations only. The mean monthly temperature is provided in **Exhibit 4.63** and **Exhibit 4.64** and mean monthly precipitation data is provided in **Exhibit 4.65** to **Exhibit 4.67**.

Most of the stations operated by the Pakistan Meteorological Department (PMD) in high altitudes are not representative of the respective catchments, as these are located in the valleys, and there is a positive correlation, particularly between winter precipitation and elevation, in the region. Therefore, point data, i.e. Chitral, Drosh and Ashkasham stations data, is not best to characterize catchment climate characteristics. With respect to any climate change risk assessment for the Project, a gridded dataset is likely to be a requirement to specify the baseline. Gridded datasets that rely solely on station data, typically under-predict the winter rainfall, and in some instances severely under-predict the South Asian Summer Monsoon (SASM). As an example, the Asian Precipitation - Highly-Resolved Observational Data Integration Towards Evaluation (APHRODITE) dataset, which is widely considered to be the best state-of-art dataset available, since it has the largest climate station network and provides very high resolution (spatial) data, severely under-predicts Monsoon rainfall in most regions of Pakistan. The dataset is limited by the sparse gauging station data in Pakistan. Another commonly cited dataset in peer-reviewed journal literature is the Climate Research Unit (CRU) dataset. This is typically utilized as a monthly baseline in peer reviewed literature for climate change as well as for assessment of GCM historic modelled results. However, the CRU dataset has very low spatial resolution, and is only useful for analysis of baseline trends on a larger scale. In contrast to APHRODITE and CRU, the WorldClim dataset has higher spatial resolution, and provides the greatest advantage, particularly for hydrologic modelling aspects, as it uses a large amount of climate station gauging data, covariates (to varying degrees) such as elevation and distance from the coast, and satellite data that offers some improvement.

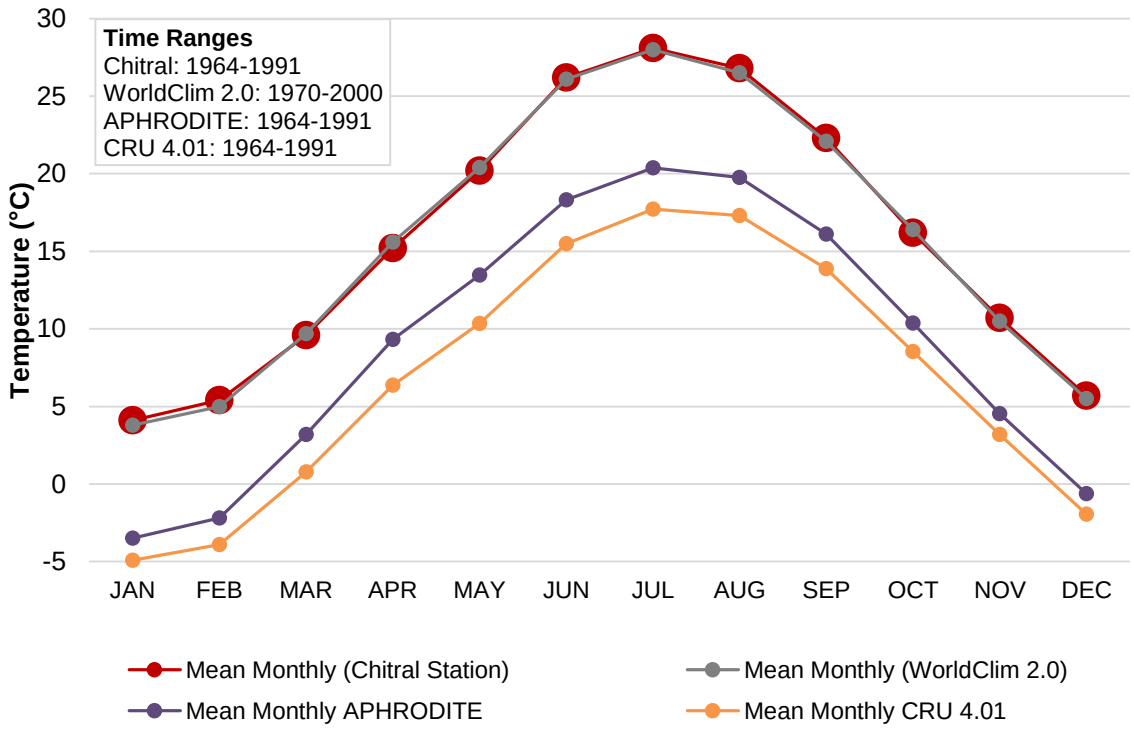
A comparison of point stations vs gridded datasets has been shown in **Exhibit 4.63** to **Exhibit 4.67.** The comparison suggests that APHRODITE and CRU datasets underestimates temperature throughout the year while WorldClim best approximate temperature with respect to weather stations (**Exhibit 4.63** and **Exhibit 4.64)**. On the other hand, in terms of precipitation (**Exhibit 4.65** to **Exhibit 4.67**), CRU overestimates precipitation especially in Monsoon period. Precipitation overestimation by CRU is well expected due to its larger grid cell. Overall, comparison shows that WorldClim 2.0 dataset gives best approximation for temperature and precipitation and thus can be used for climate change patterns analysis.

The mean monthly temperature and precipitation from the gridded WorldClim 2.0 dataset are provided in **Exhibit 4.68** to **Exhibit 4.71.** A comparison at Chitral and Drosh station shows a good match between stations and WorldClim 2.0 temperatures (**Exhibit 4.63** and **Exhibit 4.64**). However, there is a mismatch in precipitation especially at Ashkasham

station, where the WorldClim 2.0 dataset over predicts the winter westerly (**Exhibit 4.67**). Thus, where and if a gridded dataset is required for further analysis as part of further studies, bias correction will need to be performed for the precipitation dataset to adjust, based on data from a network of weather stations.

Two contrasting climatic regimes govern in the northern Pakistan including the winter westerlies and the SASM. Based on the WorldClim dataset (**Exhibit 4.70** and **Exhibit 4.71**), the Arkari Gol catchment is totally run by winter westerlies and area does not get any impression of SASM [70] and thus have least precipitation in summer season in contrast to other regions of Pakistan. Arkari Gol region starts getting increase in precipitation in December (winter) and receives maximum amount of precipitation in March and April. Once the winter season sets-off, precipitation starts decreasing and reaches to significantly low value in summer and summer monsoon seasons. September is the month with least precipitation.

Exhibit 4.63: Mean Monthly Temperature Comparisons at Chitral Station



[70] Also known as the South-West Monsoon

Exhibit 4.64: Mean Monthly Temperature Comparisons at Drosh Station

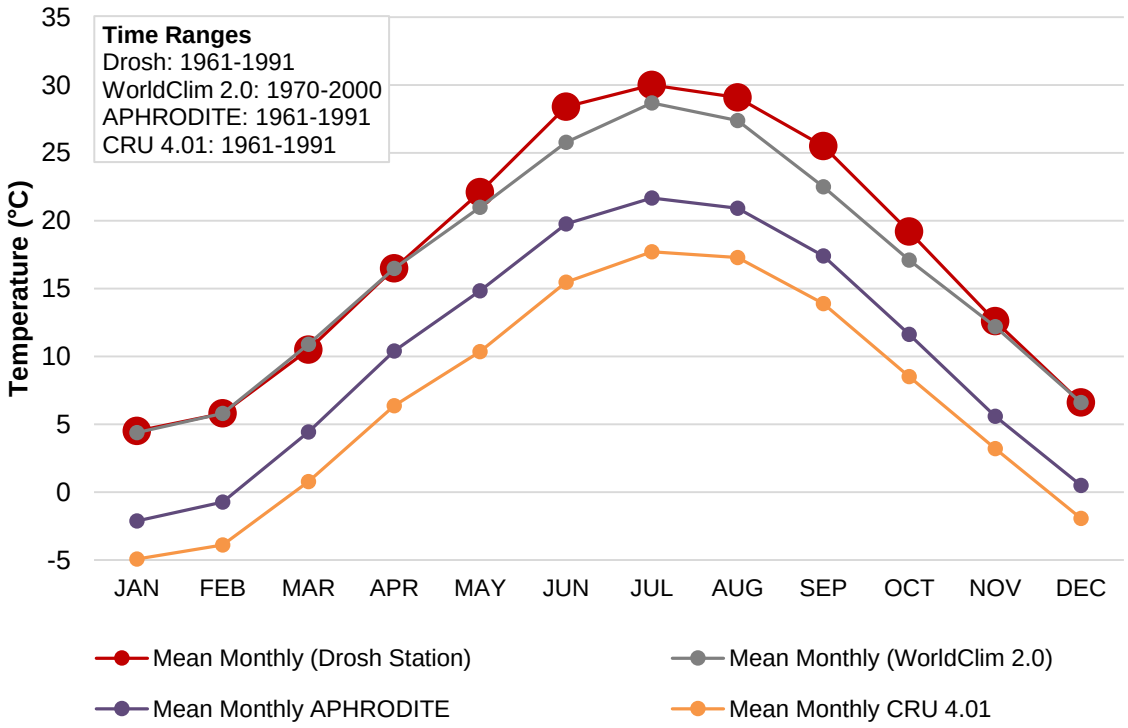


Exhibit 4.65: Mean Monthly Precipitation Comparisons at Chitral Station

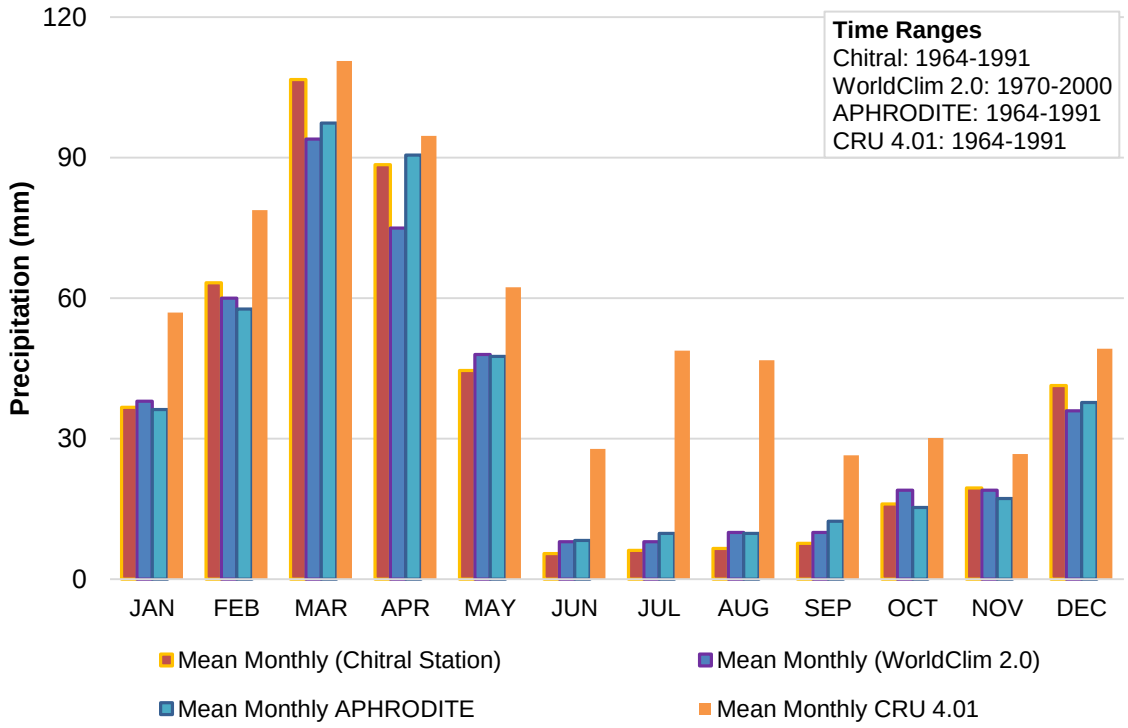


Exhibit 4.66: Mean Monthly Precipitation Comparisons at Drosh Station

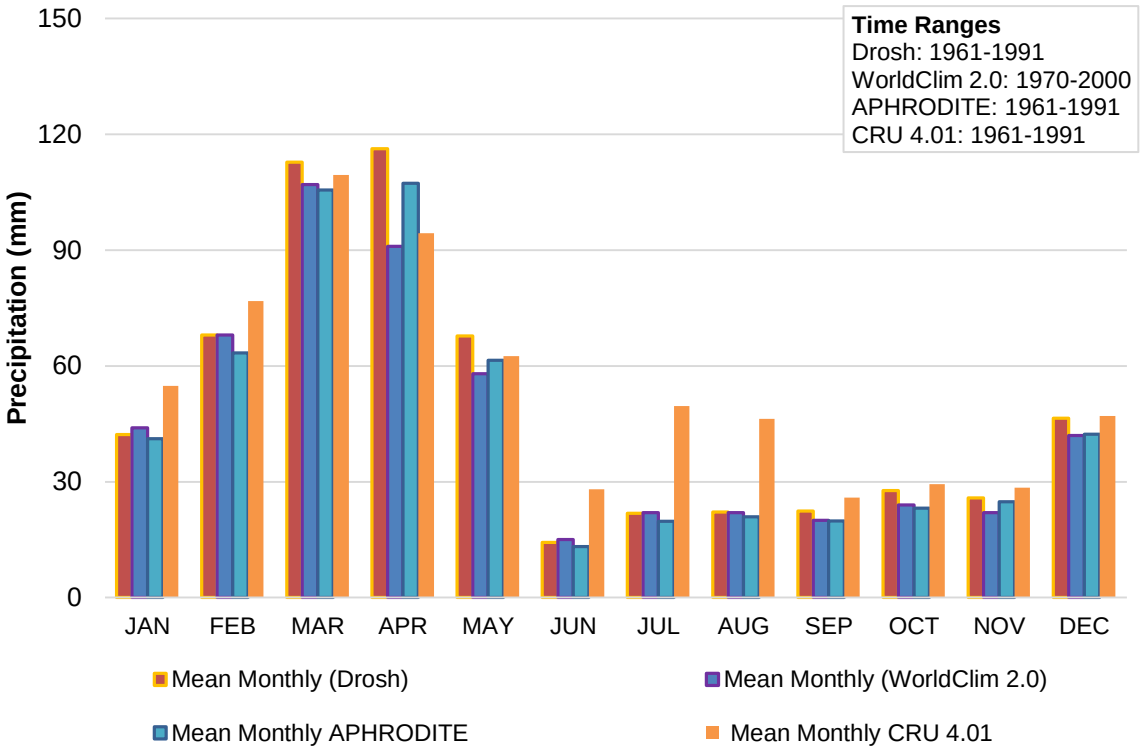


Exhibit 4.67: Mean Monthly Precipitation Comparisons at Ashkasham Station

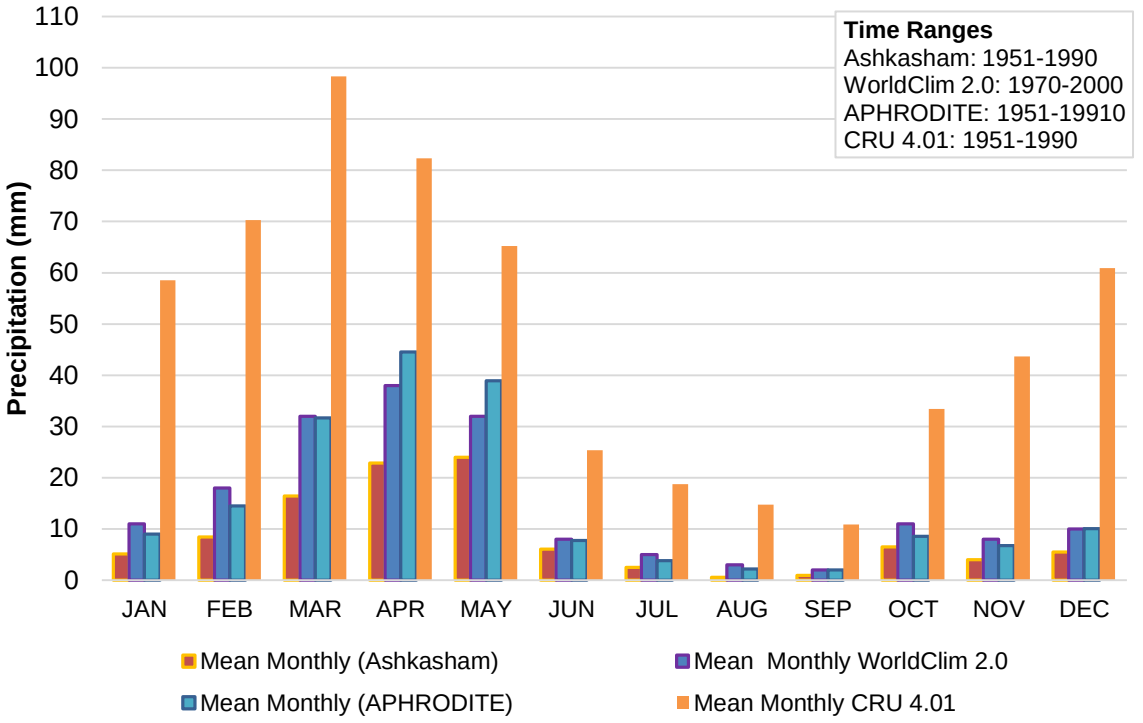


Exhibit 4.68: Mean Monthly Temperature at Larger Scale (WorldClim 2.0)

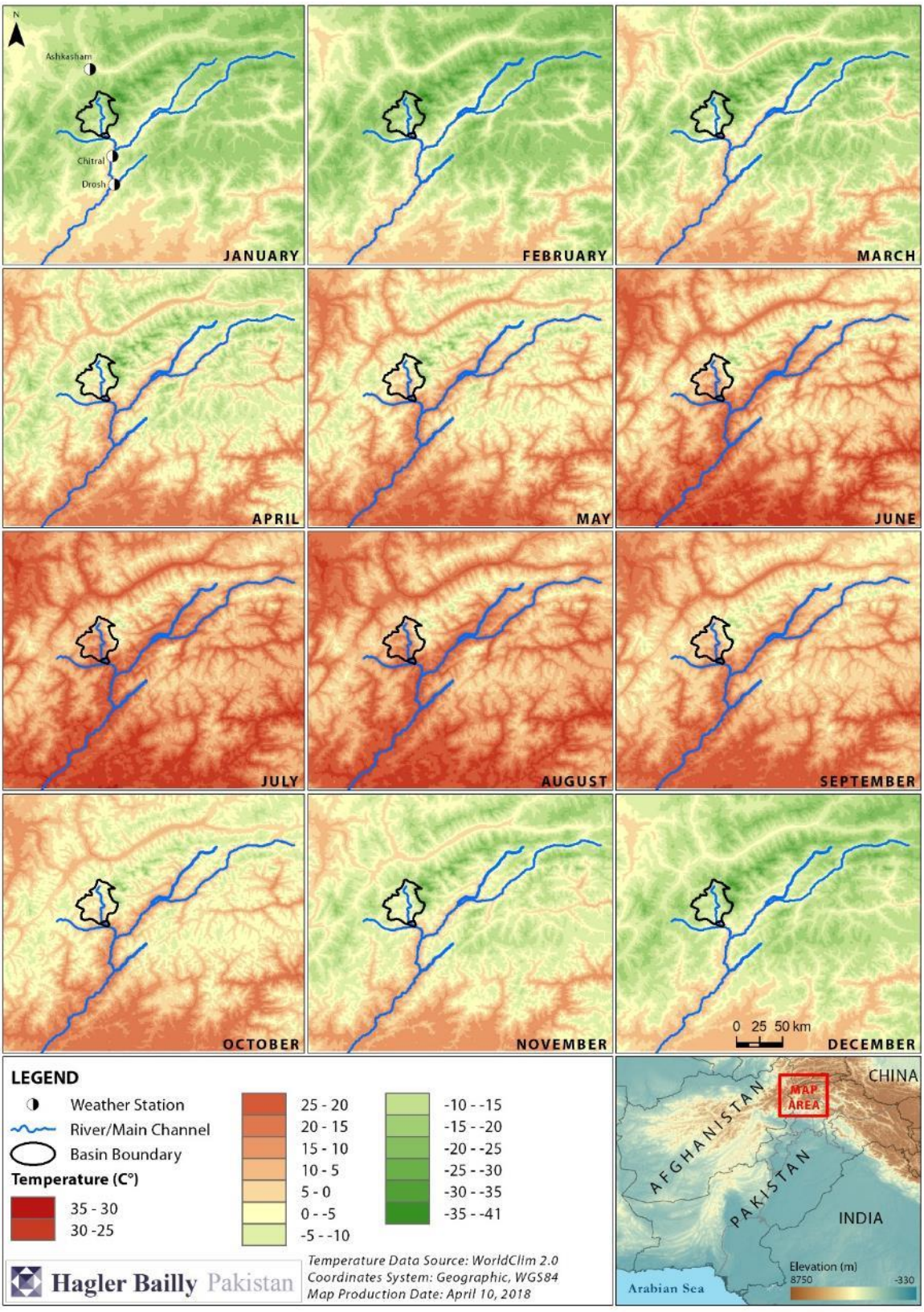


Exhibit 4.69: Mean Monthly Temperature at Arkari Gol Basin (WorldClim 2.0)

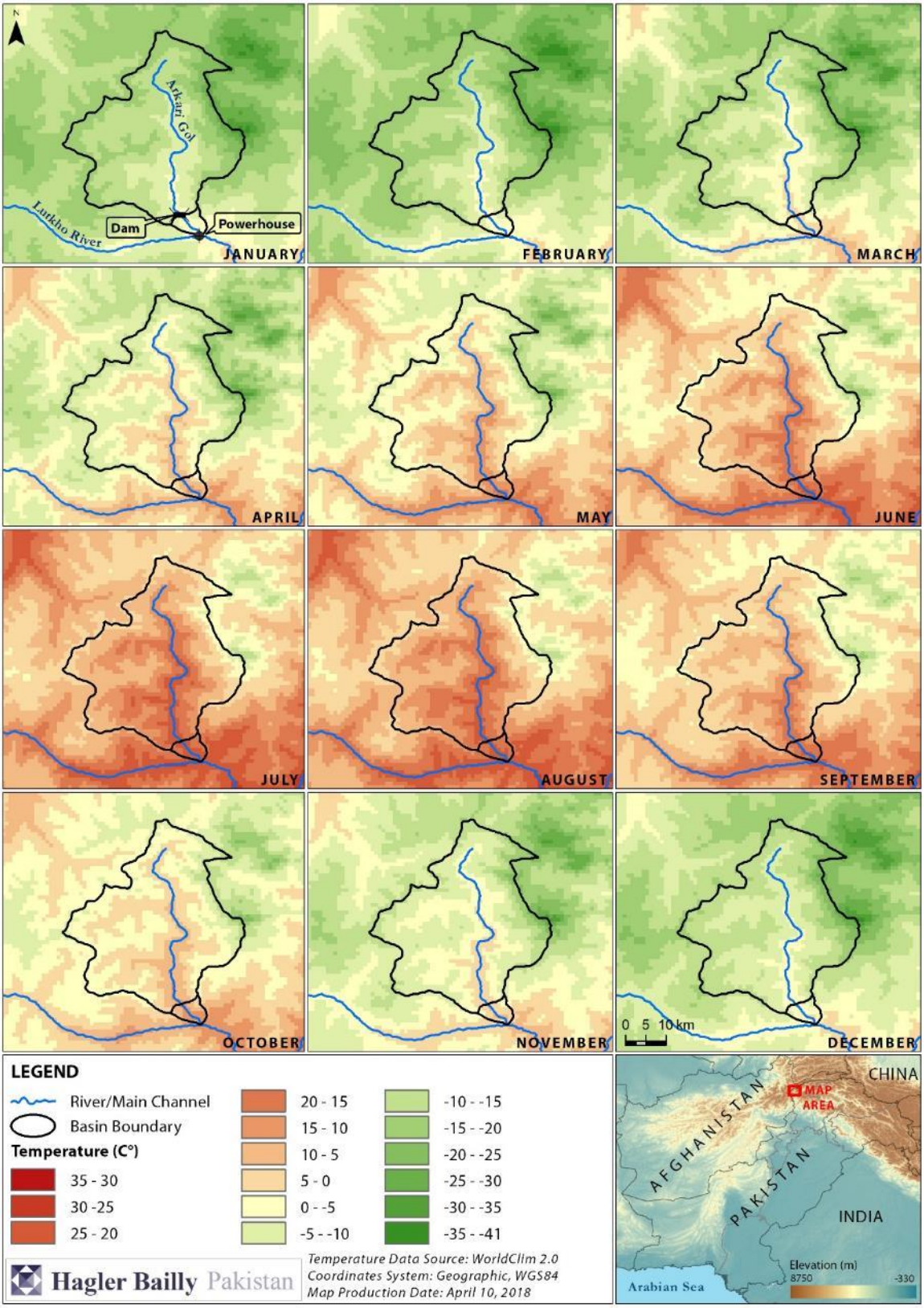


Exhibit 4.70: Mean Monthly Precipitation at Larger Scale (WorldClim 2.0)

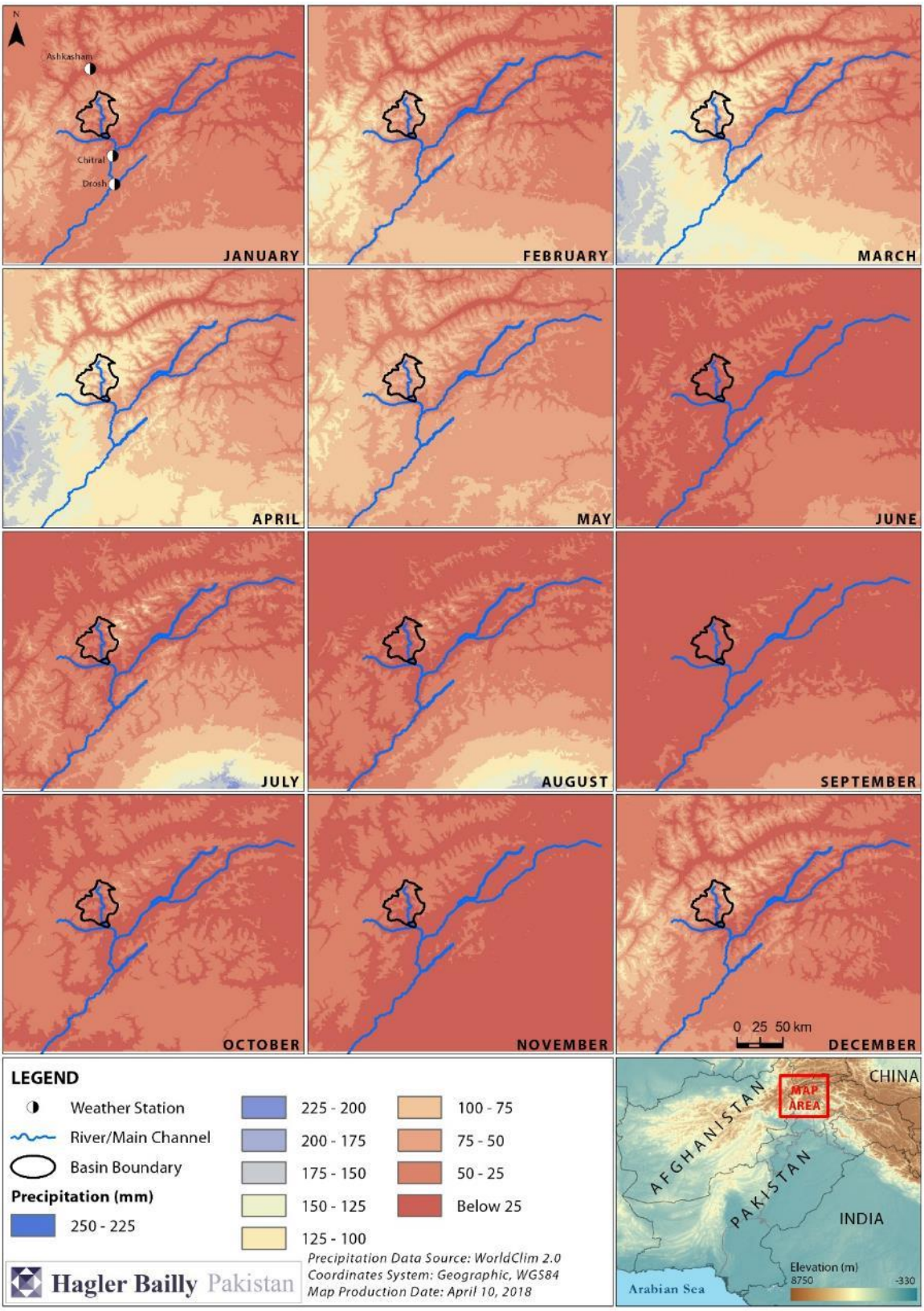
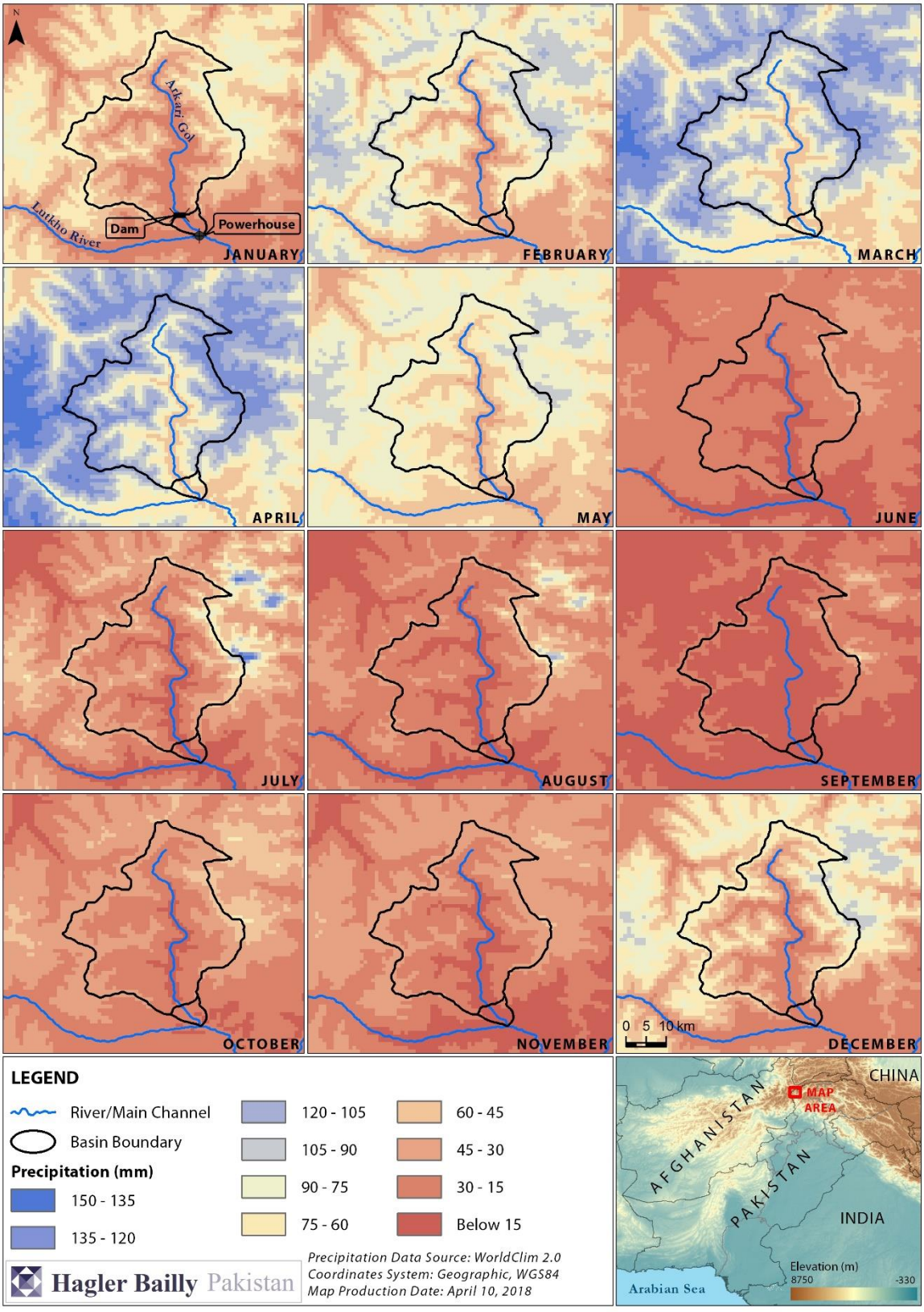


Exhibit 4.71: Mean Monthly Precipitation at Arkari Gol Basin (WorldClim 2.0)

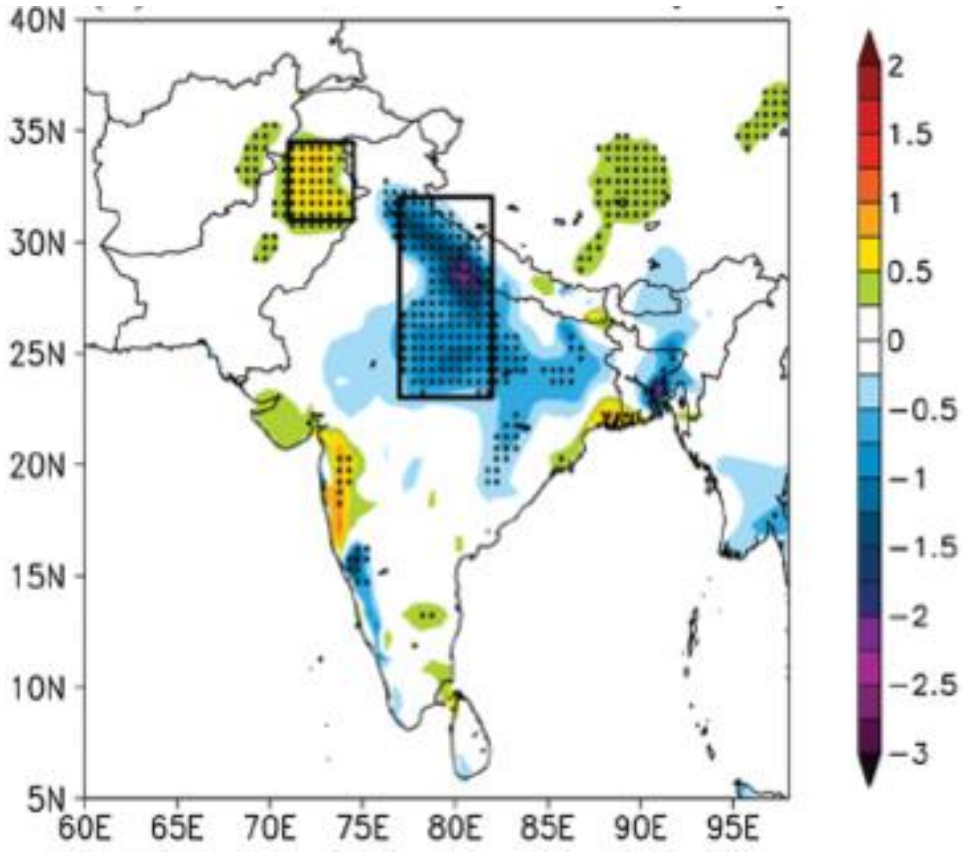


Trends in Precipitation

Observed trends indicate that the annual, as well as June, July, August and September (JJAS) rainfall, i.e. SASM rainfall, over most of India is decreasing.[71] [72] However, the trend in Pakistan shows increasing JJAS rainfall (**Exhibit 4.72**). **Exhibit 4.72** indicates that the Arkari Gol catchment has a consistent status for JJAS precipitation i.e. there is no trend in precipitation.

Analysis of WorldClim 2.0 dataset indicates that the Arkari Gol region receives most of the precipitation in December, January, February, March and April (majority in winter season) due to a phenomena called Western Disturbances. Different studies have shown an increase in temperature in this region but there are no major trends in the winter seasonal precipitation. However, there is a significant increase in the occurrence of extreme precipitation events in recent decades[73].

Exhibit 4.72: Trend in SASM Rainfall - JJAS (1951-2011) using CRU dataset (mm/year)



Source: Latif, M., Syed, F., & Hannachi, A. (2016). Rainfall trends in the South Asian summer monsoon and its related large-scale dynamics with focus over Pakistan. Climate Dynamics, 48(12), 3565-3581.

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[71] Latif, M., Syed, F., & Hannachi, A. (2016). Rainfall trends in the South Asian summer monsoon and its related large-scale dynamics with focus over Pakistan. Climate Dynamics, 48(12), 3565-3581.

[72] Kumar, V., Jain, S. K. & Singh, Y. (2010) Analysis of long-term rainfall trends in India. Hydrol. Sci. J. 55(4), 484–496.

[73] Madhura, R. K., R. Krishnan, J. V. Revadekar, M. Mujumdar, and B. N. Goswami. "Changes in western disturbances over the Western Himalayas in a warming environment." Climate dynamics 44, no. 3-4 (2015): 1157-1168.

4.2.5 Ambient Air Quality

This section describes the current ambient air quality in the area where Project activities are proposed. As traffic volumes are minimal (see **Section 4.2.8**) and housing density is sparse, low levels of anthropogenic sources of air pollutants are expected. Particulate matter, however, is often high in the region due to natural sources.

Therefore, respirable particulate matter (both coarse (PM_{10})[74] and fine ($PM_{2.5}$)[75]), was selected as a pollutant for evaluation, based on baseline emission sources in the area, the expected emissions from the Project activities, and the level of risk to human health.

Methodology and Sampling Locations

Air quality sampling was carried out at three different locations for 24 hours each in the Study Area between March 29 and April 1, 2018. A description of the air quality samples (including locations of sampling) and the rationale of selection of each sampling site is given in **Exhibit 4.73**.

Particulate matter was sampled using Airmetrics MiniVol Portable Air Samplers. This equipment draws an air sample through an inlet by a vacuum pump at a fixed flow rate. The particulates are filtered using an impactor and collected on a filter paper which is dried and weighed after the sampling to obtain the weight of particulates in the sampled volume of air. The samples were analyzed in the HBP Laboratory, Islamabad after collection. Weather data[76] was collected alongside sampling for particulate matter using a Kestrel 5500 weather meter.

Photographs of the sampling sites are shown in **Exhibit 4.74**. The sampling locations, along with nearby settlements and roads are shown in **Exhibit 4.75.**

Exhibit 4.73: Details of Air Quality Samples and Locations

Sample ID	*Coordinates*	*Altitude (m)*	*Location*	*Rationale for Site Selection*
A1	36° 01' 11.6" N 71° 44' 16.1" E	1846	Andahti Village	To document baseline air quality at the Powerhouse construction site.
A2	36° 02' 07.5" N 71° 43' 22.7" E	1922	Mumi Village	To document baseline air quality near the temporary construction facility.
A3	36° 04' 10.5" N 71° 41' 32.9" E	2206	Uchhtar Village	To document baseline air quality near the Dam construction site.

[74] PM_{10} is particulate matter 10 micrometers or less in diameter

[75] $PM_{2.5}$ is particulate matter 2.5 micrometers or less in diameter

[76] Weather data includes wind speed and direction, temperature, humidity and barometric pressure.

Exhibit 4.74: Ambient Air Quality Sampling Site Photographs

Weather meter and PM samplers at A1

Weather meter and PM samplers at A2

Weather meter and PM samplers at A3

Results and Analysis

The air quality sampling results are summarized in **Exhibit 4.76** and measured weather parameters during sampling in **Exhibit 4.77.** The values exceeding either the NEQS or the IFC-EHS guidelines are highlighted. The complete lab results are provided in **Appendix G**.

The following analysis of results are presented:

- PM_{10} and $PM_{2.5}$ readings were well within the IFC EHS interim target 1 guideline values at all locations.
- The 24-hour PM_{10} concentration comply with the NEQS at all sampling locations. The level of PM_{10} is ranges between about 52-78% of the limit.
- The 24-hour $PM_{2.5}$ concentration does not comply with NEQS at A2 and A3.
- The highest readings for both PM_{10} and $PM_{2.5}$ were recorded at A2 (Mumi village) which is a settlement along the road and near the temporary construction site 2.

Exhibit 4.75: Air Quality Sampling Locations

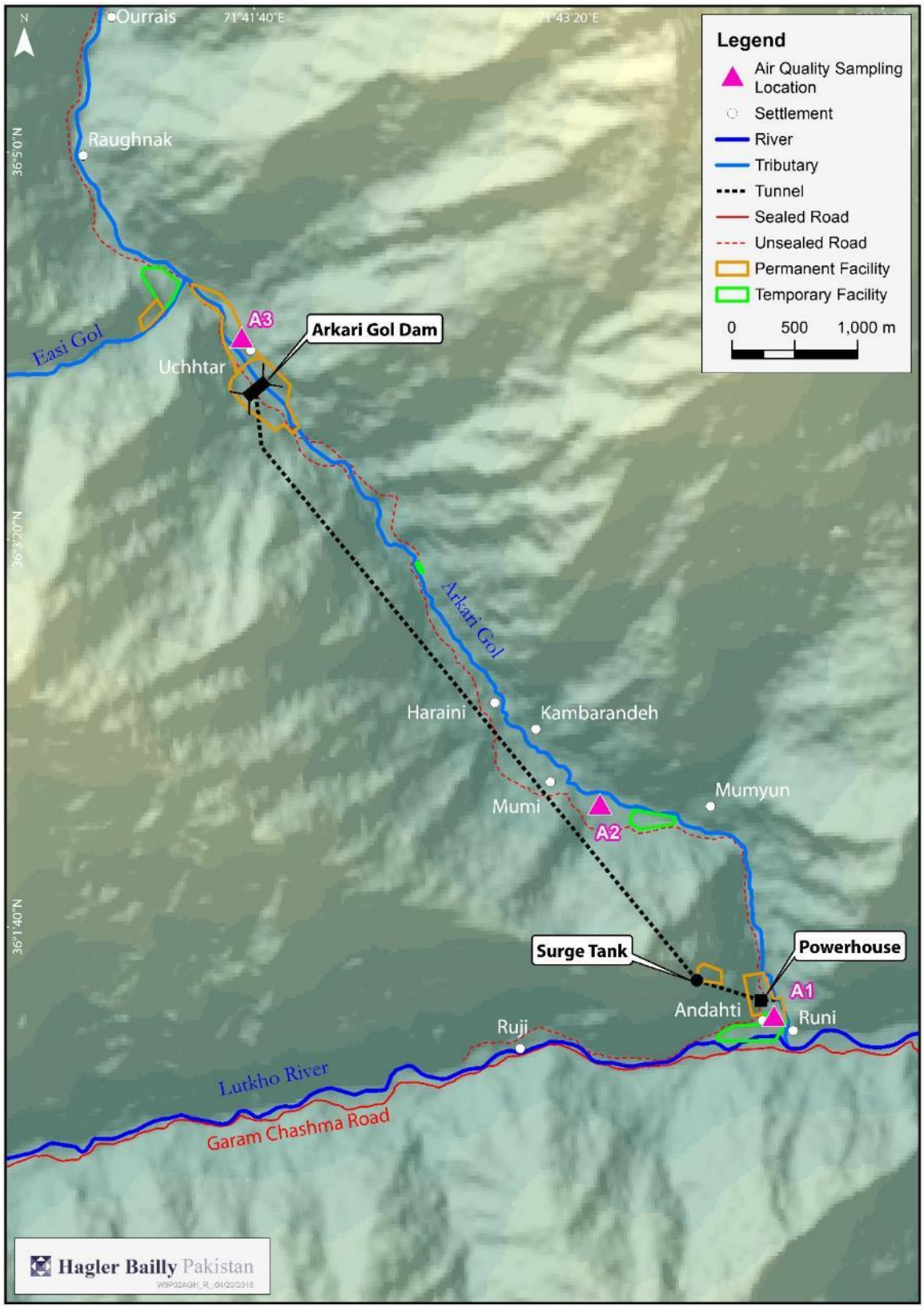


Exhibit 4.76: Results of Ambient Air Quality Sampling (µg/m^3)

Sample ID	*PM_{10}*	*$PM_{2.5}$*
LOR	100 µg	100 µg
A1	77.90	25.96
A2	117.33	65.17
A3	95.21	39.26
NEQS (24-hour)	**150**	**35**
IFC EHS (24-hour – interim target 1)	**150**	**75**

Note: LOR: Level of Reporting

Exhibit 4.77: Results of Weather Parameters during Air Sampling (µg/m^3)

Sample ID		*Temperature (deg C)*	*Relative Humidity (%)*	*Barometric Pressure (mb)*	*Wind Speed (m/s)*
A1	Min	5.2	11.8	819.7	0.0
	Mean	13.2	34.1	822.1	1.5
	Max	22.9	58.1	824.5	7.1
A2	Min	7.2	8.5	809.2	0.0
	Mean	15.1	33.0	812.7	0.5
	Max	28.9	64.0	814.7	4.4
A3	Min	11.8	12.7	779.7	0.0
	Mean	18.0	25.3	782.6	0.8
	Max	28.2	35.7	784.5	2.9

4.2.6 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 is defined as a loud, undesired sound that interferes with normal human activities. If it affects the well-being of the surrounding community (environmental noise), it is considered a nuisance and normally has no direct health impacts. Exposure to very high noise levels (exceeding 85 dBA), particularly for prolonged period can cause hearing loss. This level of noise is usually encountered in the workplace around construction sites and is considered an occupational hazard.

In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is clearly noticeable, and an increase of 10 dB is perceived as a doubling of sound level

The following is a brief description of terminology used in this assessment:

- *Sound*: A vibratory disturbance created by a vibrating object, which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone
- *Noise*: Sound that is loud, unpleasant, unexpected, or otherwise undesirable
- *Decibel (dB)*: A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals
- *A-Weighted Decibel (dB(A))*: An overall frequency-weighted sound level in decibels, which approximates the frequency response of the human ear. The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts on people, an electronic filter is used that de-emphasizes certain frequencies in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies. All of the noise levels reported in this Section are A-weighted.
- *Equivalent Sound Level (L_{eq})*: The equivalent steady state sound or vibration level, which in a stated period of time, typically one hour, would contain the same acoustical or vibration energy.

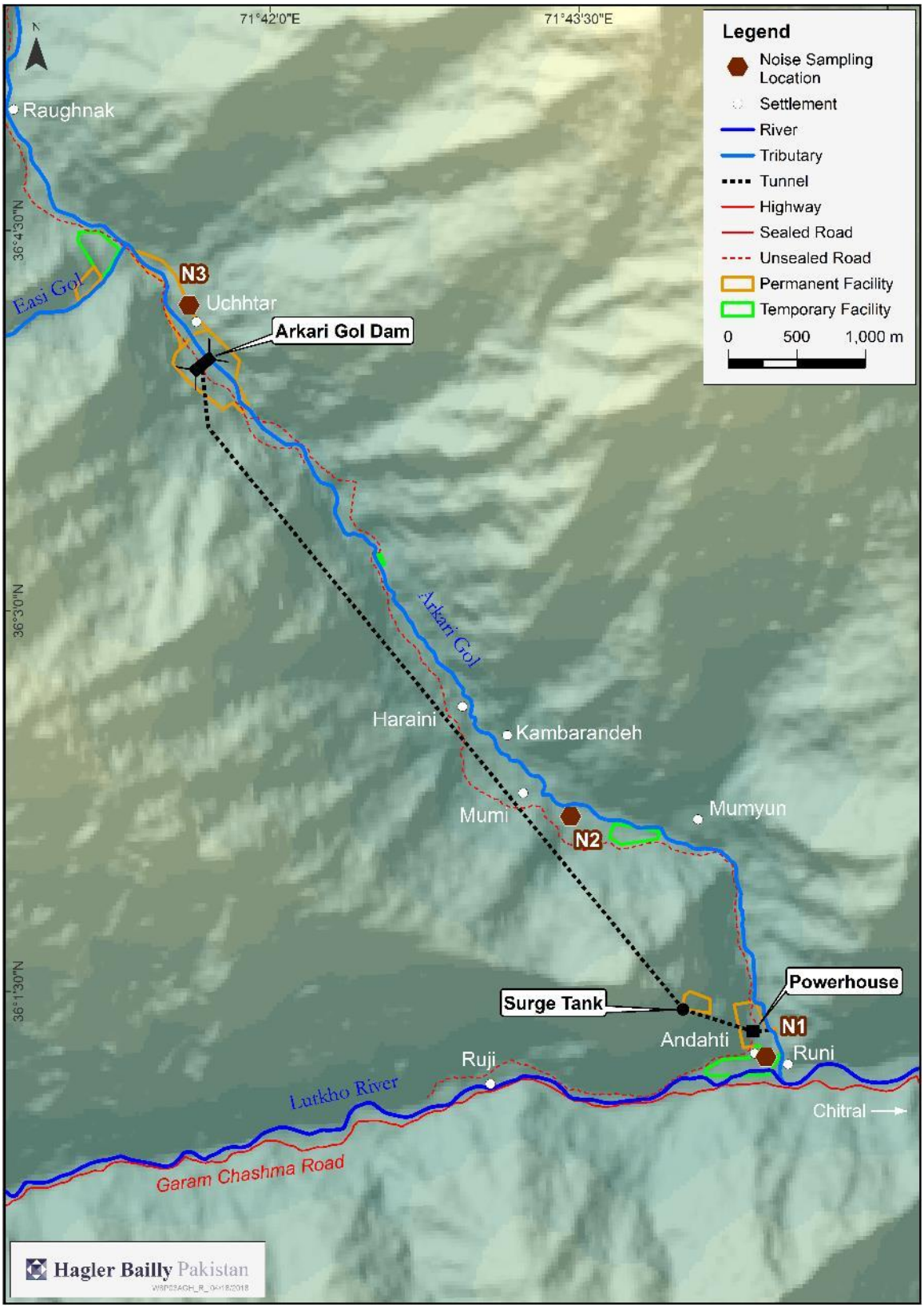
Methodology and Sampling Locations

Noise measurements were taken at three locations listed in **Exhibit 4.78** and shown in **Exhibit 4.79**. Noise readings were taken for 24 hours at each site.

Exhibit 4.78: Noise Sampling Locations

ID	*Location*	*Coordinates*	*Dates of Survey*	*Description*
N1	Andahti Village	36° 01' 09.4" N 71° 44' 15.8" E	March 29 to 30, 2018	Settlement and road near Powerhouse site.
N2	Mumi Village	36° 02' 07.6" N 71° 43' 20.8" E	March 30 to 31, 2018	Settlement and road near temporary construction facility.
N3	Uchhtar Village	36° 04' 11.1" N 71° 41' 33.7" E	March 31 to April 1, 2018	Settlement and road dam site.

Exhibit 4.79: Noise Sampling Locations



The noise levels were measured using portable Cirrus Research plc.'s sound level meter, Model CR:1720. The instrument meets the International standards IEC 61672-1:2002, IEC 660651:1979, IEC 60804:2001, IEC 61260:1995, IEC 60942:1997, IEC 61252:1993, ANSI S1.4-1983, ANSI S1.11-1986, and ANSI S1.43-1997 where applicable. The instruments have a resolution of 0.1 dB.

The meter was calibrated at the start of measurement at each site, using Cirrus Research plc.'s acoustic calibrator, Model: CR:514. The instrument was mounted on a tripod, to avoid interference from reflecting surfaces within the immediate neighborhood, and a wind shield was used in all measurements. Photographs of the sampling equipment setup are provided in **Exhibit 4.80**.

Exhibit 4.80: Noise Sampling Site Photographs

Sound meter at N1

Sound meter at N2

Results and Analysis

A summary of the results and NEQS are provided in **Exhibit 4.81**. L_{10} and L_{90} refer to percentile noise levels that are exceeded 10% and 90% of the time, respectively. Hourly L_{eq} noise levels are shown in **Exhibit 4.82** and graphed in **Exhibit 4.83** as IFC EHS guidelines require hourly compliance.

The following analysis of results are presented:

- The daytime noise levels at all locations are within limits of PEQS, and for most hours for IFC EHS.
- Nighttime noise levels are higher than the NEQS at N-2 and N-3. However, the background noise levels (L_{90}) are close to the nighttime limit at both these locations. Nighttime average noise levels are only 2.7 and 1.6 dBA higher than the background noise at N-2 and N-3 respectively. Moreover, when analyzed at an hourly level fluctuations of nighttime noise levels were within 1 dBA at N-2 and N-3, further showing that the noise levels are from constant natural sources.
- The highest L_{10} noise level is of 51.3 dBA at N-3. Therefore, it can be concluded that while there is significant natural background noise, which may be caused due

to stream and river flow, insects, animals, and wind there are minor sources of anthropogenic noise in the area.

Exhibit 4.81: Summary Statistics of Noise Levels (dBA)

Sample ID	*24 hour*				*Daytime*	*Nighttime*
	L_{90}	L_{50}	L_{10}	L_{EQ}	L_{EQ}	L_{EQ}
N-1	42.5	44.5	48.8	52.5	54.2	44.6
N-2	46.8	49.2	50.2	49.9	50.1	49.5
N-3	44.8	46.1	51.3	51.3	52.8	46.4
NEQS Limits					**55**	**45**

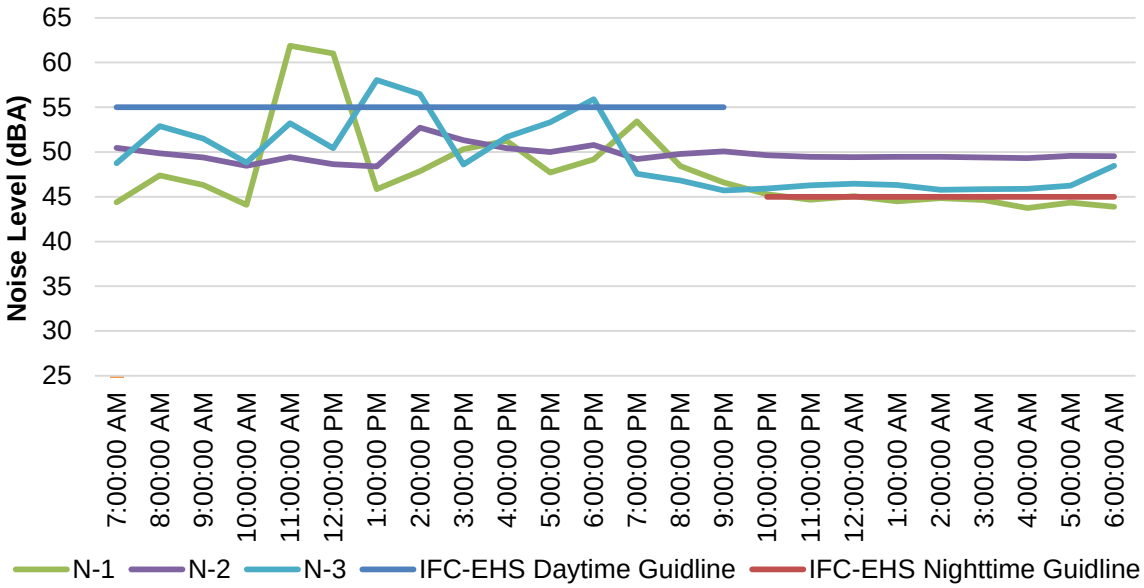
Note: For NEQS daytime hours are from 6 am to 10 pm and nighttime hours from 10 pm to 6 am

Exhibit 4.82: Hourly L_{eq} (dBA) of Noise Levels during the Survey

Time	*IFC-EHS Guideline*	*N1*	*N2*	*N3*
7:00:00 AM	55	44.4	50.5	48.7
8:00:00 AM	55	47.4	49.9	52.9
9:00:00 AM	55	46.3	49.4	51.5
10:00:00 AM	55	44.1	48.5	48.8
11:00:00 AM	55	61.9	49.4	53.2
12:00:00 PM	55	61.0	48.6	50.4
1:00:00 PM	55	45.8	48.4	58.0
2:00:00 PM	55	47.8	52.7	56.5
3:00:00 PM	55	50.3	51.3	48.6
4:00:00 PM	55	51.3	50.4	51.7
5:00:00 PM	55	47.7	50.0	53.3
6:00:00 PM	55	49.2	50.8	55.9
7:00:00 PM	55	53.4	49.2	47.6
8:00:00 PM	55	48.4	49.8	46.8
9:00:00 PM	55	46.6	50.1	45.7
10:00:00 PM	45	45.3	49.6	45.9
11:00:00 PM	45	44.7	49.5	46.3
12:00:00 AM	45	45.1	49.4	46.5
1:00:00 AM	45	44.5	49.5	46.3
2:00:00 AM	45	44.8	49.5	45.8
3:00:00 AM	45	44.6	49.4	45.8
4:00:00 AM	45	43.7	49.3	45.9
5:00:00 AM	45	44.3	49.6	46.3
6:00:00 AM	45	43.9	49.5	48.5

Note: For IFC EHS daytime hours are from 7 am to 10 pm and nighttime hours from 10 pm to 7 am.

Exhibit 4.83: Hourly Leq of Noise Levels during the Survey (dBA)



4.2.7 Water Resources and Sediment

Water resources in the area consist of surface water including rivers and nullahs and groundwater including mountain springs. The information in this section is obtained largely from the Feasibility Study and, where specified, other sources.

Regional Hydrology

The Project reservoir and dam are located on the Arkari Gol, a left bank tributary of the Lutkho River. The Lutkho River drains into the Mastuj/Kunar River. After passing Chitral, the Mastuj River is known as the Chitral River, which on entering Afghanistan is known as the Kunar River, a left bank tributary of the Kabul River. The Kabul River reenters Pakistan near Peshawar, where it combines with the Swat River, and then flows into the Indus River downstream of the Tarbela Dam near Attock City. The route from the Arkari Gol to the Indus River is shown in **Exhibit 4.84**.

Flow Regime at Dam Site

While the Feasibility Study was being conducted, the quality of data available at the Arkari stream gauging station was low, therefore a regional analysis was undertaken to calculate the mean annual flow at the site. Data from gauging stations in the vicinity of the Project was used to generate a 48 year hydrology time series for the Arkari HPP dam site. The resulting generated mean monthly flows at Arkari Gol stream gauging station (1964 – 2011) are shown in **Exhibit 4.85**. A ten-year average (2006 to 2015) of mean monthly flows from the Arkari gauging station is presented in **Exhibit 4.86**.

Exhibit 4.84: Mastuj River and Principal Tributaries

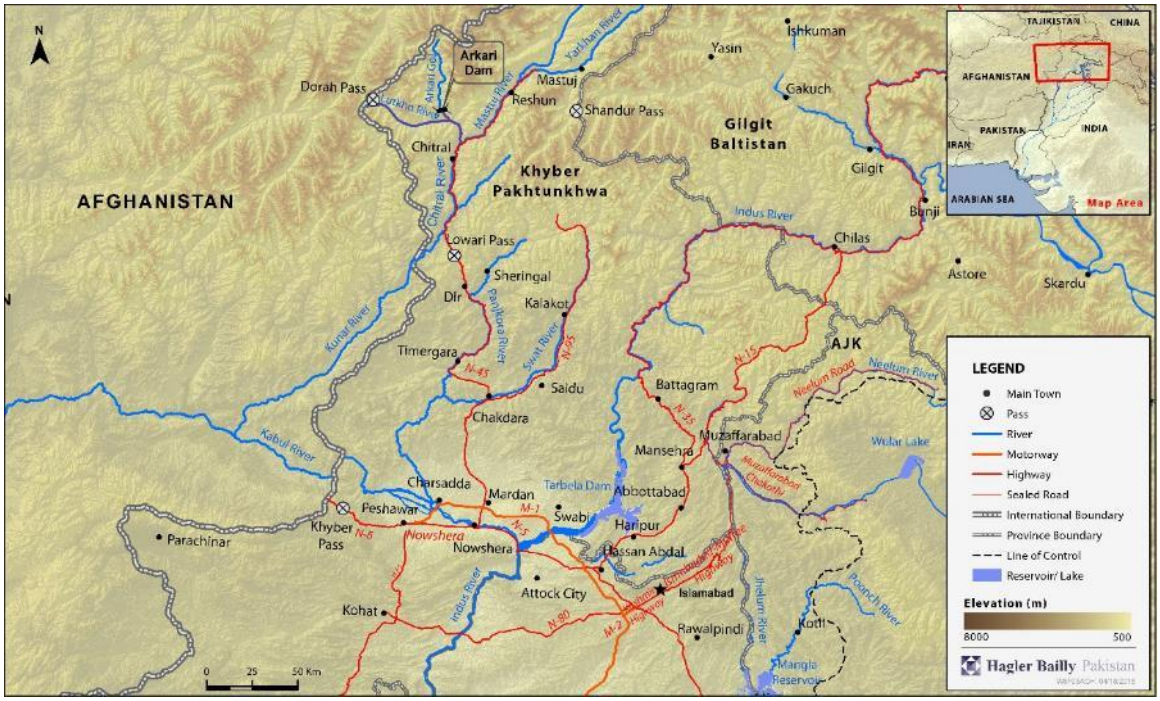


Exhibit 4.85: Generated Average Flow by Month along Arkari Gol (1964 – 2011)

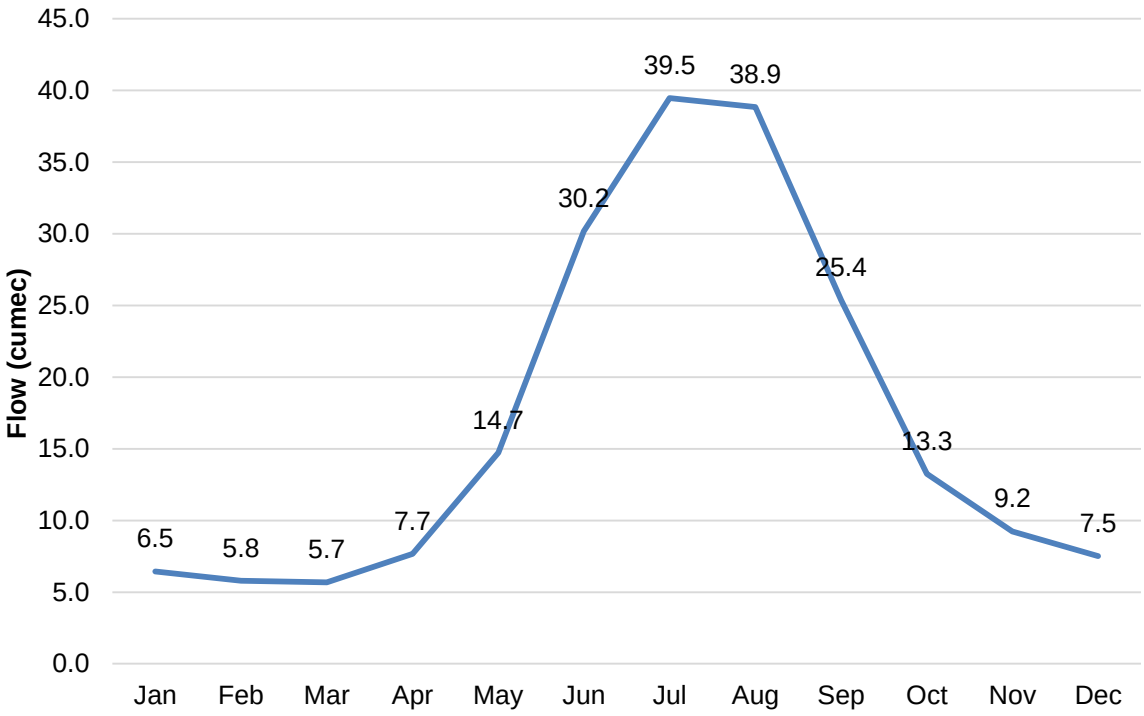
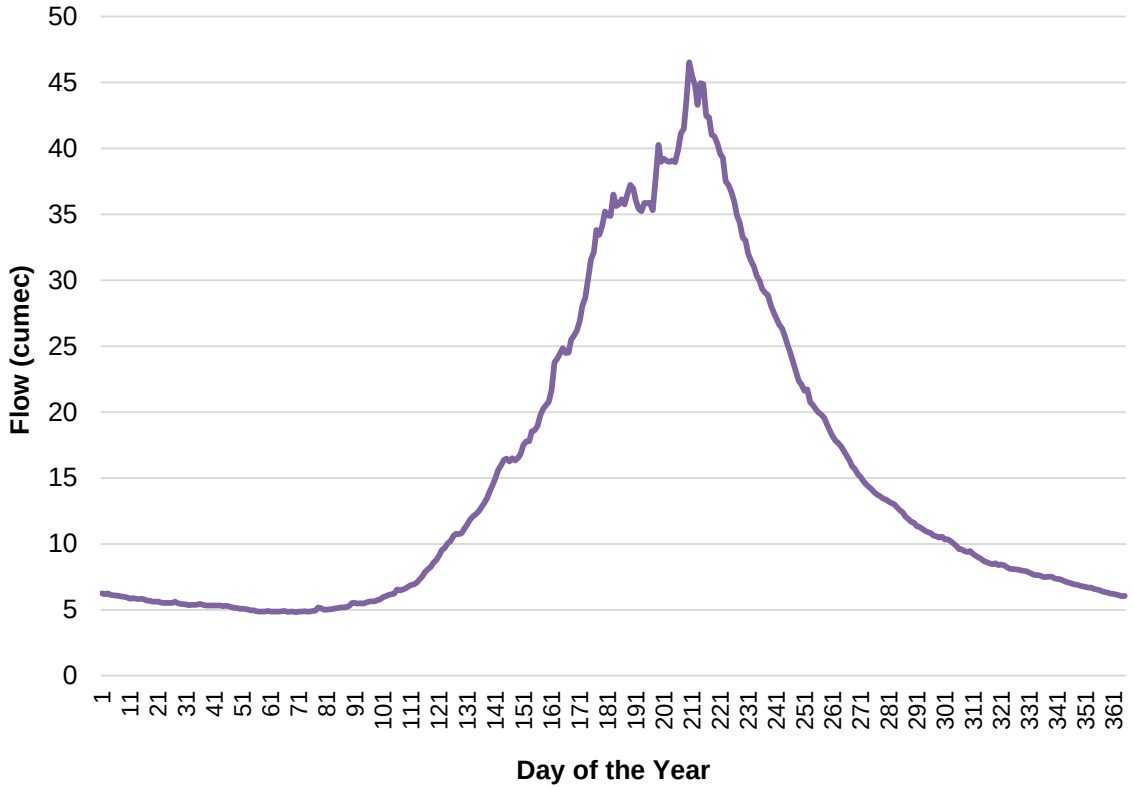


Exhibit 4.86: Average Flow Arkari Gol (2005 – 2015)



The hydrology at the dam site is characterized by:

- Peak flows in the month of July and August associated with melting of snow and ice at higher elevations in the catchment
- Dry or low flow winter season typically extends from December through March when the flows are reduced to the order of one sixth of peak in the month of August.
- Median values of key parameters of the hydrology at the dam site are presented in **Exhibit 4.87.**

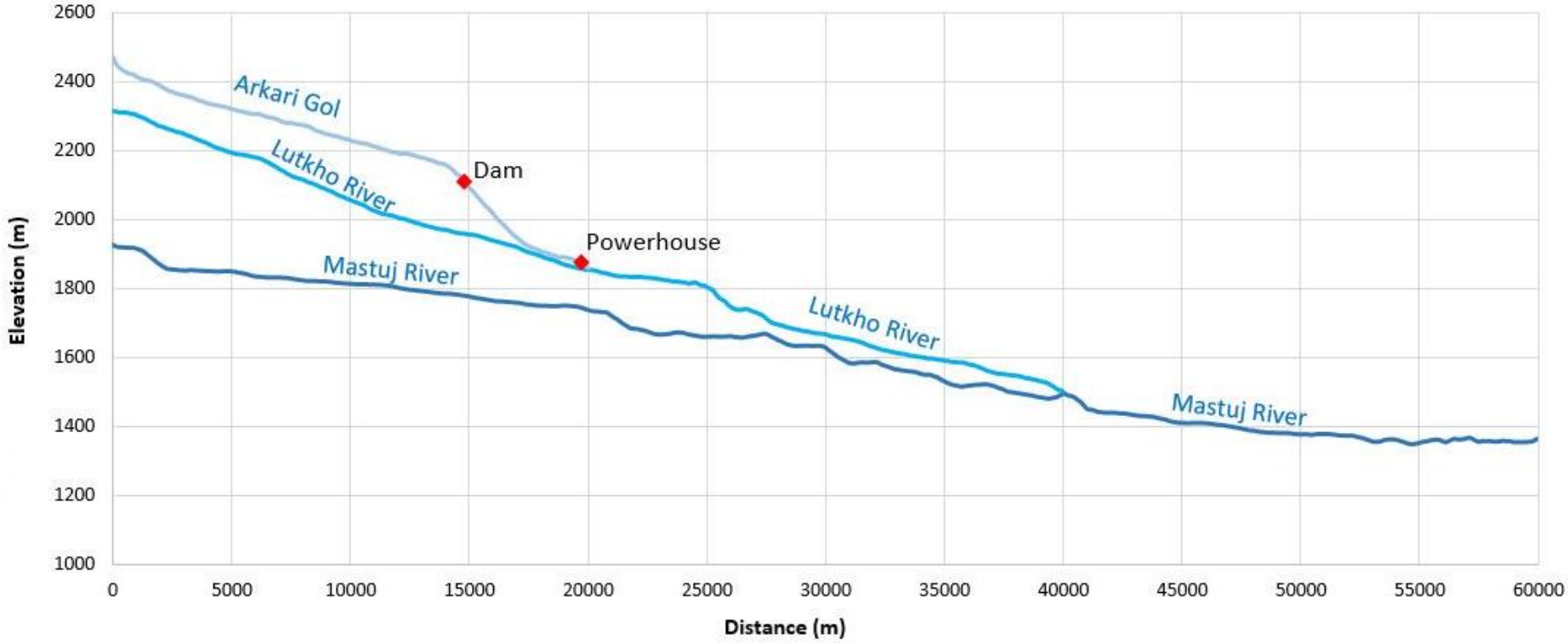
Exhibit 4.88 presents the riverbed elevation of the Arkari Gol as compared to the Lukho and Mastuj rivers. It can be observed that the Arkari Gol flows at a much higher elevation than both the Lutkho and Mastuj rivers.

Exhibit 4.87: Average Flow Arkari Gol G(2005 – 2015)

	Units	*Value*
Mean Annual Runoff	m^3/s	14
Mean flood peak	m^3/s	46
Mean flood volume	Mm^3	271
Dry Season		
Dry season onset	calendar week	42
Dry season relative onset	weeks	0
Dry season duration	days	210
Min 5 day dry season flow	m^3/s	4.2
Wet Season		
Wet season onset	calendar week	24
Wet season duration	days	106
Flood volume	Mm^3	215
Max 5 day flood season flow	m^3/s	35

Based on 10 year hydrology from the Arkari gauging station

Exhibit 4.88: Riverbed Elevation of Mastuj River and its Tributaries



Sediment at Dam Site

May, June, July, August and September are months of significant amounts of suspended sediment in the Arkari Gol (see **Exhibit 4.89**). In August suspended sediment at the site peaks at 81,605 tons, whereas January has the lowest suspended sediment load at 791 tons. There is little vegetation cover in the watershed as it remains covered with glaciers and snow during the winter. Consequently, the river is fed mostly by snow and glacial melt and flows steadily throughout the year. Additional flow in the river in summer months is from the rainfall runoff flow during monsoon experienced from June to September which causes an increase in sediment.

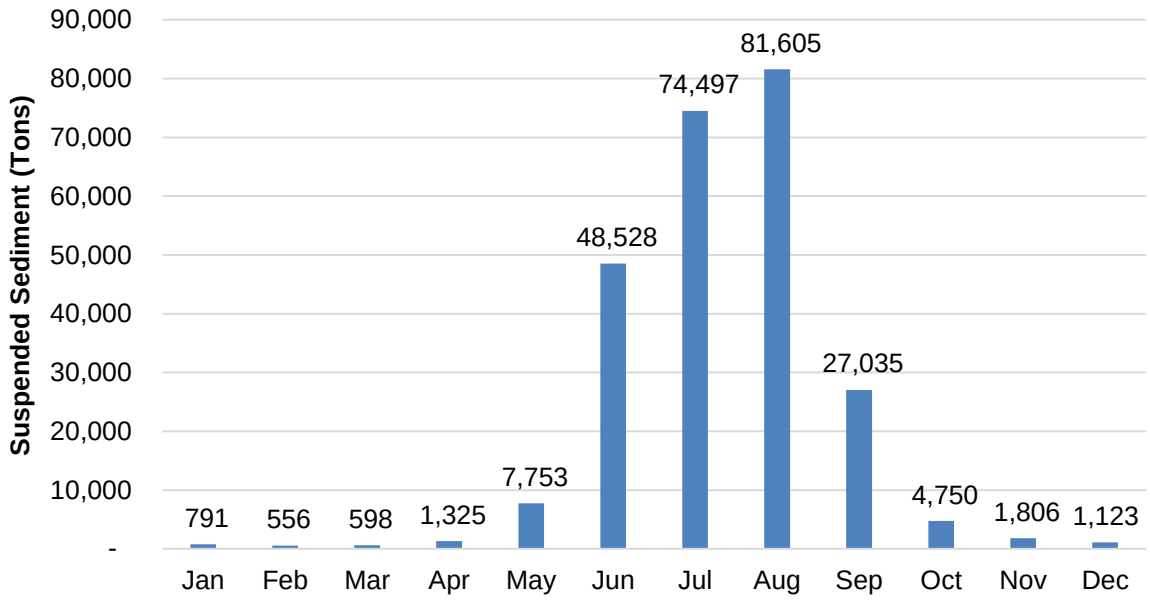
On an annual basis the Chitral River carries 435 times more sediment but only 17 times more water than the Arkari Gol (see **Exhibit 4.90**). The high value of suspended sediment at low elevation (Chitral) is mainly owing to high rainfall runoff erosion and increased sediment transport.

Exhibit 4.89: Mean Monthly Suspended Sediment Load at Arkari Dam Site

River	*Gauging Station*	*Source*	*Duration of Data*	*Watershed (km^2)*	*Annual Suspended Sediment Load (M tons)*	*Mean Annual Flow (m3/s)*
Chitral	Chitral	SWHP	1964-2010	11,400	23.087	280.57
Arkari Gol	Uchhtar	SHYDO	2006-2013	1015	0.053	16.37

Source: Feasibility Study

Exhibit 4.90: Monthly Suspended Sediment Load at Arkari Dam Site



Source: Feasibility Study

Community Water Supply (Mountain Spring) Census

A census was carried out to map the community water resources for villages near Project facilities. A 500 m buffer around the Project facilities that may need excavation (including the dam and underground tunnels) was demarcated for the survey to account for the distance to which the impact on ground water might possibly extend. All the springs within this buffer have to be sampled irrespective of the distance from the Project facility. This area and the surveyed water resource infrastructure are shown in **Exhibit 4.91**.

The methodology is presented as part of the survey plan attached as **Appendix F**.

Results and Analysis

A total of 13 water resource infrastructure points (9 mountain springs and 4 water supply schemes) were identified (see **Exhibit 4.91**) and characterized within the hydrocensus area. 74 households depend on the springs, whereas 487 households depend on the water supply schemes in the area covered by the hydro-census. Mountain springs in the area are largely undeveloped and have no associated infrastructure. These springs are a major sole potable water supply for the majority of households. 90% of active water sources are used to supply drinking water to humans and all water sources are used for livestock drinking as well. Residents of the area also use the Arkari Gol for drinking, other uses, and for their livestock. Images depicting the water infrastructure are shown in **Exhibit 4.92** and **Exhibit 4.93**.

The four water supply schemes in the area were developed by the government or NGOs as detailed below:

- S-8: This water supply scheme was funded by the Public Health Department, Government of KP in 2017. This scheme supplies water to Mumi and Haraini villages via a 2 inch diameter pipe. It routes water from the Essi Forest 4 km away from Haraini village.
- S-9: This water supply scheme was funded by the Sarhad Rural Support Programme (SRSP) in 2008. This supply line is a second source of water for households in Mumi and Haraini villages. Spring water coming from the Icci Forest 4 km away from Haraini village through a 2 inch diameter pipe.
- S-10: This water supply scheme was funded by Water and Sanitation Extension Programme (WASEP) in 2012 for 60 houses in the villages of Andahti and Ruji. The mountain spring from where the water is sourced is located 5 km away from Andahti village via a 2 inch diameter pipe.
- S-11: This water supply scheme was funded by the Public Health Department, Government of KP in 1992. This scheme supplying water to 47 houses in Ruji village via a 4 inch diameter pipe. The water is sourced from coming from a mountain spring in Kochga, 2 km away from Ruji village.

Identifying characteristics of the community water resources are presented in **Exhibit 4.94** and water quality and water use data provided in **Exhibit 4.95**. Based on the pH and electrical conductivity, the water is fresh and potable.

Exhibit 4.91: Hydro-census Locations

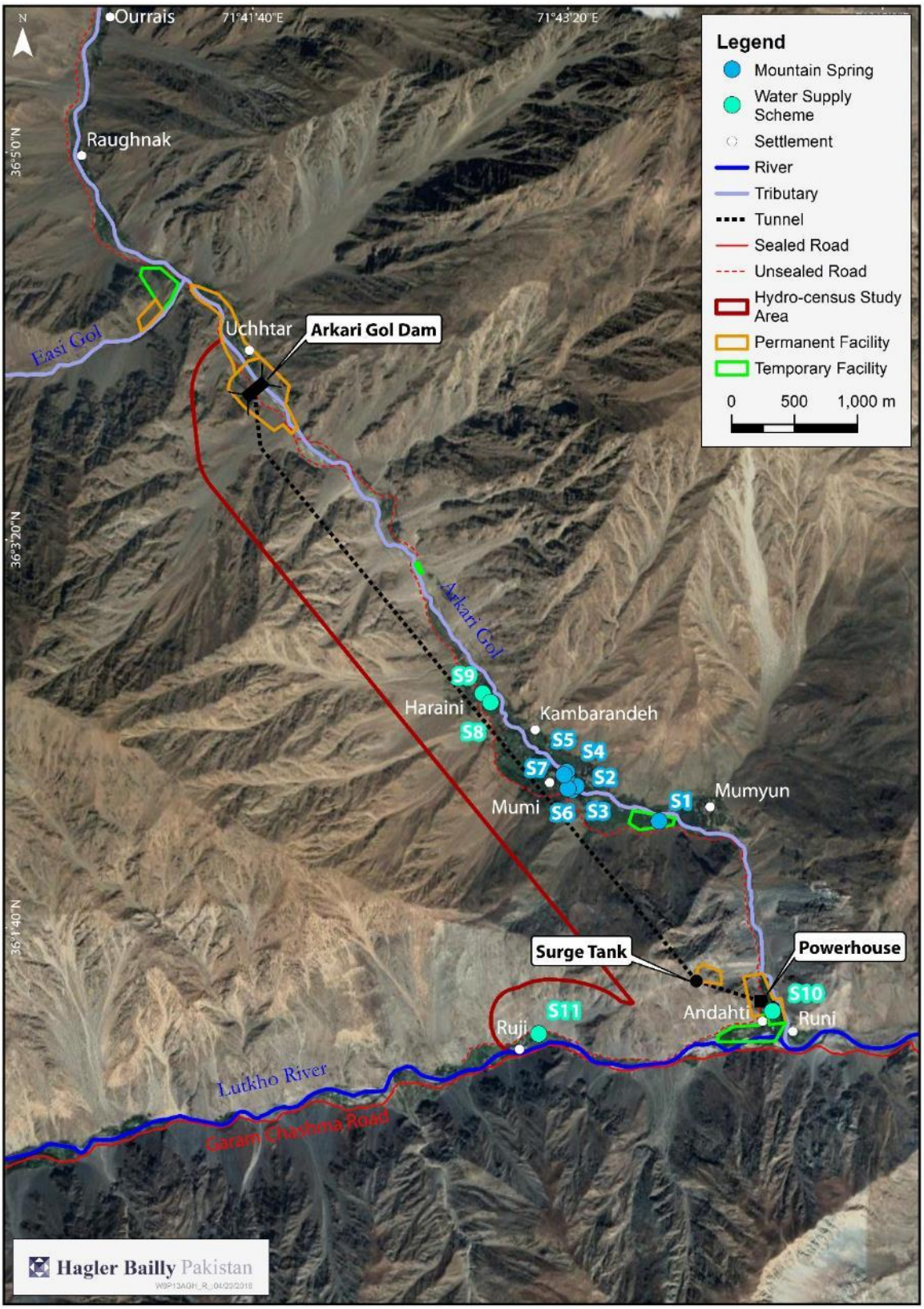
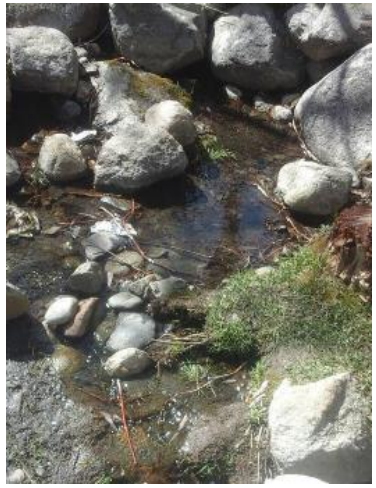


Exhibit 4.92: Photographs of Mountain Springs in the Study Area

Mountain spring S-1

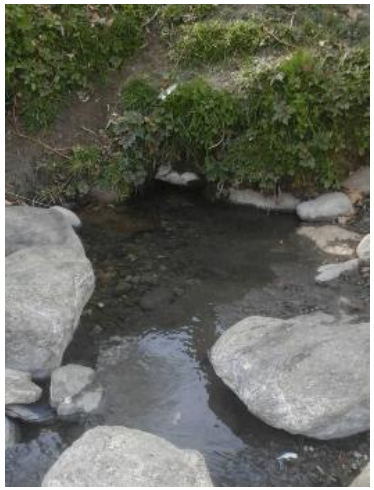
Mountain spring S-2

Mountain spring S-3



Mountain spring S-4

Mountain spring S-5



Mountain spring S-6

Mountain spring S-7

Exhibit 4.93: Photographs of Water Supply Infrastructure in the Study Area

Water Supply S-8

Water Supply S-8

Water Supply S-9

Mountain spring S-10

Mountain spring S-10

Mountain spring S-11

Water storage tank for mountain spring S-11

Exhibit 4.94: Surveyed Springs in the Study Area

ID	*Date of Survey*	*Time of Survey*	*Coordinates*	*Village*	*Ownership*	*Age*	*Extraction Method*
S-1	April 1, 2018	1310	36° 02' 02.73" N 71° 43' 41.46" E	Mumi	Mustahkam	1968	Manual
S-2	April 1, 2018	1350	36° 02' 12.37" N 71° 43' 15.58" E	Mumi	Ikhlas ud Din	1968	Manual
S-3	April 1, 2018	1410	36° 02' 11.38" N 71° 43' 14.05" E	Mumi	Ikhlas ud Din	1968	Manual
S-4	April 1, 2018	1415	36° 02' 16.14" N 71° 43' 12.64" E	Mumi	Mir Muhammad	1918	Manual
S-5	April 1, 2018	1430	36° 02' 15.41" N 71° 43' 11.74" E	Mumi	Gulazam	1918	Manual
S-6	April 1, 2018	1450	36° 02' 14.66" N 71° 43' 12.40" E	Mumi	Zarmast Khan	1918	Manual
S-7	April 1, 2018	1510	36° 02' 11.78" N 71° 43' 12.86" E	Mumi	Mir Muhammad	1918	Manual
S-8	April 1, 2018	1550	36° 02' 34.58" N 71° 42' 49.04" E	Haraini	Water Supply Scheme	1917	Gravity Pipe
S-9	April 2, 2018	1445	36° 02' 36.95" N 71° 42' 46.67" E	Haraini	Water Supply Scheme	2008	Gravity Pipe
S-10	April 2, 2018	1645	36° 01' 12.89" N 71° 44' 15.82" E	Andahti	Water Supply Scheme	2012	Gravity Pipe
S-11	April 2, 2018	1730	36° 01' 08.75" N 71° 43' 01.39" E	Ruji	Water Supply Scheme	1992	Gravity Pipe

Comments: Water in all springs increase during the summer months.
Water in spring S-1 becomes hot in winter months.

Exhibit 4.95: Water Quality and Water Use Data of Springs in the Study Area

	Altitude (m amsl)	*Temperature (˚C)*	*pH*	*Electrical Conductivity (µS/cm)*	*Number of Livestock Using Spring*	*Number of Households Using Spring*	*Water use per Household (liters/day)*	*Total Estimated Usage (liters/day)*
Summary Statistic								
Minimum	1833	13.4	7.5	179	20	4	75	300
Mean	1895	14.6	7.8	301	533	51	216	14,800
Median	1895	14.7	7.7	319	100	15	100	1,500
Maximum	1956	15.8	8.2	353	2,500	250	500	52,000
Individual								
S-1	1895	15.8	7.7	353	20	4	75	300
S-2	1912	14.9	7.8	318	100	14	100	1,400
S-3	1833	15.2	7.7	319	100	16	100	1,600
S-4	1877	14.3	7.6	331	40	10	100	1,000
S-5	1883	14.7	7.8	327	50	5	100	500
S-6	1912	13.4	7.6	333	150	15	100	1,500
S-7	1956	13.7	7.5	337	100	10	100	1,000
S-8			8.2	264	1,300	130	500	52,000
S-9			8.2	298	2,500	250	200	50,000
S-10			8.2	250	800	60	500	30,000
S-11			7.5	179	700	47	500	23,500

Comments: All springs other than S-11 are used for human drinking. All springs are used for livestock drinking and other human uses

Use of River Water for Irrigation

There are four main water channels that are diverting river water for irrigation from near the dam site. These channels have been constructed by the community using locally quarried stone and materials (see **Exhibit 4.96**). Approximately 202 acre of land is irrigated from water diverted by these channels. Crops are grown in both winter (maize crop) and in the summer (wheat crop). Additional discussion on these channels is presented in **Section 4.3** (*Socioeconomic Baseline*).

Exhibit 4.96: Photographs of Water Channels

Water Quality

Water quality samples from the Arkari Gol, Lutkho River, and mountain springs were collected and analyzed for establishing baseline conditions for surface and groundwater.

Methodology and Sampling Locations

Water was sampled on April 2, 2018 from 5 surface water sources and 5 mountain springs. Photographs of collected samples are shown in **Exhibit 4.97.** Samples were sent to the labs listed in **Exhibit 4.98**, and onsite field tests were also carried out. Sampling locations are described in **Exhibit 4.99** and shown in **Exhibit 4.100**.

Exhibit 4.97: Photographs from the Water Sampling

Collection of sample at W-1

Water quality sample W-1

Spring water quality sample W-10 and duplicates

Field testing sample W-6

Exhibit 4.98: Laboratories used for Water Quality Sample Tests

Laboratory	*Parameters*
Field Testing	Physical parameters (pH, Conductivity, Temperature, DO)
HBP Laboratory, Islamabad	General Parameters (TDS, TSS, BOD, COD, Turbidity), major ions (Nitrate, Phosphate), Metals (Manganese, Zinc,)Iron
Pakistan Institute of Nuclear Sciences & Technology , Islamabad	Metals (Arsenic, Mercury, Antimony, Selenium, Silver, Aluminum, Boron, Barium, Cadmium, Chromium, Copper, Nickel, and Lead)
Excel Labs, Islamabad	Microbiology (Coliforms, E Coli)

Exhibit 4.99: Water Quality Sampling Location Details

ID	*Coordinates*	*Description*	*Justification*
W-6	36° 04' 32.6" N 71° 40' 58.3" E	Arkari Gol (upstream of Weir)	To document the baseline water quality of the Arkari Gol.
W-7	36° 03' 11.3" N 71° 42' 25.6" E	Arkari Gol (downstream of Weir)	
W-1	36° 01' 11.0" N 71° 44' 19.7" E	Arkari Gol before confluence with Lutkho River	
W-2	36° 01' 02.0" N 71° 43' 46.4" E	Lutkho River before confluence with Arkari Gol	To document the baseline water quality of the Lutkho River.
W-3	36° 01' 04.0" N 71° 44' 42.6" E	After Confluence of Lutkho River with Arkari Gol	To analyze the effect of dilution by the Lutkho River.
W-4	36° 02' 02.5" N 71° 43' 41.6" E	Mountain spring (S-1)	To document baseline water quality of springs that are used by the community as a source of water
W-5	36° 02' 12.1" N 71° 43' 14.3" E	Mountain spring (S-3)	
W-8	36° 02' 15.0" N 71° 43' 12.1" E	Mountain spring (S-7)	

ID	*Coordinates*	*Description*	*Justification*
W-9	36° 02' 14.5" N 71° 43' 12.3" E	Mountain spring (S-5)	
W-10	36° 02' 13.3" N 71° 43' 11.8" E	Mountain spring (S-6)	
W-10D	36° 02' 13.3" N 71° 43' 11.8" E	Duplicate of W-10	Quality control sample

Results and Analysis

The water quality results are provided in **Exhibit 4.101** and discussed below:

- No bacterial contamination was found in the mountain spring water that was tested and was classified as excellent for drinking based on its microbiology.
- All parameters tested were below the NEQS limits and the water quality is uncontaminated in the area.
- The Lutkho River has lower conductivity and higher pH than the Arkari Gol and the mountain spring water in the Arkari Gol catchment.

Complete water quality lab results are presented in **Appendix G**.

Exhibit 4.100: Water Quality Sampling Locations

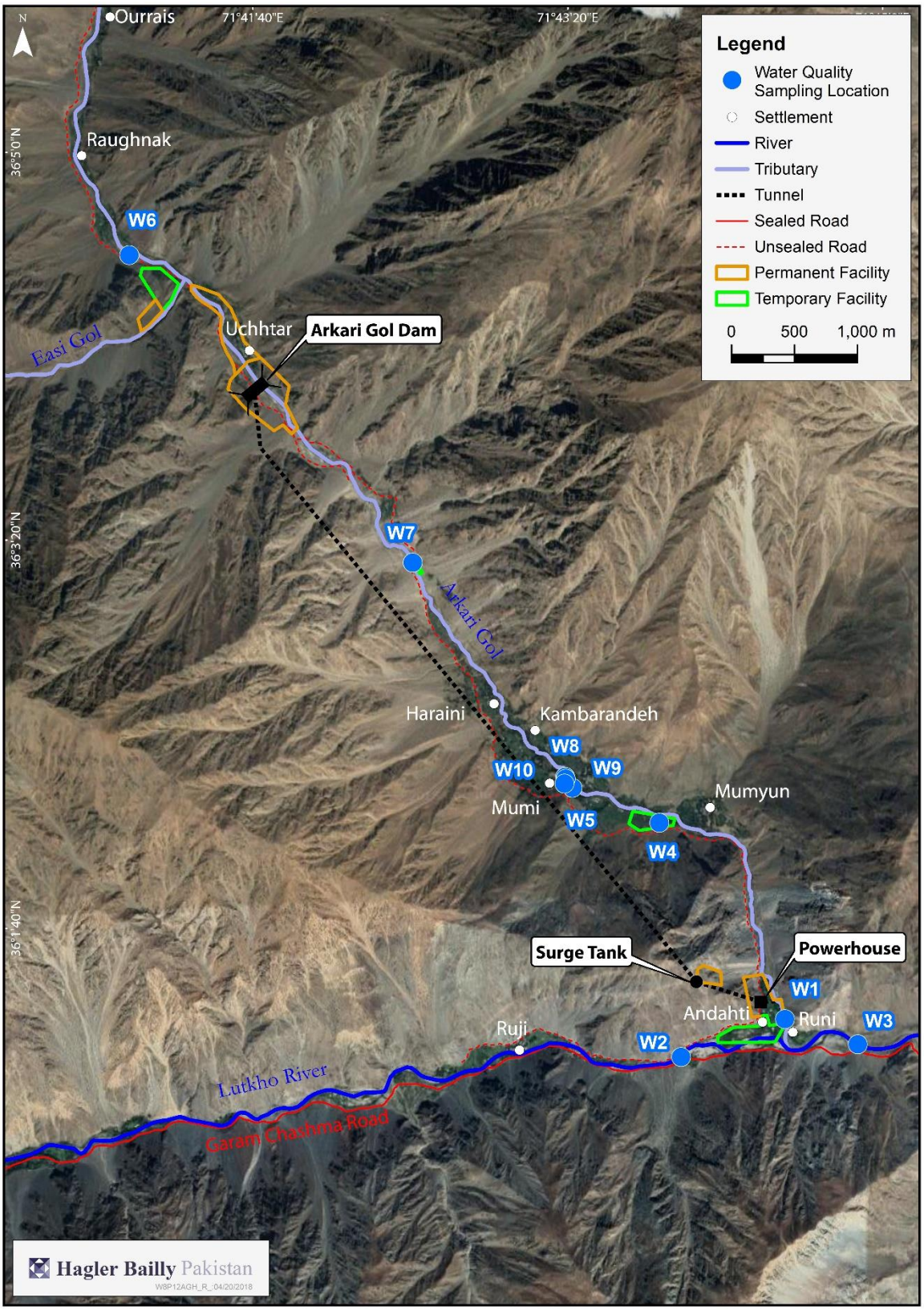


Exhibit 4.101: Water Quality Results

	Unit	*Analytical Method*	*LOR*	*NEQS*	*Arkari Gol*			*Luthko River*		*Mountain Springs*					
					W–6	*W–7*	*W–1*	*W–2*	*W–3*	*W–4*	*W–5*	*W–8*	*W–9*	*W–10*	*W–10D*
Field Tests															
pH		US EPA 150.1	0.1	6.0–9.0	7.85	7.91	7.85	8.27	8.09	7.74	7.74	7.79	7.58	7.50	7.50
Conductivity	µS/cm	US EPA 120.1	1	–	399	402	398	189	290	353	319	327	333	337	338
Temperature	°C	US EPA 170.1	1	–	12.3	12.8	12.9	12.0	12.6	15.8	15.2	14.7	13.4	13.7	13.7
DO	mg/l	US EPA 360.1	0.1	–	11.21	11.07	10.54	10.87	11.01	8.43	8.56	8.21	8.45	8.51	8.50
General															
TDS	mg/l	US EPA 160.1	10	3,500	290	294	NT	NT	198	243	220	NT	NT	224	226
TSS	mg/l	US EPA 160.2	4	200	16.66	17	NT	NT	17	ND	ND	NT	NT	ND	ND
BOD	mg/l	US EPA 405.1	5	80	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
COD	mg/l	US EPA 410.2	5	150	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Turbidity	FAU	HACH 8037	0	–	7	7	NT	NT	12	3	0	NT	NT	3	3
Nitrate	mg/l	US EPA 352.1	0.1	–	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Phosphate	mg/l	SMEW	0.1	–	ND	ND	NT	NT	ND	ND	ND	–	–	ND	ND
Metals															
Manganese	mg/l	SMEW	0.1	1.5	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Zinc	mg/l	SMEW	0.1	5	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Iron	mg/l	SMEW	0.1	8	–	–	NT	NT	–	–	–	NT	NT	ND	ND
Silver	µg/l	ICP	90	0	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Aluminum	µg/l	ICP	220	200	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Boron	µg/l	ICP	20	300	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND

	Unit	*Analytical Method*	*LOR*	*NEQS*	*Arkari Gol*			*Luthko River*		*Mountain Springs*					
					W–6	*W–7*	*W–1*	*W–2*	*W–3*	*W–4*	*W–5*	*W–8*	*W–9*	*W–10*	*W–10D*
Barium	µg/l	ICP	10	700	20	10	NT	NT	10	10	10	NT	NT	10	10
Cadmium	µg/l	ICP	10	10	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Chromium	µg/l	ICP	20	50	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Copper	µg/l	ICP	30	500	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Nickel	µg/l	ICP	10	20	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Lead	µg/l	ICP	30	50	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Arsenic	ng/l	ICP	0.64	–	ND	1.95	NT	NT	ND	7.66	14.47	NT	NT	12.89	11.97
Mercury	ng/l	ICP	0.52	–	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Antimony	ng/l	ICP	0.72	–	ND	2.95	NT	NT	ND	ND	ND	NT	NT	ND	ND
Selenium	ng/l	ICP	0.78	–	ND	ND	NT	NT	ND	ND	ND	NT	NT	ND	ND
Microbiology															
Coliforms	MPN/ 100ml	Internal	0	1 to 3	NT	NT	NT	NT	NT	NT	0 or Excellent	NT	NT	0 or Excellent	NT
E.Coli	MPN/ 100ml	Internal	0	1 to 3	NT	NT	NT	NT	NT	NT	0 or Excellent	NT	NT	0 or Excellent	NT

NT: Not tested

ND: Not detected

4.2.8 Traffic

The 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. The transport route options are described in **Section 3** (*Description of Project*).

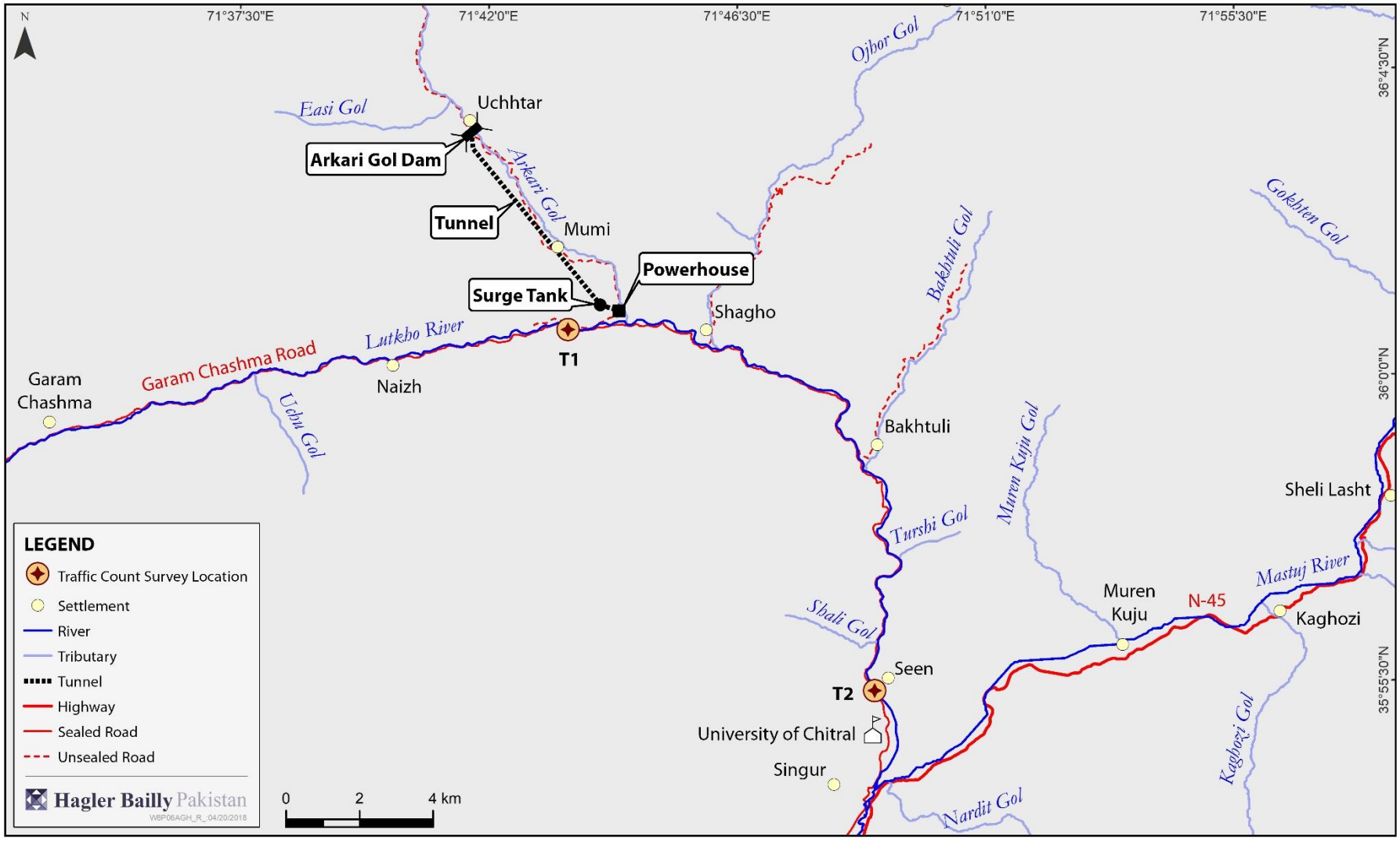
Methodology and Sampling Locations

Traffic counts were conducted at two locations on the transport route, as listed in **Exhibit 4.102** and shown in **Exhibit 4.103**. A team of qualified surveyors was selected and a pilot count was conducted before the actual survey. At the counting site, one person was stationed to separately count traffic for each direction. The traffic count was conducted on April 2, 2018, over a 15-hour period starting at 7 am and ending 10 pm.

Exhibit 4.102: Traffic Count Locations

ID	*Coordinates*	*Location*	*Rationale*
T1	36° 01' 00.2" N 71° 43' 16.0" E	Near Powerhouse	Located on intersection point where traffic diverts towards the Project site.
T2	35° 55' 34.0" N 71° 48' 37.8" E	Near Seen Village and University of Chitral	Along the main transport route from Chitral

Exhibit 4.103: Traffic Survey Locations



Passenger Car Equivalent (PCE) or Passenger Car Unit (PCU) is a metric unit used to assess traffic-flow rate.[77] PCU, is a measure of the relative space requirement of a vehicle compared to that of a passenger car under a specified set of roadway, traffic and other conditions. The value assigned to each of the classification of the vehicles may depend on a number of factors such as:

- dimensions, power, speed, acceleration and braking characteristics of the vehicle;
- road characteristics such as geometrics including gradients, curves, access controls, type of road: rural or urban, presence and the type of intersections;
- transverse and longitudinal clearances between vehicles moving on road, which in turn depends upon the speeds, driver characteristics and the classes of other moving vehicles;
- environmental and climatic conditions and;
- Traffic control methods, speed limits, and barriers.

The PCU for different classes of vehicles are not defined universally, however, the values used here are typical for Pakistani road conditions. The PCUs are calculated on the basis of traffic counts. **Exhibit 4.104** shows PCU factor for each vehicle**.**

Exhibit 4.104: PCU Values for Selected Vehicle Types

Vehicle	*PCU Factor*
Motorcycles	0.50
Auto rickshaws	0.75
Cars (sedans)	1.00
Jeeps/Pickups	1.25
Mini Bus	1.50
Bus	2.00
Truck - 2 axle	2.50
Truck - 3 axle	3.00
Truck - 4 axle	3.50
Truck - 5 axle	4.00

Results and Analysis

Key findings of the survey are presented below. The complete results of the survey are provided in **Appendix H**.

- 94% to 100% of the traffic consists of LTV. HTV observed consisted of buses and two axle trucks.
- At T-2, an early morning peak was observed from Garam Chashma to Chitral, whereas an afternoon peak was observed in the opposite direction. This may

[77] Ahuja, Amanpreet Singh (2004). *Development of passenger car equivalents for freeway merging section*

indicate that people travel into Chitral for work in the morning and return in the afternoon.

- At T-1 the Arkari to Chitral and Garam Chashma to Chitral routes show similar early morning peaks as observed at T2. The remaining routes have minimal traffic on them.

The hourly traffic PCU is graphed in **Exhibit 4.105** to **Exhibit 4.107**. The summary of the two-way traffic count at the sampling locations is presented in **Exhibit 4.108** and graphed in **Exhibit 4.109**.

Exhibit 4.105: Distribution of HTV and LTV in each Direction

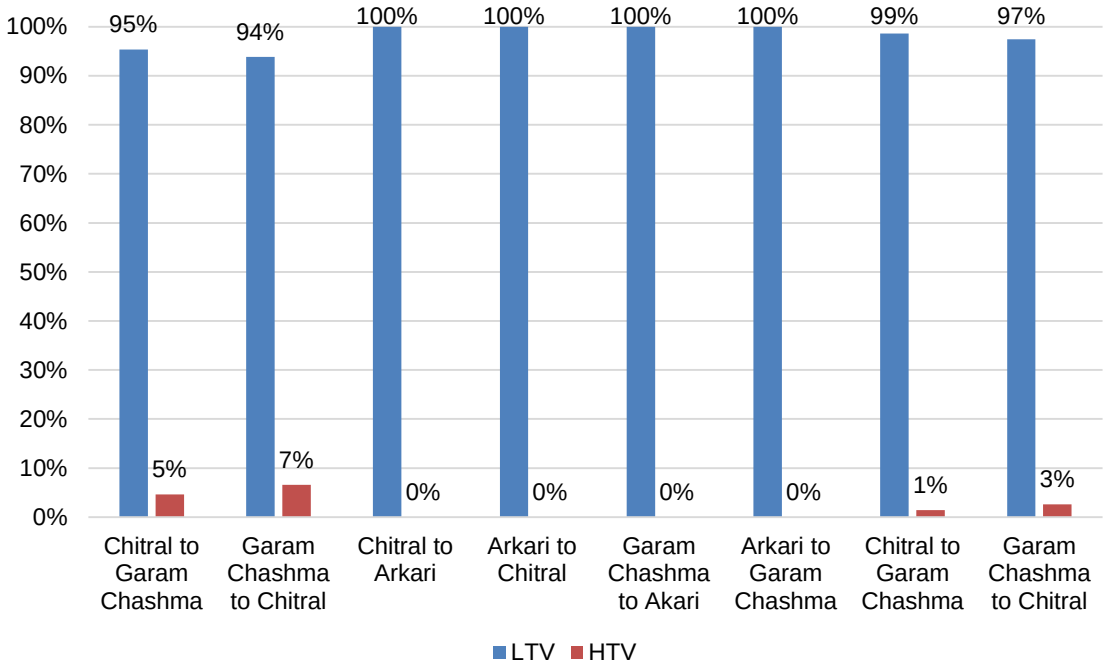


Exhibit 4.106: Calculated PCU at T-1

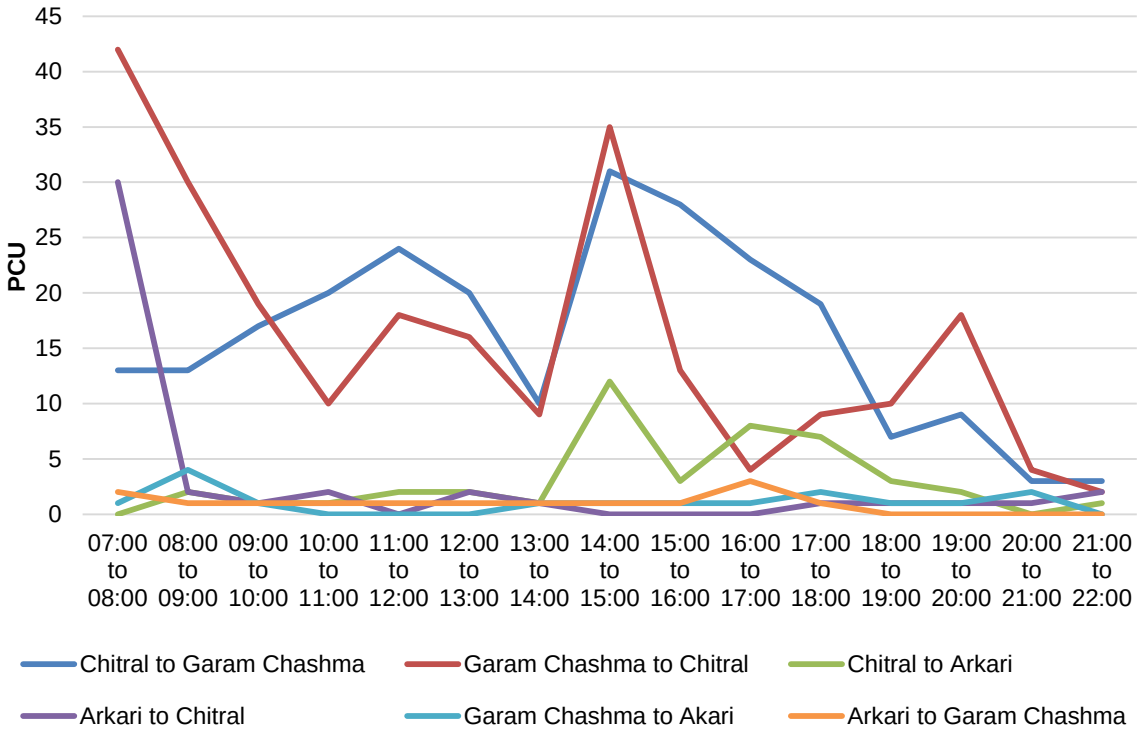


Exhibit 4.107: Calculated PCU at T-2

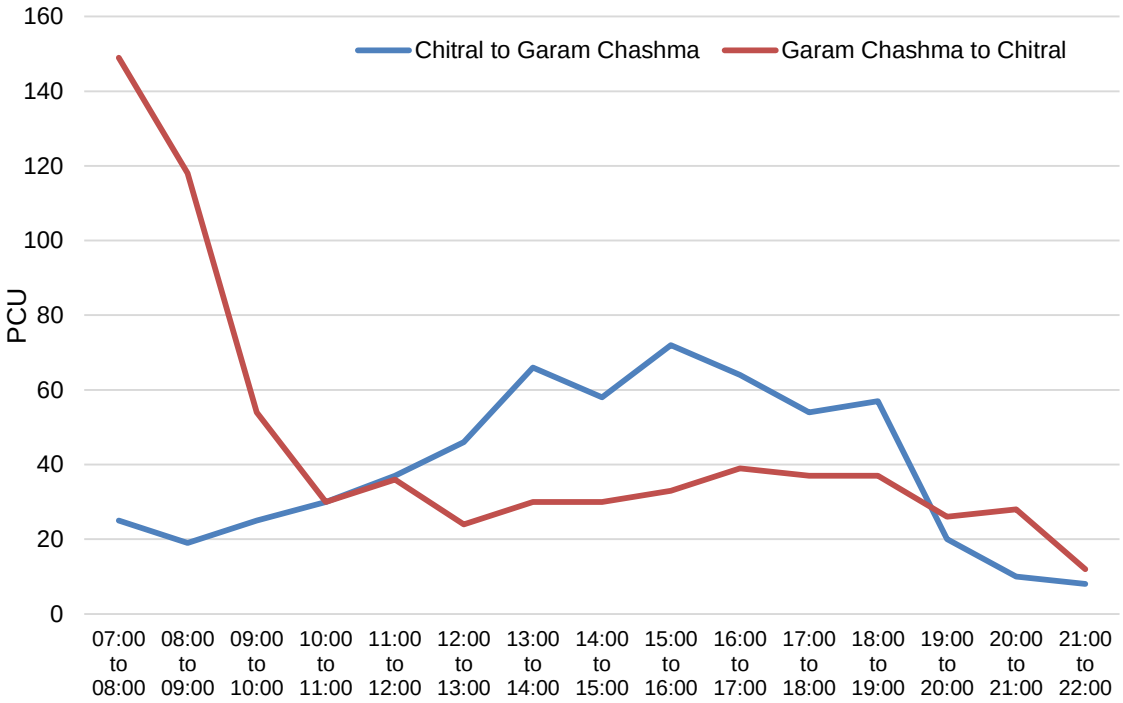
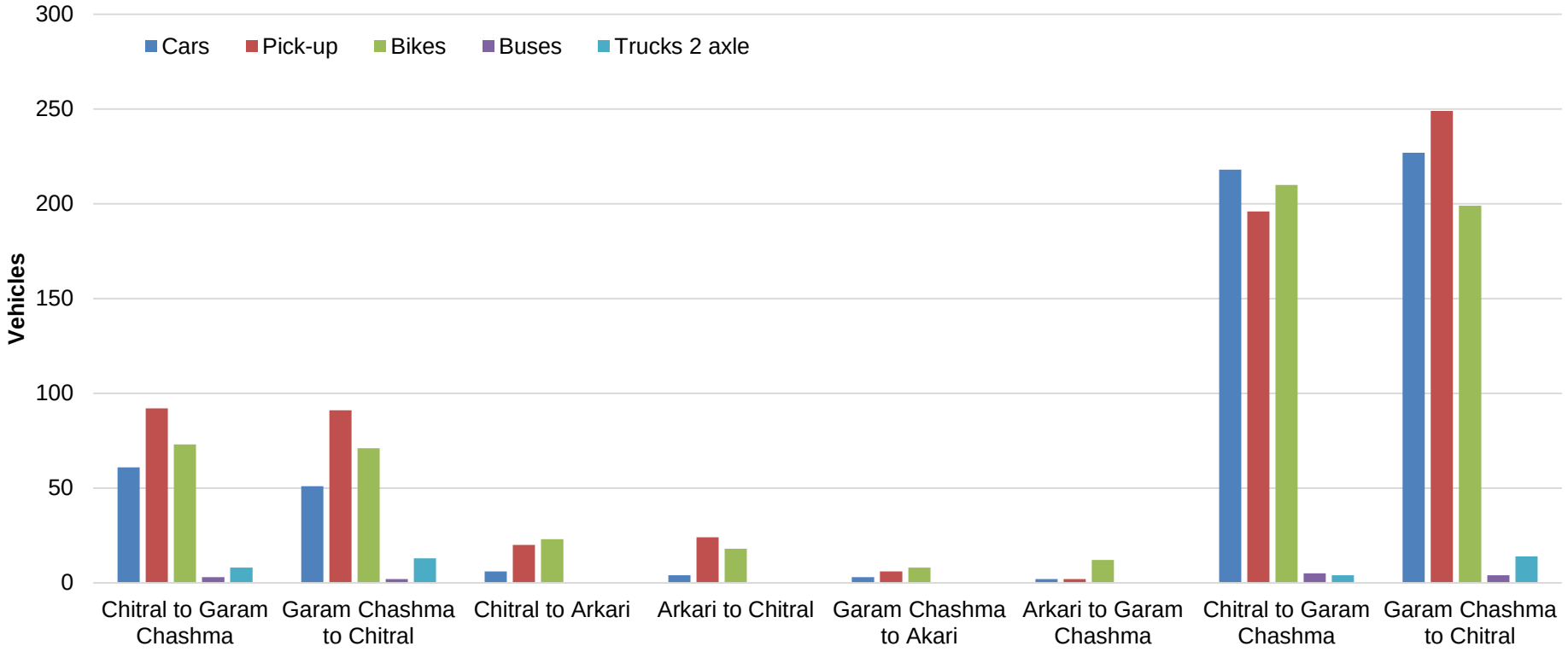


Exhibit 4.108: Two-Way Traffic at each Traffic Count Location

Direction	*Cars*	*Pick-up*	*Bikes*	*Buses*	*Trucks 2 axle*	***Total***	*Total LTV*	*Total HTV*	*%LTV*	*%HTV*	***Total PCUs***
Location T-1											
Chitral to Garam Chashma	61	92	73	3	8	**237**	226	11	95%	5%	**239**
Garam Chashma to Chitral	51	91	71	2	13	**228**	214	15	94%	7%	**237**
Chitral to Arkari	6	20	23	–	–	**49**	49	–	100%	–	**43**
Arkari to Chitral	4	24	18	–	–	**46**	46	–	100%	–	**43**
Garam Chashma to Akari	3	6	8	–	–	**17**	17	–	100%	–	**15**
Arkari to Garam Chashma	2	2	12	–	–	**16**	16	–	100%	–	**11**
Total at Intersection T-1	**127**	**235**	**205**	**5**	**21**	**593**	**568**	**26**	**96%**	**4%**	**588**
Location T-2											
Chitral to Garam Chashma	218	196	210	5	4	**633**	624	9	99%	1%	**588**
Garam Chashma to Chitral	227	249	199	4	14	**693**	675	18	97%	3%	**681**
Total at Intersection T-2	**445**	**445**	**409**	**9**	**18**	**1326**	**1299**	**27**	**98%**	**2%**	**1269**

Note: The survey form contains space for Trucks 3 to 5 axles, Trailors, Tractors and Other. However, no such vehicles were noted during the survey.

Exhibit 4.109: Total Vehicles Counted each Traffic Count Location



4.2.9 Visual Character

The visual baseline documents the current aesthetic and visual conditions of the proposed Project site as seen from the nearby receptors.

Methodology and Sampling Locations

Visual survey locations are listed in **Exhibit 4.110.** The survey to establish the visual baseline was conducted on April 1, 2018, involving the following at each survey location:

- The coordinates of the locations were recorded using a GPS unit.
- A camera and tripod were used to take panoramic photographs spanning 180°.
- A compass was used to record the bearings, in degrees, for the panorama center.

Exhibit 4.110: Visual Survey (Receptor) Locations

ID	*Coordinates*	*Altitude (m)*	*Bearing of Image Center*	*Location*	*Rationale*
V1	36° 01’ 01.6" N 71° 44’ 19.6" E	1868	Northwest	Powerhouse site	View of Powerhouse site from the main road.
V2	36° 02 ‘01.5" N 71° 43’ 41.7" E	1915	North	Temporary Facility 2	View of temporary facility from the main road.
V3	36° 04’ 02.6" N 71° 41’ 30.0" E	2224	East	Dam site	View towards area inundated by reservoir and dam site.

Results and Analysis

The visual survey locations are shown in **Exhibit 4.111**. **Exhibit 4.112** shows the views of proposed Project facility locations from nearby receptors. The mountainous landscape, deep gorges restricts visibility to a maximum of 0.5 to 1.5 km at receptor locations. However, the lack of vegetation and distance between mountains allows for clear visibility within the valley.

Exhibit 4.111: Visual Survey Locations and Directions

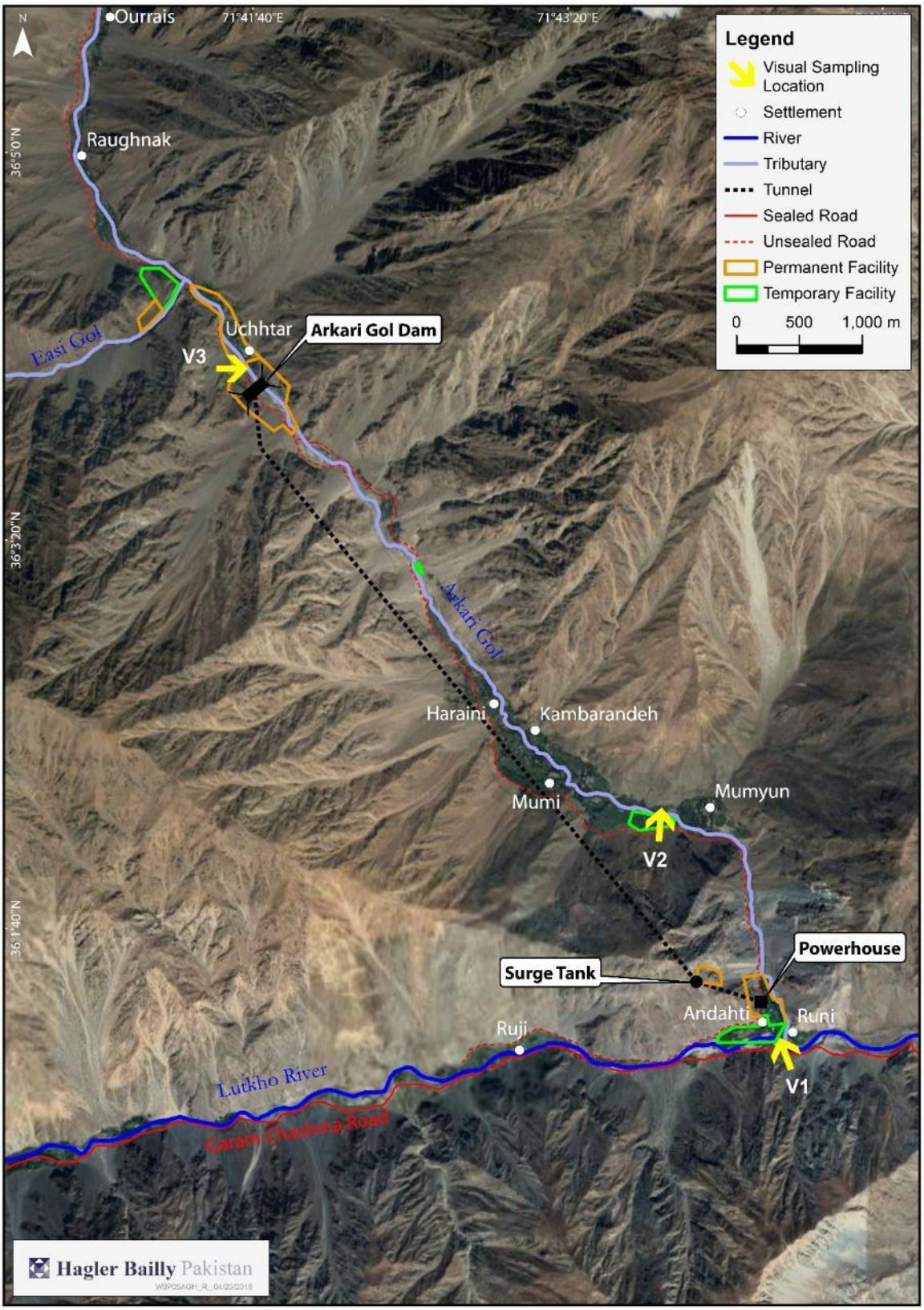


Exhibit 4.112: Visual Survey Photographs

View from V1 on the Garam Chashma Road (180 degree view, at 1868 meters elevation, centered at bearing northeast, right bank Lutkho River). The wide barren valley allows for extensive views of the site.

View from V2 (180 degree view, at 1915 meters elevation, centered at bearing North, right bank Arkari Gol). Agricultural land can be observed at the location of the temporary construction site 2. The Arkari Gol can be seen in the distance.

View from V3 (180 degree view, at 2224 meters elevation, centered at bearing East, right bank Arkari Gol). View of Uchhtar and proposed site for the dam and reservoir.

Note: Locations f Project facilities are approximate and for illustrative purposes.

4.3 Socioeconomic

Exhibit 4.113 shows the Socioeconomic Study Area. The Socioeconomic Study Area has been delineated using the following buffers and boundaries:

- **1 km buffer around reservoir**: along reaches that may be affected due to the Project, where there is river dependence (i.e., sediment mining, fishing, use of drift wood, or recreational activities).
  - All settlements with a center of the settlement within the 1 km buffer around reservoir.
  - All settlements with more than 50% of their land area within the 1 km buffer.
- **1 km buffer around Project facilities:** for coverage of communities that will be directly affected through either resettlement, or construction related impacts such as disturbance due to noise or dust.
- **1 km buffer around Low Flow Area:** for coverage of communities that will be affected by reduction in water of River.

4.3.1 Methods of Data Collection

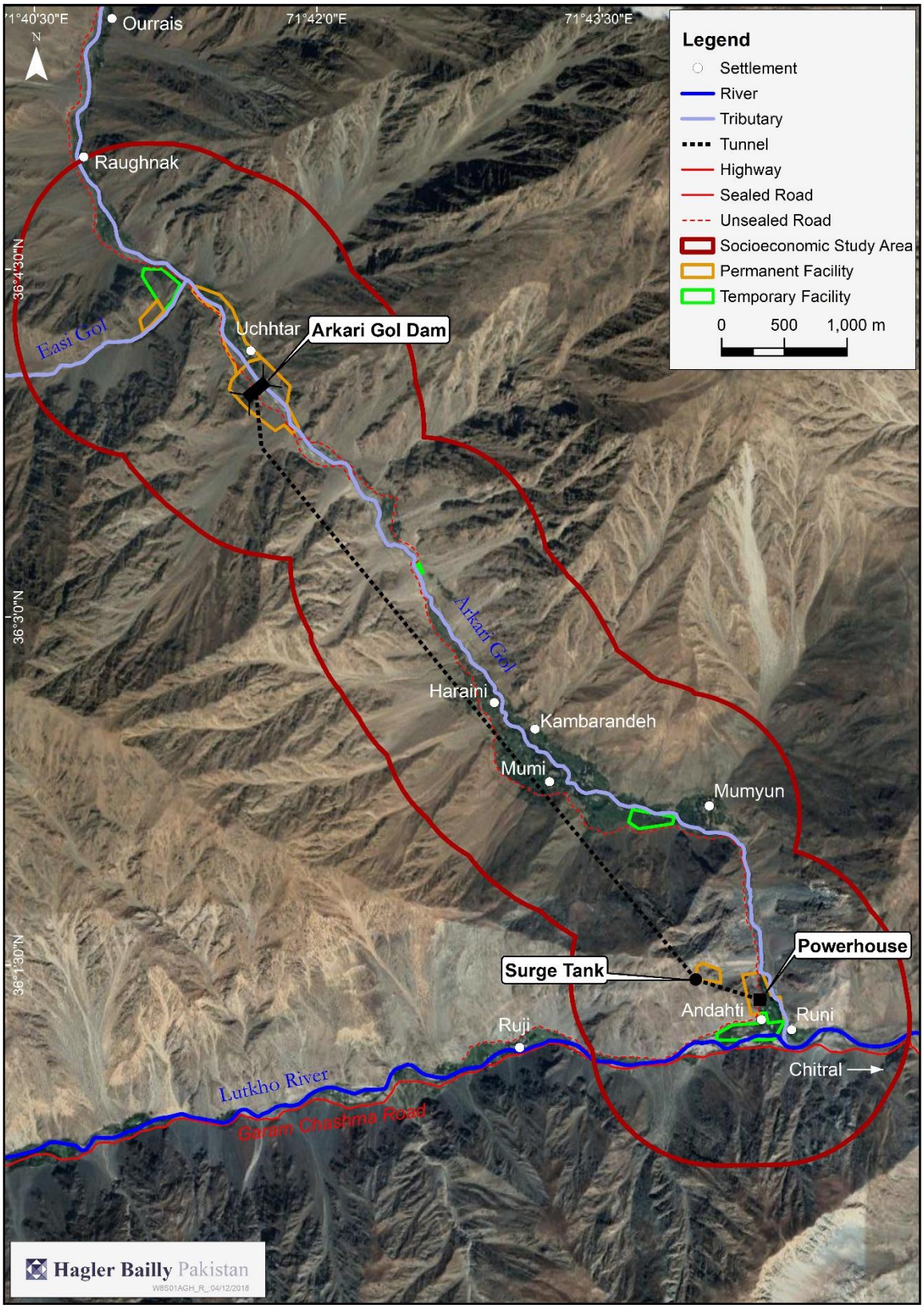
Primary data was collected at the settlement level by administering settlement level questionnaires.

Socioeconomic Aspects of Interest

Socioeconomic aspects of interest include the following:

- **Demography:** a description of the sample population and its characteristics, such as dependency ratio, population pyramid and sex ratio.
- **Infrastructure:** information on existing social and physical infrastructure, such as roads, police facilities, electricity availability, water and sanitation and postal services.
- **Health:** information on key health issues prevailing in the area and access to health facilities.
- **Education:** information on educational institutions and their accessibility.
- **Livelihood:** information on key occupations and income sources.
- **Income and poverty:** discussion on incomes, use of natural resources, expenditures and debts.
- **Dependence on ecosystems services:** dependence on ecological/natural resources (including the river) of the area as a source of livelihood, to meet day to day requirements, or for recreation.
- **Gender:** All socioeconomic information gathered was disaggregated by gender and vulnerability.

Exhibit 4.113: Socioeconomic Study Area



Surveys

The settlement level survey was completed by a team of social and resettlement experts appointed by HBP, in view of the complex and qualitative nature of information to be obtained in a semi-literate environment. Information was obtained in discussion with a group of 4 to 5 key informants including, but not limited to, the following:

- Union Council (local government) heads
- Educated persons (with Higher School Certificate as minimum level of education attained)
- School teachers
- Local government representatives and leaders
- Community based organization active in the area

Settlement Level Survey was undertaken in all the settlements within Socioeconomic Study Area. A pilot survey was carried out prior to start of the rural settlement survey. Based on the pilot survey results, settlements for rural settlement surveys were selected based on their use of the river (domestic uses and irrigation) and potential impacts of the Project. Detailed interviews were conducted with key informants (male and female) to gather information on selected settlements' social and economic setup including gender issues, with focus on infrastructure and livelihoods;

4.3.2 Overview of the Socioeconomic Study Area

The Socioeconomic Study Area falls within the jurisdiction of Chitral district of KP Province. **Exhibit 4.114** shows administrative boundaries around the Socioeconomic Study Area.

Administration and Governance

The total area of Chitral district is 14, 850 km^2 and it is the largest district of KP province in terms of area.[78] This mountainous district is situated in the northernmost region of Pakistan. It shares borders with Gilgit Baltistan in east, Afghanistan in west, and the narrow Wakhan Corridor of Afghanistan separates it from Tajikistan in north. The districts of Swat and Upper Dir are located in south.

The ex-state of Chitral was transformed into a district in 1969. The Executive Officer of the district is Deputy Commissioner, Chitral. There are two sub divisions of the district namely, Chitral and Mastuj administered by two sub-divisional officers (Assistant Commissioners). Under each sub-divisional officer there are two Extra Assistant Commissioners and one Tehsildar to assist the Assistant Commissioner. For each tehsil there is one Naib Tehsildar working under the Assistant Commissioner for administrative and revenue works. The entire district comprises 24 union councils. The Project is located in village Shaghor and Union Council Shaghor.

[78] District Profile -Chitral 2014, http://kpbos.gov.pk/files/1432633137.pdf, accessed on April 18, 2018

History

As mentioned in District Profile-Chitral 2014[79] no authentic account of the history of Chitral State prior to the 100 AD is available. It is recorded in a Sanskrit inscription carved on a rock near Barenis in Mastuj Sub-Division probably by Buddhists and under the rule of Jaipal, King of Kabul. The area has been ruled by Kushan of Peshawar, Chinese and the Iranians. It was inhabited by the Kalash who were Buddhist or followed a religion similar to Buddhism. Alexander the Great also passed through its southern tip while crossing into northern India via east Afghanistan known as little Kashghar, Chitral in the old days was on the trade route between China and Western Asia. In the fourteenth century it was conquered by Torkhoman Prince called Rais who established the Rais Dynasty which flourished for about 275 years. The Raisas subdued the remaining Kalash strong-holds in southern Chitral and conquered the whole country stretching from Gilgit to Asmar. Then the Taimuris, descend, ants of Mirza Hussain of Hirat overthrew the Rais ruler and established the Katura rule. Chitral was then ruled by Katur dynasty from 1590 to 1947.

Demography

As per Pakistan Poverty Alleviation Fund[80] the total population of the Chitral District is 479,000 (2014) with a household size of 7 persons per household and population density of 32 persons/ km^2.

Social Profile and Languages

Original inhabitants of Chitral are said to be *"Khow"*.[81] These people (Khow) accounts for 92 % of the population of Chitral and are spread in many villages.[82] Other tribes of Chitral are Kalass, Shubgali, Wakhi, Madaklashti/ Tajik, Gujars, Dameli, Gawari or Arandui, Sariquli, Kirghiz, Pathan, Dangerik, Afghans and Mukhbani or Yidgha.

Original language of Chitral district is Khowar, made up of words from various tongues and dialects. In some parts such as Lutko, Madaklasht, Kalashgum there are local dialects in which they talk between themselves but they also know Khowar. Other than Khowar some other languages are also spoken in some parts of district Chitral like Warshikwar (Upper Chitral, Warshigum and Yaseen Areas), Dangarik (Ashuret, Kalkatak and Buri), Narsatwar (Arandu), Damariwar (Domel), Kalashwar (Kalashgum) and Persian (Madaklasht and Broghil)

The majority of the people in the district Chitral are Sunni-Muslims whereas there is a sizeable population of Shia Muslims and Ismaili Muslims. The district also home to an indigenous community named the Kalasha tribe. The People of Kalash and various tribes of it are thought to believe in various gods and in very old rituals and religions[83]. Kalasha tribe lives in Kalash Valley located 37 km south of the Project and 22 km away from Chitral City.

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79 Ibid

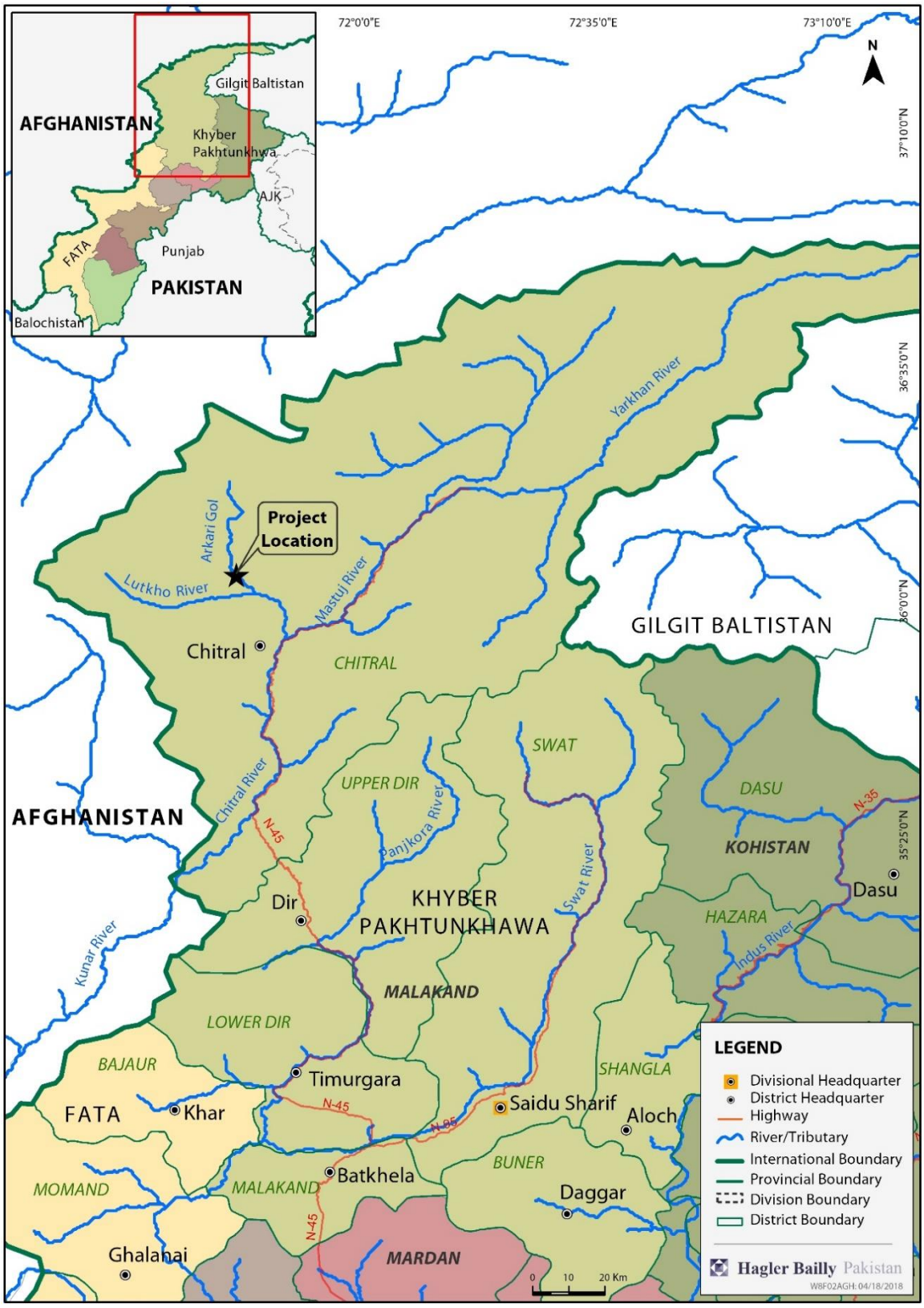
80 Development Profile of Chitral District, Pakistan Poverty Alleviation Fund, January 2015

81 District Profile -Chitral 2014, http://kpbos.gov.pk/files/1432633137.pdf, accessed on April 18, 2018

82 http://merachitral.blogspot.com/2010/05/tribes-of-chitral.html accessed on April 18, 2018

83 http://historypak.com/chitral-a-place-for-tourists accessed on April 19, 2018

Exhibit 4.114: Administrative Boundaries around the Socioeconomic Study Area



Education

The Chitral district literacy ratio is 77.42%[84] which is comparatively higher than the rest of districts of KP. A study[85] in 2014 shows that there are 641 primary schools, 88 middle schools, 66 high schools, 4 higher secondary schools, 7 community schools, 157 private schools and 4 intermediate/degree colleges in Chitral district.

Agriculture

The total cultivated area in district Chitral is 22,552 hectares.[86] The chief source of irrigation in Chitral district is mountain streams from where water channels have been constructed. Main crops are wheat, maize, barley and paddy. Vegetables and fruits are also grown.

Trade and Industry

As mentioned in District Profile - Chitral 2014[87] the mineral resources of Chitral have never been properly explored. The illiteracy and lack of enterprise of the inhabitants proves an effective bar to the profitable exploitation of her mineral even for internal use. Orpiment or Yellow Arsenic is found in the Lonkhuh valley in Tirich village. It is extracted but in small quantity. Lead is found in various parts in small quantity but is not exported. The best quality of marble stone is available in Chitral. Director of Industries, Commerce, Mineral Development Department have issued a number of licenses for exploration of minerals in some selected areas (see **Exhibit 4.115**).

Exhibit 4.115: Minerals Production 2012-13

Type of Minerals	*Quantity (Tones)*
Antimony	54
Iron Ore	160
Lead	122
Marble	5,625
Soap Stone	317

Indigenous Cultures and People

The Kalasha tribe of Chitral is considered as indigenous people due to their existence from hundreds of years with unique culture, language and ethnicity. As narrated in web based source, the culture and traditions of Chitral[88], in the tenth and eleventh century, the Kalash ruled over Lower Chitral, up till Hurbuns. In 1220, the tribe of Khow defeated Bal Singh, the Kalash ruler, and pushed them to the south western valleys of Chitral. Living

[84] Chitral Today, Basic needs for education in Chitral, https://www.chitraltoday.net/basic-needs-for-education-in-chitral/ cited on April 19, 2018

[85] District Profile -Chitral 2014, http://kpbos.gov.pk/files/1432633137.pdf, accessed on April 18, 2018

[86] Bureau of Statistics, Planning & Development Department, Government of Khyber Pakhtunkhwa and UNICEF. *District Profile: Chitral 2014*.

[87] Ibid

[88] http://merachitral.blogspot.com/2010/05/tribes-of-chitral.html accessed on April 18, 2018

with the Khow, they gradually embraced Islam. Those in the valleys of Bomborate, Birir and Rumbur however have retained their religion and culture.

Until the 1970s, not much was known about this tribe that resided in the south west of Chitral, in the three valleys of Bomborate, Birir and Rumbur. This pagan tribe of 3,000 people follows its own distinct culture and traditions. Their native language is Kalasha or Kalashamun.

Field survey reveals that none of the culture, religion, ethnic minority and indigenous community is residing in the vicinity of the Project and none of the indigenous household is being affected by the Project.

4.3.3 Socioeconomic Conditions in the Socioeconomic Study Area

Rural Settlements and Population

There are a total of 8 settlements in the Socioeconomic Study Area. All the settlements in the area are located along the River within a radius of 300 meter from the center of the river. All the settlements are small in terms of number of households (HHs) raining from 5 to 70 HHs. The area is mountainous and there are small patches of plains therefore, houses in the settlements are scattered with clusters of 3 to 8 houses at a single location. Houses are surrounded by small patches of agricultural lands as well as fruit and non-fruit trees. All settlements are connected to main road (Chitral_Garam Chasma Road) through an un-sealed road. **Exhibit 4.116** shows typical settlements in the Socioeconomic Study Area.

Exhibit 4.116: Typical Settlements in the Socioeconomic Study Area

Uchhtar Settlement

Mumi Settlement

As shown in **Exhibit 4.117**, the average household size in the Socioeconomic Study Area is 6.67 individuals, with a minimum of 5.63 and a maximum of 7.5 individuals. Male to female ratio is 1.01:1. Exhibit 4.6 shows population of settlements.

Exhibit 4.117: Average Household Size

Settlement	*Number of HHs*	***Total Population***	*Male Population*	*Female Population*	*Average Household Size*
Uchhtar	22	**147**	78	69	6.68
Mumyun	40	**300**	153	147	7.50
Mumi	70	**450**	225	225	6.43
Haraini	16	**110**	53	57	6.88
Kambarandeh	15	**100**	51	49	6.67
Andahti	13	**90**	46	44	6.92
Raughnak	16	**90**	43	47	5.63
Runi	5	**32**	15	17	6.40
Total	**197**	**1,319**	**664**	**655**	**6.67**

Migration Trends

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. Very little out migration was recorded, whereas no in-migration was recorded in any settlement.

As shown in **Exhibit 4.119** in previous 10 years there is no in-migration reported during the rural settlement survey in any settlement however 7 incidences of out migration were reported which is also insignificant. Households have migrated to Chitral and other main cities of the country for livelihood, education of children and batter living standards. There are also few HHs (less than 5 %) who have two houses one in the Socioeconomic Study Area and one in the main cities (Chitral, Islamabad etc.). These HHs spend summer in Socioeconomic Study Area and winter in their second houses.

Exhibit 4.118: Average Household Size

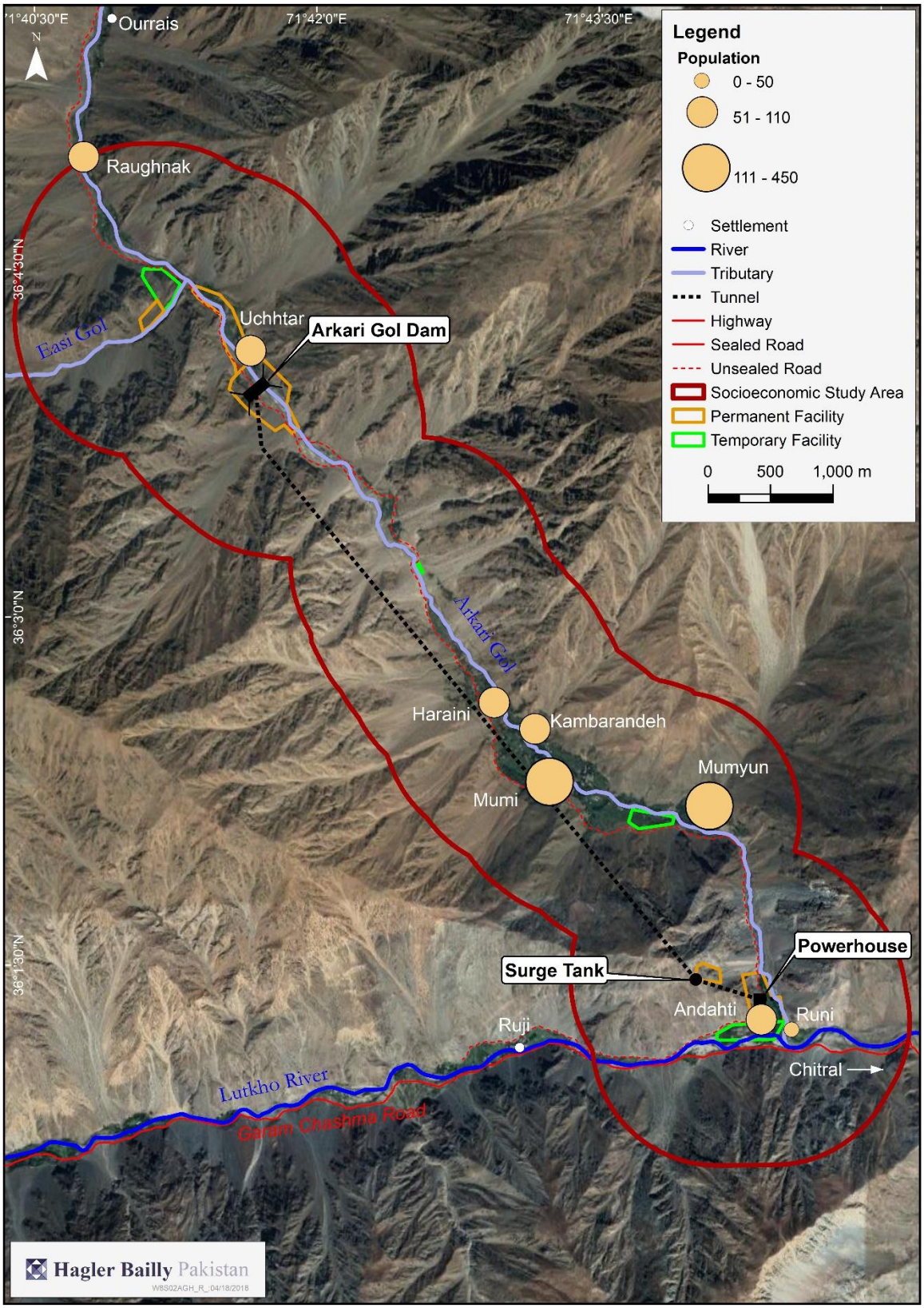


Exhibit 4.119: Migration Trends and Patterns

Settlement	*In Migration*	*Out Migration*
Uchhtar	–	–
Mumyun	–	1
Mumi	–	–
Haraini	–	–
Kambarandeh	–	–
Andahti	–	–
Raughnak	–	6
Runi	–	–
Total	**–**	**7**

Castes

A caste is a social group identity which individuals get through their status as close class separated from other classes by distinctions of hereditary status or profession. It is different from the open class system for the reason that in the open class system one may change identity through wealth but in a caste it is forever and hereditary. In settlements in the Socioeconomic Study Area, it not only represents an individual's familial ties, but also political affiliations and social standing. **Exhibit 4.120** shows the cast distribution of the population in the Socioeconomic Study Area. Main castes in the Socioeconomic Study Area are Zondray, Khuja Alanjas and Raees.

Exhibit 4.120: Distribution of Population on Caste Basis

Castes	*Uchhtar*	*Mumyun*	*Mumi*	*Haraini*	*Kambarandeh*	*Andahti*	*Raughnak*	*Runi*	***Total***
Katur	–	–	–	–	–	100%	–	–	**7%**
Zondray	–	100%	–	50%	–	–	–	–	**25%**
Dashmaner	–	–	15%	–	–	–	–	–	**6%**
Raees	–	–	10%	–	–	–	100%	–	**12%**
Mir	–	–	–	–	–	–	–	100%	**3%**
Khuja Alanjas	100%	–	15%	50%	100%	–	–	–	**26%**
Raza Khel	–	–	10%	–	–	–	–	–	**4%**
Quazia	–	–	20%	–	–	–	–	–	**7%**
Shagoria	–	–	15%	–	–	–	–	–	**6%**
Bojongee	–	–	5%	–	–	–	–	–	**2%**
Khorya	–	–	10%	–	–	–	–	–	**4%**

Languages Spoken

Like entire Chitral district the predominant language in the Socioeconomic Study Area is Khwar (100%), with Urdu as the main secondary language. Urdu, the national language is understood everywhere especially among younger people.

Literacy and Education

There are only three primary schools in the Socioeconomic Study Area, one secondary school (up to level10) and one higher secondary school (up to level 12) are located in Shaghor at a distance of 5 km to 12 km. There is no Degree college and university accessible from Socioeconomic Study Area. This is also evident in **Exhibit 4.121** which shows current school and college enrolment in the Socioeconomic Study Area. The number of students at different educational levels in all settlement is given, and the data is also broken down by gender.

This data indicates that children from the Socioeconomic Study Area are enrolled in primary and high schools and male and female enrolment is almost comparable. However no student from the Socioeconomic Study Area is enrolled in any college or university from the entire Socioeconomic Study Area. **Exhibit 4.121** shows photographs of primary schools available in the Socioeconomic Study Area and higher educational institutions in Chitral city.

Exhibit 4.121: Photographs of Education Infrastructure

Govt. Primary school at Uchhtar settlement

Agha Khan school at Mumi settlement

Chitral College of Education at Chitral

University of Chitral at Chitral

As provided in **Exhibit 4.122** literacy rate in the Socioeconomic Study Area is 60 % which is less than the 75 % literacy rate of the district. Moreover literacy rate of female is less then literacy rate of male.

Exhibit 4.122: Literacy Rate in the Socioeconomic Study Area

Settlement	*Literacy Rate*		
	Male	*Female*	***Total***
Uchhtar	80%	60%	**71%**
Mumyun	70%	50%	**60%**
Mumi	80%	50%	**65%**
Haraini	50%	10%	**29%**
Kambarandeh	75%	50%	**63%**
Andahti	90%	60%	**75%**
Raughnak	70%	15%	**41%**
Runi	70%	45%	**57%**
Total	**75%**	**45%**	**60%**

Health

There is no health facility available in the Socioeconomic Study Area, only lady health visitors/ workers (LHVs and LHWs) visit the settlements and provide basic health services. LHVs and LHWs also provide polio vaccination service in the Socioeconomic Study Area.

The nearest health facility is a Basic Health Unit (BHU) in Shahgor, while district hospital is located in Chitral city, photograph of BHU Shahgor is shown in **Exhibit 4.124**.

Exhibit 4.125 shows the reported incidence of common diseases in the Socioeconomic Study Area, as a percentage. No disease was reported as an epidemic. As expected, the most common illness reported in the children, adult male and female populations was flu/fever. Other illnesses reported included dysentery, diabetes and jaundice. The prevalence of these is within a negligible proportion of the population.

Exhibit 4.123: Distribution of Enrolled Population by Gender, Education Levels

Settlement	*Uchhtar*		*Mumyun*		*Mumi*		*Haraini*		*Kambarandeh*		*Andahti*		*Raughnak*		*Runi*	
Gender	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
Primary (Nursery to Class V) for Boys	12	6	30	25	70	80	20	18	10	6	8	9	8	14	4	7
Primary (Nursery to Class V) for Girls or Co-Ed	–	–	–	–	–	–	–	–	4	4	3	2	–	–	–	–
Middle (Class VI to VIII) for Boys	7	6	12	8	50	50	15	15	–	–	–	–	3	–	1	–
Middle (Class VI to VIII) for Girls or Co-Ed	–	–	–	–	–	–	–	–	1	1	2	2	–	4	–	2
Secondary (Class IX to X) for Boys	–	–	12	8	25	25	12	10	–	–	–	–	8	5	4	3
Secondary (Class IX to X) for Girls	–	–	6	4	–	–	–	–	–	–	–	–	–	–	–	–
Intermediate College for Boys/Girls	–	–	–	–	15	15	5	3	–	–	–	–	–	1	–	1
Degree College for Boys	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Degree College for Girls	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Technical and Vocational Training Institutes for Boys	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Technical and Vocational Training Institutes for Girls	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Madrassah	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–
Other	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**

Exhibit 4.124: Basic Health Unit Shahgor

Exhibit 4.125: Reported Incidences of Diseases in Socioeconomic Study Area, %

Settlements	*Uchhtar*			*Mumyun*			*Mumi*			*Haraini*			*Kambarandeh*			*Andahti*			*Raughnak*			*Runi*		
	M	*F*	*C U 15*	*M*	*F*	*C U 15*	*M*	*F*	*C U 15*	*M*	*F*	*C U 15*	*M*	*F*	*C U 15*	*M*	*F*	*C U 15*	*M*	*F*	*C U 15*	*M*	*F*	*C U 15*
Flu/Fever	80%	80%	90%	50%	70%	90%	25%	50%	50%	30%	30%	40%	50%	60%	80%	50%	50%	80%	30%	30%	40%	50%	50%	80%
Malaria	5%	5%	10%	50%	60%	60%	20%	30%	30%	30%	30%	40%	10%	40%	50%	10%	10%	20%	–	–	–	10%	10%	20%
Chicken Pox	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Typhoid	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Diarrhea/Dysentery	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tuberculosis	–	–	–	–	–	–	5%	3%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Goiter/Thyroid	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Jaundice	–	–	–	10%	5%	–	5%	5%	–	–	–	–	50%	40%	–	5%	3%	–	20%	15%	0%	5%	3%	–
Diabetes	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5%	2%	–	–	–	–

Physical Infrastructure

The presence of roads, communication networks and other infrastructure are indicators of development in a region. The survey determined that there is considerable scope for development in the infrastructure, as access to various facilities and infrastructure is low in most parts.

Roads and Transportation

The settlements situated on both side of Arkari Gol in the Socioeconomic Study Area are connected to main towns and cities through Arkari Road which links settlements to Chitral Garam Chashma road on one side and to Arkari town to other side. Arkari Road is an unsealed road in poor condition moreover, it is a landslide area and occasionally land sliding also damages the road. **Exhibit 4.126** shows the conditions of the road.

Exhibit 4.126: Road Network in Socioeconomic Study Area

Unsealed road

Transport

Foot bridge

A bridge for vehicles

Water Supply Sources

All surveyed settlements are 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. Distances of the settlements to sources of water ranges from 1 km to 4 km. Almost all surveyed settlements also reported having access to spring water at relatively short distances.

The dependence on the Arkari Gol for drinking is negligible in all settlements, although river water is occasionally used for livestock. **Exhibit 4.127** shows the water supply source

Exhibit 4.127: Pictures of Water Supply Sources

Sanitation and Waste Disposal

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 Arkari Gol, affecting water quality However, dilution rates are high as population is low and quality of river water is relatively unaffected.

Most settlements surveyed reported access to pit latrines of some type, although a significant number of households are still using open latrines.

Power and Fuel Source

As shown in **Exhibit 4.128**, 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.

All settlements of the Socioeconomic Study Area are connected to the local micro hydro power project located at settlement Mumi provided by AKRSP. **Exhibit 4.129** shows micro hydro power plant. Electricity is mainly used for lighting purposes and running household electrical appliances. For cooking, water and space heating purposes, fuelwood is used in almost all the HHs however some of the HHs also use. Fuelwood is commonly used as a source of fuel. Communities' source fuelwood from individual lands and communal forests, paying only for the transportation cost.

Exhibit 4.128: Fuel Sources

Settlement	*Uchhtar*	*Mumyun*	*Mumi*	*Haraini*	*Kambarandeh*	*Andahti*	*Raughnak*	*Runi*
Electricity	100%	100%	100%	100%	100%	100%	100%	100%
Fuel wood (Gathered)	100%	100%	100%	100%	100%	100%	100%	100%
Fuel wood (Market)	–	–	–	–	–	–	30%	–
Drift Wood	–	–	–	–	–	–	–	–
LPG	80%	–	–	75%	60%	–	45%	40%
Diesel	–	–	–	–	–	–	–	–
Other	–	–	–	–	–	–	–	–

Exhibit 4.129: Micro Hydro Power Plant in Settlement Mumi

Communication Infrastructure

None of the settlements are connected to the country's landline telephone network, however all the area does receive a mobile phone signal. Post office is also available in Shaghor village and is accessible to all the settlements.

Police

The Socioeconomic Study Area and surroundings are generally peaceful, and there are no major law and order problems reported. However, police presence in the entire area is quite low, police check post is available in Shaghor. The police check posts mainly monitors incoming traffic to determine the purpose of visitors to the area.

Other Facilities

There are no banks or markets within the Socioeconomic Study Area. For major purchases the surveyed settlements depend on nearby town Shaghor, Garam Chashma and Chitral city. There were one or two small shops selling basic groceries found in all settlements, mostly belonging to household having vehicles. **Exhibit 4.130** shows nearby villages and cities to the study area. **Exhibit 4.131** shows commercial activities in the Socioeconomic Study Area.

Exhibit 4.130: Micro Hydro Power Plant in Settlement Mumi

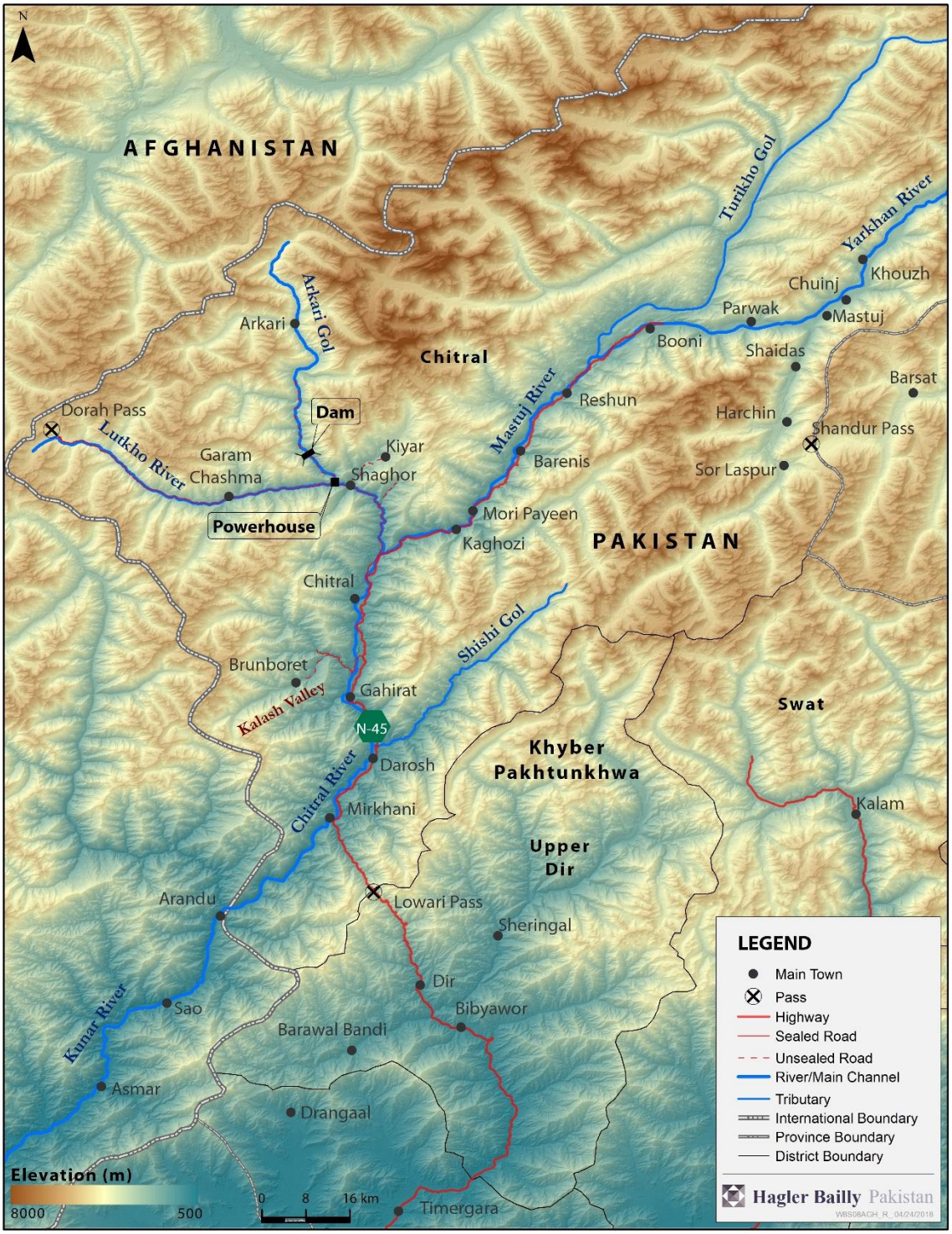


Exhibit 4.131: Commercial Activities in Socioeconomic Study Area

Income and Employment

Sources of income, access to sustainable income sources, diversity of sources and dependence on these sources have a direct impact on poverty, income distribution and economic development. There are certain issues inherent to employment such as literacy skill level and lack of opportunities in the Socioeconomic Study Area. **Exhibit 4.132** shows the sources of livelihood as a percentage by settlement in the Socioeconomic Study Area. The major sources of income are private jobs (23%), Agriculture (22%) Government services (21%) and labor (19%). For women major sources of income are private jobs (33%), Government services (33%), Agriculture (24%) and livestock (10%) Moreover, as mentioned in Exhibit 4.20 average income for male is higher in business sector followed by private sector and government services sector. For women average income is higher for Private services sector followed by government services and agriculture.

Exhibit 4.132: Employment and Livelihoods

Settlement	*Uchhtar*	*Mumyun*	*Mumi*	*Haraini*	*Kambarandeh*	*Andahti*	*Raughnak*	*Runi*	***Percent***
Male									
Private service	8	12	21	2	5	2	5	3	**23%**
Agriculture	–	–	28	6	5	4	12	–	**22%**
Labor	12	6	–	4	12	–	11	2	**19%**
Livestock	–	–	–	5	–	–	8	–	**5%**
Business	–	3	5	1	–	1	–	–	**4%**
Skilled Artisan	–	3	–	1	–	–	2	–	**2%**
Government service	4	22	6	3	5	5	3	3	**21%**

Settlement	*Uchhtar*	*Mumyun*	*Mumi*	*Haraini*	*Kambarandeh*	*Andahti*	*Raughnak*	*Runi*	***Percent***
Other occupations	–	–	7	–	–	–	–	–	**3%**
Female									
Private. Service	1	3	3	–	–	–	–	–	**33%**
Agriculture	–	–	–	–	–	–	5	–	**24%**
Labor	–	–	–	–	–	–	–	–	**–**
Livestock	–	–	–	–	–	–	2	–	**10%**
Business	–	–	–	–	–	–	–	–	**–**
Skilled Artisan	–	–	–	–	–	–	–	–	**–**
Government service	–	3	2	–	–	–	2	–	**33%**
Other occupations	–	–	–	–	–	–	–	–	**–**

Exhibit 4.133: Average Income from Different Sources

Settlement	*Uchhtar*	*Mumyun*	*Mumi*	*Haraini*	*Kambarandeh*	*Andahti*	*Raughnak*	*Runi*	***Total***
Male									
Private. Service	25,000	45,000	25,000	40,000	20,000	20,000	12,000	25,000	**26,500**
Agriculture	–	–	15,000	25,000	15,000	–	10,000	–	**16,250**
Labor	–	15,000	–	1,500	15,000	–	15,000	15,000	**12,300**
Livestock	–	–	–	10,000	–	–	5,000	–	**7,500**
Business	–	25,000	25,000	50,000	30,000	30,000	20,000	–	**30,000**
Skilled Artisan	–	–	–	10,000	–	20,000	8,000	–	**12,666**
Government service	20,000	30,000	25,000	30,000	25,000	25,000	25,000	24,000	**25,500**
Female									
Private. Service	40,000	25,000	20,000	–	–	–	–	–	**28,333**
Agriculture	–	–	–	–	–	–	5,000	–	**5,000**
Labor	–	–	–	–	–	–	–	–	
Livestock	–	–	–	–	–	–	3,000	–	**3,000**
Business	–	–	–	–	–	–	–	–	
Skilled Artisan	–	–	–	–	–	–	–	–	**–**
Government service	–	20,000	15,000	–	–	–	20,000	–	**18,333**
Other occupations	–	–	–	–	–	–	–	–	

Exhibit 4.134 shows the distribution of households in surveyed settlements by level of income. A significant portion (30%) of households in the Socioeconomic Study Area earn less than PKR 20,000, and can therefore be considered impoverished. A fairly small percentage (12%) of households earn more than PKR 50,000. There is some variation in income across the settlements, however variation appears to be random, with no particular settlement being significantly better or worse off.

Exhibit 4.134: Household Income Levels by Settlement (PKR/month)%

Settlements	*Very Low Income Group less than PKR 10,000 (%)*	*Low Income Group PKR 10,000 – 20,000 (%)*	*Middle Income Group PKR 20,000 – 50,000 (%)*	*High Income Group more than PKR 50,000 (%)*
Uchhtar	–	–	33%	67%
Mumyun	5%	20%	65%	10%
Mumi	5%	15%	75%	5%
Haraini	15%	50%	30%	5%
Kambarandeh	5%	15%	70%	10%
Andahti	10%	25%	60%	5%
Raughnak	80%	15%	4%	1%
Runi	–	–	60%	40%
Total	**12%**	**18%**	**58%**	**12%**

Land Holding and Farming

Exhibit 4.135 shows the average land holding size by settlement in the Socioeconomic Study Area. The average landholding in settlements ranges from 2 to 7 kanals (0.10-0.35 hectares) per household. People grow wheat in winter and maize in summer season vegetables are also grown in the Socioeconomic Study Area. Although the area is mountainous and land holdings are small still people have made water channels up to a length of 3-4 km to irrigate their lands. Therefore, crop yields are good in the Socioeconomic Study Area. Due to small land holdings quantity of crop production is limited and not even sufficient for the households themselves, and no crops are sold in the market. **Exhibit 4.136** shows agriculture in the socioeconomic area and **Exhibit 4.137** shows average crop yield in the Socioeconomic Study Area.

Exhibit 4.135: Average Land Holding by Settlements

Average Land Holding	*Uchthar*	*Mumyun*	*Mumi*	*Haraini*	*Kambarandeh*	*Andahti*	*Raughnak*	*Runi*
Kanal	7	1.5	3	1.5	2	2	6	3
Hectares	0.35	0.08	0.15	0.08	0.10	0.10	0.30	0.15

Exhibit 4.136: Crops Grown by Season

Water channel extracted from Arkari Gol

Wheat crop in Mumi settlement

Exhibit 4.137: Average Yield by Type of Crop by Settlement

Settlements	*Uchhtar*	*Mumyun*	*Mumi*	*Haraini*	*Kambarandeh*	*Andahti*	*Raughnak*	*Runi*
Wheat								
Maund/ Kanal	5	4	4	4	4	5	4	4
Tons /Hectare	4.36	3.49	3.49	3.49	3.49	4.36	3.49	3.49
Maize/Corn								
Maund/ Kanal	6	6	5	4	5	6	4	5
Tons/ Hectare	5.23	5.23	4.36	3.49	4.36	5.23	3.49	4.36
Pulses								
Maund/ Kanal	2	1	1.5	–	–	2	–	1.5
Tons/Hectare	1.74	0.87	1.31	-	-	1.74	-	1.31

Livestock Rearing

People keep cows and goats for milk production and chicken for eggs and meat. A small number of buffalos and sheep was also reported. As previously shown in **Exhibit 4.138**, most of the population is engaged in livestock rearing. Trends in livestock rearing were found to be consistent across the settlements, and animals commonly owned include bullocks/buffalos, cows, goats. Livestock owners often engage herders to rear goats, whereas poultry, cows and buffalo are reared at home. **Exhibit 4.139** below shows photographs of livestock in the Socioeconomic Study Area.

Exhibit 4.138: Distribution of Livestock by Animal Type

Animals	*Uchhtar*	*Mumyun*	*Mumi*	*Haraini*	*Kambarandeh*	*Andahti*	*Raughnak*	*Runi*	***Total***
Buffalo	–	–	–	–	–	–	5	–	**5**
Cow	45	50	300	50	25	60	17	25	**572**

Animals	*Uchhtar*	*Mumyun*	*Mumi*	*Haraini*	*Kambarandeh*	*Andahti*	*Raughnak*	*Runi*	***Total***
Goat	5	–	500	–	2	–	60	–	**567**
Sheep	–	–	–	–	–	–	10	–	**10**
Poultry	100	50	500	–	–	100	80	45	**875**

Exhibit 4.139: Photographs of Livestock in the Socioeconomic Study Area

Goats grazing along Arkari Gol

Cows, Mumi settlement

Exhibit 4.140 shows the average value of livestock by type of animal in the Socioeconomic Study Area. Animals are mostly sent within the settlements for grazing however, animals are also provided fodder especially in winter.

Exhibit 4.140: Average Value of Livestock by Type of Animal, PKR

Animals	*Uchhtar*	*Mumyun*	*Mumi*	*Haraini*	*Kambarandeh*	*Andahti*	*Raughnak*	*Runi*
Bullock/Buffalo	–	–	–	–	–	–	60,000	–
Cow	50,000	40,000	50,000	50,000	40,000	40,000	50,000	40,000
Goat	12,000	–	10,000	–	10,000	–	15,000	–
Poultry	1,000	1,000	800	–	–	800	600	800
Other	–	50,000	–	–	–	–	–	–

River-Dependent Socioeconomic Activities

As described earlier, rural settlement surveys were undertaken in selected settlements with river dependence or within one km of Project facilities. Detailed consultations and village profiling were conducted in each settlement to collect data on livelihoods and dependency on natural resources including on the Arkari Gol for the settlements on both river banks. The socioeconomic activities investigated in detail included sediment mining from the river, irrigation, migratory birds hunting, fishing, and recreation and tourism.

On the whole, river dependent socioeconomic activities in the Socioeconomic Study Area were found to be limited mainly to irrigation. Details are given in the following sections.

Irrigation

Main River dependent socioeconomic activity is the irrigation of agricultural lands. As reported by the local communities and observed by the survey team more than 150 acres of land is being irrigated by the Arkari Gol in Socioeconomic Study Area. Moreover, four water flour mills and one micro hydro power plant at settlement Mumi are also operating on these water channels. This irrigation system may be affected by the Project and mitigation measures are required. **Exhibit 4.141** provides photographs of irrigation channels.

Exhibit 4.141: Photographs of Irrigation Channels

Irrigation Channel passing through agricultural fields

Irrigation channel passing through mountains

Hunting of Migratory Birds

Hunting of migratory birds is quite common through the entire stretch of the Socioeconomic Study Area. Photographs related to birds hunting in Socioeconomic Study Area are shown in **Exhibit 4.142**. Large size artificial ponds have been constructed near the bank of the river in the Socioeconomic Study Area and decoys ducks are used to attract migratory ducks. A small hunting hide, built from large stones, is used for hunting purposes (**Exhibit 4.142**). Consultations with the local communities and wildlife department confirmed that permits are issued for hunting of migratory ducks. Permits are issued at the rate of PKR 2,000 to each hunter for a specific period of the year. With one permit each hunter can kill 20 waterfowls per day. It was also observed that people hunt birds without permits.

Exhibit 4.142: Photographs of Irrigation Channels

Hunter searching for ducks

Artificial pond and hunting hide near Uchttar

Sediment Mining

As observed during the field survey and consultation with the local communities sediment mining in the Socioeconomic Study Area is limited and insignificant. There is no commercial sediment mining however people collect sand from the river for their own use when required. Moreover as road is in a poor condition commercial sediment miners prefer to extract material from the mountains along the Chitral-Garam Chashma road.

Fishing

As observed during the field survey and consultation with the local communities fishing in the Socioeconomic Study Area is insignificant.

Tourism and Recreational Activities

There is very little tourism in the Socioeconomic Study Area and recreational dependence on the river was reportedly low in all the settlements. During the survey the survey team did not observe riverside fishing, boating or picnics as a recreational activity or source of income along Arkari Gol in Socioeconomic Study Area.

Physical Cultural Heritage

No physical cultural heritage was identified in the Socioeconomic Study Area based on consultation with the local communities and observation of the survey team.

Indigenous Peoples

The IFC's Performance Standard 7 recognizes that "Indigenous Peoples (IP) are social groups with identities that are distinct from dominant groups in national societies and that they are often the most marginalized and vulnerable segments of the society. Their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also

come under threat. As a consequence, Indigenous Peoples may be more vulnerable to the adverse impacts associated with project development than non-indigenous communities."

In IFC Performance Standard 7, the term "Indigenous Peoples" is usually used in a generic sense to refer to a distinct social and cultural group possessing the following characteristics in varying degrees:

- Self-identification as members of a distinct indigenous cultural groups and recognition of this identity by others;
- Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;
- Customary cultural, economic social or political institutions that are separate from those of the dominant society or culture; or
- An indigenous language, often different from official language of the country or region.

Keeping in view the above mentioned characteristics no Indigenous Peoples are residing in the Socioeconomic Study Area. More than 90 % of the entire population of the Socioeconomic Study Area belongs to Ismaili sect of Islam and others belong to Ahle Sunat sect. Ismaili sect is in minority in entire Pakistan however, based on the above mentioned characteristics it cannot be categorized as Indigenous Peoples.

5. Analysis of Alternatives

A key component in the ESIA process is the consideration of alternatives. Most guidelines use terms such as 'reasonable', 'practicable', 'feasible' or 'viable' to define the range of alternatives that should be considered. Essentially there are two types of alternatives:

- incrementally different (modifications) alternatives to the project; and
- fundamentally (totally) different alternatives to the project.

Alternatives are essentially, different ways in which the developer can feasibly meet the Project's objectives, for example by carrying out a different type of action, choosing an alternative location or adopting a different technology or design for the project. At the more detailed level, alternatives merge into mitigating measure where specific changes are made to the project design or to methods of construction or operation to avoid, reduce or remedy environmental effects. All ESIA systems also require developers to consider mitigation (i.e. measures to avoid, reduce and remedy significant adverse effects).

Alternatives and mitigation therefore cover a spectrum ranging from a high level to very detailed aspects of Project design. The "No Project" scenario must also be considered as the baseline against which the environmental effects of the Project should be considered.

This section presents an analysis of the following alternatives from the perspective of economic and environmental considerations:

1. No project option
2. Alternative options for power generation
3. Environmental flow and management alternatives
4. Options for transportation of equipment to project site

5.1 No Project Option

The No Project alternative will have the following economic and environmental consequences:

- Pakistan is going through an acute power shortage. The gap between supply and demand was 7,000 MW in May 2017.[1] The GoP is enhancing generation capacity to meet the requirements and at the same time encouraging hydropower both in the public and private sectors. The proposed Project will supply the much needed power to reduce the current gap. Thus in the absence of this project, the gap in power supply and demand will continue to grow.
- Environmentally, this Project will contribute towards reducing the deterioration of air quality, as in the long run it will supply power that would otherwise be generated using coal or fuel oil, which increase the concentrations of pollutants in

[1] Dawn News, https://www.dawn.com/news/1331738, accessed November 7, 2017

the air in the surrounding areas. The Project will also reduce the volume of greenhouse gases emitted into the atmosphere for the same reason.

- The Chitral District, as compared to other districts, has a shortage of power and is lagging behind other valleys and districts in the Jhelum, Indus and Kaghan in terms of hydropower development. This Project will be the first in the valley. The Arkari Gol HPP will support economic and infrastructure development and will save on transmission costs by generating power in the district itself.
- Anthropogenic pressures on the ecosystem in this valley are limited as compared to other areas such as Jhelum and Poonch. The Project will result in some decline in population of fish species mainly in the 6 km reach of the river in the low flow section downstream of the dam. However, with the recommended modes of operation these declines can be limited. The Project will support the government departments for protection of habitat and illegal exploitation of wildlife which is presently occurring in the area in absence of organized protection. This will not only mitigate the loss due to Project, but in the long term will contribute to improvement in biodiversity as compared to the No Project alternative where protection level is weak.

Considering the pressures and issues described above, unless economically and environmentally more viable options can be found, which appears unlikely, the 'no project' option will have a negative impact on the economy as well as on the environment in Arkari Gol.

5.2 Alternative Technologies and Scale for Power Generation

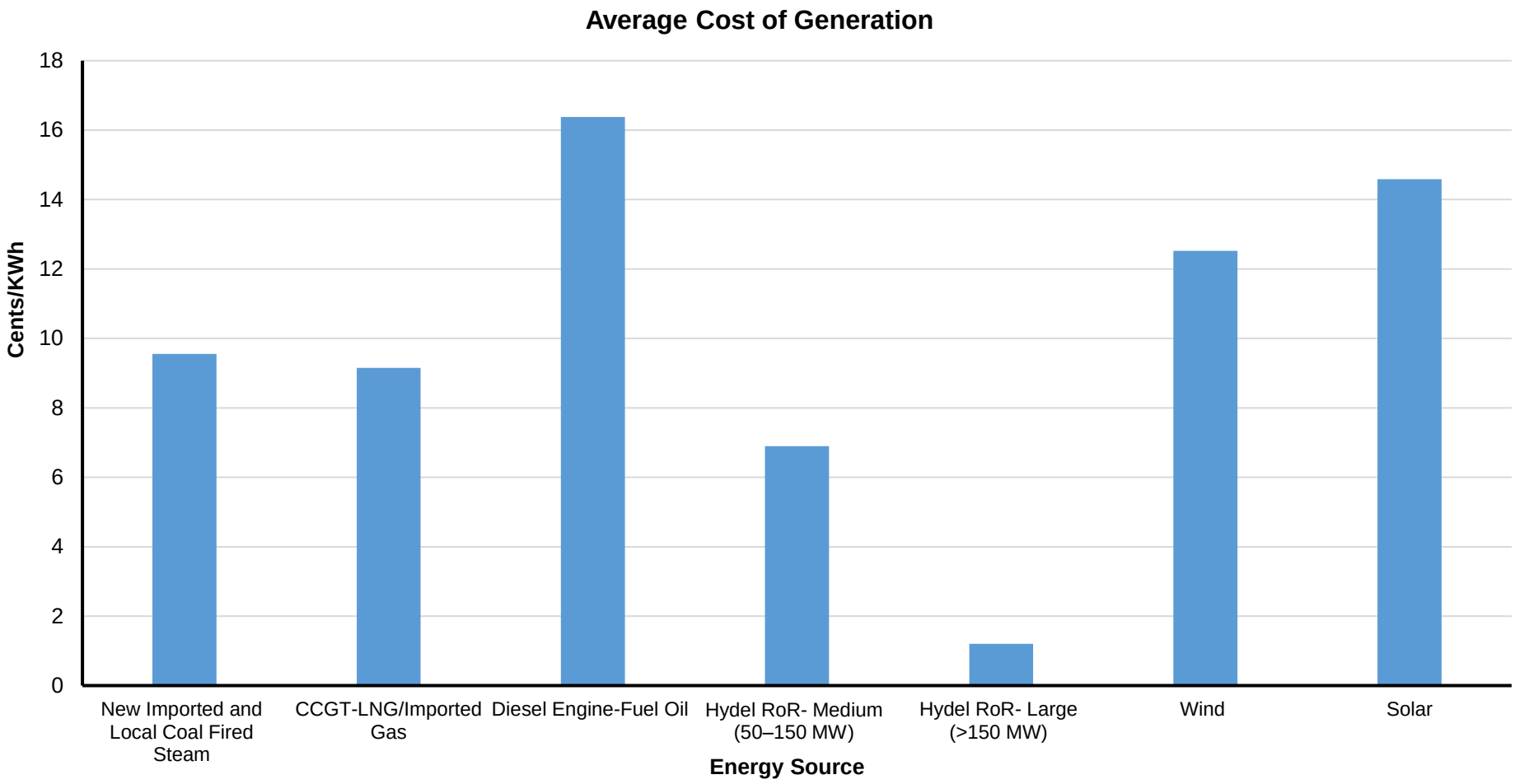
The alternatives to the proposed hydropower project include power generation from LNG/imported natural gas based combined cycle gas turbines (CCGTs), coal fired steam plants, and fuel oil based diesel engines. In addition, other technologies such as nuclear, and wind and solar renewable energy power plants could also be considered as alternatives. An analysis of the life cycle average cost of generation from the competing technologies was carried out to assess the least cost generation alternative of the project.

Exhibit 5.1 shows the comparison of cost of generation from various technology alternatives. The cost of power generation for the proposed large size RoR hydropower project is lower than that for LNG and coal based options. Cost of power generation for the large hydropower projects is also lower than that for wind energy and solar PV projects where power generation is intermittent and weather dependent, and requires back up fossil fuel based power generation capacity to maintain supply in the grid. Larger hydropower projects such as Diamer-Basha Dam that have also capacity for water storage can produce power at a slightly lower cost than the smaller RoR hydropower projects. Such large projects, however, generally involve extensive resettlement and technical studies, tend to be delayed for these reasons and can take 7-12 years to complete, and frequently face cost overruns.[2] In addition, investment is difficult to mobilize in Pakistan at present due to risk rating of the country. Given the risk of delays and cost over runs in larger dams, shortage of power in the country, and investment constraints, the Project as a large capacity RoR that

[2] Should we build more large dams? The actual costs of hydropower megaproject development, Atif Ansara, Bent Flyvbjergb, Alexander Budzierb, Daniel Lunnc, Energy Policy, Volume 69, June 2014

can be completed in four years is an acceptable option amongst currently available alternatives in terms of technology and scale of projects. In terms of socioeconomic impacts the Project is much simpler to implement than a large hydropower project involving large scale resettlement. Environmentally, potential Project impacts will be mitigated and managed through the implementation of the EMP.

Exhibit 5.1: Average Cost of Power Generation from the Project Alternatives



Source: National Electric Power Regulatory Authority, State of Industry Report 2015
National Transmission & Dispatch Company, Power System Statistics 2015 – 2016

5.3 Environmental Flow Assessment

Environmental flow (EFlow), or flow that has to be released from the dam to meet the requirements of the aquatic ecosystem, is generally of concern when the powerhouse is located at a distance from the dam, which can result in an extended stretch of river drying up. In the case of Arkari Gol HPP the power house is located 7.3 km from the dam. This will be the low flow section over which to maintain flowing conditions. An environmental flow ranging from 0.8-2 m^3/s over different months of the year is recommended. In the case of impacts downstream of the powerhouse due to peaking operations the EFlow Assessment (**Appendix M**) considers three scenarios including run of river operation, peaking and a modified form of peaking and presents the impacts of each operational scenario on indicator fish species. It recommends an approach to power generation which will balance the economic value of peaking power and impacts on river ecology in order to justify "No Net Loss Where Feasible" in Natural Habitats as defined in PS6.

5.4 Offsets to Balance the Impact on Aquatic Ecology

Conversion of lotic river habitat to lentic habitat (lake habitat) in the reservoir created by the Project will not have an impact on fish population as this stretch of the river is very limited in biodiversity. This is because of the presence of a natural barrier (waterfall) 3 km downstream of the dam which prevents fish migration to that part of the river. Losses as a result of creation of a low flow section and peaking downstream of the tailrace will be offset by maintaining an environmental flow as described above as well as by providing support to the Wildlife and Fisheries Departments to improve protection of fish habitat in the Chitral Valley.

5.5 Peaking vs. Non-peaking

Hydropower dams with storage can be operated in the peaking mode in the dry season when the river flow drops. In this mode of operation, water is typically stored in the reservoir during the day, and released through power generation turbines for three to four hours in the evening to meet the peak electricity demand. Environmental issues that are of concern with such a mode of operation include an adequate release of water through the dam when water is being stored in it to support aquatic life (environmental flow), and the impact of sudden changes in flow on aquatic life when the water is released from the dam for peaking purposes.

The powerhouse can also be operated continuously or at baseload without resorting to peaking in the low flow dry season. In other words, the dam can be operated in a true Run of the River mode where water coming into the reservoir can be allowed to flow through the power house without storing it in the reservoir created by the dam. This will minimize the impact of the flow release from project on the river biodiversity downstream of the dam.

The preferred option is to operate the Project as a true run-of-river project as this mode of operation will have minimal impacts on aquatic ecology. However, this is not economically feasible. The other operational scenarios include a peaking operation and a modified form of peaking. In the latter the flow is gradually ramped up to peak level and is then ramped down towards the end of the peaking period which buffers the impact of a full peaking operation. This form of peaking will also result in losses but at a lower level

than with full peaking mode. The approach to power generation should be selected in consultation with the power purchaser which provides a balance between economic value of peaking power and impacts of the Project on river ecology to achieve "No Net Loss Where Feasible" in a Natural Habitat as defined in PS6.

5.6 Fish Passages

A fish ladder is not required as fish were not observed upstream of the natural fall in the river located about 2.5 km downstream of the dam.

6. Information Disclosure, Consultation, and Participation

As part of the ESIA process, consultations are undertaken with communities and institutions that may have interest in the proposed Project or may be affected by it. This section documents the consultation process for the ESIA of the proposed Project and summarizes its results. The consultation process was designed to be consistent with the relevant national legislation and the IFC Guidelines[1] on Stakeholder Engagement.

6.1 Regulatory Requirements

Public consultation is mandated under national environmental law. The Pakistan Environmental Protection Agency, under Regulation 6 of the IEE-EIA Regulations 2000, issued a set of guidelines of general applicability and sectoral guidelines indicating specific assessment requirements. These guidelines have been adopted by the KP-EPA for use in its jurisdiction. This includes Guidelines for Public Consultation, 1997 (the 'Guidelines'), that are summarized below:

- **Objectives of Public Involvement:** 'To inform stakeholders about the proposed project, to provide an opportunity for those otherwise unrepresented to present their views and values, providing better transparency and accountability in decision making, creating a sense of ownership with the stakeholders'.
- **Stakeholders:** 'People who may be directly or indirectly affected by a proposal will clearly be the focus of public involvement. Those who are directly affected may be project beneficiaries, those likely to be adversely affected, or other stakeholders. The identification of those indirectly affected is more difficult, and to some extent it will be a subjective judgment. For this reason it is good practice to have a very wide definition of who should be involved and to include any person or group who thinks that they have an interest. Sometimes it may be necessary to consult with a representative from a particular interest group. In such cases the choice of representative should be left to the group itself. Consultation should include not only those likely to be affected, positively or negatively, by the outcome of a proposal, but should also include those who can affect the outcome of a proposal'.
- **Mechanism:** 'Provides sufficient relevant information in a form that is easily understood by non-experts (without being simplistic or insulting), allow sufficient time for stakeholders to read, discuss, consider the information and its implications and to present their views, responses should be provided to issues and problems raised or comments made by stakeholders, selection of venues and timings of events should encourage maximum attendance'.

[1] International Finance Corporation (IFC), 2007, Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets

- **Timing and Frequency:** Planning for the public consultation program needs to begin at a very early stage; ideally it should commence at the screening stage of the proposal and continue throughout the ESIA process.
- **Consultation Tools:** Some specific consultation tools that can be used for conducting consultations include; focus group meetings, needs assessment, semi-structured interviews; village meetings and workshops.

Important Considerations: 'The development of a public involvement program would typically involve consideration of the following issues; objectives of the proposal and the study; identification of stakeholders; identification of appropriate techniques to consult with the stakeholders; identification of approaches to ensure feedback to involved stakeholders; and mechanisms to ensure stakeholders' considerations are taken into account'.

6.2 Lender's Requirements

The Project is being developed by MHL which is seeking financing from OPIC. MHL is following OPIC guidelines. OPIC uses the IFC PSs to guide the ESIA including the stakeholder consultation process. IFC PSs are designed to manage social and environmental risks and impacts and to enhance development opportunities. Eight PSs are established which are described in **Section 2.6.2** (*International Finance Corporation's (IFC) Environmental and Social Performance Standards on Sustainability*). Clients of IFC, or other financial institutions electing to apply the Standards to projects that it is financing, are expected to meet these standards throughout the life of an investment by IFC or other relevant financial institution. The Performance Standard 1 (PS1) relevant to information and disclosure is described below.

PS 1 Social and Environmental Assessment and Management System

The PS1 establishes the importance of integrated assessment to identify the social and environmental impacts, risks, and opportunities in the project's area of influence. PS1 requires Social and Environmental Assessment and Management Systems for managing social and environmental performance throughout the life cycle of this Project and runs through all subsequent PSs. Community engagement or stakeholder engagement is one of the seven elements of PS1. The specific requirements of the stakeholder engagement are summarized below.

- **Stakeholder Analysis:** Clients should identify the range of stakeholders that may be interested in their actions and consider how external communications might facilitate a dialog with all stakeholders. Where projects involve specifically identified physical elements, aspects and/or facilities that are likely to generate adverse environmental and social impacts to Affected Communities, the client will identify the Affected Communities.
- **Engagement Planning:** The client will develop and implement a Stakeholder Engagement Plan that is scaled to the project's risks, impacts, and development stages, and will be tailored to the characteristics and interests of the Affected Communities. Where applicable, the Stakeholder Engagement Plan will include differentiated measures to allow the effective participation of those identified as disadvantaged or vulnerable. When the stakeholder engagement process depends

substantially on community representatives, the client will make every reasonable effort to verify that such persons do in fact represent the views of Affected Communities and that they can be relied upon to faithfully communicate the results of consultations to their constituents.

- **Disclosure of Information:** The client will provide Affected Communities with access to relevant information[2] on: (i) the purpose, nature, and scale of the project; (ii) the duration of proposed project activities; (iii) any risks to and potential impacts on such communities and relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism.
- **Consultation:** When Affected Communities are subject to identified risks and adverse impacts from a project, the client will undertake a process of consultation in a manner that provides the Affected Communities with opportunities to express their views on project risks, impacts and mitigation measures, and allows the client to consider and respond to them. Effective consultation should: (i) begin early in the process of identification of environmental and social risks and impacts and continue on an ongoing basis as risks and impacts arise; (ii) be based on the prior disclosure and dissemination of relevant, transparent, objective, meaningful and easily accessible information which is in a culturally appropriate local language(s) and format and is understandable to Affected Communities; (iii) focus inclusive engagement on those directly affected as opposed to those not directly affected; (iv) be free of external manipulation, interference, coercion, or intimidation; (v) enable meaningful participation, where applicable; and (vi) be documented. The client will tailor its consultation process to the language preferences of the Affected Communities, their decision-making process, and the needs of disadvantaged or vulnerable groups.
- **Informed Consultation and Participation:** For projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation (ICP) process that will build upon the steps outlined above in 'Consultation' and will result in the Affected Communities' informed participation. ICP involves a more in-depth exchange of views and information, and an organized and iterative consultation, leading to the client's incorporating into their decision-making process the views of the Affected Communities on matters that affect them directly, such as the proposed mitigation measures, the sharing of development benefits and opportunities, and implementation issues. The consultation process should (i) capture both men's and women's views, if necessary through separate forums or engagements, and (ii) reflect the different concerns of men and women and their priorities regarding project impacts, mitigation mechanisms, and benefits, where appropriate. The

[2] Depending on the scale of the project and significance of the risks and impacts, relevant document(s) could range from full Environmental and Social Assessments and Action Plans (i.e., Stakeholder Engagement Plan, Resettlement Action Plans, Biodiversity Action/Management Plans, Hazardous Materials Management Plans, Emergency Preparedness and Response Plans, Community Health and Safety Plans, Ecosystem Restoration Plans, and Indigenous Peoples Development Plans, etc.) to easy-to-understand summaries of key issues and commitments. These documents could also include the client's environmental and social policy and any supplemental measures and actions defined as a result of independent due diligence conducted by financiers.

client will document the process, in particular the measures taken to avoid or minimize risks to and adverse impacts on the Affected Communities, and will inform those affected about how their concerns have been considered.

6.3 Consultation Methodology

Consultations with the Project stakeholders were undertaken in late April 2018. The main document for distribution to stakeholders during the consultations was the Background Information Document (BID) that informed the stakeholders about the ESIA process and provided a background about the Project. The BID was made available in English and Urdu (**Appendix I**) to suit the language preferences of different stakeholders. The feedback from the communities was recorded and the detailed logs of consultations with the attendees were prepared. Separate meetings with institutional stakeholders were arranged in Chitral.

6.3.1 Stakeholders Consulted

Community Stakeholders

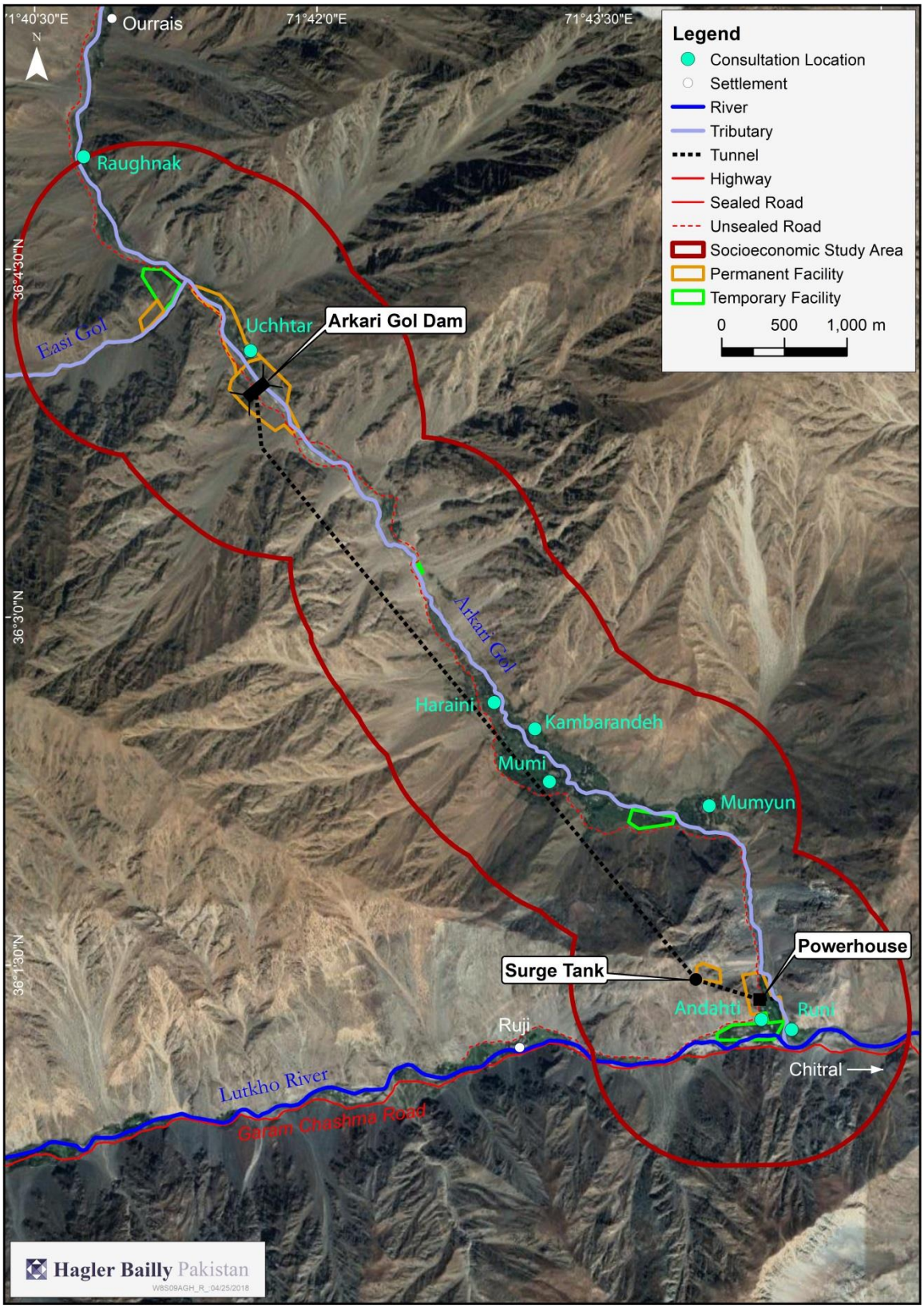
Stakeholders are groups or individuals that can affect or take affect from a project's outcome. Affected Communities include population that is likely to be affected by the Project activities. Potential impacts of the Project on the local environment include disturbances and changes to the physical and biological environment, such as, land transformation, noise disturbances, and air and water quality issues. These disturbances can result in indirect socioeconomic impacts, such as, physical or economic displacement. These impacts are expected to reduce with the increased distance from the Project facilities. A basin wide study approach was used for the ESIA of Arkari Gol HPP; therefore 8 rural communities were consulted along the Arkari Gol River.

Exhibit 6.1 lists the community stakeholders consulted. Consultation were conducted in representative number of communities while ensuring that people from various segments of the society participate in the consultation, to ensure proper coverage of possible stakeholder concerns. **Exhibit 6.2** shows location of stakeholders consulted near Project Site.

Exhibit 6.1: List of Community Stakeholders Consulted

Stakeholders	*Consultation Group*		*Date Consulted*
	No. of Men	*No. of Women*	
Raughnak	4	0	April 5, 2018
Mumyun	8	9	April 7, 2018
Kambarandeh	9	10	April 6, 2018
Haraini	6	11	April 8, 2018
Andahti / Runi	10	13	April 8, 2018
Uchhtar	8	11	April 7, 2018
Mumi 1	8	7	April 6, 2018

Exhibit 6.2: Consultation Locations



Institutional Stakeholders

The institutional stakeholders consulted for the Project included relevant government agencies. The list of stakeholders consulted is shown in **Exhibit 6.3**.

Exhibit 6.3: List of Institutional Stakeholder

Stakeholders	*Date Consulted*
Wildlife Department, Chitral	April 10, 2018
Forest Department, Chitral	April 10, 2018
DC Office, Chitral	April 11, 2018
Fisheries Department, Chitral	April 11, 2018
Sarhad Rural Support Programme (SRSP), Chitral	April 12, 2018
Aga Khan Rural Support Programme (AKRSP), Chitral	April 12, 2018
Helping Hand, Chitral	April 13, 2018
Justice Aid and Development Foundation (JAD), Chitral	April 13, 2018

6.3.2 Consultations Mechanism

Community Consultation

The Potentially Affected Communities (PAC) were visited and consultations were conducted with the community members within their settlements to encourage and facilitate their participation. Representatives, notables and other interested groups from the Potentially Affected Communities were invited. In most of the consultation, women also participated, however, where required, separate consultations were conducted with community women.

Institutional Stakeholder Consultation

Letters to inform experts/institutional stakeholders about the objective of the consultation process and to arrange meetings with the stakeholders were dispatched in advance. BID and a detailed Institutional Stakeholder Consultation documents were enclosed with the letters for the information of the stakeholders.

For institutional consultation, HBP organized meetings in Chitral district for government departments and agencies. Invitations for the meetings were sent a week before the meeting and these were followed up with phone call to ensure maximum participation.

The key agenda items for the meetings with the communities, experts/institutional stakeholders, fishermen and sand miners communities included:

- An overview of the Project description to the community representatives;
- Description of the ESIA process that will be undertaken for the Project and presentation of a structure of the ESIA report to facilitate understanding of the report;
- A list of the possible environmental and social impacts of the Project.

6.3.3 Consultation Team

An ESIA specialist led the team, which comprised of stakeholder consultation experts and male/female social assistants that were familiar with the area and the local languages.

6.4 Summary of Consultations

6.4.1 Community Consultation

Exhibit 6.4 summarizes the key concerns emerging from community consultations and explains how each concern is addressed in the ESIA. The detailed log of consultations is provided in **Appendix J.** Photographs of the consultation are shown **Exhibit 6.5.**

6.4.2 Institutional Consultation

The key concerns emerging from institutional stakeholder consultations are summarized in **Exhibit 6.7**. The detailed log of consultations is provided in **Appendix K.**

Exhibit 6.4: Summary of Concerns Expressed and Management Measures Recommended

Concerns Expressed by Stakeholders	*How they are Addressed*	*Institution/ Community*
Opportunities		
The locals expressed their interest in jobs that will be available due to the Project.	The ESIA includes preference for locals in jobs.	Community
The locals expressed their interest in the improvements in education and healthcare that may be brought to their communities.	MHL will contribute to the community through Corporate Social Responsibility (CSR).	Community
The community wants the Project to bring improvements in livelihood, for example, access to safe drinking water, education facilities, hospitals etc.	MHL will contribute to the community through Corporate Social Responsibility (CSR) keeping in mind the developments mentioned by the community.	Community
The community wants new roads to be constructed and others to be improved so that land sliding is reduced. Land sliding is a serious risk in the area.	The Project will involve reconstruction of new roads for its implementation. These will benefit the community as well. It should be noted that building new roads for the community is not the responsibility of the Project. MHL will contribute to the community through Corporate Social Responsibility (CSR).	Community
The community requested that the Project supply them with LPG at subsidized rates so that they no longer need to use forest wood for fuel.	Supplying the community with LPG is not the responsibility of the Project. MHL will contribute to the community through Corporate Social Responsibility (CSR).	Community

Concerns Expressed by Stakeholders	*How they are Addressed*	*Institution/ Community*
Priority in jobs should be given to those who are most affected.	The ESIA includes preference for locals in jobs.	Community
Electricity should be provided to the affectees free of cost.	The Project proponent cannot take this decision. This is a federal government level consideration.	Community
Job opportunities will increase and infrastructure will improve.	The ESIA includes preference for locals in jobs.	Institutions
Electricity should be provided free of cost.	The Project proponent cannot take this decision. This is a federal government level consideration.	Institutions
Source of water		
The river is a source of water for the locals and the construction of a dam will result in interruption in this water supply. Therefore, their livelihoods will be affected for example impacts on agriculture.	The Project will not use the community water supply. If any local's water supply is affected, the Project will provide alternative supply. This is included in the budget of the EMP in ***Section 9***, Environmental Management Plan.	Community
Irrigation systems depend on river water and may be disrupted due to the Project.	If any irrigation water channel is affected, the Project will provide alternative supply. This is included in the budget of the EMP in ***Section 9***, Environmental Management Plan.	Community
Traffic		
Increased traffic due to the Project will results in difficulties for the locals especially for school-going children.	Impacts due to traffic are considered as part of the ESIA and mitigations for impacts due to increased traffic are provided in **Section 9**, *Environmental Management Plan*.	Community
Increased traffic especially heavy traffic will result in an increase in air and noise pollution.	Impacts due to traffic are considered as part of the ESIA and mitigations for impacts due to increased traffic are provided in **Section 9**, *Environmental Management Plan.*	Community
Graveyards		
If any graveyards and places of worship are affected the Project should provide them with newly constructed places of worship.	The Project is not affecting any graveyard. The places of worship that are being affected will be replaced by the Project.	Community

Concerns Expressed by Stakeholders	*How they are Addressed*	*Institution/ Community*
Resettlement		
Affected households should be properly compensated for the loss of land and property. The government should build homes for them.	A comprehensive Resettlement Action Plan (RAP) has been developed for the resettlement of affected people.	Community
People's homes are very important to them and hold value in terms of family ties.	People will be properly compensated for loss of houses and other assets. A comprehensive Resettlement Action Plan (RAP) has been developed.	Community
Land acquisition should be minimized. Those affected should be properly compensated. This should be done for all assets, not just land.	A comprehensive Resettlement Action Plan (RAP) has been developed for the resettlement of affected people. This includes compensation for loss of assets.	Community
Project developers should build a colony for affectees and provide alternative land.	The majority of affectees have opted for compensation instead of a colony.	Community
Grazing areas		
Grazing areas are watered using river water. A decrease in water in the river will result in a decrease in grazing areas as water will not be available for them.	If any source of water is affected, the Project will provide alternative supply. This is included in the budget of the EMP in **Section 9**, *Environmental Management Plan*.	Community
Springs		
Springs may dry up due to construction activities.	If any local's water supply is affected, the Project will provide alternative supply. This is included in the budget of the EMP in **Section 9**, *Environmental Management Plan*.	Community
Springs may become dry due to construction activities.		Institutions
Tunnel construction		
Construction of the tunnel may result in instability and an increase in landslides.	If there is any damage to community assets due to landsliding caused by tunnel construction, compensation will be provided. The Arkari Road will be upgraded, metaled and maintained. Extensive measures will be taken for stability in spoil disposal areas. These are included in **Section 9**, *Environmental Management Plan.*	Community
Land sliding is a major issue in the area.		Institutions

Concerns Expressed by Stakeholders	*How they are Addressed*	*Institution/ Community*
Influx of outsiders		
Due to influx of outsiders mobility of women will be affected.	A code of conduct will be included in the workers agreement to ensure that the locals' way of life is not affected.	Community
Fish fauna		
Fish may be affected and their populations may decrease due to dam construction.	An assessment of impacts on fish fauna is presented in **Section 7**, *Anticipated Environmental Impacts and Mitigation Measures* are included as well. These mitigation measures are made part of the **Section 9**, *Environmental Management Plan*.	Institutions
Flow-related issues		
River as well as the major tributaries with a significant perennial flow that support breeding of fish also affects due to dam construction	An assessment of impacts on fish fauna is presented in **Section 7**, *Anticipated Environmental Impacts and Mitigation Measures* and mitigation measures are included as well. These mitigation measures are made part of the **Section 9**, *Environmental Management Plan*.	Institutions

Exhibit 6.5: Photographs of Community Consultations

Consultation with men at settlement Andahti

Consultation with men at settlement Mumyun

Consultation with women at settlement Uchhtar

Consultation with women at settlement Mumi 1

Exhibit 6.6: Photographs of Stakeholder Consultations

Consultation with DFO, Wildlife Department, Chitral

Consultation with RPM, AKRSP, Chitral

Consultation with DPM, SRSP, Chitral

6.5 Future Consultations

Further consultations to be undertaken as part of the Project ESIA process have been outlined in the **Stakeholder Engagement Plan** in **Appendix L**.

The Project management will continue community engagement activities throughout the life of the Project. Visits will be undertaken in all the communities twice or more times in a year, depending on the number of concerns raised under each consultation. Ongoing community engagement activities relevant to the ESIA include:

- Ongoing reporting on progress on the implementation of environmental and social management measures identified during the ESIA process and recording of comments on the effectiveness of these measures;
- Updating communities about new project developments and recording comments on these; and,
- Ongoing operation of the grievance redress mechanism (**Appendix L**).

An overview of Stakeholder Engagement Plan is provided in **Exhibit 6.7**.

Exhibit 6.7: List of Stakeholders and their Relevance for the ESIA and the Project

Stakeholder Group	*Stakeholders*	*Engagement Method*	*Frequency*
Government Institutions	Fisheries Department, KP Forest Department, KP Wildlife Department, KP Deputy Commissioner Office (DCO), Chitral	▶ Face-to-face meetings. ▶ Periodic reports	▶ Annually or earlier, if required
Non-Government Organizations	Aga Khan Rural Support Programme (AKRSP), Chitral Sarhad Rural Support Programme (SRSP), Chitral Helping Hand, Chitral Justice Aid and Development Foundation (JAD), Chitral	▶ Face-to-face meetings. ▶ Periodic reports	Annually or earlier, if required
Communities being relocated	Communities with river-dependent livelihoods and being relocated/resettled	▶ Meetings with the communities ▶ Visit to homes ▶ Group meetings ▶ Sharing of documents in Urdu	On an ongoing basis during resettlement process
Communities within a 500 m buffer of the river	Communities with river-dependent livelihoods	▶ Meetings with the communities ▶ Group meetings	At least once every year
Communities within 1 km of the Project infrastructure	Communities that may be directly impacted by the Project	▶ Meetings with the communities ▶ Group meetings ▶ Sharing of documents in Urdu	At least once every six month

7. Anticipated Environmental Impacts and Mitigation Measures

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. In this section, the potential environmental and social impacts are evaluated. The impacts have been identified based on consideration of the information presented in previous sections. To avoid unnecessary repetition of supporting information, cross referencing to previous sections is given where necessary. Following the impact assessment, the mitigation measures related to each impact category is presented.

7.1 Introduction

The general methodology used for impact assessment is described in this section. It describes the process of impact identification and definition, significance rating, the mitigation, management and good practice measures.

7.1.1 Impact Identification and Definition

There are several guidelines and textbooks on identification and description of environmental and social impacts. These documents use various tools in an attempt to define a comprehensive and consistent method to capture the potential impacts of a proposed Project. However, it is now widely recognized by ESIA practitioners that impact evaluation is not a purely objective and quantitative exercise. It has a subjective element; often based on judgment and values as much as scientific criteria. Recognizing this, a uniform system of impact description is used to enable the reviewers to understand how impacts have been interpreted. The description of each impact will have the following features:

- a definition of the impact using an **impact statement** identifying the Project activity or activities that causes the impact, the pathway or the environmental parameter that is changed by the activity, and the potential receptors of the impact (aspect-pathway-receptor)
- **description of the sensitivity and importance value** of the receiving environment or receptors (based on the stakeholder consultations undertaken)
- **extent of change** associated with the impact
- **rating of the significance** of the impact
- description of appropriate mitigation and management measures and potential effectiveness of the proposed measures
- characterization of the level of uncertainty in the impact assessment

The significance of an impact is determined based on the product of the consequence of the impact and the probability of its occurrence. The consequence of an impact, in turn, is a function primarily of three impact characteristics:

- magnitude
- spatial scale
- timeframe

Magnitude is determined from quantitative or qualitative evaluation of a number of criteria including:

- sensitivity of existing or reasonably foreseeable future receptors
- importance value of existing or reasonably foreseeable future receptors, described using the following:
  - inclusion in government policy
  - level of public concern
  - number of receptors affected
  - intrinsic or perceived value placed on the receiving environment by stakeholders
  - economic value to stakeholders
- severity or degree of change to the receptor due to impact, measured qualitatively or quantitatively, and through comparison with relevant thresholds:
  - legal thresholds—established by law or regulation
  - functional thresholds—if exceeded, the impacts will disrupt the functioning of an ecosystem sufficiently to destroy resources important to the nation or biosphere irreversibly and/or irretrievably
  - normative thresholds—established by social norms, usually at the local or regional level and often tied to social or economic concerns
  - preference thresholds—preferences for individuals, groups or organizations only, as distinct from society at large
  - reputational thresholds—the level of risk a company is willing to take when approaching or exceeding the above thresholds

Spatial scale is another impact characteristic affecting impact consequence. The spatial scale of impacts can range from localized (confined to the proposed Project site) to extensive (national or international extent). They also may vary depending on the component being considered.

The impact **timeframe** is the third principal impact characteristic defining impact consequence and relates to either its duration or its frequency (when the impact is intermittent). Impact duration can range from relatively short (less than four years) to long (beyond the life of the Project). Frequency ranges from high (more than 10 times a year) to low (less than once a year). These timeframes will need to be established for

each Project based on its specific characteristics and those of the surrounding environment.

Once the impact consequence is described on the basis of the above impact characteristics, the **probability of impact** occurrence is factored in to derive the overall impact significance. The probability relates to the likelihood of the impact occurring, not the probability that the source of the impact occurs. For example, a continuous Project activity may have an unlikely probability of impact if there are no receptors within the area influenced by that activity.

The **reversibility of each impact** at the end of construction and operation are important, as these impacts may need on-going management after operation. The reversibility of each impact at the end of construction and operation will be noted and described alongside the three primary characteristics of magnitude, spatial scale and duration. The characteristics are outlined in **Exhibit 7.1**.

Exhibit 7.1: Characteristics Used to Describe Impact

Characteristics	*Sub-components*	*Terms used to describe the impact*
Type		Positive (a benefit), negative (a cost) or neutral
Nature		Biophysical, social, cultural, health or economic Direct, indirect or cumulative
Phase of Project		Construction, operation, decommissioning or post closure
Magnitude	Sensitivity of receptor	High, medium or low capacity to accommodate change High, medium or low conservation importance Vulnerable or threatened Rare, common, unique, endemic
	Importance or value of receptor	High, medium or low concern to some or all stakeholders High, medium or low value to some or all stakeholders (for example, for cultural beliefs) Locally, nationally or internationally important Protected by legislation or policy
	Severity or degree of change to the receptor	Gravity or seriousness of the change to the environment Intensity, influence, power or strength of the change Never, occasionally or always exceeds relevant thresholds
Spatial scale	Area affected by impact - boundaries at local and regional extents will be different for biophysical and social impacts.	Area or Volume covered Distribution Local, regional, transboundary or global

Characteristics	*Sub-components*	*Terms used to describe the impact*
Timeframe	Length of time over which an environmental impact occurs or frequency of impact when intermittent	Short term or long term Intermittent (what frequency) or continuous Temporary or permanent Immediate effect (impact experienced immediately after causative project aspect) or delayed effect (effect of the impact is delayed for a period following the causative project aspect)
Probability - likelihood or chance an impact will occur		Definite (impact will occur with high likelihood of probability) Possible (impact may occur but could be influenced by either natural or project related factors) Unlikely (impact unlikely unless specific natural or Project related circumstances occur)
Reversibility/Sustainability		Potential for recovery of the endpoint from a negative impact Reversible or irreversible Sustainability for positive impacts
Effectiveness of management measures (will management measures reduce impact to an acceptable level)		Indication of what could occur in the absence of management measures Effectiveness of proposed measures
Confidence in impact evaluation (degree of certainty in the significance ascribed to the impact)		Scientific uncertainty – limited understanding of ecosystem (or community) and processes governing change Data uncertainty – restrictions introduced by incomplete or incomparable information, or by insufficient measurement techniques Policy uncertainty – unclear or disputed objectives, standards or guidelines

7.1.2 Impact Significance Rating

The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the approval process; secondly, it serves to show the primary impact characteristics, as defined above, used to evaluate impact significance. The impact significance rating system is presented in **Exhibit 7.2** and described as follows:

- **Part A**: Define impact consequence using the three primary impact characteristics of magnitude, spatial scale and duration.
- **Part B**: Use the matrix to determine a rating for impact consequence based on the definitions identified in Part A; and
- **Part C**: Use the matrix to determine the impact significance rating, which is a function of the impact consequence rating (from Part B) and the probability of occurrence.

Using the matrix, the significance of each described impact is rated.

Exhibit 7.2: Method for Rating the Significance of Impacts

PART A: DEFINING CONSEQUENCE IN TERMS OF MAGNITUDE, DURATION AND SPATIAL SCALE *Use these definitions to define the consequence in Part B*			
Definition		Criteria	
MAGNITUDE		Negative	Positive
	Major	Large number of receptors affected Receptors highly sensitive and/or are of conservation importance Substantial deterioration, nuisance or harm to receptors expected Relevant thresholds often exceeded Significant public concern expressed during stakeholder consultation Receiving environment has an inherent value to stakeholders	Large number of receptors affected Receptors highly amenable to positive change Receptors likely to experience a big improvement in their situation Relevant positive thresholds often exceeded
	Moderate	Some receptors affected Receptors slightly sensitive and/or of moderate conservation importance Measurable deterioration, nuisance or harm to receptors Relevant thresholds occasionally exceeded Limited public concern expressed during stakeholder consultation Limited value attached to the environment	Some receptors affected Receptors likely to experience some improvement in their situation Relevant positive thresholds occasionally exceeded
	Minor	No or limited receptors within the zone of impact Receptors not sensitive to change Minor deterioration, nuisance or harm to receptors Change not measurable or relevant thresholds never exceeded Stakeholders have not expressed concerns regarding the receiving environment	No or limited receptors affected Receptors not sensitive to change Minor or no improvement in current situation Change not measurable Relevant positive thresholds never exceeded No stakeholder comment expected
TIMEFRAME (determine specific to each Project)		Duration of continuous aspects	Frequency of intermittent aspects
	Short term/ low frequency	Less than 5 years from onset of impact coinciding with the active construction period	Occurs less than once a year
	Medium term/ frequency	More than 5 years from onset of impact up to 15 years	Occurs less than 10 times a year but more than once a year
	Long term/ high frequency	Impact is experienced during and beyond 15 years	Occurs more than 10 times a year
SPATIAL SCALE (determine specific to each project)		Biophysical	Socio-economic
	Small	Within the project fence line or within 200 m of unfenced facilities, or to less than a 6 km reach of a river on which the project is located	Within the 200 m of the Project footprint in which the activity occurs

	Intermediate	Within 3 km of the area in which the facilities are located, or to more than 6 km reach of the river on which project is located, but not extending beyond the sub basin	Within 15 km of the Project activities
	Extensive	Beyond 3 km of the area in which the facilities are located, or extending basin wide in the river system	Beyond 15 km of the Project activity

PART B: DETERMINING CONSEQUENCE RATING

Rate consequence based on definition of magnitude, spatial extent and duration

MAGNITUDE	TIMEFRAME	SPATIAL SCALE		
		Small	Inter-mediate	Extensive
Minor	Short term / low frequency	Low	Low	Medium
	Medium term / frequency	Low	Low	Medium
	Long term / high frequency	Medium	Medium	Medium
Moderate	Short term / low frequency	Low	Medium	Medium
	Medium term / frequency	Medium	Medium	High
	Long term / high frequency	Medium	High	High
Major	Short term / low frequency	Medium	Medium	High
	Medium term / frequency	Medium	Medium	High
	Long term / high frequency	High	High	High

PART C: DETERMINING SIGNIFICANCE RATING

Rate significance based on consequence and probability

		CONSEQUENCE		
		Low	Medium	High
PROBABILITY (of exposure to impacts)	Definite	Low	Medium	High
	Possible	Low	Medium	High
	Unlikely	Low	Low	Medium

7.1.3 Mitigation, Management and Good Practice Measures

Using the matrix, the significance of each described impact is initially rated. This initial rating assumes the management measures inherent in the Project design and described in the Project description (**Section 3**, *Description of the Project*) are in place. For example, if a fuel store has secondary containment, the initial impact rating takes this into account.

Wherever the Project is likely to result in unacceptable impact on the environment, additional mitigation measures are proposed (over and above the inherent design measures included in the Project description). In addition, good practice measures may be proposed however these are unlikely to change the impact significance. In the case of positive impacts, management measures are suggested to optimize the benefits to be gained. Where mitigation measures are required the impact will be rated again to show the residual impact after implementation of management controls.

The following mitigation hierarchy will be utilized in selecting practical mitigation measures for unacceptable impacts as follows (in order of preference):

- avoid the impact wherever possible by removing the cause(s)
- reduce the impact as far as possible by limiting the cause(s)
- ameliorate the impact by protecting the receptor from the cause(s) of the impact
- providing compensatory measures to offset the impact, particularly where an impact is of high significance and none of the above are appropriate.

A rating of impact considering mitigations will be carried out to highlight the effectiveness of proposed management measures designed to mitigate or enhance the impact, and by characterizing the level of confidence or uncertainty in the assessment.

For each of the impacts identified, a table will be filled in **Exhibit 7.3**.

Exhibit 7.3: Impact Assessment Template

Impact 01: Changes in ecological conditions downstream of the dam i.e. creation of a flow section								
Applicable Project Phase	*Construction*							
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Long Term	Extensive	High	Definite	High	-	High
Mitigation Measures:								
Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Major	Long Term	Extensive	High	Definite	High	+	High

7.1.4 Impact Grouping

The impacts in this Section are grouped as follows:

- Ecology
  - 7.2 Aquatic Ecology
  - 7.3 Terrestrial Ecology
- Physical Environment
  - 7.4 Ambient Air Quality
  - 7.5 Blasting and Vibration
  - 7.6 Construction Noise
  - 7.7 Water Availability and Quality
  - 7.8 Soil, Topography, Land Stability
  - 7.9 Aesthetics
  - 7.10 Traffic and Road
- Socioeconomic Environment
  - 7.11 Livelihood and Well-being
  - 7.12 Socio-cultural Impacts
- Cross-thematic Aspects
  - 7.13 Greenhouse Gas Emissions
  - 7.14 Climate Change
  - 7.15 Cumulative Impact Assessment

7.2 Aquatic Ecology

An overview of the aquatic ecological resources in the Study Area is given in **Section 4.1.4**, *Aquatic Ecology*.

Project impacts on aquatic ecology are assessed within the river and tributaries where the aquatic ecological resources are likely to be impacted by the Project, called the Area of Impact (AoI). Details are presented in **Appendix M** (*Environmental Flow Report*). The AoI (**Exhibit 7.4**) considers the Project footprint including the reservoir, the changes it will make to the hydrology and connectivity of the river, including the major tributaries that drain into the stretch of Jhelum River affected by the Project. The AoI can be divided into three distinct segments. The segments which the Project will impact are described below:

- Arkari Gol, upstream of its confluence with Lutkho River: the riverbed in this segment has a relatively higher slope resulting in higher water velocities and frequent rapids and falls. The valley is V shaped with relatively steep and narrow. The migratory Snow Trout was not recorded in this section. No fish were recorded above the water fall (Segment 1 in **Exhibit 7.4**) which presents a barrier

to upstream movement of the Snow Trout. Relative abundance of fish is apparently low (see **Section 4.1.4**) downstream of the waterfall (Segment 2 in **Exhibit 7.4**), and the habitat is least conducive to supporting fish populations relative to that in other segments in the Aquatic Study Area (see **Section 4.1.1**).

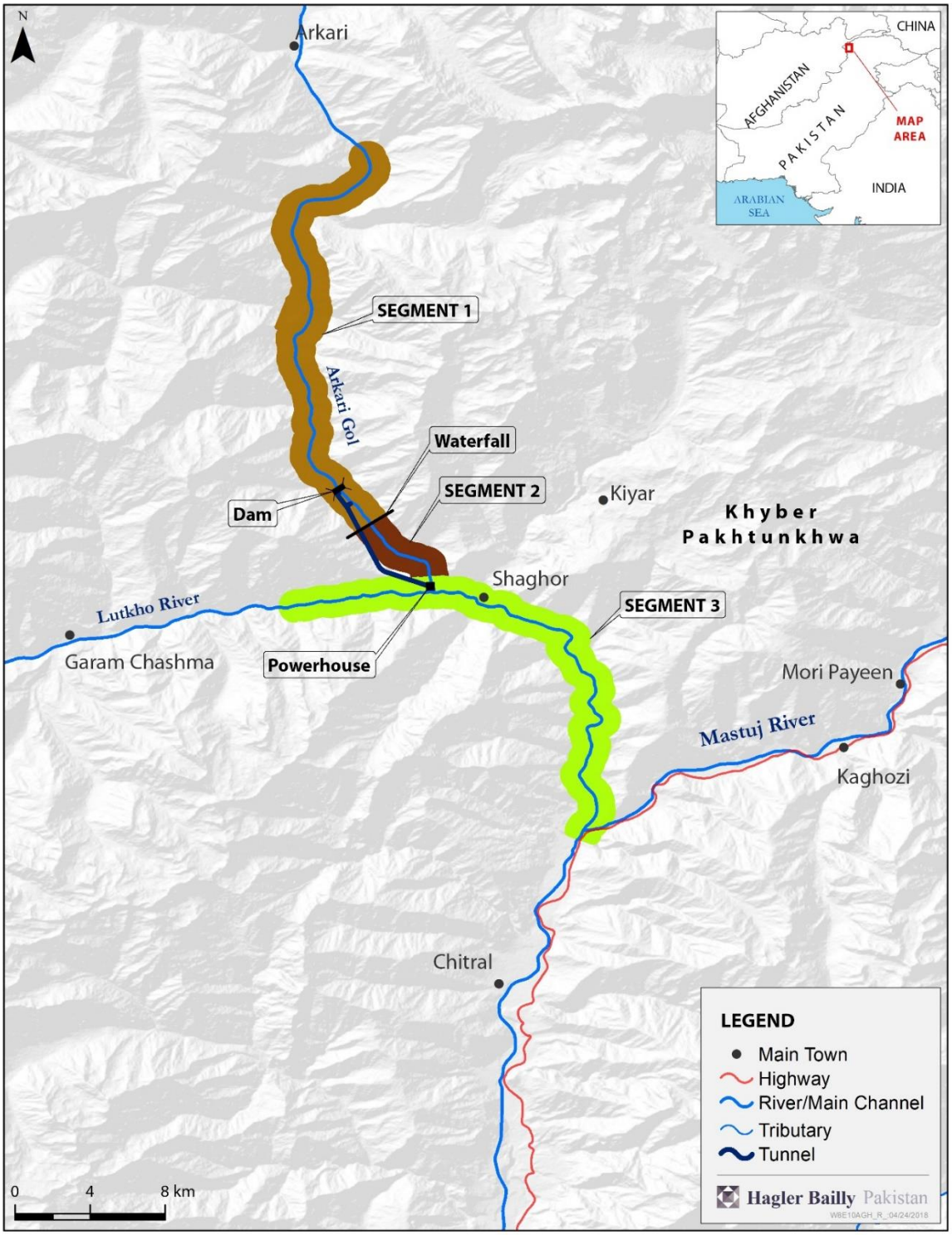
- Lutkho River: With a slope of the riverbed that is lower in comparison to that in Arkari Gol, the habitat in this segment (Segment 3 in **Exhibit 7.4**) is comparatively stable with sequences of pools and rapids. The valley is U shaped with gentle slopes. Diversity and abundance of fish is relatively higher with existence of the three species namely the Snow Trout, the Himalayan Catfish, and the Chitral Loach, and breeding of Snow Trout (**Exhibit 4.10**). A flow downstream of confluence with Arkari Gol also increases, increasing the extent of habitats. Sediment loads are low (about 4% of sediment in Chitral River), and abundance of macro-invertebrates is relatively high due to well armored cobble beds.

Flow as well as sediment loads are substantially higher in Mastuj/Chitral River (**Exhibit 7.4**). Suitable fish habitats exist in side channels where flow is moderate. Diversity is expected to be higher as there are number tributaries that feed into this river. Habitat conditions are not likely to be suitable for breeding as compared to those in Lutkho River, and food availability for fish, mainly macroinvertebrates, is also likely to be lower as the river bed would consist of sand and boulders as compared to predominantly cobbles in the Lutkho River and Arkari Gol. During summer months the river carries a very large amount of silt in suspension giving the water a distinctly reddish color on account of the color of the soil over which it flows. The impact of the Project on this section associated with variations ion flow will be limited by attenuation of the peaking flows from the Project by the flow of Mastuj/Chitral River. There will be some residual impact associated with the impact the Project flow alterations due to the project will have on the breeding of the Snow Trout in the Arkari Gol and Lutkho Rivers, and its consequential impacts on its population in the Mastuj/Chitral River. This impact will also be very limited as there are a number other tributaries of Mastuj/Chitral River that provide breeding grounds for the Snow Trout, in addition to the main river itself. The ecological impacts of the Project on Segment 4, i.e. Mastuj/Chitral River, are therefore not discussed further in this section.

The construction of the Project will result in the formation of a reservoir upstream of the dam. A segment of the river of length 1.3 km upstream of the dam will be inundated by the creation of the reservoir, where the river will cease to exist. As there is a natural barrier (waterfall) about 2.5 km downstream of the dam, there are no species in the waters upstream of the dam. Therefore, the reservoir will not have significant impacts on the fish fauna of Arkari Gol. While production of macroinvertebrates in the impoundment will be severely affected, the areas downstream of the dam are also productive for macroinvertebrates. The impact of loss of macroinvertebrates which are a food source for the fish was considered in the EFlow assessment for the Project.

The river downstream of the dam will be exposed to lower flows due to diversion of the river flow. The low flow section will be 7.3 km. Environmental flow ranging from 0.8-2 m^3/s over different months of the year is recommended (see **Appendix M,** *Environmental Flow Report*).

Exhibit 7.4: Area of Impact



The impacts of the proposed Project on the aquatic biodiversity are summarized below and described in detail in **Appendix M** (*Environmental Flow Report*). These include:

- Impact 01: Changes in ecological conditions downstream of the dam i.e. creation of a low flow section leading to loss of aquatic biodiversity
- Impact 02: Changes in ecological conditions downstream of the powerhouse due to release of water leading to loss of aquatic biodiversity

7.2.1 Loss of Aquatic Biodiversity due to Creation of a Low Flow Section Downstream of the Dam

Impact 01: Loss of Aquatic Biodiversity due to Creation of a Low Flow Section Downstream of the Dam								
Applicable Project Phase	*Construction and Operation*							
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Long Term	Small	Moderate	Definite	Medium	-	High
Mitigation measures: 1. Maintain environmental flow as recommended in Project design 2. Regulate activities of the staff so that they do not engage in illegal exploitation of wildlife such as illegal fishing and poaching 3. Construction activities should be carried out whilst ensuring that there is no run-off of silt into the river and that the river is not contaminated to ensure that water quality is not affected 4. Illegal fishing activities will be curtailed by providing support to the government in implementation of river protection. 5. The Project will help the Wildlife and Fisheries Departments by providing one field office, three motor cycles, 5 guards and 1 inspector to protect river biodiversity and terrestrial wildlife, subject to an agreement in which the responsibilities of the Project and the Departments are clearly defined and performance of the protections activities is independently monitored. Improvement in aquatic and terrestrial biodiversity through protection will partly offset the residual impacts of the Project on aquatic ecology. 6. Limited subsistence fishing using rods and cast nets could be allowed through a permitting system.								
Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Long Term	Small	Moderate	Definite	Medium	-	High

Details of impacts on aquatic ecology are provided in **Appendix M** (*Environmental Flow Report*). Fish were not observed to be present in the 3 km segment of the river above the waterfall in the low flow section (**Exhibit 7.4**), which presents a natural barrier to movement of the fish upstream. Impacts on fish fauna will therefore be limited to the 6 km reach of the river in the low flow segment downstream of the waterfall. Here there will be a degradation of ecological habitat due to reduction in flow. The impacts on the riverine biodiversity in the low flow section will mainly be on macro-invertebrates, Snow Trout and Chitral Loach. The abundance of all three is expected to decrease to 56%, 58% and 20% of their present day populations respectively over a period of 31 years.

For macro-invertebrates represented by Ephemeroptera, Plecoptera and Tricoptera (EPT) abundance, this will be due to reduction in the wet season duration and the delay in the onset of wet season will not provide sufficient time for eggs to mature and hatch. Similarly, the Snow Trout will decline in abundance in the low flow section due to

reduction in the maximum flood season flows and the barrier to migration created by the Project.

The Snow Trout is a long distance migratory fish therefore cues and suitable habitat during migration and breeding are key factors for its survival. The delay in the onset of the wet season, (and a lack of wet season in years where there are little to no spills) will affect migration and breeding in this reach. Similarly, due to reduction in the maximum flood season flows, inflow to pools will be less and water levels will be lower in this reach. Flood peaks also scour pools and with a reduction in flood peak, the pools will become shallower. Therefore, smaller flood peaks will lead to a degradation in overall yearlong habitat for the fish over time in this reach. More details are provided in **Appendix M** (*Environmental Flow Report*).

The Chitral Loach is a more sensitive species as compared to the Snow Trout in terms of food sources, summer and winter habitat and breeding cues. It feeds exclusively on aquatic invertebrates and therefore, a decline in EPT abundance will have a greater impact on it relative to impacts on the Snow Trout which is a more opportunistic feeder with an omnivorous diet.

While impacts on aquatic ecology in the low-flow section are expected to be significant, the basin-wide impacts on the aquatic ecological resources will not be high. This is because all the fish species reported from the Aquatic Study Area are widespread. There are no endemic fish species and the only fish of conservation importance is the Snow Trout which is a long distance migratory fish, has high commercial importance and is listed as Vulnerable in the IUCN Red List. This fish is widespread and has been reported from India, Nepal, Bhutan, Pakistan and Afghanistan. In the Study Area, the Snow Trout is not found above an altitude of 2,810 m and in the Arkari Gol the presence of a natural water fall (2.5 km downstream of the proposed dam site) restricts its presence upstream of the waterfall.

7.2.2 Loss of Aquatic Biodiversity due to Changes in Ecological Conditions Downstream of the Powerhouse as a Result of Release of Water

Impact 02: Loss of Aquatic Biodiversity due to Changes in Ecological Conditions Downstream of the Powerhouse as a Result of Release of Water								
Applicable Project Phase	*Construction and Operation*							
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Long Term	Small	Moderate	Definite	Medium	-	High

Mitigation measures:

1. Design peaking operation to reduce impacts on aquatic ecology as recommended in the EFlow Assessment (see **Appendix M**)
2. Regulate activities of the staff so that they do not engage in illegal exploitation of wildlife such as illegal fishing and poaching
3. Construction activities should be carried out whilst ensuring that there is no run-off of silt into the river and that the river is not contaminated to ensure that water quality is not affected
4. Illegal fishing activities will be curtailed by providing support to the government in implementation of river protection.
5. The Project will help the Wildlife and Fisheries Departments by providing one field office, three motor cycles, 5 guards and 1 inspector to protect river biodiversity and terrestrial wildlife, subject to an

agreement in which the responsibilities of the Project and the Departments are clearly defined and performance of the protections activities is independently monitored. Improvement in aquatic and terrestrial biodiversity through protection will partly offset the residual impacts of the Project on aquatic ecology. 6. Limited subsistence fishing using rods and cast nets could be allowed through a permitting system.								
Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Long Term	Small	Moderate	Definite	Medium	-	High

Downstream of the tailrace the impacts on aquatic ecology depend on the operational scenario selected. Under true run of river conditions where no peaking is carried out populations of the Snow Trout and Chitral Loach will not decline due to the Project. However, under peaking conditions their populations will decline to 40% and 50% of present day baseline levels, respectively, over a period of 31 years. A modified peaking scenario is an option in which the peak is reduced to 24 m^3/s and flow is gradually ramped up to peak level and is then ramped down towards the end of the peaking period. This will buffer the impact of a peaking operation. Under this operational scenario the Snow Trout will decline to 70% of baseline while the Chitral Loach will not be significantly impacted downstream of the powerhouse. More details are provided in **Appendix M** (*Environmental Flow Report*).

As mentioned above, the fish species of the Aquatic Study Area are widespread. No endemic fish species have been reported and the only fish of conservation importance is the Snow Trout. While the fish fauna immediately downstream of the powerhouse will decline as a result of water release, the basin-wide impacts on the fish will not be high.

7.3 Terrestrial Ecology

The Project is a run-of-river hydropower project and will require construction of a dam on the Arkari Gol which is a tributary of the Lutkho River. The Project, with design capacity of 99 MW, will use the water resources of the Arkari Gol for power generation.

The major structures associated with the Project include the dam and spillway, headrace tunnel and tailrace channel, workshop building, diversion tunnels, powerhouse, construction camps, waste disposal areas and quarry areas. A detailed description of the Project is provided in **Section 3** (*Description of the Project*). The permanent footprint of the proposed Project includes the area that will be acquired for the dam, reservoir, powerhouse and other facilities. A temporary footprint includes the land that will be required or disturbed due to the facilities that will be developed during the construction phase.

The Area of Habitat Loss is defined as the areas that will be occupied due to construction and operation of Project infrastructure.[1] It has been demarcated taking into consideration the footprint of each Project facility and a 50 m zone around each facility, as well as the area that will be submerged under water due to formation of the reservoir (**Exhibit 7.5**). The Area of Habitat Loss is estimated at 1.03 km^2.

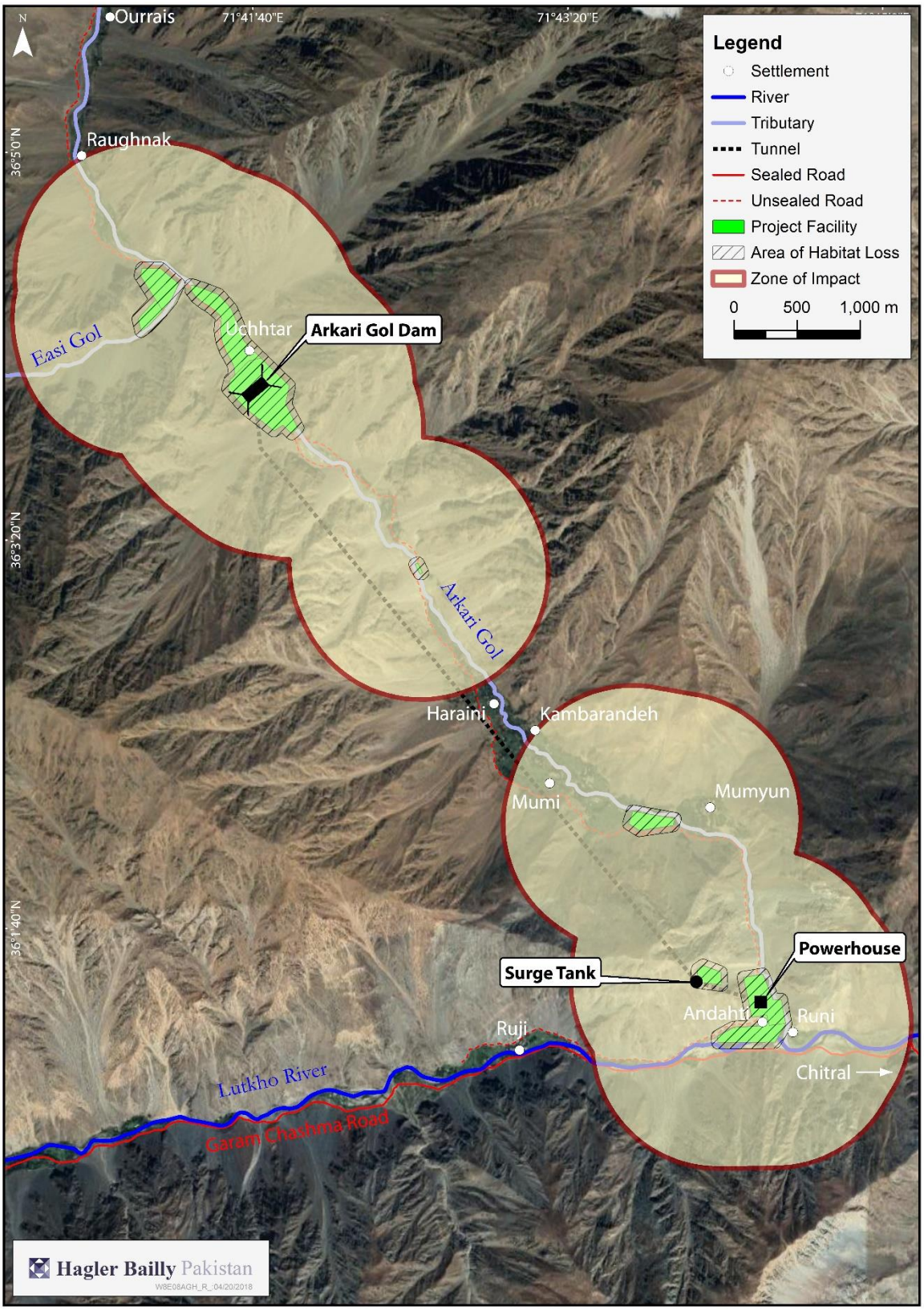
[1] This includes temporary facilities

The Zone of Impact for Terrestrial Ecological Resources (referred to in this section as the Zone of Impact) consists of the Project facilities and a 1 km potential impact zone around these facilities to account for an area in which the ecological resources may be impacted by Project-related disturbances such as sound, light and vibrations during construction and operations (**Exhibit 7.5**).

The terrestrial ecological resources of the Study Area are described in **Section 4.2.7** (*Terrestrial Ecology*). The aspects affecting ecology and biodiversity in the Terrestrial Study Area are discussed below:

- Impact 03: Terrestrial habitat loss caused by construction related activities.
- Impact 04: Decline in abundance and diversity of terrestrial flora and fauna caused by construction related activities.
- Impact 05: Project operation leading to animal disturbance, displacement and decline.

Exhibit 7.5: Zone of Impact and Area of Habitat Loss



7.3.1 Terrestrial Habitat Loss

Impact 03: Terrestrial habitat loss caused by construction of Project infrastructure								
Applicable Project Phase				*Construction*				
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Possible	Low	-	High
Mitigation measures:								
1. Minimize the Project footprint, clearly delineate and restrict access beyond work sites and other areas to be disturbed. 2. Minimize disturbance to, or movement of, soil and vegetation; Prevent soil damage and erosion; retain as much natural vegetation as possible. 3. Prevent Alien Invasive Species (AIS) establishment on exposed stored soil (do not store bare soil near known sources of AIS). Invasive plant species was not observed in the Terrestrial Study Area, however few invasive species like Marijuana, Strumarium *Xanthium strumarium* and Castor Oil Plant *Ricinus communis* were observed in the lower parts of the Aquatic Study Area. 4. Train and raise awareness regarding AIS among Project staff and contractors. 5. Solid waste should only be disposed of at designated sites and a Waste Management Plan developed and implemented. 6. Within the quarry areas, activities will be restricted to areas at a distance from perennial water channels so as to avoid disturbances to them including the risk of siltation.								
Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Possible	Low	-	High

Site clearance and construction of Project infrastructure such as the powerhouse, dam, and the inlets and outlets of the tunnels will result in immediate and direct modification of land and loss of approximately 0.373 km^2 (37.3 hectares) of terrestrial habitat leading to loss of plants and displacement of animals in this area. There will be a permanent modification of land within the footprint of specific Project facilities and its ancillaries but the loss will be less severe in the areas that lie adjacent to and immediately outside the Project facilities. In addition, once the Project begins operations, an area of approximately 0.12 km^2 (12 hectares) will become submerged due to formation of a reservoir upstream of the dam (**Section 3**, *Project Description*). The submerged terrestrial habitat will be converted into aquatic habitat. The habitat loss and fragmentation resulting from Project infrastructure will lead to displacement of terrestrial species.

The Area of Habitat Loss (total of 7.5 km^2) consists largely of Barren Land, Vegetation Cluster and Riparian habitat. Common plant species found in the area of habitat loss include *Artimisa maritima, Rumex hastatus, Sisymbrium irio, Robinia pseudoacacia* and *Salix acmophylla.* Of these *Artimisa maritima* is a medicinally important plant.

All these species are common and abundant in the wider area. Habitat loss caused by construction of Project infrastructure will not have any significant impact on the overall population of these vegetation species though individual plants are likely to suffer harm.

7.3.2 Impacts on Biodiversity due to Construction Activities

Impact 04: Decline in abundance and diversity of terrestrial flora and fauna caused by construction related activities.

Applicable Project Phase *Construction*

Initial Impact	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Possible	Low	-	High

Mitigation measures:

1. Provide awareness training to staff and contractors on: prevention of injury of animals; identification of likely species found on site (Snow Leopard, Grey Wolf, Red Fox, Asiatic Jackal, Flare-horned Markhor and Himalayan Ibex); identifications of animal hazards (such as venomous snakes); what to do if dangerous animals are encountered; report kills of large mammals and other migratory water fowls particularly designated species of conservation concern.
2. Provide adequate knowledge to the workers on relevant government regulations and punishments for illegal poaching and trade in animals and plants; incorporate in contract documents regulations for Project staff and contractors to avoid illegal poaching of wild animals (Flare-horned Markhor and Himalayan Ibex); MHL to report incidents of poaching and illegal fishing to concerned government departments.
3. Large flood lights should not be installed outside 50 m of the Project fence. The lights should be directed towards Project facilities and not towards the natural habitats
4. Enforce speed limits in ecologically sensitive areas if identified.
5. The Contractor shall prepare an Environmental Training Plan for all construction workers and all Contractor's employees shall be required to provide evidence that they attended the training sessions detailed in the Plan. The Plan should include information about the following issues: fire arm possession, traffic regulations, illegal logging and collection of non-timber forestry products, non-disturbance of resettlement communities, hunting and fishing restrictions, waste management, erosion control, health and safety issues, the Code of Conduct requirements and disciplinary procedures, and general information on the environment in which they will be working and living;
6. Coordinate with the government departments (Fisheries and Wildlife Departments)
7. Facilitate government department staff when they arrive at the site for example provide them accommodation and vehicles.
8. Equipment emitting excessive noise in comparison with other similar equipment will not be allowed to operate. Equipment under use will be regularly maintained, tuned, and provided with mufflers to minimize noise levels;
9. Blowing of horn will be prohibited on all sensitive areas except under emergency conditions.
10. Source goods/materials locally where possible.
11. Minimize disturbance to, or movement of, soil and vegetation; prevent soil damage and erosion;
12. Prevent AIS establishment on exposed stored soil (do not store bare soil near known sources of AIS).
13. Plant compensatory trees for those damaged during construction
14. Train and raise awareness regarding AIS among Project staff and contractors (see **Section 4.2.7)**.
15. Solid waste should only be disposed of at designated sites.

Residual Impact	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Possible	Low	-	High

Construction of Project infrastructure such as the powerhouse, dam and tunnels will result in disturbance to the floral and faunal species in the Zone of Impact around the Project facilities (**Exhibit 7.5**) due to blasting, noise, vibrations, illumination, and introduction of alien species. Pollution may increase due to vehicles and machinery, spillage of fuels or chemicals, emissions and noise. Increased movement of vehicles will increase the risk of incidences of vehicle collisions with wildlife.

Habitat loss, habitat fragmentation and sensory disturbances may result in a decrease in species abundance and possibly change species diversity within the Zone of Impact. In addition, the spatial and temporal distribution of species will also be affected as a result of loss of habitat integrity due to habitat fragmentation and degradation. Habitat alteration and disturbance may increase the likelihood of introduction of alien invasive species such as Marijuana, Castor Oil Plant and Strumarium. The three habitat types (**Section 4.1,** *Ecology Baseline*) found in this Zone of Impact will be affected. However, no terrestrial Critical Habitat was identified in the Zone of Impact and it does not contain any threatened or unique ecosystem. Moreover, the habitats found in this Area of Habitat Loss are homogenous and widespread. Therefore, at a local scale, a decrease in biodiversity and ecological function caused by construction-related disturbances is of minor magnitude near the Project facilities. Moreover, because of the homogenous and widespread distribution of species, the area-wide impact on biodiversity is also minor.

The wider area around the Project provides habitat to the terrestrial mammals of conservation importance including the Himalayan Ibex and Flare-horned Markhor which are animals licensed for trophy hunting. The Flare-horned Markhor and Grey Wolf are listed as Endangered in Pakistan National Red List. Snow leopard is also known to inhabit the area and is listed as Critically Endangered in the Pakistan National Red List and Vulnerable in the IUCN Red List. Improved access to the site as a result of the Project may indirectly increase the incidence of poaching or trade in animal parts. Even though rules to regulate hunting exist, it is important that project staff and contractors abide by these regulations.

The wider area around the Project provides habitat to the terrestrial mammals of conservation importance. The Common Leopard, Snow Leopard, and Asiatic Black Bear are listed as Vulnerable, while Pallas's Cat and Flare–horned Markhor are listed as Near Threatened in the IUCN Red List. In addition, the waterbodies in the vicinity of the Project site provide habitat for a number of migratory birds which can be hunted by obtaining permits from the KP Wildlife Department. Improved access to the site as a result of the Project may indirectly increase the incidence of poaching or trade in animals and their parts. Even though rules to regulate hunting exist, it is important that project staff and contractors abide by these regulations.

7.3.3 Impacts on Terrestrial Biodiversity due to Project Operation

Impact 05: Project operation leading to animal disturbance, displacement and decline.								
Applicable Project Phase	*Operations*							
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Long Term	Small	Medium	Possible	Medium	-	High
Mitigation measures: 1. Large flood lights should not be installed outside 50 m of the Project fence; these lights should be directed towards Project facilities and not towards the natural habitats. 2. Provide awareness training to staff and contractors on: prevention of injury of animals; identification of likely species (Snow Leopard, Grey Wolf, Asiatic Jackal, Red Fox, Flare-horned Markhor, Himalayan Ibex and other migratory water fowls) found on site; identifications of animal hazards (such as venomous snakes); what to do if dangerous animals are encountered; report kills of large mammals particularly designated species of conservation concern.								

3. Provide adequate knowledge to the workers on relevant government regulations and punishments for illegal poaching of wildlife species (Snow Leopard, Flare-horned Markhor, Himalayan Ibex and other migratory water fowls); report any wildlife law violations to concerned government departments; incorporate in contract documents regulations for Project staff and contractors to avoid illegal poaching
4. Facilitating government department staff when they arrive at the site for example providing them accommodation and vehicles.
5. Close coordination with the government departments (Fisheries and Wildlife Departments);
6. Train and raise awareness regarding AIS among Project staff and contractors (see **Section 4.1.5)**.
7. The Contractor shall prepare an Environmental Training Plan for all construction workers.
8. Solid waste should only be disposed of at designated sites.

Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Long Term	Small	Low	Possible	Low	-	High

The operation of the hydropower plant and associated activities will result in some potential disturbances to species, which may exacerbate the effects of habitat loss and decreased species abundance. In addition, the spatial and temporal distribution of species will also be affected as a result of loss of habitat integrity due to habitat fragmentation and degradation. These disturbances include noise and light. As plant operation will be continuous, the disturbances will also be continuous and affect both diurnal and nocturnal wildlife. The lighting required for operation and safety at the Project site can influence nocturnal foraging behaviors as well as disrupt sleep patterns of crepuscular and nocturnal species. However, considering the fact that no threatened ecosystem or species of conservation importance is reported from the Zone of Impact, the magnitude of this impact is considered minor.

7.4 Ambient Air Quality

Ambient air quality will be affected by construction activities. The air quality baseline (**Section 4.2.5** *Ambient Air Quality)* shows that the baseline concentration of particulate matter (PM_{10} and $PM_{2.5}$) is within IFC EHS guideline values. PM_{10} is also within NEQS whereas $PM_{2.5}$ exceeds the PEQS limits in 2 out of 3 cases. As the construction activities could be a significant source of particulate matter emission, the potential impact of the construction activities on the particulate matter levels is considered a risk and is discussed in this section.

Although the construction equipment will be a source of gaseous emissions, the total emission from them will be small and is unlikely to increase the concentration of these gases in the ambient air significantly. Therefore, gaseous emissions are not considered a risk and are not discussed further. The only exception could be the power generators if they are located close to any settlement. A mitigation measure is proposed requiring keeping a safe distance from settlements.

The impacts are identified and rated below:

Impact 06: Increase in ambient concentration of air pollutants from construction activities and vehicular movement may cause health impacts on the community.

Applicable Project Phase *Construction*

Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Short Term	Intermediate	Medium	Possible	Medium	-	High

Mitigation measures:

Management

1. Develop and implement an Air Pollution Control Plan.
2. Prepare a Site Specific Environmental Management Plan (SSEMP) for each construction site that must outline areas to be cleared, vegetated areas to be protected or fenced, solid waste disposal locations, and sprinkling locations.

Fugitive and exhaust emissions from transport vehicles

3. Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard (i.e., the minimum required space between the top of the load and the top of the trailer).
4. Install and maintain appropriate emission control equipment on vehicles and machinery.
5. Regularly maintain vehicles and equipment to keep a check on emissions.
6. Ensure that smoke from internal combustion engines is not visible for more than ten seconds.
7. Use new and low emission equipment and vehicles to the extent possible.
8. Purchase best quality fuel and lubes and where possible use lead free oil and lubes.
9. Sprinkle water on all unsealed roads used by Project vehicles that are within 200 m of any settlement.
10. Cover loads and long-term piles of friable material to reduce fugitive dust emission.
11. Reduce traffic speeds on all unpaved surfaces to 30 km/hr or less to avoid dust emissions from vehicular movement.
12. Absolute prohibition on soil or mud accumulation on public roads. Public and Project access roads should be frequently cleaned and visually inspected daily to prevent any soil or mud accumulation.
13. Install wheel washers where vehicle exit onto the paved road from unpaved and prior to each trip.

Fugitive dust emissions from blasting

14. Indicate the limits of a clearing land with highly visible markers.
15. Leave a layer of about 5 m of undisturbed softs above the top of the overburden blasts. This will act as a blanket to contain air blast, dust and fly rock.
16. Sprinkle water on the area where blasting is done to settle down the particulate matter emissions.

Fugitive dust emissions from quarry areas

Indicate the limits of a clearing land with highly visible markers.

17. Avoid earth stripping or moving in periods of dry and windy weather.
18. Carry out dust generating activities where maximum protection can be obtained through topography or in areas where prevailing winds will blow dust away from sensitive areas/uses.
19. Suspend dust generating when wind speed exceeds 20 km/hr in areas within 500 m of any settlement.
20. Sprinkle water on conveyors/conveyor transfer points, stockpiles, and roads.
21. Cover fine dry loads or spray water on loads prior to exiting the site, and if necessary regular cleaning of public roads in the vicinity of the entrance.

Fugitive dust emissions from concrete batching plants

22. Suspend earthwork operation when wind speed exceeds 20 km/hr in areas within 500 m of any settlement.
23. Perform weighing and mixing process in a fully enclosed environment.
24. Install dust collectors to the mixers to avoid dust emissions.
25. Ensure that bunkers and conveyors are sited in the leeward direction to minimize the effects of the wind.
26. Consider the natural wind barriers such as trees and landforms to help control the emission of dust from the batching plant.

Fugitive dust emissions from aggregate production and handling system
27. Suspend operation when wind speed exceeds 20 km/hr in areas within 500 m of any settlement.
28. Consider prevailing wind direction to ensure that aggregate handling systems located in the leeward direction to minimize the effects of the wind.
29. Sprinkle water on all exposed surfaces, particularly those close and up-wind of settlements.
Wind-blown dust from exposed surfaces such as bare land, stockpiles, and waste dumping sites
30. Cover all exposed surfaces, particularly those close and up-wind of settlements.
31. Suspend all grading operations on a Project when winds exceed 20 km/hr.
32. Minimize disturbance to, or movement of, soil and vegetation.
33. Sprinkle water on all exposed surfaces, particularly those close and up-wind of settlements.
34. Retain as much natural vegetation as possible.
35. Cover on-site dirt piles or other stockpiled areas.
36. Install windbreaks and employ water and/or soil stabilizers to reduce wind-blown dust emissions.
37. Adequately wet, cover with plastic, or provide with wind shield all stockpiles to reduce dust emission

Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Intermediate	Low	Possible	Low	-	High

7.4.1 Emission Sources

The construction of the Project will result in number of emission sources including emissions from:

- movement of vehicles
- blasting and quarrying operations
- operation of concrete batching plants and aggregate production systems
- exposed surfaces

The above sources are identified and appropriate mitigations for each source are discussed in **Exhibit 7.6**

7.4.2 Identification of High Risk Areas and Mitigation Measures

The housing density in the area near the Project facilities is low, and much of the existing households near the Project will be relocated (see **Resettlement Action Plan**). The village of Runi is 310 m from the Powerhouse site, whereas there are a few settlements near the temporary construction site along the tunnel including Mumi and Haraini villages. These two areas are considered at risk of deterioration in air quality. At the Dam site after resettlement the nearest residence is at a distance of 1790 m and therefore while all mitigation measures are applicable at the Dam site, it is at risk to impacts due to changes in air quality.

The potential air quality impacts and appropriate mitigation measure for each construction activity is presented in **Exhibit 7.6**. Based on the zone of air quality impact buffers around each source to identify the high-risk areas that are falling under the buffer.

The locations of the following Project facilities were not described in the Feasibility Study and therefore, sensitive receptors near these facilities could not be identified:

- Quarry Areas
- Batching Plants

- Aggregate Production Plants
- Waste Dumping Sites
- Adit Mouths

Before the start of construction, the location of these facilities should be identified and sensitive receptors near these sites should be documented to supplement the information provided below. Air quality monitoring should be conducted based on the location of these receptors. Receptors that are within the Zone of Impact are prone to be affected by the possible increase in pollutant levels due to the construction activities.

The Project access road and 50 m buffer is presented in **Exhibit 7.7**.

Exhibit 7.6: Inventory of Emission Sources, Zone of Impact and Mitigation and Monitoring Measures

Source/Activity	*Zone of Impact*	*Mitigation/Monitoring Measures*
Fugitive and exhaust emissions from transport vehicles Transport emissions include emissions from vehicles moving on roads and from their exhausts. As vehicles move on the road, due to friction between vehicle's tire and road, the dust particles come in suspension which causes dust (PM_{10} and $PM_{2.5}$) emissions. Exhaust emissions include emissions attributable to engine related processes such as fuel combustion and particles that exit the tailpipe.	**General Guidelines:** ▶ A buffer of 50 meters (m) along the route(s) used by construction vehicles as given in Guidance on the Assessment of Dust from Demolition and Construction document by Institute of Air Quality Management, 2014.[2] **Project Specific Zone:** ▶ Transport of material will come to the Project site from different areas of Pakistan (see **Section 3** *Project Description*). From here the material will go to the construction sites through access roads. ▶ The access road to the site is currently unpaved. It will be paved and upgraded to facilitate traffic movement. This will have the added benefit of reducing fugitive emissions during transport. ▶ The material generated on-site both as raw material and as waste material will go to their final destination through access roads to dam site and waste dumping sites. ▶ The buffer around the proposed access roads is shown below.	▶ Pave the access route to the Project site. ▶ Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard (i.e., the minimum required space between the top of the load and the top of the trailer). ▶ Install appropriate emission control equipment on vehicles and machinery. ▶ Regularly maintain vehicles and equipment to have a check on emissions. ▶ Monitor smoke from internal combustion engines that should not be visible for more than ten seconds. ▶ Use new and low emission equipment and vehicles to the extent possible. ▶ Purchase best quality fuel and lubes and where possible use lead free oil and lubes. ▶ Sprinkle water on all unsealed roads used by Project vehicles that are within 200 m of any settlement. ▶ Reduce traffic speeds on all unpaved surfaces to 30 km/hr or less to avoid dust emissions from vehicular movement.

[2] Guidance on the Assessment of Dust from Demolition and Construction document by Institute of Air Quality Management, 2014. http://www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf

Source/Activity	*Zone of Impact*	*Mitigation/Monitoring Measures*
		▶ Absolute prohibition on soil or mud accumulation on public roads. Public and Project access roads should be frequently cleaned and visually inspected daily to prevent any soil or mud accumulation. ▶ Install wheel washers where vehicles exit onto paved road from unpaved and prior to each trip.
Fugitive dust emissions from blasting Tunnels, adits and underground powerhouse will be excavated through drilling and blasting. Air quality due to blasting will be degraded near the mouth of these sites where the blasting will be near the surface. Along the length of the tunnel and the underground powerhouse etc. air quality will not be affected as this is far underground.	**General Guidelines:** A buffer of 200 m from the point of blasting where there is a high risk of dust emissions according to the Impact Evaluation of Blasting, 2009.[3] **Project Specific Zone:** The locations of tunnels are identified however adit mouths are not identified in the Feasibility Study.	▶ Indicate the limits of a clearing land with highly visible markers. ▶ Leave a layer of about 5 m of undisturbed softs above the top of the overburden blasts. This will act as a blanket to contain air blast, dust and fly rock. ▶ Sprinkle water on the area where blasting is done to settle down the particulate matter emissions.
Fugitive dust emissions from quarry areas Quarry areas are used to excavate stones, rocks, sand, gravel, and aggregate from the ground. This includes stripping of topsoil, blasting of the area, crushing and screening of aggregates and loading of excavated material from quarries to stockpiles.	**General Guidelines:** ▶ A buffer of 500 m from the quarry areas where there is a high risk of dust emissions as discussed in the Guidelines for Planning Authorities for Quarries and Ancillary Activities, 2004.[4] **Project Specific Zone:** ▶ The locations of quarry areas are not identified in the Feasibility Study.	▶ Indicate the limits of a clearing land with highly visible markers. ▶ Avoid earth stripping or moving in periods of dry and windy weather. ▶ Suspend dust generating activities when wind speed exceeds 20 km/hr in areas within 500 m of any settlement.

[3] Impact Evaluation of Blasting, Vlakfontein Opencast Project, 200

[4] Guidelines for Planning Authorities for Quarries and Ancillary Activities, Department of the Environment, Heritage and Local Government, 2004. http://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/DevelopmentandHousing/Planning/FileDownLoad%2C1606%2Cen.pdf

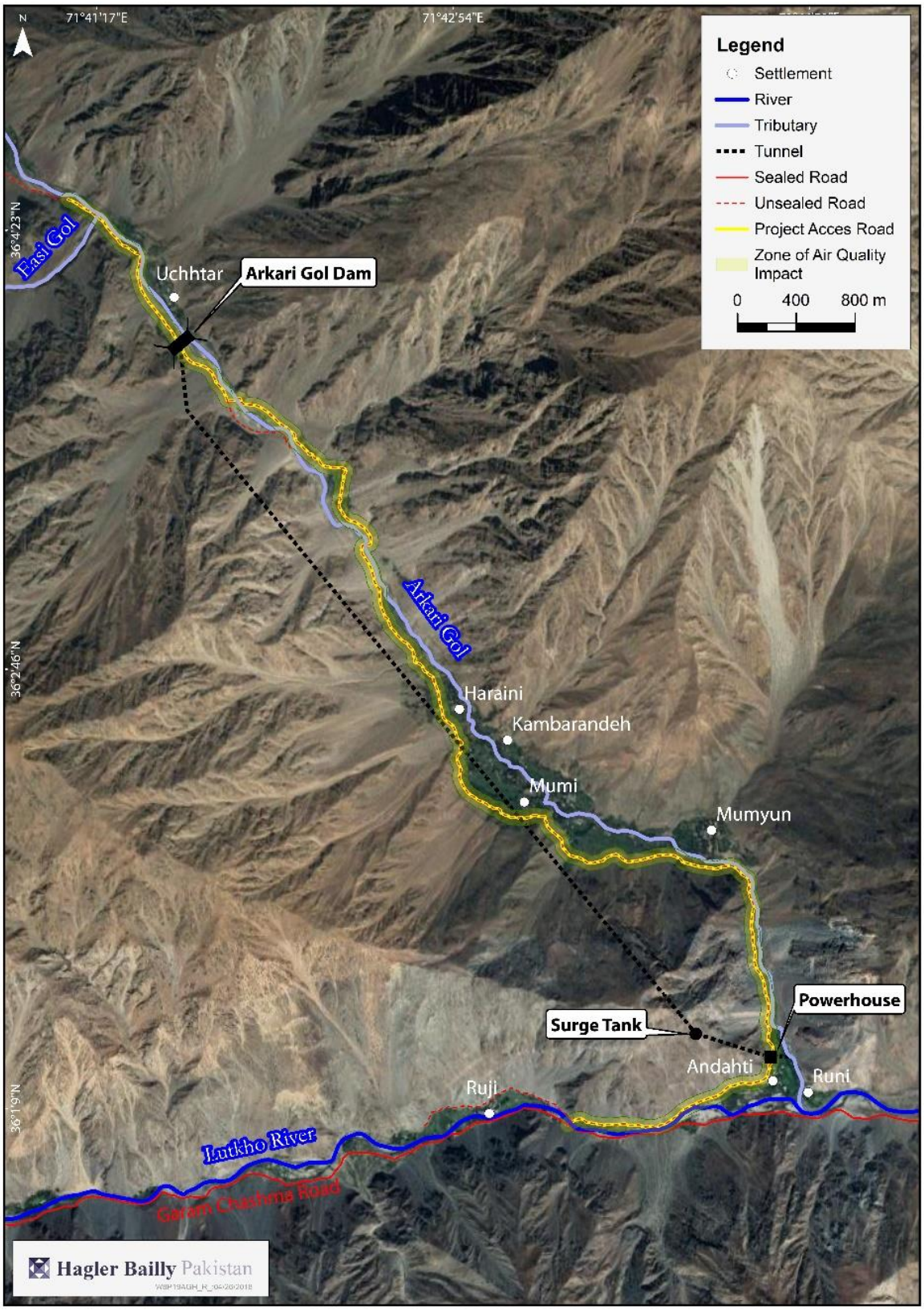
Source/Activity	*Zone of Impact*	*Mitigation/Monitoring Measures*
Wind erosion from exposed surfaces also leads to dust emissions.		▶ Sprinkle water on conveyors/conveyor transfer points, stockpiles, and roads. ▶ Cover fine dry loads or spray water on loads prior to exiting the site, and if necessary regular cleaning of public roads near the entrance.
Fugitive dust emissions from concrete batching plants Concrete batching plants are where ingredients such as sand, cement, water, and aggregate are mixed to form concrete. This consists of various activities such as storage of raw materials in bunkers and stockpiles, transfer of raw materials by front-end loaders, conveyors, hoppers and loading of materials to the trucks.	**General Guidelines:** ▶ A buffer of 100 m between batching plants and sensitive land uses as included in the Recommended Buffer Distances for Industrial Residual Air Emissions, 1990.[5] **Project Specific Zone:** ▶ The locations of batching plants are not identified in the Feasibility Study.	▶ Suspend the plant operations when wind speed exceeds 20 km/hr if the plant is near settlements. ▶ Perform weighing and mixing process in a fully enclosed environment. ▶ Install dust collectors to the mixers to avoid dust emissions. ▶ Ensure that bunkers and conveyors are sited in the leeward direction to minimize the effects of the wind. ▶ Consider the natural wind barriers such as trees and landforms to help control the emission of dust from the batching plant.
Fugitive dust emissions from aggregate production and handling system Sand and gravel are typically mined in a moist or wet condition by open pit excavation or dredging. After mining, the materials are transported to the processing plant where the material is dried, screened and crushed which is a source of particulate matter emissions.	**General Guidelines:** ▶ A buffer of 1000 m between the point of operations and sensitive land uses. **Project Specific Zone:** ▶ The locations of aggregate production plants are not identified in the Feasibility Study. ▶ Fine aggregate production should be minimized and directly extracted where possible.	▶ Suspend operation when wind speed exceeds 20 km/hr. ▶ Consider prevailing wind direction to ensure that aggregate handling systems located in the leeward direction to minimize the effects of the wind. ▶ The prevailing wind direction should be considered to ensure that aggregate handling systems located in the leeward

[5] Environmental Guidelines for the Concrete Batching Industry, http://www.epa.vic.gov.au/~/media/Publications/628.pdf

Source/Activity	*Zone of Impact*	*Mitigation/Monitoring Measures*
Typically, the dust associated with aggregate operations consists of particles from exposed soil and rock.	▶ Final aggregate handling and production systems should be located further than 1000 m of sensitive receptors such as homes, schools, mosques etc. ▶ In case the above is not possible, then homes within this zone should either be temporarily relocated or mitigation measures strictly implemented in this zone.	direction to minimize the effects of the wind. ▶ Sprinkle water on all exposed surfaces, particularly those close and up-wind of settlements.
Wind-blown dust from exposed surfaces such as bare land and waste dumping sites Waste dumping sites are not themselves an emission source but unloading the waste (dumping) onto dump sites results in dust emissions.	**General Guidelines:** ▶ A buffer of 250 m between waste dumping sites and residential development as given in IFC-EHS Guidelines Waste Management Facilities, 2007.[6] **Project Specific Zone:** ▶ The locations of waste dumping sites are not identified in the Feasibility Study.	▶ Cover all exposed surfaces, particularly those close and up-wind of settlements. ▶ Suspend all grading operations on a Project when winds exceed 20 km/hr. ▶ Minimize disturbance to, or movement of, soil and vegetation. ▶ Sprinkle water on all exposed surfaces, particularly those close and up-wind of settlements. ▶ Retain as much natural vegetation as possible. ▶ Cover on-site dirt piles or other stockpiled areas. ▶ Install windbreaks and employ water and/or soil stabilizers to reduce wind-blown dust emissions. ▶ Adequately wet, cover with plastic, or provide all stockpiles with wind shields to reduce dust emission.

[6] IFC-EHS Guidelines Waste Management Facilities, 2007, http://www.ifc.org/wps/wcm/connect/1cd72a00488557cfbdf4ff6a6515bb18/Final+-+Waste+Management+Facilities.pdf?MOD=AJPERES

Exhibit 7.7: Zone of Air Quality Impact



7.5 Vibration from Blasting

Blasting will be undertaken at the quarry site and for the tunnel boring. The key impacts of blasting include vibration, noise and dust, hazards due to flying debris, and disturbance to underground water channels. Dust impacts are discussed in **Section 7.4** the risk from flying debris in **Section 7.6** noise impacts in **Section 7.7**. The potential impacts due to vibration are considered here.

Potential impacts from blasting in mountain springs are discussed in **Section 7.6**

Impact 07: Vibration from blasting during the construction phase may disturb local communities.

Applicable Project Phase *Construction*

Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Short Term	Small	Low	Possible	Low	-	High

Mitigation measures:

1. Develop a Blasting and Explosives Management Plan.
2. Conduct a pre-construction survey of structures at risk of vibration impacts households.

- In the initial stages, the blasting induced vibration shall be measured as a function of maximum instantaneous charge and distance from the blasting site. This data shall be then used to refine the Blasting Induced Vibration Risk Zones on the basis of the adopted criteria.
- Using, the refined Blasting Induced Vibration Risk Zones maps and the tunnel boring schedule, the Supervision Consultant in consultation with the MPCL and the Construction Contractor, shall identify the houses that will be affected and the impact duration and schedule.
- For the houses that will fall in the Structural Damage Risk Zone, a temporary relocation plan will be developed. An amendment to the Resettlement Action Plan (RAP) will be commissioned for this purpose. Before the start of blasting, all residents of houses in the Structural Damage Risk Zone will be relocated as per the RAP.
- A survey will be undertaken in both zones, to determine the pre-blasting conditions of the buildings. The survey will be commissioned by the Supervision Consultant and will identify and record any existing damage to the structures. The survey will cover the following aspects:
  - Overall condition of the structures, both exterior and interior.
  - Documentation of defects observed in the structure using digital imagery along with notes, measurements and sketches.
  - Documentation of pre-existing cracks using digital imagery along with notes, measurements, and sketches.

3. Following completion of the blasting, the survey will be repeated in the Structural Damage Risk Zone to determine the condition of the buildings and verify that they are safe for re-occupation. If the buildings are safe, the residents will be allowed to return to their houses following any necessary damage repairs. If the buildings are damaged beyond repair, compensation will be paid to the owners as per the RAP. If there are any claims or reports of damage in the Cosmetic Damage Risk Zone, the affected house will be surveyed against the pre-Project survey and repairs will be undertaken as appropriate.
4. Following are key mitigation measures for the management of blasting:

- Blasting will be scheduled during the day only.
- Local communities will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule.
- A Blasting and Explosives Management Plan will be developed by the Construction Contractor. The Plan will be reviewed and approved by the Supervision Contractor before the initiation of the blasting work.

- Throughout the blasting activity, vibration sensors will be installed at strategic locations to monitor the impact of blasting and to ensure that the vibration levels are within the adopted criteria. The monitoring plan will be part of the Blasting and Explosives Management Plan.
- Unscheduled blasting will be strictly prohibited in any case.

5. Meaningful contact with the community shall be maintained and their grievance shall be attended to in a timely manner. In this regard:

- A meaningful community engagement plan will be developed. The plan will cover identify the affected community; the key contact persons; frequency of engagement; the information to be shared; the responsibilities to manage the plan; and the notice period to be giving to the community for various blasting related generating activities.
- The Grievance Redress Mechanism will be used to record, investigate, and respond to any complaints. Investigation of the complaints will be undertaken by the Supervision Consultant.

6. Develop a Noise and Vibration Control Plan that will include monitoring of vibration levels and frequency around the blasting sites. The objectives of the monitoring will be to:

- Ensure that vibration levels in the communities are within the adopted criteria levels;
- Maintain record of vibration to settle any potential conflicts; and
- Monitor changes in the vibration levels due to possible changes in the rock formation and take appropriate corrective actions.

Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Medium Term	Small	Low	Possible	Low	-	High

Sources of vibration include construction equipment movement, pile driving, compaction, hammering (hydraulic or pneumatic), the operation of batching plant and generators. Another source of vibration will be the blasting to be undertaken for tunneling and blasting at the quarry sites. The propagation of vibration from construction activities is different in nature from the vibration from blasting. The construction activities are undertaken essentially on the ground surface and spread as two-dimensional waves. In contrast, the tunneling is undertaken below the surface and spreads in three-dimension. For this reason, the impact of the two is assessed separately.

In the case of ground vibrations, the level of vibration is measured by the Peak Particle Velocity (PPV) with units of millimeters of movement per second. The proposed criteria for damage to buildings are shown in **Exhibit 7.8**. These are derived from British Standard BS 6472 and are German Standards DIN 4150-3:1999

Exhibit 7.8: Criteria for Structural Damage Due to Vibration

Risk Zone	*PPV Range*
No damage likely	PPV < 5 mm/s
Cosmetic damage risk zone	PPV 5 to 15 mm/s
Structural damage risk zone	PPV > 15 mm/s

7.5.1 Vibration Impact of Construction Activities on the Surface

Exhibit 7.9 provides an indication of the approximate vibration levels that may be expected for various vibration sources.

These levels are well below the threshold of any possibility of damage to structures due to vibrations from typical construction activities related to roller, compactors, and movement of construction equipment.

Exhibit 7.9: Approximate Vibration Levels for Various Sources

Activity	*Typical levels of ground vibration*
Vibratory rollers	Up to 1.5 mm/s at distances of 25 m Higher levels could occur at closer distances; however, no damage would be expected for any building at distances greater than approximately 12 m (for a medium to heavy roller)
Hydraulic rock breakers (levels typical of a large rock breaker operating in hard sandstone)	4.50 mm/s at 5 m 1.30 mm/s at 10 m 0.4 mm/s at 20 m 0.10 mm/s at 50 m
Compactor	20 mm/s at distances of approximately 5 m, 2 mm/s at distances of 15 m. at distances greater than 30 m, vibration is usually below 0.3 mm/s
Bulldozers	1 to 2 mm/s at distances of approximately 5 m. at distances greater than 20 m. vibration is usually below 0.32 mm/s
Air track drill	4 to 5 mm/s at a distance of approximately 5 m, and 1.5 mm/s at 10 m. at distances greater than 25 m, vibration is usually below 0.6 mm/s and at 50 m or more, vibration is usually below 0.1 mms
Truck traffic (over normal (smooth) road surfaces)	0.01 to 0.2 mm/s at the footing of buildings located 10 to 20 m from a roadway
Truck traffic (over irregular surfaces)	0.1 to 2.0 mm/s at the footings of buildings located 10 m to 20 m from a roadway

Source: Northern Expressway Environmental Report: Noise and Vibration technical Paper. 2007. http://www.southroad.sa.gov.au/__data/assets/file/0019/13780/Noise_and_Vibration_Technical_Paper.pdf

7.5.2 Vibration Impact of Tunnel and Underground Powerhouse Construction

Blasting for construction results in noise as well as ground vibrations that cannot be confined to the site. As blasting is an occasional activity it does not affect the ambient noise limits evaluated but can be disturbing to local communities with short-term noise exceeding 10 dBA. Single noisy events such as blasting can be audible over a large area.

Although each incident is short-term in nature, the repetitiveness of the noise may give rise to complaints if not managed sensitively. The subjective reaction to a single disturbing noise event will depend on the activities being undertaken by the receptor and the manner in which the program for noisy events is communicated to identified receptors. For example, a large noise event at nighttime may give rise to complaints, where at any other time it would be accepted.

The Project will conduct construction blasting consistent with Pakistan and international safety standards. Open pit blasting will be conducted using standard mining industry practices and procedures for securing personnel and equipment. This includes evacuating

the blast area to a distance of at least 500 m to avoid any damage from fly rock (**Section 7.6** discusses impacts of fly rock exclusively). The PPV is directly related to the size of the blast and the distance from the blast—the closer to the blast the greater the vibration.

PPV is calculated as follows:

$$PPV = K (R/Q^{0.5})^{B},$$

where:

PPV = peak particle velocity (mm/s);

K = site constant (1140)

R = distance to point of concern (m);

B = rock properties constant (-1.6); and

Q = maximum instantaneous charge weight (see **Exhibit 7.10**)

Exhibit 7.10: Instantaneous Charge Weight Calculation

Parameter	*Tunnel Type*		*Explanation*
	Headrace	*Pressure Shaft*	
Diameter (m)	3.8	4.5	From design drawings
Tunnel cross-Section (m^2)	6	8	Assumed as circular
Borehole depth (m)	5	5	Assumed, based on personal communication with construction engineer.
Rock removed in one blast cycle (m^3)	28.35	39.76	Depth times area.
Rock type	Hard	Hard	
Powder factor (kg/m^3)	0.8	0.8	For hard rock.
Total charge weight (kg)	22.68	31.81	Powder factor multiplied by rock removed in one blast.
Maximum instantaneous charge weight (kg)	3	5	Estimated from typical borehole pattern and personal communication with construction engineer.

Exhibit 7.11 shows the PPV value with distance caused by blasting in the various tunnels. For a conservative approach the largest values (for the diversion tunnel) are adopted and therefore, a PPV of 15 mm/s is calculated to occur of a distance of 40 m (or the Structural Damage Risk Zone) from the edge of the blasting source (in all directions) and a PPV of 5 mm/s is calculated to occur about 70 m (or the Cosmetic Damage Risk Zone) from the edge of the blasting. The boundaries of risk zones are drawn without

taking into consideration the variation in elevation of the terrain. The actual boundaries are likely to be closer to the tunnels

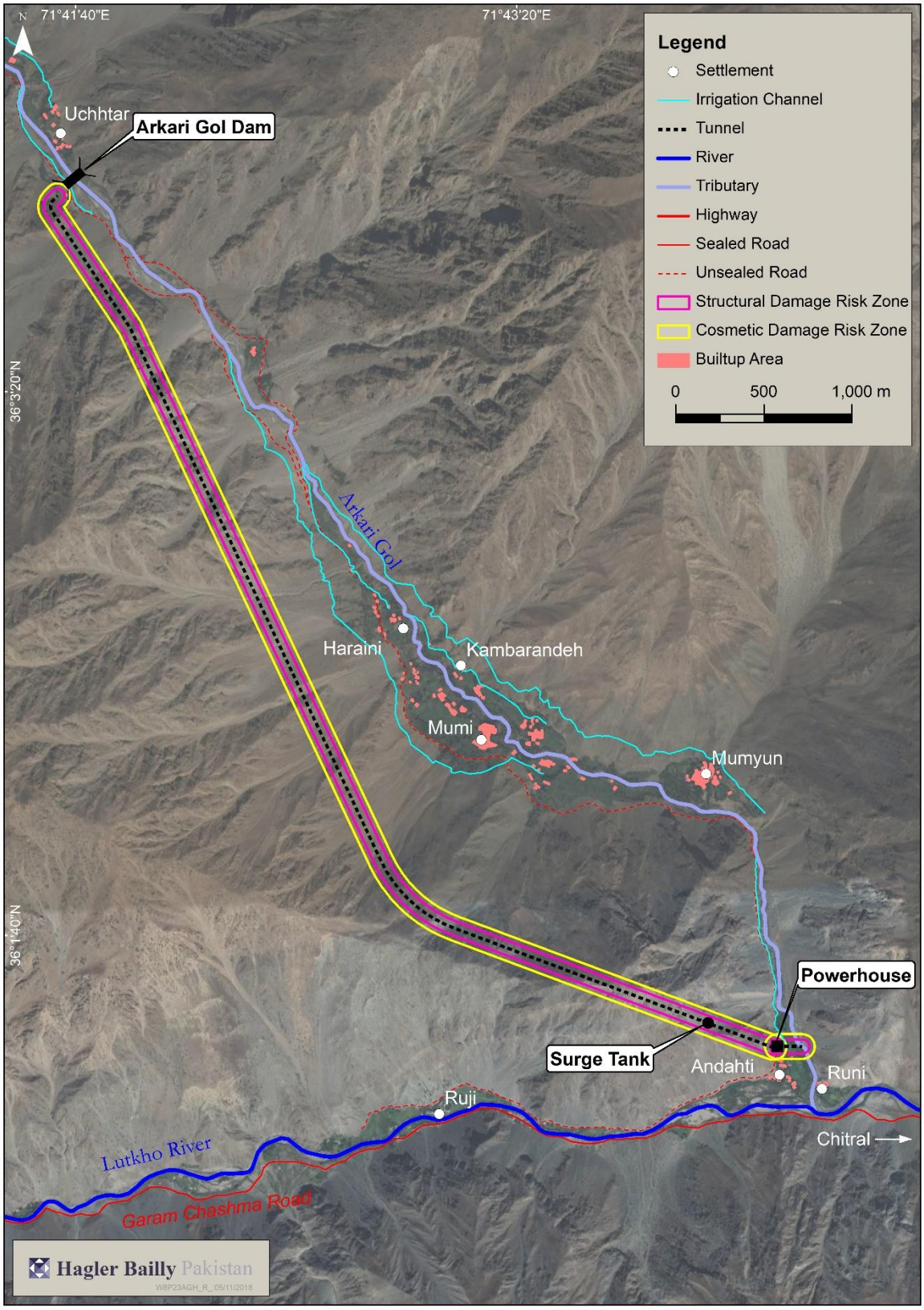
Exhibit 7.11: Calculated PPV as Function of Distance from Blast Site

Orange: PPV ~ 15 mm/s, Green: PPV ~5 mm/s

R (m)	*PPV (mm)*	
	Headrace Tunnel	*Penstock*
10	77.8	102.0
20	25.7	33.6
30	13.4	17.6
40	8.5	11.1
50	5.9	7.8
60	4.4	5.8
70	3.5	4.5
80	2.8	3.7
90	2.3	3.0
100	2.0	2.6

In **Exhibit 7.12** there are no houses within the risk zones that are and not included in the RAP. The structures closest to the blasting locations (and not included within the RAP) are at a distance of 150 m. It is possible that after the construction is started and these zones are reassessed no structures will fall within the zone then either. However, in case the design of the tunnel is adjusted, or if vibrations are high due to the rock structure, or large singe explosives are used, these measures are kept.

Exhibit 7.12: Blasting Induced Vibration Risk Zones – Powerhouse Site



7.5.3 Vibration Impact of Blasting at Quarry Sites

Most quarrying will consist of the excavation of loose materials, however, in some case blasting may be used. The vibrations produced by quarry blasting can be a source of concern and frustration for neighboring communities. The vibration that is felt by people living near a quarry is a combination of ground vibration and air over pressure). A well-executed blast uses as much energy as possible in the fracturing of the rock and leaves very little room to escape into the surrounding environment. Energy that isn't used for breaking rock travels either through the remaining rock or through the air.

Escaping energy from a blast that travels through the air produces a temporary increase in air pressure much like a clap of thunder or a jet engine from aircraft traveling overhead. This increase in air pressure, called air overpressure, is measured in decibels. Air overpressure travels in a wave form and much like wind pushes on anything in its path.

Ground vibration is produced by energy escaping through the remaining solid rock, so it tends to be more discernable behind the blast. Unlike air overpressure, the intensity of ground vibration tends to be more predictable since it travels through a more solid medium.

During construction, the actual ground vibration and air blast overpressure will be measured and should meet the criteria set forth in **Exhibit 7.8** and **Exhibit 7.13** at the nearest sensitive receptor of the blast site. The criteria given in **Exhibit 7.13** is taken from the Australian Standards ABN 46 640 294 485.

Exhibit 7.13: Air blast Overpressure Limits for Surface Blasting

Limits	*Criteria for Sensitive Locations*
Air blast overpressure	115 dB (Linear) Peak for 9 out of 10 consecutive blasts initiated and not greater than 10 mm/second peak particle velocity at any time

7.5.4 Mitigations Measures

Overall Approach

The PPV is predicted using a semi-empirical model which is the best alternate in the absence of measured field data. Although there is reasonable confidence in the predicted value, the norm is to measure field data to assess vibration levels. In the initial stages, the blasting induced vibration shall be measured as a function of maximum instantaneous charge and distance from the blasting site. This data shall be then used to refine the Blasting Induced Vibration Risk Zones on the basis of the adopted criteria.

Early during the construction phase, the construction contractor shall develop a detailed blasting and explosives management plan as part of the overall construction schedule. The plan shall also specify, to a reasonable level of accuracy, the schedule for quarrying.

Using, the refined Blasting Induced Vibration Risk Zones maps and schedule, the Supervision Consultant in consultation with MHL and the Construction Contractor, shall identify the houses that will be affected and the impact duration and schedule.

If any houses fall in the Structural Damage Risk Zone, a temporary relocation plan will be developed. An amendment to the RAP will be commissioned for this purpose. Before

the start of blasting, all residents of houses in the Structural Damage Risk Zone will be relocated as per the amended RAP. Temporary relocation means relocation while blasting is being conducted while too close to the houses, and depends on the blasting schedule. It is likely that no houses are near enough to be classified as within the Structural Damage Risk Zone due to the low population density in the area.

Following are key mitigation measures for the management of blasting:

- Blasting will be scheduled during the day only.
- Local communities will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule.
- A Blasting and Explosives Management Plan will be developed by the Construction Contractor. The Plan will be reviewed and approved by the Supervision Contractor before the initiation of the blasting work.
- Throughout the blasting activity, vibration sensors will be installed at strategic locations to monitor the impact of blasting and to ensure that the vibration levels are within the adopted criteria. The monitoring plan will be part of the Blasting and Explosives Management Plan.

Unlike other construction activities, it is recognized that the impact of blasting on the community can be significant or can be perceived as significant by the community. It is therefore vital that regular and meaningful contact with the community shall be maintained and their grievance shall be attended to in a timely manner. In this regard:

- A meaningful Community Engagement Plan will be developed. The plan will cover identify the affected community; the key contact persons; frequency of engagement; the information to be shared; the responsibilities to manage the plan; and the notice period to be giving to the community for various blasting related generating activities
- The Grievance Redress Mechanism will be used to record, investigate, and respond to any complaints. Investigation of the complaints will be undertaken by the Supervision Consultant.

Vibration Monitoring

Noise and Vibration Control Plan will include monitoring of vibration levels and frequency around the blasting sites. The objectives of the monitoring will be to:

- Ensure that vibration levels in the communities are within the adopted criteria levels;
- Maintain record of vibration to settle any potential conflicts; and
- Monitor changes in the vibration levels due to possible changes in the rock formation and take appropriate corrective actions.

Vibration data will be documented, reviewed, and preserved. It will be regularly shared with OPIC, MHL and KP-EPA as part of the quarterly progress report.

7.6 Hazards of Fly Rock from Blasting

Fly rock is an unplanned projection of material from the blast site to any area beyond the designated safety area. These rocks, if not controlled, may result in damage to the surrounding structures and may also pose a safety hazard.

Impact 08: Blasting may pose a safety hazard due to flying debris.

Applicable Project Phase *Construction*

Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Short Term	Intermediate	Medium	Possible	Medium	-	High

Mitigation measures:

1. Provide a minimum buffer of 500 m between the settlements and point of blasting. If not possible then households falling within this buffer should be temporarily evacuated when blasting is done at the quarry.
2. Leave a layer of about 5 m of undisturbed softs above the top of the overburden blasts. This will act as a blanket to contain air blast, dust and fly rock.
3. Ensure that the holes are correctly collared with respect to the back-break/inclination of the face and that digging alongside the initiation face well controlled.
4. Inadequate forward displacement of the front row burden arising out of the under charging of these holes will result in fly rock from vertical catering of the rear holes.
5. Where fly rock pose a serious problem, the stemming length should not be less than the hole burden. Also, an effective stemming material like crushed angular rock should be used to prevent premature venting of explosion gases through the stemming column.
6. The forward fly rock could be fairly controlled to the commonly used 'inline open loop' pattern. The maximum inter-row delay interval consistent with the absence of cut off helped in minimizing the fly rock formation. As a thumb rule, an inter-row delay of 4-8ms/m of burden could be used for this purpose.
7. Adequate care should be taken while connecting the delay devices in the holes/rows and the initiation sequence properly checked before firing to avoid initiation of blast holes out of sequence.
8. Blasts designed on a face length to width ratio in the range of 3 to 4 produces minimum fly rock.

Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Possible	Low	-	High

Fly rock occurs when the amount of explosive energy is greater than that required to break the mass of rock between the blast position and the free face, the excess energy projects the rock debris beyond the safety area. Uncontrolled fly rock from blasting can travel hundreds of meters, with known cases up to 1000 m. This range is for extreme cases where very little blasting control is applied and is due to over-charging of holes or under-burdening of holes.

Use of large diameter blast holes for small benches, variation in burden due to over break of toe or back crack that results in uneven face, drilling deviation, inadequate burden and too closing spacing are the possible causes of fly rock.

Even though fly rock consumes only 1% of the explosive energy used in a blast it is more serious in nature than any other damage caused by blasting.

Residents should be temporarily evacuated from the homes that fall within the 500 m buffer during blasting at these quarries. An evacuation plan should be developed for temporary evacuation if blasting is required in the quarries.

Temporary relocation means relocation while blasting is being conducted while too close to the houses, and depends on the blasting schedule. It is likely that no houses are near enough to be classified as within the Risk Zone due to the low population density in the area.

7.7 Construction Noise

Construction noise is a component of environmental noise associated with construction activities. Construction noise arises from an activity at a construction site. It includes:

- noise from operation of construction machinery and equipment for the construction activities including excavation and demolition work, site preparation work, foundations and concrete placement, erection of metal structures, installation of mechanical and electrical equipment and building maintenance or repair work;
- noise from movement of vehicles within, entering or leaving a construction site; and
- noise from blasting.

The noise generated through these activities can be categorized as follows:

- Airborne noise: Noise that travels through air and caused by general construction and construction traffic.
- Ground borne noise: Noise that is generated through rumbling sound caused by vibration due to impact-induced construction activities such as blasting, pile driving and tunneling and movement of heavy transportation such as trucks.
- Air blast noise: Noise generated through blasting, also known as blast overpressure, which is the pressure wave (or pulse) transmitted through the air as the result of an explosion. Air blast may have both acoustic effects in terms of overpressure and vibration effects in terms of airborne and ground borne vibration.

Construction noise emanates from the source and propagates through the atmosphere. There are numerous factors influencing the noise level received at a sensitive receptor including:

- The degree to which the radiation emitted is concentrated in a single direction.
- Atmospheric absorption (i.e. attenuation which is a function of temperature, humidity, and frequency within the atmosphere).
- Meteorological influences (attenuation or enhancement due to surface temperature and humidity, vertical temperature profile, wind speed, and direction).
- Ground absorption (influence of hard or soft ground types on propagation).
- Topography and structures (attenuation due to intervening buildings and terrain features.

Impact 09: Increase in ambient noise levels due to the operation of construction equipment, movement of construction traffic and blasting may create a nuisance for nearby communities and visiting tourists.

Applicable Project Phase *Construction*

Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Short Term	Intermediate	Medium	Possible	Medium	-	High

Mitigation measures:

1. Develop a Noise and Vibration Control Plan.

Noise generated from construction sites from construction activities

2. Select the quietest available plant and equipment that can economically undertake the work required.
3. Undertake maintenance of the equipment as simple maintenance can reduce noise levels by as much as 50%. Parts may become loose, creating more noise because of improper operation or scraping against other parts. Grinding noises may also occur as the result of inadequate lubrication.
4. Maintain equipment under use regularly.
5. Install mufflers on the equipment to minimize noise levels.
6. Use visual alarms in preference to audible alarms.
7. Enclose noisy equipment.
8. Provide noise attenuation screens, where appropriate.
9. Build an enclosure around the noise source so that noise is contained. The enclosure should be free from gaps and made of dense material and be lined with noise-absorbing material like glass or polyester batts.
10. Locate noisy equipment behind parking lots or parks.
11. Close liaison with the community and regular monitoring of the noise levels in the community are key to the successful implementation of the above mitigation measures. Specifically, inform communities of all major construction activities three days in advance.

Construction noise from traffic

12. Install residential class mufflers and silencers to the mobile plants such as excavators, front-end loaders, and other diesel-engine equipment as applicable.
13. Construct paved Project access roads and locate where the gradient is low.
14. Implement special noise reduction measures, such as erecting purpose-built acoustic barriers, restricting opening hours and maintaining transport vehicle.
15. Prepare and implement a Traffic Management Plan including, timing of traffic through communities, route planning to avoid sensitive locations, etc.

Construction noise from on-site plant operations and equipment

16. Select plant equipment appropriately that required minimal mitigation.
17. Install mufflers and silencers on the equipment and provide acoustical enclosures.
18. Modify the equipment or the work area to make it quieter by substituting existing equipment with quieter equipment; retro-fitting existing equipment with damping materials, mufflers, or enclosures; erecting barriers; and maintenance.
19. Shift to a quieter construction process for example pile driving is very loud as compared to boring which is a much quieter way to do the same work.
20. Combine noisy operations to occur in the same time period. The total noise level produced will not be significantly greater than the level produced if the operations were performed separately.
21. Maintain and monitor plant and equipment regularly.
22. Move static plant and equipment as far as possible from sensitive boundaries, as work allows. A distance of four times further away lowers the noise by 12 dBA. A reduction of 10 dBA will sound half as loud.
23. Provide baffles and specialized mufflers, and acoustic enclosures to the plant and equipment.
24. Design and built acoustic barriers if needed. Vegetated buffer zones can also be planted to mitigate noise from operations using suitably selected native plantings local to the area.

25. Reduce workers' exposure to high noise levels by keeping moving workers away from the noise source; restricting access to areas; rotating workers performing noisy tasks, and shutting down noisy equipment when not needed.
26. Use earplugs to reduce workers' exposure to high noise levels.

Noise generated from the blasting in quarry areas

27. Use vibratory piling instead of impact piling.
28. House conveyor belts and crushing/screening equipment to provide acoustic screening.
29. Ensure that the noise-reduction equipment fitted to machinery is used and maintained properly.
30. Erect earth mounds around the site boundary can provide acoustic as well as visual screening.

Noise emissions from concrete batching

31. Locate noisy equipment behind sound barriers or sound absorbers – for example, gravel stockpiles or constructed barriers.
32. Install silencing devices to all pressure operated equipment.

Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Possible	Low	-	High

7.7.1 Existing Conditions

There is no continuous major anthropogenic source of noise in the communities. Noise baseline conditions at the Project construction sites in the villages are around 50-54 dBA for daytime and 44-50 dBA for nighttime. The detailed noise levels are presented in **Section 4.2.6** (*Noise Levels*).

7.7.2 Criteria for Determining Significance

The IFC EHS guidelines and NEQS for noise require that the sound level in residential areas should not exceed 55 dBA during the day and 45 dBA during the night as presented in **Exhibit 7.14**. IFC EHS guidelines also state that noise impacts should not exceed the levels presented in **Exhibit 7.14** or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. The Project site will be considered residential as there are no designated industrial or commercial zones in the area.

Exhibit 7.14: NEQS and IFC Guidelines on Ambient Noise Levels

Specific Environment	*Maximum Allowable Log Equivalent (Hourly Measurements), in dB A*			
	IFC-EHS limit Day (7:00-22:00)	*IFC-EHS limit Night (22:00-7:00)*	*NEQS Day (6:00-22:00)*	*NEQS Night (22:00-6:00)*
Residential, institutional, educational	55	45	55	45
Industrial	75	65	70	70
Commercial	65	55	70	70

7.7.3 Impact Analysis

The analysis presented in this section is based on the approach recommended by Federal Highway Administration of the US Department of Transportation for assessment of construction noise.[7]

Precise prediction of noise due to construction activity at given location at a given time requires the list of all equipment that is operational at the time and the following information regarding each piece of equipment:

- The maximum and minimum noise levels, measured at a reference distance from the equipment, during a work cycle
- The fraction of time it operates at maximum level during a work cycle
- The usage factor, i.e., the number of hours during the day when the equipment is operational
- The distance of the equipment from the receptor
- Potential noise barriers and other topographic features that attenuate the sound.
- Atmospheric conditions—the wind speed and direction, humidity and barometric pressure—also affect the propagation of sound, however, for short distances the effect of these is insignificant compared to other variables.

Construction noise levels at the nearest receptor in the nearby village, would fluctuate depending on the type, number, distance from receptor, and duration of use of various pieces of construction equipment. In this analysis, first, the noise level due to each piece of equipment, which is likely to be used in the construction, is calculated. The peak noise levels of construction equipment mainly used at a typical construction site, are shown in **Exhibit 7.15**. The list includes all equipment except vehicles and some minor pieces of equipment. Using this data, the expected noise level, $L_{eq(8\text{-}hr)}$, is calculated. The predicted noise levels are shown in **Exhibit 7.16**. It shows that the highest equivalent noise level for an 8-hour shift due to a single piece of equipment at a receptor 500 m from the source will be about 52 dBA. This is under no-mitigation conditions and assuming no attenuation due to ground features.

When more than one piece of equipment are working simultaneously, the noise level at the receptor will increase. Generally speaking, the noise level will increase by 3 dBA due to the first equipment. Increase due to subsequent addition of equipment will gradually decrease from 3 dBA. So if five equipment, each producing 52 dBA at the receptor, are working simultaneously, the resulting noise level will be around 59 dBA. The attenuation due to topographic factors could be up to 5 dBA. Good maintenance of equipment with the installation of noise mufflers can reduce the noise by another 5 dBA.

[7] Highway Construction Noise: Measurement, Prediction, and Mitigation, Reagan, J. A. and C. A. Grant, Special Report. US. Department of Transportation, Federal Highway Administration.

Exhibit 7.15: Construction Equipment Noise Ranges (dBA)

Equipment	*Peak Noise Range at 15.2 m*	*Typical Peak Sound Level in a Work Cycle*[a]	*Typical 'Quieted Equipment' Sound Level*[b]	*Construction Phase*		
				Earthworks	*Structures*	*Installation*
Batching plant	82-86	84	81		Y	
Concrete mixers	76-86	85	82		Y	
Cranes	70-94	83	80		Y	Y
Excavators	74-92	85	82	Y		
Tractors and trolleys	77-94	88	85	Y	Y	Y
Water bowsers	85-93	88	85	Y	Y	Y
Graders	72-92	85	82	Y		
Bulldozers	65-95	80	75	Y		
Paver	87-89	88	80	Y		
Pumps	68-72	76	75	Y	Y	Y
Diesel generators	72-82	78	75	Y	Y	Y
Vibrators	68-82	76	75	Y	Y	
Drilling machines	82-98	90	87		Y	Y
Compressors	74-84	81	71		Y	
Dumpers	77-96	88	83	Y	Y	Y
Road rollers	73-77	75	72	Y		

Sources: Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances. USEPA; Bolt, Beranek, and Newman, 1971.

Notes:

[a] Where typical value is not cited in literature, mean of the peak noise range is assumed

[b] Quieted equipment can be designed with enclosures, mufflers, or other noise-reducing features. Where data is not available, a 3 dB reduction is assumed

Exhibit 7.16: Predicted Noise Level for Construction Equipment (dBA)

Equipment	*Equivalent Noise Level in an 8-hr Shift at Receptor 250-500 m from Source*	*Individual Compliance*	
		Daytime	*Nighttime*
Batching plant	59	No	No
Concrete mixers	59	No	No
Cranes	54	Yes	No
Excavators	54	Yes	No
Tractors and trolleys	49	Yes	No

Equipment	*Equivalent Noise Level in an 8-hr Shift at Receptor 250-500 m from Source*	*Individual Compliance*	
		Daytime	*Nighttime*
Water bowsers	49	Yes	No
Graders	45	Yes	Yes
Bulldozers	45	Yes	Yes
Paver	45	Yes	Yes
Pumps	45	Yes	Yes
Diesel generators	43	Yes	Yes
Vibrators	43	Yes	Yes
Drilling machines	43	Yes	Yes
Compressors	43	Yes	Yes
Dumpers	43	Yes	Yes
Road rollers	43	Yes	Yes

It can be seen that some equipment is in compliance with the NEQS and IFC-EHS limits when they are operated on an individual basis. Nighttime construction activities may exceed the limits for certain construction equipment as shown in **Exhibit 7.16**. It is, therefore, predicted that the resultant noise levels at the receptors when the construction work is carried out at a distance of the 350 m from the receptor could be in the range 50-55 dBA. As the noise levels of construction equipment vary considerably, the community can easily notice the variation. However, the overall noise level, $L_{eq,}$ is likely to be within the predicted limited.

In addition to inherent fluctuation in equipment, the other factors that can increase the noise levels at the community include, simultaneous operation of a very large number of equipment, equipment working in close vicinity of the dwellings, receptors located on elevated area thus eliminating attenuation due to topography, and receptors located downwind of the equipment.

7.7.4 Mitigation

Noise mitigation measures for each construction activity are presented in **Exhibit 7.17**.

Exhibit 7.17: Mitigation Measures for Controlling Noise

Source/Activity	*Mitigation Measures*
Noise generated from construction sites from construction activities Construction activities include removal of topsoil and overburden, excavation with machinery, drilling and blasting of rock, crushing and screening of aggregates, transport of raw materials and finished products within the site and on public roads, etc.	**Source Mitigation** ▶ Select the quietest available plant and equipment that can economically undertake the work required. ▶ Undertake maintenance of the equipment as simple maintenance can reduce noise levels by as much as 50%. Parts may become loose, creating more noise because of improper operation or scraping against other parts. Grinding noises may also occur as the result of inadequate lubrication. ▶ Maintain equipment under use regularly. ▶ Install mufflers on the equipment to minimize noise levels. ▶ Use visual alarms in preference to audible alarms **Pathway Mitigation** ▶ Enclose noisy equipment. ▶ Provide noise attenuation screens, where appropriate. ▶ Building an enclosure around the noise source so that noise is contained. The enclosure should be free from gaps and made of dense material and be lined with noise-absorbing material like glass or polyester batts. ▶ Locate noisy equipment behind parking lots or parks. **Receiver Mitigation** ▶ Close liaison with the community and regular monitoring of the noise levels in the community are key to the successful implementation of the above mitigation measures. Specifically, ▷ Inform communities will of all major construction activities three days in advance, ▷ Discuss noise control measures with the community through informal and formal meetings, and ▷ Implement a complaint registering, tracking and redressal mechanism and undertake on-demand monitoring also in case of any complaints.
Construction noise from traffic Heavy vehicles on access routes can create disturbing noise entering and exiting the facility. The siting of such facilities need to consider the traffic routes the vehicles will travel,	**Source Mitigation** ▶ Install and maintain residential class mufflers and silencers to the mobile plants such as excavators, front-end loaders, and other diesel-engine equipment as applicable. **Pathway Mitigation** ▶ Construct paved Project access roads if practicable and locate where the gradient is low.

Source/Activity	*Mitigation Measures*
preferably not through built-up residential areas.	**Receiver Mitigation** ▶ Implement special noise reduction measures, such as erecting purpose-built acoustic barriers, restricting opening hours and maintaining transport vehicle. ▶ Prepare and implement a Traffic Management Plan including, timing of traffic through communities, route planning to avoid sensitive locations, etc.
Construction noise from on-site plant operations and equipment The extent to which plant and equipment may disturb neighboring properties will depend on local circumstances and on the nature, level or frequency of the sound emitted, its duration and the time at which it is made.	**Source Mitigation** ▶ Select plant equipment appropriately that required minimal mitigation. ▶ Install mufflers and silencers on the equipment and provide acoustical enclosures. ▶ Modify the equipment or the work area to make it quieter by substituting existing equipment with quieter equipment; retro-fitting existing equipment with damping materials, mufflers, or enclosures; erecting barriers; and maintenance. ▶ Shift to a quieter construction process for example pile driving is very loud as compared to boring which is a much quieter way to do the same work. ▶ Combine noisy operations to occur in the same time period. The total noise level produced will not be significantly greater than the level produced if the operations were performed separately. ▶ Maintain and monitor plant and equipment regularly. **Pathway Mitigation** ▶ Move static plant and equipment as far as possible from sensitive boundaries, as work allows. A distance of four times further away lowers the noise by 12 dBA. A reduction of 10 dBA will sound half as loud. ▶ Provide baffles and specialized mufflers, and acoustic enclosures to the plant and equipment. ▶ Design and built acoustic barriers if needed. Vegetated buffer zones can also be planted to mitigate noise from operations using suitably selected native plantings local to the area. **Receiver Mitigation** ▶ Reduce workers' exposure to high noise levels by keeping moving workers away from the noise source; restricting access to areas; rotating workers performing noisy tasks; and shutting down noisy equipment when not needed. ▶ Use earplugs to reduce workers' exposure to high noise levels.

Source/Activity	*Mitigation Measures*
Audible noise generated from the blasting in quarry areas Blasting (which occurs at quarries, but not in sand and gravel pits) can give rise to vibration, audible noise, fly rock and dust. Nonetheless, vibration transmitted through the ground and pressure waves through the air ("air overpressure") can shake buildings and people and may cause a nuisance. Audible noise accompanies overpressure.	**Source Mitigation** ▶ Use vibratory piling instead of impact piling. ▶ House conveyor belts and crushing/screening equipment to provide acoustic screening. ▶ Ensure that the noise-reduction equipment fitted to machinery is used and maintained properly. **Pathway Mitigation** ▶ Erect earth mounds around the site boundary can provide acoustic as well as visual screening.
Noise emissions from concrete batching Concrete batching plants are where ingredients such as sand, cement, water, and aggregate are mixed to form concrete. This consists of various activities such as storage of raw materials in bunkers and stockpiles, transfer of raw materials by front-end loaders, conveyors, hoppers and loading of materials to the trucks.	**Source Mitigation** ▶ Locate noisy equipment behind sound barriers or sound absorbers – for example, gravel stockpiles or constructed barriers ▶ Install silencing devices to all pressure operated equipment

7.8 Water Availability and Quality

The key impacts on water availability and quality due to the Project include:

- Impact 10: Alterations of natural passage of springs due to tunnel construction may disrupt the water availability at mountain springs for local community.
- Impact 11: Use of local water resources for construction activities may reduce the water availability for local communities.
- Impact 12: Contamination of surface and groundwater due to discharge from the construction activities and sewage from the construction camps may affect agricultural productivity and human health.

7.8.1 Changes to Groundwater Patterns

Impact 10: Alterations of natural passage of springs due to tunnel construction may disrupt the water availability at mountain springs for local community.								
Applicable Project Phase	*Construction*							
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Major	Long Term	Intermediate	High	Possible	High	-	Medium
Mitigation measures: 1. Record location of the springs close to the Project construction site. 2. Monitor flow for located springs and maintain records and ensure the availability of water to the communities and the access of the communities to the water resources being used by them is not adversely affected. Provide water to communities where needed to offset any disturbance. 3. Support the community in development of alternate water supply schemes through local NGOs.								
Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Medium Term	Intermediate	Low	Possible	Low	-	Medium

Heavy construction activities especially the blasting activities for underground construction of the headrace tunnel and powerhouse (see **Section 7.5** *Vibration from Blasting*) and excavation may cause alterations to the groundwater flow patterns in areas proximal to the Project construction site.

The construction area is in the valley, and there are limited households near it. Furthermore, the springs (and households) that have a possibility to be affected fall into the scope of the land acquisition plan. Lastly, these changes will only cause negative impacts when they occur where people or ecological systems are using the water, and for three of the nearby springs nobody uses the spring water.

An inventory of mountain springs and other community water resources is developed in **Section 4.2.7** *(Water Resources and Sediment)*. Mountain springs do not lie proximity to the headrace tunnel or other areas where blasting is expected.

7.8.2 Disturbance to Surface Irrigation Channels

Surface irrigation channels have been constructed by the local residents to divert water from the river into their farms. The channels on the right bank of the Arkari Gol pass in

close proximity of the headrace tunnel at several locations. Some of the intake structures of these channels fall within the Dam construction site and will be relocated.

Impact 11: Damage to community irrigation channels may occur during construction especially during blasting of the headrace tunnel

Applicable Project Phase				*Construction*				
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Major	Long Term	Intermediate	High	Possible	High	-	Medium

Mitigation measures:

1. Document the current status of the irrigation channels. Record location of the springs close to the Project construction site.
2. Engage local communities through GRM for periodic monitoring of the status of the channels.
3. If the channel is damaged, then provide support for fast and complete repair.

Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Medium Term	Intermediate	Low	Possible	Low	-	Medium

7.8.3 Water Resource Depletion

Impact 12: Use of local water resources for construction activities may reduce the water availability for local communities.

Applicable Project Phase				*Construction*				
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Short Term	Intermediate	Medium	Possible	Medium	-	High

Mitigation measures:

1. Develop a Water Sourcing and Abstraction Plan.
2. Source water for construction from authorized abstraction sources agreed between the local communities, local government and EPC contractor.
3. Develop and implement water conservation techniques through the EPC contractor.
4. Keep clear access routes of the community to water sources so that their water requirements are not compromised.
5. Exercise care while moving heavy machinery to avoid damage or blockage of natural waterways and channels.
6. Maintain records of water usage in all Project activities.
7. Incorporate the above measures in the Construction Site Environmental Management Plan..

Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Unlikely	Low	-	High

The main source of drinking water in the area is spring water indicated as part of the hydro census (see **Section 4.2.7,** *Water Resources and Sediment*). Water demand for the construction site and camp may take water away from other users if not controlled. Unauthorized abstraction from shallow springs could reduce the yield available or block access for other users, leading to resentment and increasing the risk of hardship.

7.8.4 Contamination of Surface and Groundwater from Construction Activities

Impact 13: Contamination of surface and groundwater due to discharge from the construction activities and sewage from the construction camps may affect agricultural productivity and human health.

Applicable Project Phase *Construction*

Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Short Term	Small	Low	Possible	Low	-	High

Mitigation measures:

1. Develop and implement a Water Quality Management Plan.
2. Develop and implement a Hazardous Material Management Plan.
3. Prepare and implement a Waste Management Plan.
4. Septic treatment facility will be developed at each camp and construction site to manage waste generated on-site.
5. Prepare and implement a Spill Prevention and Response Plan and inducted to the staff for any incident of a spill.
6. Provide and use spill prevention trays at refueling locations.
7. Collect runoff from maintenance workshops using impervious channels and pass through oil water separators (OWS) before final disposal. Properly dispose of the sludge and oil collected at the OWS.
8. Build separate impervious pits (with concrete walls and proper shed) at the construction sites for temporary handling and storage of contaminated soil and water if encountered during construction such as sludge from OWS.
9. Keep all fuel storage tanks and lubricating oil drums in secondary containment impervious pits with impervious shed walls.
10. Avoid on-site maintenance of construction vehicles and equipment, as far as possible.
11. Regularly inspect construction vehicles and equipment to detect leakages.
12. Store fuels and lubricants in covered and dyked areas, underlain with impervious lining.
13. Spill control kits (shovels, plastic bags, and absorbent materials) will be available near fuel and oil storage areas, vehicle parking, and vehicle maintenance areas as well as at construction sites.
14. Remove contaminated soil from the site and dispose of in a manner to ensure the protection of water sources.
15. Construct the bottom of any soak pit or septic tank at least 100 m away from springs and water bores.
16. Maintain records of spills and volume of removed contaminated soil.
17. Maintain a record of remedial measures taken.
18. Use silt traps to prevent contamination of river and streams.
19. Mechanical works and shops, secondary containment (>110% of volume) for storage and use of paints and other hazardous materials should be done over impermeable surfaces.
20. Incorporate the above measures in the Construction Site Environmental Management Plan.

Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Unlikely	Low	-	High

Major risks to water bodies during construction are accidental spills of fuels, lubricants, reagents and other potentially hazardous chemicals.

7.9 Soil, Topography, Land Stability

The impacts associated with soil topography and land stability are discussed in this section. A detailed description of the geology, land use and soil quality is provided in

Section 4.2.2 (*Geology, Soils and Seismic Hazards*). The potential impacts are as follows:

- Impact 13: Contamination of soil as a result of accidental release of solvents, oils, and lubricants can degrade soil fertility and agricultural productivity.
- Impact 14: Land clearing, excavation, tunnel boring and other construction activities may loosen the top soil in the Project area resulting in loss of soil, accelerated soil erosion, and landslides, especially in the during summer Monsoon.
- Impact 15: Increased erosion and sediment load entering the river from bunds and sediment ponds during the construction phase and as a consequence of the failure of spoil dumping sites.

7.9.1 Soil Quality

Impact 14: Contamination of soil as a result of accidental release of solvents, oils, and lubricants can degrade soil fertility and agricultural productivity.

Applicable Project Phase *Construction*

Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Medium	Small	Medium	Possible	Medium	-	High

Mitigation measures:

1. Develop and implement a Hazardous Material Management Plan.
2. Prepare a Spill Prevention and Response Plan and inducted to the staff for any incident of spill.
3. Provide and use spill prevention trays at refueling locations
4. Appropriately mark fuel tanks by content and store in dyked areas with an extra 10% of the storage capacity of the fuel tank. The area will be lined with an impervious base.
5. Install grease traps on the site, wherever needed, to prevent the flow of oily water.
6. Ensure availability of spill cleaning kit (shovels, plastic bags, and absorbent materials) near fuel and oil storage areas, vehicle parking, and vehicle maintenance areas as well as at construction sites.
7. Carry cleanup kits in all fuel trucks.
8. Carry out fueling and store and use other hazmats only over impermeable surfaces.
9. Ensure the bottom of any soak pit or septic tank at least 10 m above the groundwater table. The distance can be reduced, based on the soil properties, if it is established that distance will not result in contamination of groundwater.
10. The runoff from maintenance workshops will be collected by impervious channels and be passed through oil water separators (OWS) before final disposal. The sludge and oil collected at the OWS will be disposed of properly.
11. Build separate impervious pits (with concrete walls and proper shed) at the construction sites for temporary handling and storage of contaminated soil and water if encountered during construction such as sludge from OWS.
12. Keep all fuel storage tanks and lubricating oil drums in secondary containment impervious pits with impervious shed walls.
13. Avoid on-site maintenance of construction vehicles and equipment, as far as possible.
14. Regularly inspect construction vehicles and equipment to detect leakages.
15. Remove contaminated soil from the site and dispose in a manner to ensure protection of water sources
16. Maintain records of spills and volume of removed contaminated soil.
17. Use silt traps to prevent contamination of river and streams.

18. Mechanical works and shops, secondary containment (>110% of volume) for storage and use of paints and other hazardous materials should be done over impermeable surfaces.
19. Incorporate the above measures in the Construction Site Environmental Management Plan.

Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Medium	Small	Low	Unlikely	Low	-	High

Oil spills during construction process will result in contamination of soil as well as groundwater. Due to hilly nature of the Project area, soil contamination on the construction site has the potential to travel to surrounding areas and contaminate the soil. Such spills can occur during construction process when tankers will access the area for refueling of excavation and other construction machinery.

Improper handling of oils, lubricants, and other such solvents may result during machinery refueling. Storage in areas with no lining and low-quality storage containers poses another threat of soil contamination. The impact will be minimized by adopting mitigation measures and extra caution during refueling and machinery maintenance at on-site workshops.

7.9.2 Soil Erosion

Impact 15: 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.

Applicable Project Phase *Construction*

Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Medium Term	Intermediate	Medium	Definite	Medium	-	High

Mitigation measures:

1. Develop a Surface Runoff, Site Restoration and Erosion Control Plan.
2. Limit vegetation loss to demarcated construction area.
3. Cover areas such as muck disposal area, batching plant, labor camp and quarry sites after the closure shall with grass and shrubs.
4. Adopt slope stabilization measures such as adequate vertical and horizontal drains, drainage along roadsides, cross drainage and retaining walls.
5. Monitor slope movements around excavation work areas.
6. Salvage, store, and reuse all topsoil at all construction sites.
7. Minimize height and increase surface area for the stockpile to the extent possible to minimize emissions.
8. Ensure careful stripping of topsoil to avoid its mixing with subsoil.
9. Revegetate the stockpiles to minimize loss of soil quality and weed infestation, maintain soil organic matter levels, soil structure, and microbial activity.
10. Clearly, signpost the topsoil stockpiles for easy identification and minimization of any inadvertent losses.
11. Monitor the establishment of declared plants on the stockpiles and implement control programs as required.
12. Treat topsoil with temporary soil stabilization and erosion control measures.
13. Gradually remove the topsoil in layers (less than 0.5 m thick) in Project affected areas where restoration needs to be done.
14. Mix the top layer with the remainder of the stockpile to ensure that living organisms are distributed throughout the topsoil material at the time of final placement. The use of micro-organism inoculates may be necessary to re-establish micro-organisms in topsoil material.
15. Select local species for plantation to restore the biodiversity of the area in consultation with Forest Department after completion of respective activities.

Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Possible	Low	-	High

Any excavation work during the construction activities, whether permanent or temporary, would lead to loss of soil. Excavated material collected during boring of the diversion tunnels will be used for the construction of a cofferdam to divert water. Furthermore, construction will require excavation for the powerhouse, tunnels and other Project associated facilities. Erosion of soil can also occur from the removal of vegetation cover, runoff from unprotected excavated areas, muck disposal and quarry sites. Excavations on slopes would also decrease its stability. Given the topography of the area, unprotected excavations on sloping grounds may lead to landslides, especially during the rainy season. Major landslides will disturb the slopes of the area and may also alter the bed of Arkari Gol.

Topsoil from the Project site will be stockpiled for use during the restoration process therefore, it is important that it must retain its advantageous chemical, physical, and biological properties. Generally, the soil is adversely affected during storage if the depth of the stockpile is more than 3 m. Otherwise, anaerobic conditions are created in the deeper depths, which results in a decrease in microbial activity in the stockpiled soil and consequently adversely affect the biological properties. The mitigation measures proposed for ensuring the regeneration of biological activity in the topsoil are provided and will be followed.

7.9.3 Spoil Disposal Areas

Impact 16: Increased erosion and sediment load entering the river from bunds and sediment ponds during the construction phase and as a consequence of the failure of spoil dumping sites.

Applicable Project Phase	*Construction and Operation*							
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Long Term	Intermediate	High	Possible	High	-	High

Mitigation measures:

1. Design sedimentation ponds and dumping sites to a have a flood prevention design for a 20-year flood since the dumps will be left in place permanently.
2. Periodically remove sediments from bunds and sedimentation ponds before monsoon and after each large flood.
3. Maintain and monitor the sedimentation ponds to avoid sediment introduction in the river.
4. Undertake vegetation restoration works at all dumping sites including surface leveling, covering and forest/grass planting or agricultural land rehabilitation
5. Monitor slope movements excavation work areas.
6. Restore to the maximum extent possible the hydrological regime and reinstate natural drainage of the land (including provisions to maintain the water balance of the site and protect from flooding where appropriate)
7. Reinstate topsoil (in case it was stripped before construction activities)
8. Revegetate sites with suitable native plant species
9. Drain spoil piles to prevent the concentration of flow and to prevent rill and gully erosion
10. Separate organic material (e.g., roots, stumps) from the dirt fill and store separately. Place this material in long-term, upland storage sites, as it cannot be used for fill.
11. Store “clean” material in a short-term disposal site (stockpile) if it will likely be re-used for fill.
12. Recycle asphalt material in embankments and shoulder backing, where possible. Place these materials where they will not enter the stream system. Asphalt that is 5 years old is considered “inert” (that is, all oils washed off).

13. Do not add excess unusable material to permanently closed sites.
14. Spread material not to be re-used in compacted layers, generally conforming to the local topography.
15. Design the final disposal site reclamation topography to minimize the discharge of concentrated surface water and sediment off the site and into nearby watercourses. Cover the compacted surfaces with a 6-inch layer of organic or fine-grained soil, if feasible.
16. After placement of the soil layer, track walk the slopes perpendicular to the contour to stabilize the soil until vegetation is established. Track walking creates indentations that trap seed and decrease erosion of the reclaimed surfaces.
17. Revegetate the disposal site with a mix of native plant species. Cover the seeded and planted areas with straw compost, mulched with straw at a rate of 1 to 1 ½ tons per acre. Apply jute netting or similar erosion control fabric on slopes greater than 1:2 if site is erosive.
18. Locate stockpiles away from drainage lines, at least 10 meters away from natural waterways and where they will be least susceptible to wind erosion.
19. Ensure that stockpiles and batters are designed with slopes no greater than 1:2 (vertical\ horizontal).
20. Regularly rehabilitate areas not in use for Project activities during construction to minimize erosion. This includes regrading and immediate revegetation (using fast-growing species and different functional groups of plants for keeping soil in place) of slopes to minimize erosion.
21. Install erosion and sediment control measures, if possible before construction commences. Identify drainage lines and install control measures to handle predicted storm water and sediment loads generated in the mini-catchment.
22. Establish an adequate inspection, maintenance and cleaning program for sediment runoff control structures. Ensure that contingency plans are in place for unusual storm events.
23. Continually assess the effectiveness of sediment control measures and make necessary improvements.
24. Keep temporary disposal sites out of wetlands, adjacent riparian corridors, and ordinary high water areas as well as high risk zones, such as 100-year floodplain and unstable slopes.
25. Anticipate sufficient storage area with no risk for sediment delivery for piles that may slump. Stress cracks indicate that the pile is at risk of slumping.
26. Incorporate the above measures in the Spoil Disposal Plan.

	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
Residual Impact Rating	Moderate	Medium Term	Intermediate	Medium	Unlikely	Low	-	High

In the event of failure of a waste dumping site, there can be a danger to downstream communities due to release of sediment into the river impacting the ecology. Sites not revegetated or rehabilitated can be a constant source of fugitive dust emissions due to wind erosion from the surface. Critical mitigation measures listed above ensure spoil units are stable for the coming decades and centuries.

7.10 Aesthetics

The landscapes of remote mountainous areas of northern Pakistan are a source of enjoyment for residents, as well as for the tourists visiting the area.

Although the environmental laws of Pakistan, [8] do not mention visual impacts explicitly, the definition of the environment[9] clearly implies that visual impacts need to be

[8] For example, the Punjab Environmental protection Act 199 and the AJK Environmental Protection Act 2000.

[9] Section 2(x) of the Punjab Environmental Protection Act 1997 defines "environment" as “(a) air, water and land; … (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions

considered. Accordingly, Pakistan Guideline[10] recognizes visual impacts of development projects and requires them to be assessed.

A scenic area is any area or landscape that is visually appealing to the observer. It may be an asset to the residents of the area who may have chosen the place of residence because of the scenic beauty or it may be an asset to the businesses in the area who depend on the tourist visiting the area due to the scenic beauty. A visual impact assessment (VIA) is undertaken to ascertain whether the proposed Project will affect the aesthetic value of the area and hence potentially impact the homeowners and tourism industry. The impact on the aesthetic value of an area is inherently subjective in nature. However, reasonably consistent results can be followed, if a standard procedure is used for assessment.

A VIA simulates, in perspective view, the visual effects of proposed Project. The effects could be permanent or temporary. Visual impacts are not necessarily negative. A well-designed project can actually improve the visual experience of observers, hence the Project may have important opportunities to for homeowners and tourism industry in the area. The visual impact to nearby receptors of the Project include:

- Impact 16: Deterioration of aesthetic value of the area due to construction activities may affect tourists, businesses, and nearby homeowners.
- Impact 17: Permanent change in the aesthetic value of the area due to the reservoir and dam.

Section 4.2.9 (*Visual Character*) describes the existing visual (aesthetic) character of the site. The mountainous landscape and deep gorges greatly restricts visibility to a maximum of 0.5 to 1.5 km at receptor locations.

7.10.1 Degradation of Aesthetic Value

<table>
<tr><td colspan="9">Impact 17: Deterioration of aesthetics and visual amenity of nearby receptors due to construction activities, including vehicular movement on roads, may cause a disturbance in aesthetics for nearby communities.</td></tr>
<tr><td colspan="2">Applicable Project Phase</td><td colspan="7">Construction</td></tr>
<tr><td rowspan="2">Initial Impact Rating</td><td>Magnitude</td><td>Duration</td><td>Scale</td><td>Consequence</td><td>Probability</td><td>Significance</td><td>+/-</td><td>Confidence</td></tr>
<tr><td>Minor</td><td>Short Term</td><td>Small</td><td>Low</td><td>Possible</td><td>Low</td><td>-</td><td>High</td></tr>
<tr><td colspan="9">Mitigation measures:
1. Minimize disturbance to, or movement of, soil and vegetation.
2. Back fill to original levels.
3. Reshape to match in with surrounding topography.
4. Reinstate vegetation around construction sites.</td></tr>
<tr><td rowspan="2">Residual Impact Rating</td><td>Magnitude</td><td>Duration</td><td>Scale</td><td>Consequence</td><td>Probability</td><td>Significance</td><td>+/-</td><td>Confidence</td></tr>
<tr><td>Minor</td><td>Short Term</td><td>Small</td><td>Low</td><td>Possible</td><td>Low</td><td>-</td><td>High</td></tr>
</table>

affecting community life; and (g) the inter-relationships between any of the factors in sub-clauses (a) to (f);

[10] Guidelines for the Preparation and Review of Environmental Reports. Pakistan Environmental Protection Agency, November 1997.

The construction phase visual impact will be local and temporary. The construction will take place at the powerhouse site and dam site. The activities during construction that will affect the aesthetics of the area include excavation, stacking of material onto stockpiles and dumping at the waste disposal areas. Borrow pits and quarry areas will be excavated, useful material will be stacked to stockpiles whereas waste and spoils will be dumped to waste disposal areas.

Quarries and borrow areas may leave a permanent scar on the hillsides as once they are opened, will likely to continue to stay in use and as a result, change the surrounding landscape. Access roads, tunnel faces[11], and adits will necessitate the clearing of vegetation for their construction. Some of the access roads to construction sites will be entirely new and permanent and some will be reconstructed to accommodate the additional construction traffic load which will also alter the landscape of the area. The tunnel faces and adits during the construction phase will be obvious cuts into the mountainsides, many of which will be likely to be visible to residents, especially those on opposing sides of the valleys. For all of these features during the construction phase, there will be an impact on vegetation, as additional areas will be cleared around the feature to provide a working area. These activities will result in the creation of artificial and unnatural features in the landscape. Localized light pollution will also be an issue during construction

7.10.2 Permanent Change in Visual Character

<table>
<tr><td colspan="9">Impact 18: Permanent impact on aesthetics due to proposed developments.</td></tr>
<tr><td colspan="2">Applicable Project Phase</td><td colspan="7">Operation</td></tr>
<tr><td rowspan="2">Initial Impact Rating</td><td>Magnitude</td><td>Duration</td><td>Scale</td><td>Consequence</td><td>Probability</td><td>Significance</td><td>+/-</td><td>Confidence</td></tr>
<tr><td>Minor</td><td>Long Term</td><td>Small</td><td>Low</td><td>Possible</td><td>Low</td><td>-</td><td>High</td></tr>
<tr><td colspan="9">Mitigation measures:
1. Develop and implement a Site Rehabilitation and Landscaping Plan for quarry areas, spoil disposal sites, construction camps and dam site.
2. Use colors that better integrate with the landscape.
3. Disguise elements with vegetation where possible.
4. Retain as much natural vegetation as possible.</td></tr>
<tr><td rowspan="2">Residual Impact Rating</td><td>Magnitude</td><td>Duration</td><td>Scale</td><td>Consequence</td><td>Probability</td><td>Significance</td><td>+/-</td><td>Confidence</td></tr>
<tr><td>Minor</td><td>Long Term</td><td>Small</td><td>Low</td><td>Possible</td><td>Low</td><td>-</td><td>High</td></tr>
</table>

There will be a long-term visual impact due to the construction of the dam and the formation of the reservoir. The Arkari Gol HPP consists of a 20 m high dam wall and a 1.3 km long reservoir. The impact due to the reservoir is subjective as it may be argued that a reservoir is visually appealing and the land use is compatible with the surroundings. Natural lakes in the northern areas of Pakistan are popular tourist

[11] Working face of tunnels

attractions, and the reservoir created will offer similar opportunities. The diversion tunnels and powerhouse will be underground limiting their visual impact

7.11 Traffic and Road

There are two categories of roads that will be used to transport material and equipment to the Project facilities, namely Project external roads and Project access roads. Roads will be required to service the site during construction and for the operational life of the scheme.

7.11.1 Project External Roads

It is anticipated that the large mechanical equipment, metal structure, electromechanical device and special steels, that cannot be sourced locally, will be imported. After arriving at port of Karachi it will be transported to the Lahore through the national highway (N5) and then onwards Rashakai, Dargai, and Chakdara. From Chakdara the material will be transported to Dir and then to Drosh via the Lowari tunnel and then onwards to Chitral. Transport route options are further discussed in **Section 3** (*Project Description*).

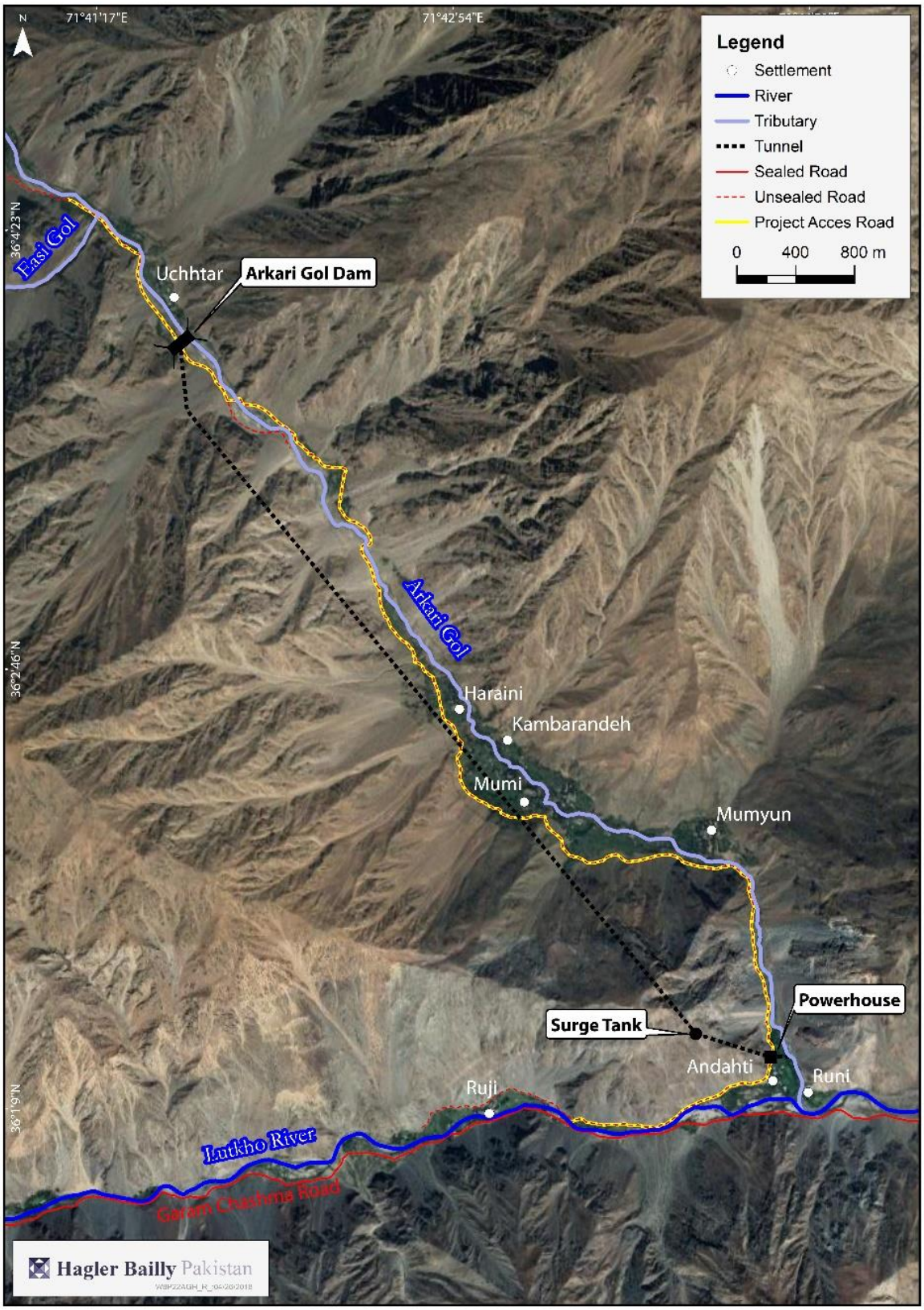
Certain section of the external roads from Chakdara to Chitral will require widening, upgradation and rehabilitation to support Project transport. Heavy vehicular traffic is already present on roads up till Chitral and, therefore, the incremental impact of Project traffic will be marginal.

7.11.2 Project Access Roads

From Chitral to Uchhtar village, where the Dam site is located, is a 37 km, whereas the powerhouse site is 29 km from Chitral. Current access to the dam site is limited via a jeepable track shown in **Exhibit 7.18**. This track branches of from the Chitral Garam Chashma Road 2 km upstream of the confluence of the Arkari Gol and the Lutkho River as shown in **Exhibit 7.19.**

Exhibit 7.18: Access Road near Dam Site

Exhibit 7.19: Project Access Roads



7.11.3 Impact Analysis for Project Access Roads

The key potential impacts of traffic on Project access roads are:

- Impact 19: Improved accessibility for locals due to the construction of Project access roads.
- Impact 20: Increase in congestion, due to increased traffic during construction will cause delays.
- Impact 21: Increased risk to community safety due to increased traffic volume during the construction phase near communities.
- Impact 22: Degradation of the pavement due to use by heavy construction traffic.

Accessibility

Impact 19: Improved accessibility of locals due to construction of Project access roads.								
Applicable Project Phase	*Construction and Operation*							
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Medium Term	Small	Low	Possible	Low	+	High
Mitigation measures: 1. Construct Project access roads considering the community connectivity with each other. 2. Allow communities use of new Project access roads.								
Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Medium Term	Small	Low	Definite	Low	+	High

Accessibility for people, living close to the roads, will be improved by the construction of Project access roads. Mountainous terrain in the area is difficult to traverse and construction of new site access roads will improve connectivity in the area.

Congestion

Impact 20: Increase in congestion, due to increased traffic during construction will cause delays.								
Applicable Project Phase	*Construction*							
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Possible	Low	-	High
Mitigation measures: 1. Prepare and implement a Traffic Management Plan. 2. Retain as much natural vegetation as possible to reduce the impact of smoke due to vehicles. 3. Completely cover the vehicles going on the spoil routes and passing through the communities to avoid dust emissions. 4. Strictly implement speed limits and defensive driving policies.								
Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Possible	Low	-	High

Traffic congestion is a condition that results as road use increases and is characterized by slower speeds, longer trip times, and increased vehicular queuing. The Project will upgrade public roads for use as access roads for transporting materials to the Project

facilities. There is minimal existing traffic on these roads which may also benefit from the upgradation resulting in faster travel times.

Total external traffic during construction period will carry construction material of ~ 0.2755 million tonnes (see **Section 3.2.2,** *Construction Material*). This will be transported via dump trucks with a capacity of 10-20 tonnes over a 4 year construction period. As a worst case scenario, the capacity of one truck is assumed to be 10 tonnes and 310 active working days[12] are considered. On average, there will be 22 trucks per day. As a worst case-scenario, 40% peaking factor was used that will result in 32 trucks per day.

Community Safety

Impact 21: Increased risk to community safety due to increased traffic during the construction phase near communities.

Applicable Project Phase *Construction*

	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
Initial Impact Rating	Major	Short Term	Small	Medium	Possible	Medium	-	High

Mitigation measures:

1. Develop and implement a Traffic Management Plan.
2. Route planning to avoid sensitive areas (mosques, hospitals, schools) during peak activity hours
3. Identify suitable times to transport equipment.
4. Road safety awareness education will also be included during community visits or information sessions so that communities can be familiarized with common road signs and the types of vehicles and equipment that will be moving through the area.
5. Train drivers to move along long transport route to keep their vehicle speed in limits and consider traffic signs and boards.
6. Keep speeds slow (30 km/hr) where there is traffic exchange between roads.
7. Make roundabouts for the congestion points.
8. Designate traffic wardens at roads on the transport route to manage traffic during school hours.
9. Construction traffic will not travel during school starting and ending hours on designated road segments in front of schools on the transport route.
10. Strictly implement speed limits and defensive driving policies.
11. Maintain vehicles, especially brakes.

	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
Residual Impact Rating	Minor	Short Term	Small	Low	Possible	Low	-	High

[12] Considering that transportation activity will be done for 85% of a year

Pavement Condition

Impact 22: Degradation of the pavement due to use by heavy construction traffic.								
Applicable Project Phase				*Construction*				
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Possible	Low	-	High
Mitigation measures: 1. Promptly and properly repair and maintain roads that are subject to damage by Project activities.								
Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Small	Low	Possible	Low	-	High

Heavy transport vehicles in use by the Project during the construction phase may damage the local roads. In case of any damage by Project activities, these roads should be promptly and properly repaired and maintained.

7.12 Seismic and Flood Hazard

Owing to limited availability of flow data (2006-2011) and Arkari Gol largely being a snowy (non-tropical) watershed, Regional Analysis approach was adopted to calculate flood magnitudes at Arkari Gol HPP dam site and powerhouse as shown in **Exhibit 7.20.**

Exhibit 7.20: Flood Magnitudes for Various Return Periods

Return Period	*Flood magnitude at Arkari Gol HPP Dam Site*	*Flood magnitude at Arkari Gol HPP Powerhouse*
10 Years return	158	161
100 Years return	247	252
1000 Years return	333	340
10000 Years return	419	428

The 64 km Arkari Gol runs in a narrow valley with average river gradient of 3.4%. The housing density in the area near the Project facilities is low, and much of the existing households near the Project will be relocated (see **Resettlement Action Plan**).

It is estimated that the diversion facilities will presumably be in service for approximately three construction years. The river diversion facilities will be designed for a flood according to 10-years return period of 284 m^3/s and the design flood for the Project will be selected according to a 1000 years return period with the peak discharge value of 562 m^3/s as per international practice (see **Exhibit 7.20**). In case of floods with higher frequency, the cofferdams would be over spilled and flushed downstream.

Projected Maximum Credible Earthquake (MCE) for Arkari Gol HPP falls between 0.60-0.61g. The Project structure will be designed for Operational Basis Earthquake (OBE) of 0.305 g (which is half of MCE). However, as the Pakistan Building code specifies a PGA of 0.34 g where the Project is located, therefore OBE is set at 0.34 g in compliance with

the Pakistan Building Code. The Maximum Design Earthquake (MDE) is also set at the same value as the OBE. Lastly, the GHSAP values are 0.41g to 0.49 g which are much higher than the ones selected for the OBE or the MDE.

The design criteria set for the Project while consistent with the building code is less than the values prescribed in GSHAP and the MDE is the same as the OBE, which is normally set at a higher PGA rating.

The following safety concerns are important for concrete dams[13]:

- **Instability:** The most important safety concern of concrete dams subjected to earthquakes is excessive cracking, which can lead to potential instability from sliding or overturning. Although no concrete dam has failed as a result of earthquake loadings, failure modes can be postulated and tested on shake tables. In general, instability of gravity and arch dams caused by excessive cracking of the concrete is most likely to occur in the upper half of the dam.
- **Importance of Foundation:** Historical experience shows that foundation (abutment) induced failure is the chief source of concern for concrete dams. In contrast to the dam itself, the supporting medium consists of natural materials of varying composition, irregular joints, and planes of weakness. The strength of this medium is generally estimated from exploratory borings and tests on only a small fraction of the material present. Key zones of weakness are critical and often difficult to detect.
- **Field Performance:** No major concrete dam is known to have failed due to earthquake-induced ground motion, although some have experienced strong ground motion and some damage.

Impact 23: A potential flood and seismic hazard under natural extreme conditions for which the dam is not designed, albeit very unlikely, has potential to cause loss of life and damage to property.

Applicable Project Phase	*Operation*							
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Major	Short Term f	Extensive	High	Unlikely	Medium	-	High

The recommended mitigation and management measures include:

- Prepare an emergency preparedness and response plan for the Project that includes consideration of flooding, earthquake, evacuation procedure, co-ordination with local administration and communities.
- Maintain network of climate gauges in the Arkari catchment to monitor potential floods through WAPDA or in conjunction with other hydropower developers.
- Automated telemetric flow gauges can be installed upstream of the reservoir. This will allow the Arkari Hydropower operators to be well aware of any potential flooding conditions using upstream flow data, in addition to climatic conditions recommended above.
- Where climatic data and flow data indicate eminent floods, appropriate measures for management of reservoir level can be undertaken by the dam operators. This includes full opening of gates (including low level outlets) with aim of reducing water levels to below Normal Operating Level at Arkari reservoir.
- Design Basis Earthquake included in the structural design for Powerhouse and weir.

[13] Federal Guidelines for Dam Safety, Earthquake Analyses and design of Dams Maye 2005 FEMA

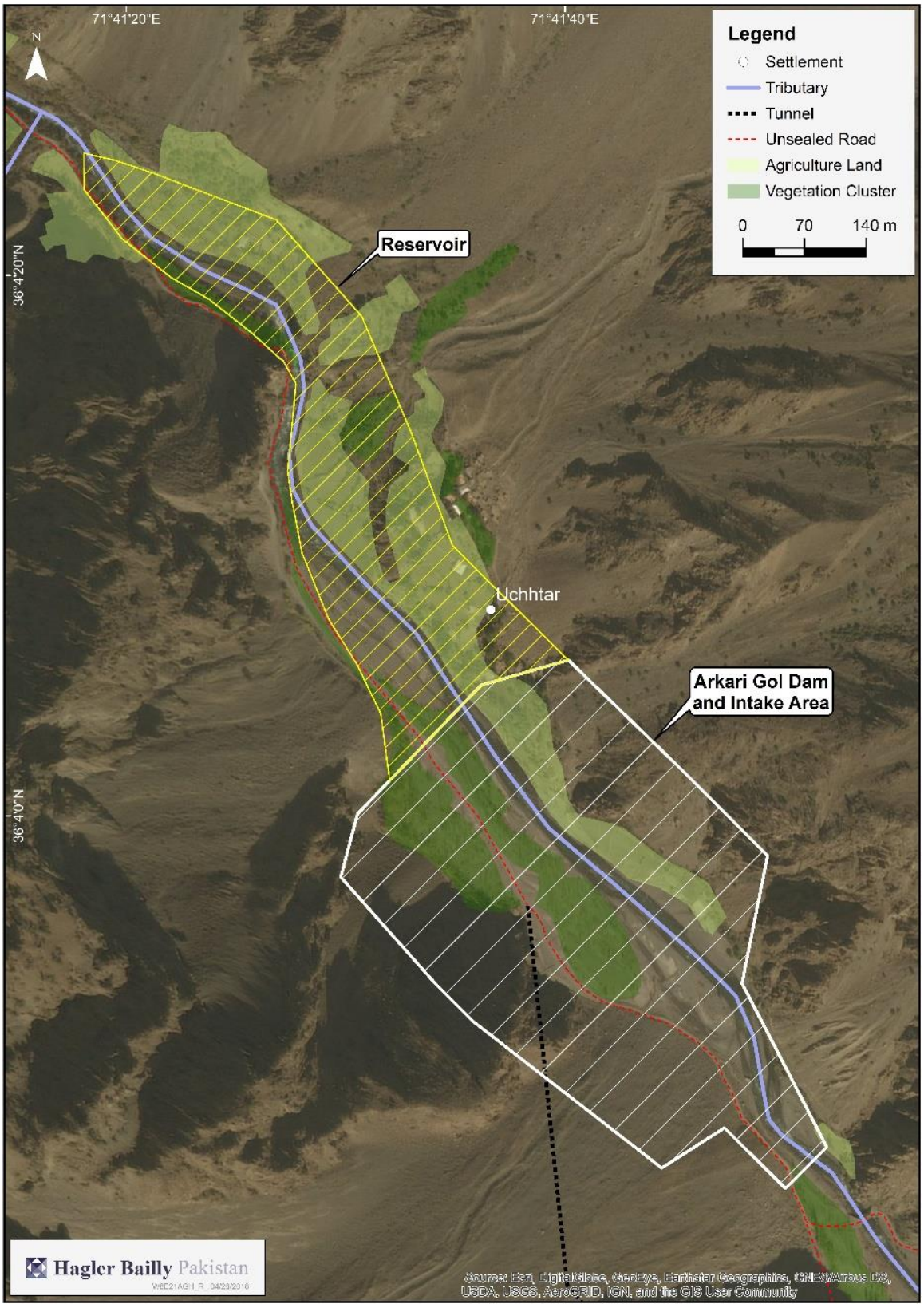
▶ Design the river diversion facilities according to 10-years return period flood as per international practice. ▶ The design of the Project to be based on 1000 years return period flood.								
Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Moderate	Short Term	Extensive	Medium	Unlikely	Low	-	High

7.13 Greenhouse Gas Emissions

The Project will result in Greenhouse Gas (GHG) emissions. Increases in greenhouse gas concentrations in the atmosphere results in global warming which has adverse impacts including climate change and ocean acidification. However, the Project has far fewer emissions as compared other power generation methods such as from the combustion of fossil fuels.

The Project will result in the following sources of GHG emissions mainly due to the embodied GHG emissions from construction materials and due to emissions from Project transport. GHG emissions (methane) due to biomass loss and decay due to inundation by Arkari Gol HPP's Reservoir will be minor due to the small reservoir and low vegetation density in the area (see **Exhibit 7.21**). These will further be reduced by the implementation of a Reservoir Clearing Plan.

Exhibit 7.21: Vegetation within the Arkari Gol HPP Reservoir



It is possible that the power generation by the hydropower project will offset more carbon-intensive generation such as that through coal-based thermal power plants. However, due to the complexities in calculating GHG offsets this analysis is not presented in this section

Impact 24: GHG emissions from dam construction will increase GHG concentration in the atmosphere thereby contributing to climate change.								
Applicable Project Phase	*Construction*							
Initial Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Intermediate	Low	Definite	Low	-	High
Mitigation Measures: 1. Implement a Reservoir Clearing Plan 2. Offsets for emissions from vehicles include: a) Make sure vehicles are maintained b) Regular inspection of vehicle exhaust emissions to meet required NEQS standard for exhaust emissions								
Residual Impact Rating	Magnitude	Duration	Scale	Consequence	Probability	Significance	+/-	Confidence
	Minor	Short Term	Intermediate	Low	Definite	Low	-	High

Much of the embodied emissions are contained within concrete production. The Project is a 20 m concrete gravity type dam with an 0.494 km headrace tunnel. The steel and concrete requirements for the Project, as estimated from the Bill of Quantities, is presented in **Exhibit 7.22**.

Exhibit 7.22: Embodied Emission from Materials used in Construction

	Mass (tonnes)	*Emission Factor (tonnes of CO_2/ tonnes of material)*[14]	*Emissions (tonnes of CO_2 e)*
Concrete	240,000	0.228	54,720
Steel	8,000	2.89	23,120
Total			**77,840**

An approximate total of 80 thousand tonnes of CO2 are emitted due to the production of concrete and steel for the Project. Assuming a 30-year lifetime and 378 GWh of electricity production per year the contribution of emissions to the emissions intensity is 0.007 kg per kWh. For comparison an average bituminous coal based thermal power plant has an emission intensity of 0.9 kg per kWh.[15]

[14] Ibid.

[15] https://www.eia.gov/tools/faqs/faq.cfm?id=74&t=11

7.14 Livelihood and Well-being

During community consultation conducted for this ESIA community members expressed a desire for the provision of transparent and merit based employment to locals, and investment in community infrastructure. There was a concern that the Project would result in a loss of livelihoods due to inundation of a significant area of productive agricultural land and unavailability of water for irrigation due to the construction of the Project.

A summary of the possible impacts on livelihoods and the well-being of communities in the Study Area is as follows:

- Impact 25: Direct, indirect and induced employment at the local level, resulting in increased prosperity and wellbeing due to higher and more stable incomes of people.
- Impact 26: Increase in the stock of skilled human capital due to transfer of knowledge and skill under the Project resulting in enhanced productivity of local labor.
- Impact 27: Decrease in productivity of agricultural fields due to unavailability of irrigation water for agricultural fields.
- Impact 28: Loss of assets and livelihood as a result of land acquired for the Project.

7.14.1 Employment

Impact 25: Direct, indirect and induced employment at the local level, resulting in increased prosperity and wellbeing due to higher and more stable incomes of people.								
Applicable Project Phase			*Construction and Operation*					
Initial Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Minor	Long term	Extensive	Medium	Possible	Medium	+	High
Enhancement measures: 1. Ensure preferential recruitment of local candidates provided they have the required skills and qualifications. 2. Include an assessment of the contractor's demonstrated commitment to domestic and local procurement and local hiring in the tender evaluation process. 3. Coordinate recruitment efforts related to non-skilled labor, including for non-skilled labor positions required by contractors. **Good practice measures:** 4. Determine what is considered to be 'fair and transparent' in recruitment and in distribution of jobs between different community groups, in consultation with local communities and their leaders.								
Residual Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Moderate	Long term	Extensive	High	Definite	High	+	Medium

A large portion of the local population is dependent on agriculture, livestock rearing, small businesses and daily wage labor and government employment.

In the Study Area, education levels of the population are lower than that of the district, as demonstrated by a literacy level of 60% which is less than the literacy rate of the district

at 75%, (**Section 4.3.3**, *Socioeconomic Conditions in the Study Area*) however is more than that of Pakistan's national average of 56%.[16] The skill set of the local community will need to be developed through vocational training programs run in conjunction with the Project.

As part of data analysis the households were distributed by level of income. A significant portion (30%) of households in the Socioeconomic Study Area earn less than PKR 20,000 per month. This equates to approximately National Poverty line of PKR 3030[17] per person per month. . A small percentage (12%) of households earns more than PKR 50,000 per month. There is some variation in income across the different settlements however this appears to be random, with no particular settlement being significantly better or worse off.

The increased incomes of people employed by the Project are likely to lead to improved nutritional status, better housing, access to education and an improvement in overall well-being of the local. Poverty cycles in poor families can be broken if children become better educated and have better livelihood options than their parents.

The Project will provide employment to a significant number of people during the construction phase, and a more limited number during the operation phase. The Project will directly and through indirect and induced mechanisms (such as more economic activity resulting from improved infrastructure) contribute towards alleviating poverty and vulnerability in the area, and towards increasing prosperity and well-being of the people employed by the Project.

7.14.2 Skill Development

Impact 26: Increase in the stock of skilled human capital due to transfer of knowledge and skill under the Project resulting in enhanced productivity of local labor.

Applicable Project Phase	*Construction and Operation*							
Initial Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Minor	Long term	Intermediate	Medium	Possible	Medium	+	Low

Enhancement measures:

1. Support a 'vocational training program' to assist local people to qualify for semi-skilled positions focusing on issues such as procurement, involvement of vulnerable groups in Project opportunities and continual professional development of staff.

Good practice measures:

2. Assist local people having practical skills but lacking qualifications to obtain certificates and thus increase their employment opportunities.
3. Support initiatives promoting a culture of learning in local communities.
4. Plan and implement training programs for vulnerable groups to encourage their participation in economic opportunities created by the Project.
5. Assist employees and local communities in improving basic personal financial life skills through training and awareness campaigns.
6. Consider further training programs to prepare retrenched workers to seek employment in sectors not related to dam construction.

[16] http://www.sciencedirect.com/science/article/pii/S2405883116300247 cited on June 2017

[17] Dawn <http://www.dawn.com/news/1250694> accessed on April 27,2018.

Residual Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Moderate	Long term	Extensive	High	Possible	High	+	Medium

The Project will result in training and skill development of local and domestic labor, especially during the construction phase. Financial and technical investment by foreign companies is generally seen as a positive opportunity for developing countries as the technology used is usually more advanced compared to locally available technology.

The knowledge and skills acquired by the local community will be of value to the labor-force of the country at national and local levels. The creation and injection of highly trained workers, qualified in multiple skills, into the economy will improve the productivity of the workforce and the benefits will extend to other firms and industries. This impact can therefore stretch to micro- and macro-economic levels.

For enhancement of employment benefits at the local and domestic levels, various training programs will be implemented by MHL. The training programs will focus on maximization of participation of members of the local community in both the construction and operational phases of the Project.

7.14.3 Unavailability of water for irrigation

Impact 27: Decrease in productivity of agricultural fields due to unavailability of water for irrigation								
Applicable Project Phase				*Operation*				
Initial Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Major	Long term	Extensive	High	Definite	High	-	High
Mitigation measures: 1. Rehabilitation of Watercourses damaged or affected by the project..								
Residual Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Minor	Short	Small	Low	Definite	Low	-	High

The main river-dependent socioeconomic activity is the irrigation of agricultural lands. As reported by the local communities and observed by the survey team more than 150 acres of land is being irrigated by Arkari Gol in the Socioeconomic Study Area. Moreover, four water flour mills and one micro hydro power plant at settlement Mumi are also working on these water channels. This irrigation system may be affected by the Project during construction.

MHL as a part of the RAP will be responsible to rehabilitate all the watercourses damaged or affected by the Project, in order to minimize the impact of the Project and the extraction of water by the community for their land in the long term while meeting the requirements of the community.

7.14.4 Land Acquisition

Impact 28: Loss of assets and livelihood as a result of land acquired for the Project.								
Applicable Project Phase				*Design and Construction*				
Initial Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Major	Long term	Extensive	High	Definite	High	-	Medium
Mitigation Measures: 2. See Resettlement Action Plan.								
Residual Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Minor	Medium	Small	Low	Possible	Low	-	High

Land acquired for the Project can potentially have serious effects on the well-being of the community. It is estimated that as about 27 households may have to be relocated as a result of the Project. The Resettlement Action Plan prepared for the Project identifies the potential social issues and proposes measures to avoid adverse impacts. Socio-Cultural Impacts

Project stakeholders expressed concerns about the potential sociocultural changes that could result from Project activities, including the enhancement or possible degradation of the social and economic landscape, and hindrance in mobility of local people due to the location of Project facilities such as the construction camp. Key impacts are listed below and discussed in this section:

- Impact 29: Increase in population due to in-migration of job seekers (in-migrants) leading to pressure on existing social infrastructure and services.
- Impact 30: Disputes over distribution of Project employment within and between Study Area inhabitants and the in-migrants resulting in social unrest.
- Impact 31: Potential social unrest in the Study Area due to conflicting socio-cultural norms amongst the inhabitants and in-migrants.
- Impact 32: Religious conflicts due to different religious beliefs of workers and locals.

7.14.5 Pressure on Social Infrastructure and Services

Impact 29: 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.

Applicable Project Phase	*Construction*							
Initial Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Moderate	Medium	Intermediate	Medium	Possible	Medium	-	Medium

Good practice measures:

1. Development of a Grievance Redressal Mechanism
2. Encourage local communities to use the grievance procedure for concerns related to deterioration of local services.
3. Support local government in the implementation of infrastructure projects.
4. Support NGOs specializing in development of local infrastructure.

Residual Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Minor	Medium	Intermediate	Low	Possible	Low	-	High

There is a potential for an influx of job seekers into the Study Area due to the jobs created by the Project. The influx will increase pressure on the availability of infrastructure and services, such as those pertaining to education, health care and medication, water and communication in the Project area. The development and implementation of a Grievance Redress Mechanism will help to identify any issues at an early stage so that they can be dealt with effectively.

7.14.6 Conflicts Due to Provision of Employment to Outsiders

Impact 30: Disputes over the distribution of Project employment within and between Study Area inhabitants and the in-migrants resulting in social unrest.

Applicable Project Phase	*Construction*							
Initial Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Moderate	Medium	Intermediate	Medium	Possible	Medium	-	Medium

Good practice measures:

1. Implement Stakeholder Engagement Plan including:
   a. maintaining regular communication with local communities and other stakeholders to minimize tensions arising from Project activities;
   b. maintaining a grievance procedure, and encourage and facilitate stakeholders to use the mechanism to express concerns; and
   c. providing sufficient resources to the community relations officers to enable them to monitor negative perceptions and associated tensions, and to address them in a timely fashion.

Residual Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Minor	Short term	Intermediate	Low	Possible	Low	-	High

A potential source of conflict is the real or perceived unequal access to Project opportunities such as employment and small contracts. Complaints can be expected from local communities residing in the Study Area if the distribution of jobs among local

communities is perceived to be unfair. Objections can also be expected if people from outside the Study Area are seen to usurp opportunities created by the Project, as the Study Area inhabitants may consider themselves as the rightful owners of Project benefits owing to their vicinity to the Project. This increases the need for open communication between MHL and the various community heads, as well as within the community heads themselves.

7.14.7 Conflicting Socio-Cultural Norms

Impact 31: Potential social unrest in the Study Area due to conflicting socio-cultural norms amongst the inhabitants and in-migrants.								
Applicable Project Phase	*Construction*							
Initial Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Minor	Short term	Small	Low	Possible	Low	-	Medium
Enhancement measures: 1. Refer to measures under Impact 28.								

The Project is likely to result in an influx of job seekers (mainly men) into the Study Area, which could result in disputes of an ethnic or cultural nature in the Study Area. There could be conflicts between the in-migrants and Study Area inhabitants due to their conflicting traditions and norms. The likelihood of this impact is low given that Project facilities are not located in immediate vicinity of local communities and where the facility borders local communities, proper fencing and barriers are provided to avoid unnecessary interaction.

7.14.8 Religious Conflicts

Impact 32: Religious conflicts due to different religious beliefs of workers and locals.								
Applicable Project Phase	*Construction*							
Initial Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Moderate	Medium	Intermediate	Medium	Possible	Medium	-	Medium
Good practice measures: 1. Refer to measures under Impact 28.								
Residual Impact Rating	*Magnitude*	*Duration*	*Scale*	*Consequence*	*Probability*	*Significance*	*+ /-*	*Confidence*
	Minor	Short term	Intermediate	Low	Possible	Low	-	High

More than 90% of the entire population of the Socioeconomic Study Area belongs to Ismaili sect of Islam and others belong to Ahl-e-Sunat sect. Sectarian violence is low in the Socioeconomic Study Area, therefore, the risk of such conflicts is low. Moreover, development and implementation of a Grievance Redress Mechanism will help to identify any issues at an early stage so that they can be dealt with effectively.

7.15 Cumulative Impact Assessment

7.15.1 Development Scenarios

The cumulative impact assessment presented in this section assumes the following development scenario:

Completed Projects

- 106 MW Golen Gol Hydropower Project on Golen Gol

Feasibility Stage

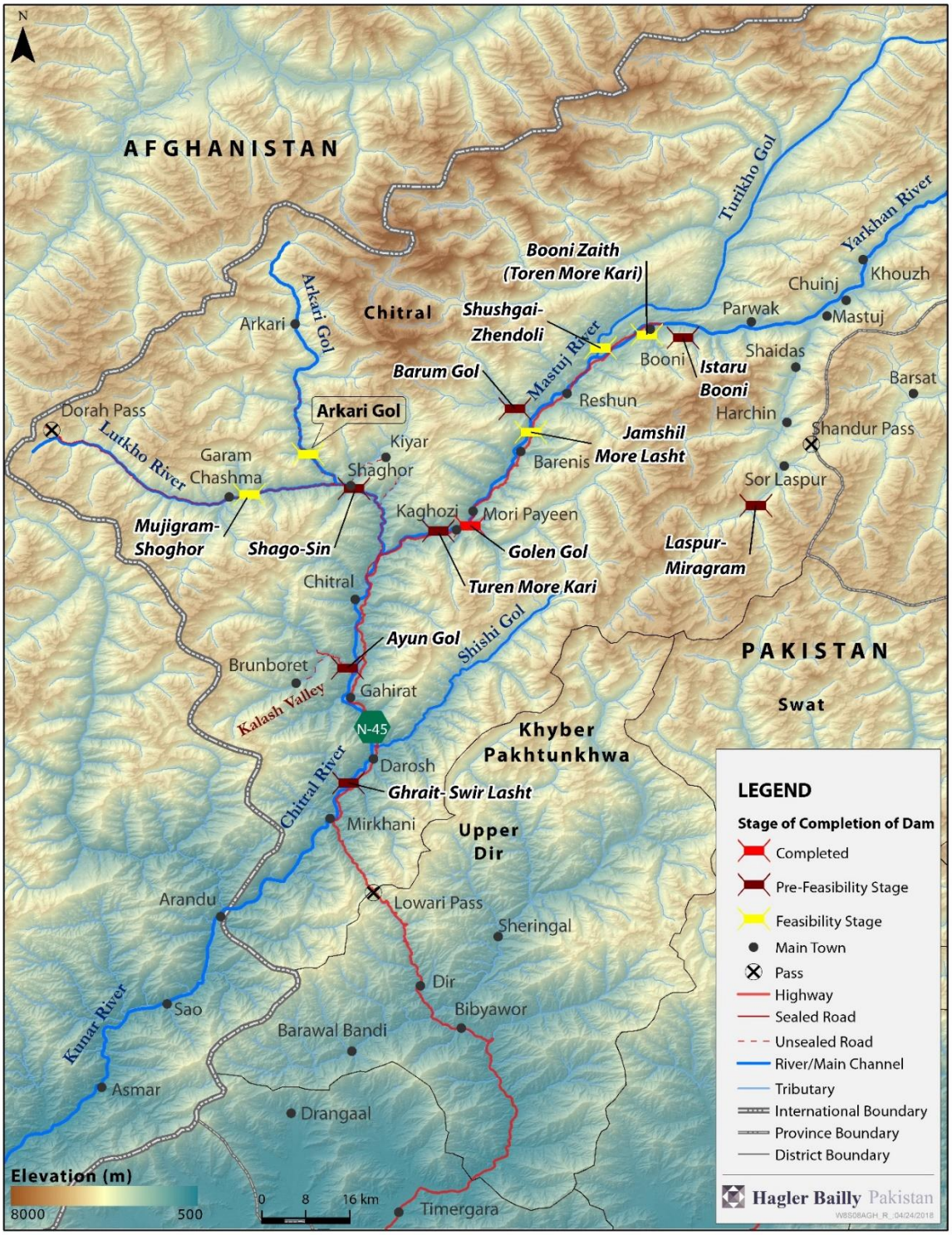
- 99 MW Arkari Gol Hydropower Project on Arkari Gol
- 64 MW Mujigram-Shoghore Hydropower Project on Lutkho River
- 144 MW Shushghai Zandholi Hydropower Project on Tirich Gol
- 350 MW Booni Zaith (Toren More Kari) Hydropower Project on Booni Gol

Prefeasibility of Conceptual Stage

- 230 MW Laspur Murigram Hydropower Project on Laspur River
- 350 MW Turen More – Kari Hydropower Project on Mastuj River
- 370 MW Ghrait-Swir Lasht Hydropower Project (location not known)
- 25 MW Barum Gol Hydropower Project on Barum Gol
- 72 MW Istaru Booni Hydropower Project on Turkuho River

Exhibit 7.23 shows the location of these projects.

Exhibit 7.23: Hydropower Projects in Chitral Valley



The discussion of cumulative impacts is structured in the following manner:

1. The impacts of proposed hydropower projects on Arkari Gol and Lutkho River is in the catchment of Lutkho River or the Lutkho-Arkari sub-basin that is of immediate concern for this ESIA are first discussed. This discussion draws on the results of the EFlow assessment conducted for the Arkari Hydropower Project for purposes of this study, and extending the results to include the impacts of the proposed Mujigram-Shoghore Hydropower Project located in the catchment of Lutkho River.
2. This is followed by a discussion of cumulative impacts of projects in the catchment of Mastuj/Chitral River in the feasibility or conceptual stage. This discussion is primarily a high level assessment of probable impacts of developments, as modeling of impacts of these projects is not in the scope of this study.

7.15.2 Impact on River Ecology in the Lutkho-Arkari Sub Basin and Management

The recommendations for EFlow management presented in **Appendix M** are based on acceptance of an environmental release from the dam that can be justified on the basis of low level of diversity and abundance in the Arkari Gol, and a barrier to migration of fish upstream of a waterfall located in the low flow section. For impacts downstream of the powerhouse due to peaking operations the EFlow Assessment (**Appendix M**) considers three scenarios including run of river operation, peaking and a modified form of peaking and presents the impacts of each operational scenario on indicator fish species. It recommends an approach to power generation which will balance the economic value of peaking power and impacts on river ecology in order to justify "No Net Loss Where Feasible" in Natural Habitats as defined in PS6. The impacts of full peaking can be mitigated using a modified form of peaking in which the flow is ramped up and ramped down to reduce impacts on fish whilst reducing power generation to about two thirds of the capacity of the powerhouse.

In case the 64 MW Mujigram-Shoghore HPP on Lutkho River is constructed, fish populations and breeding areas in the low flow section created in Lutkho River will be affected. The affects will be severe if an appropriate level of EFlow is not maintained in the low flow section. Similarly, impacts downstream of the powerhouse in the Lutkho River on the fish populations and the aquatic ecosystem will be serious if peaking operations are not managed with due attention to river ecology. In view these potential impacts which will extend to the entire Lutkho-Arkari sub basin, the same EFlow management principles will have to be applied for the Mujigram-Shoghore HPP as recommended for the Arkari Gol HPP. This will imply:

1. Selecting an operational mode in consultation with the power purchaser which provides a balance between the economic value of peaking power and impacts on river ecology in order to justify "No Net Loss Where Feasible" in Natural Habitats as defined in PS6. The operational modes presented include a modified form of peaking in which peak power generation is curtailed to about two-thirds of capacity combined with a ramp up and ramp down of flow around the peak.

2. Adjusting the release from the dam to levels higher than those set for the Arkari Gol HPP to account for more productive habitats in the Lutkho River where the low flow river section of the Project will exist.
3. Staggering the time of the peak in relation to that for Arkari Gol HPP to avoid imposition of a combined peak flow from the two projects on Lutkho River downstream of its confluence with the Arkari Gol. A 'morning peak' can be considered for the Mujigram-Shoghore HPP to avoid a coincidence with the 'evening peak' for the Arkari Gol HPP.
4. Assessing the feasibility of a fish ladder if the migratory Snow Trout is found upstream of the dam.

In case another project is planned on the Lutkho River downstream of its confluence with Arkari Gol, then the above principles will have to be extended to that project as well. Holistic EFlow assessments would be warranted following the World Bank Group's Good Practice Handbook for Environmental Flow Assessment for Hydropower Projects.

7.15.3 Impacts on River Ecology in the Chitral Basin and Management

The impacts on river ecology predicted in the previous section for the Lutkho sub-basin will be replicated and extended if the hydropower development is extended to other sub-basins in Chitral Basin. The impacts of basin-wide hydropower development will be most severe on the migratory Snow Trout, which will be confined to sections of tributaries. Loss of connectivity will lead to stress on populations of this fish as it may not be able to migrate downstream in winters to avoid colder waters upstream. In-breeding will also follow as populations get isolated and fish is not able to travel to the main stem Mastuj/Chitral River from where it an move to other valleys. Other non-migratory fish that are adapted to river habitats will be at risk from impoundments where lotic or river habitat will be lost and will be converted to lentic or lake habitat. Peaking flows from power houses will substantially reduce the extent of wet riverbed and will result in loss of habitat for the loaches that survive in cobbles and boulders in shallow waters. The following good practice measures are suggested to manage the impacts of hydropower projects in the Chitral Basin:

1. Given the topographic relief in Chitral Basin, the projects generally have shorter impoundments, of the order of 2-3 km, and longer power generation tunnels to benefit from high heads that can be utilized in Pelton turbines. As suggested for the Mujigram-Shoghore HPP in **Section 3.5**, release from the dam to levels higher than those set for the Arkari Gol HPP will have to be considered to account for more productive habitats.
2. The planned projects in the basin are generally located in tributaries, some of which flow through U shaped valleys that provide habitats for breeding of Snow Trout and do not present natural barriers to migration of fish such as that present in Arkari Gol. Depending on the location of the dams, the dams will also present barriers to migration of fish. Feasibility of fish ladders will therefore have to be examined on a case to case basis.

3. The timing of peaking for the projects in a single sub-basin will have to be adjusted to avoid overlapping of peaks and compounding of impact of peaking operations on river ecology for projects located in the same sub-basin.
4. Holistic EFlow assessments would be warranted following the World Bank Group's Good Practice Handbook for Environmental Flow Assessment for Hydropower Projects.

7.15.4 Other Impacts

Ecosystem services such as sand and gravel mining, and recreational and subsistence fishing which are somewhat significant in sub-basins such as Poonch in Jhelum Basin[18] are of comparatively lower significance in Chitral Basin (see **Section 4.3**). Supported by the geology which is different for the Jhelum Basin where sand stone is dominant (see **Section 4.2**), alternatives for mining of sediment are available in the Chitral Basin at locations other than those in or adjacent to the riverbeds. Socioeconomic impacts of hydropower developments are therefore not expected to be significant in the Chitral Basin. The projects will help in improving socioeconomic conditions in the basin through employment generation and infrastructure development.

The impacts on terrestrial ecology will be low and limited to project footprints. Given the design of the projects with limited impoundments, terrestrial habitats inundated by project reservoirs will be limited. Mammals such as the Ibex and Snow Leopard are found at higher elevations where they can shelter and are less at risk from hunting. The basin is located in the shadow of the South Asian Monsoon System with precipitation rates lower than those in the Himalayas, and vegetation cover is lower in comparison the adjacent Jhelum Basin located to the east of the Chitral Basin. Construction of transmission lines located on right of ways closer to roads along the rivers are therefore not expected to impact the terrestrial habitats significantly.

The locals are already hunting migratory birds that stop for resting in the ponds in the Arkari and Lutkho rivers. Presence of migratory birds will increase after the reservoirs are created by the dams, which is likely to result in increase in hunting pressures. The precautionary approach of hiring guards for protection of the river and reservoirs as suggested in **Section 7.2.1** and **Section 7.2.2** will help in management of such pressures, and should be extended to other hydropower projects in the basin as well as suggested in the next section.

The reservoirs created by the projects will provide an attraction for tourists and recreational activities. However, in absence of basic planning and environmental management, degradation of the reservoir banks due to tourism related impacts such as littering, erosion, and pollution from vehicles can damage the tourism potential of the reservoirs. The local governments can work with the project owners in management of tourism activities at the reservoirs to enhance the incomes of the locals while preserving landscape value.

[18] Hagler Bailly Pakistan, 2018, Draft Strategy Report, Basin-wide Studies in the Jhelum-Poonch Basin for Sustainable Hydropower. International Finance Corporation.

7.15.5 Recommendations for Basin-Wide Management

This section outlines some recommendations for management of basin-wide impacts to reduce the environmental and social impacts from development of multiple HPPs. It draws from lessons learnt for developing a Strategy for Sustainable Hydropower Development in the Jhelum Poonch Basin.[19]

Prepare Guidelines for ESIAs for Hydropower Projects Following Accepted International Best Practices

A review of available ESIAs (Environmental and Social Impact Assessment) shows that some sub-standard ESIAs have been approved by the provincial EPAs. Since these ESIAs were unable to completely identify the valued ecosystem components (VECs) or predict environmental impacts, project implementation has led to unmanaged and unmitigated environmental and social impacts.

It is recommended that every hydropower project also consider cumulative impacts of other hydropower projects in the basin in their EIAs/ESIAs. In this context, the cumulative impacts of projects should be incorporated in the Terms of Reference for carrying out full EIA studies [20] including identification of valued ecosystem components (VECs) and an assessment of how they will be impacted as a result of cumulative impacts.

To conform to international best practices, it is also recommended that ESIAs for projects in the basin follow the guidelines and standards set in the IFC Performance Standards[21] and ADB's Safeguard Policy Statement[22].

Prepare and Implement Guidelines for EFlow Assessments

Environmental flows describe the quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems. Through implementation of environmental flows, water managers strive to achieve a flow regime, or pattern, that provides for human uses and maintains the essential processes required to support healthy river ecosystems.[23]

It is recommended that provincial Environmental Protection Agencies (EPAs), KP EPA in this case, develop guidelines for hydropower projects for selecting the appropriate environmental flow in line with the principles outlined in the World Bank's Good

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[19] Hagler Bailly Pakistan, 2018, Draft Strategy Report, Basin-wide Studies in the Jhelum-Poonch Basin for Sustainable Hydropower. International Finance Corporation.

[20] Arikan, Esra; Dieterle, Gerhard; Bouzaher, Aziz; Ceribasi, Ibrahim Haluk; Kaya, Dundar Emre; Nishimura, Shinya;Aramullaoglu,Ulker; Kahraman, Bilgen. 2012. Sample guidelines: Cumulative environmental impa ct assessment for hydropower projects in Turkey. Washington DC; World Bank. http://documents.worldbank.org/curated/en/2012/12/17671936/sample-guidelines-cumulative-environmental-impact-assessment-hydropower-projects-turkey

[21] International Finance Corporation, 2012, Performance Standards

[22] Asian Development Bank, 2009, Safeguard Policy Statement, Policy paper.

[23] Postel, S., and Richter, B. 2003. Rivers for Life: Managing Water for People and Nature. Island Press, Washington, D.C.

Practice Handbook.[24]This Good Practice Handbook provides guidance to practitioners on taking rigorous and consistent approaches to assess and manage hydropower project impacts on downstream river ecosystems and people through the assessment and provision of environmental flows (EFlows).

Increase Protection Efforts to Conserve Ecological Resources

The KP Fisheries and Wildlife Departments have a clear mandate for protecting ecological resources. The wider area around the Project provides habitat to migratory birds as well as large mammals of conservation importance such as Himalayan Ibex and Markhor. With improved access to the area, as a result of the development of the hydropower project/s, poaching, illegal fishing and trade in plant and animal species is likely to increase. There is a need to step up protection efforts to minimize anthropogenic impacts, particularly illegal hunting and fishing.

It is recommended that increased budget and man-power be allocated towards these government departments tasked with protecting the river and terrestrial habitats. The individual hydropower projects can play a role in this by either directly supporting the government departments or hiring an Implementing Organization which can support the government departments in conservation efforts.

Become a Member of Hydropower Developers Working Group (HDWG).

The International Finance Corporation (IFC) of the World Bank has created a platform called the Hydropower Developers Working Group (HDWG) which includes members from the existing and planned HPPs in the Jhelum basin. The objective of the HDWG is to make sure that HPPs in the Jhelum basin have a common understanding of the issues related to hydropower development so that they can work jointly to redress these issues and problems. It is recommended that HPPs in the Lutkho-Arkari sub-basin and Chitral/Mastuj basin become a member of the HDWG.

Design HPPs to Balance Power Generation Benefits and Environmental Impacts

Large hydropower projects designed to harness a s much as possible of the river's energy to generate electricity, to maximize power generation and financial benefits. However, they also lead to significant negative environmental and social impacts. This is because dams modify the river's flow regime, and in doing so they impact this fundamental driving force of the river ecosystem, leading to knock-on effects on the sediment, chemical and thermal regimes of the river, the river's biota and all the ecosystem services valued by people. It is important for hydropower project proponents to balance power generation benefits and consider the loss of ecological resources, ecosystems, ecosystem services and livelihoods in the design, construction and operation of projects.

Maximize Synergistic Project Development

Where more than one project is being built in close proximity on the same tributary or river section, developers have the opportunity to coordinate with each other and redesign projects based on a synergistic approach. This can help maximize positive impacts and mitigate adverse environmental impacts. Coordinated mitigation measures can be

[24] World Bank Group, February 2018, Good Practice Handbook, Environmental Flows for Hydropower Projects Guidance for the Private Sector in Emerging Markets

incorporated into the design and operation plans to mitigate expected cumulative impacts at the watershed level. These measures include maintaining adequate downstream flow regimes, coordinated design of fish ladders, contribution to native fish hatcheries, open water re-stocking, and designing fish diversion structures at intakes to avoid entrapment.[25] The same approach towards synergistic project development can be adopted when planning the transmission lines.

Promote Research on River Ecology

There is a need to carry out research on a number of issues related to river ecology including development of a comprehensive baseline of ecological resources of Lutkho and Mastuj River; assessment of impacts of construction of multiple hydropower projects on migratory fish; techniques for captive breeding and stocking of fish of conservation importance that are impacted by projects; fish passages suited to local species, river conditions, and dam designs; genetic studies to determine risk of in-breeding and actions to reduce the risks; use of holistic environmental flow models to assess cumulative impacts of projects.

The establishment of an Institute for Research on River Ecology (IRRE) in the Jhelum Basin has been recommended in the Biodiversity Management Plan (BMP) of Karot HPP. The same approach has been incorporated into the BAP prepared for the Kohala HPP, Mahl and Azad Pattan HPP, all of which are located on the Jhelum River (subject to approval of the associated costs in the electricity tariff by NEPRA). The IRRE is proposed as a basin wide institution in which all the developers of HPPs in the Jhelum basin contribute to establishment and operation of the institute, and jointly benefit from the research outputs.

HPPs in the Lutkho and Chitral basin can either promote small scale research in the basin, or preferably, contribute towards the research conducted at the IRRE in Jhelum Basin, or set up an independent research institute in the Chitral Basin following the model of IRRE.

Increase Environmental Management Capacity

The KP Wildlife and Fisheries Departments are the custodians of the terrestrial and aquatic ecological resources in the basin. Capacity building of the staff of these government departments is imperative for implementing any conservation measures. In addition, it is equally important for hydropower project proponents to increase their environmental management capacity so that HPPs consider environmental protection at the design, construction and operation stage of HPP development.

7.16 Summary of the Project Impacts

In this section, a summary of the impacts of the Project are provided. The summary is provided in the form of a table (**Exhibit 7.24**).

[25] Hagler Bailly Pakistan, 2013, Strategic Environmental Assessment of Hydropower Plan for Azad Jammu and Kashmir for International Union for Conservation of Nature (IUCN), Islamabad

Exhibit 7.24: Summary of Impacts

ID	*Aspect*	*Impact*	*Phase*	*Stage*	*Magnitude*	*Timeframe*	*Spatial Scale*	*Consequence*	*Probability*	*Significance*	*+/-*
1	Aquatic Ecology	Loss of Aquatic Biodiversity due to Creation of a Low Flow Section Downstream of the Dam	C, O	Init	Moderate	Long Term	Small	Moderate	Definite	Medium	-
				Res	Moderate	Long Term	Small	Moderate	Definite	Medium	-
2	Aquatic Ecology	Loss of Aquatic Biodiversity due to Changes in Ecological Conditions Downstream of the Powerhouse as a Result of Release of Water	C, O	Init	Moderate	Long Term	Small	Moderate	Definite	Medium	-
				Res	Moderate	Long Term	Small	Moderate	Definite	Medium	-
3	Terrestrial Ecology	Terrestrial habitat loss caused by construction of Project infrastructure	C	Init	Minor	Short Term	Small	Low	Possible	Low	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
4	Terrestrial Ecology	Decline in abundance and diversity of terrestrial flora and fauna caused by construction related activities.	C	Init	Minor	Short Term	Small	Low	Possible	Low	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
5	Terrestrial Ecology	Project operation leading to animal disturbance, displacement and decline.	O	Init	Minor	Long Term	Small	Medium	Possible	Medium	-
				Res	Minor	Long Term	Small	Low	Possible	Low	-
6	Ambient Air Quality	Increase in ambient concentration of air pollutants from construction activities and vehicular movement may cause health impacts on the community.	C	Init	Moderate	Short Term	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Short Term	Intermediate	Low	Possible	Low	-
7	Vibration from blasting	Vibration from blasting during the construction phase may disturb local communities.	C	Init	Moderate	Short Term	Small	Low	Possible	Low	-
				Res	Minor	Medium Term	Small	Low	Possible	Low	-
8	Hazards of Fly Rock from Blasting	Blasting may pose a safety hazard due to flying debris	C	Init	Moderate	Short Term	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
9	Construction Nosie	Increase in ambient noise levels due to the operation of construction equipment, movement of construction traffic and blasting may create a nuisance for nearby communities and visiting tourists.	C	Init	Moderate	Short Term	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-

ID	Aspect	Impact	Phase	Stage	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance	+/-
10	Water Availability and Quality	Alterations of natural passage of springs due to tunnel construction may disrupt the water availability at mountain springs for local community.	C	Init	Major	Long Term	Intermediate	High	Possible	High	-
				Res	Minor	Medium Term	Intermediate	Low	Possible	Low	-
11	Water Availability and Quality	Damage to community irrigation channels may occur during construction especially during blasting of the headrace tunnel	C	Init	Major	Long Term	Intermediate	High	Possible	High	-
				Res	Minor	Medium Term	Intermediate	Low	Possible	Low	-
12	Water Availability and 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	-
13	Water Availability and Quality	Contamination of surface and groundwater due to discharge from the construction activities and sewage from the construction camps may affect agricultural productivity and human health.	C	Init	Moderate	Short Term	Small	Low	Possible	Low	-
				Res	Minor	Short Term	Small	Low	Unlikely	Low	-
14	Soil, Topography and Land Stability	Contamination of soil as a result of accidental release of solvents, oils, and lubricants can degrade soil fertility and agricultural productivity.	C	Init	Moderate	Medium	Small	Medium	Possible	Medium	-
				Res	Minor	Medium	Small	Low	Unlikely	Low	-
15	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	Init	Moderate	Medium Term	Intermediate	Medium	Definite	Medium	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
16	Soil, Topography and Land Stability	Increased erosion and sediment load entering the river from bunds and sediment ponds during the construction phase and as a consequence of the failure of spoil dumping sites.	C, O	Init	Moderate	Long Term	Intermediate	High	Possible	High	-
				Res	Moderate	Medium Term	Intermediate	Medium	Unlikely	Low	-

ID	*Aspect*	*Impact*	*Phase*	*Stage*	*Magnitude*	*Timeframe*	*Spatial Scale*	*Consequence*	*Probability*	*Significance*	*+/-*
17	Aesthetics	Deterioration of aesthetics and visual amenity of nearby receptors due to construction activities, including vehicular movement on roads, may cause a disturbance in aesthetics for nearby communities.	C	Init	Minor	Short Term	Small	Low	Possible	Low	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
18	Aesthetics	Permanent impact on aesthetics due to proposed developments.	O	Init	Minor	Long Term	Small	Low	Possible	Low	-
				Res	Minor	Long Term	Small	Low	Possible	Low	-
19	Traffic and Road	Improved accessibility of locals due to construction of Project access roads.	C, O	Init	Minor	Medium Term	Small	Low	Possible	Low	+
				Res	Minor	Medium Term	Small	Low	Definite	Low	+
20	Traffic and Road	Increase in congestion, due to increased traffic during construction will cause delays.	C	Init	Minor	Short Term	Small	Low	Possible	Low	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
21	Traffic and Road	Increased risk to community safety due to increased traffic during the construction phase near communities.	C	Init	Major	Short Term	Small	Medium	Possible	Medium	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
22	Traffic and Road	Degradation of the pavement due to use by heavy construction traffic.	O	Init	Minor	Short Term	Small	Low	Possible	Low	-
				Res	Minor	Short Term	Small	Low	Possible	Low	-
23	Seismic and Flood Hazard	A potential flood and seismic hazard under natural extreme conditions for which the dam is not designed, albeit very unlikely, has potential to cause loss of life and damage to property.	C	Init	Major	Short Term f	Extensive	High	Unlikely	Medium	-
				Res	Moderate	Short Term	Extensive	Medium	Unlikely	Low	-
24	Greenhouse Gas Emission	GHG emissions from dam construction will increase GHG concentration in the atmosphere thereby contributing to climate change.	C, O	Init	Minor	Short Term	Intermediate	Low	Definite	Low	-
				Res	Minor	Short Term	Intermediate	Low	Definite	Low	-
25	Livelihood and Well-being	Direct, indirect and induced employment at the local level, resulting in increased prosperity and wellbeing due to higher and more stable incomes of people.	C, O	Init	Minor	Long term	Extensive	Medium	Possible	Medium	+
				Res	Moderate	Long term	Extensive	High	Definite	High	+

ID	Aspect	Impact	Phase	Stage	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance	+/-
26	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 local labor.	C, O	Init	Minor	Long term	Intermediate	Medium	Possible	Medium	+
				Res	Moderate	Long term	Extensive	High	Possible	High	+
27	Livelihood and Well-being	Decrease in productivity of agricultural fields due to unavailability of water for irrigation	O	Init	Major	Long term	Extensive	High	Definite	High	-
				Res	Minor	Short	Small	Low	Definite	Low	-
28	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	-
29	Livelihood and Well-being	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	-
30	Livelihood and Well-being	Disputes over the 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	Medium	Intermediate	Medium	Possible	Medium	-
31	Livelihood and Well-being	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	-
32	Livelihood and Well-being	Religious conflicts due to different religious beliefs of workers and locals.	C	Init	Moderate	Medium	Intermediate	Medium	Possible	Medium	-
				Res	Minor	Short term	Intermediate	Low	Possible	Low	-

8. Grievance Redress Mechanism

Timely and effective redress of stakeholder grievances will contribute to bringing sustainability in the operations of a project. In particular, it will help advocate the process of forming and strengthening relationships between project management and the stakeholder community groups and bridge any gaps to create a common understanding, helping the project management to efficiently operate in the area.

To register and resolve community grievances a Grievance Redress Mechanism (GRM) will be established. The purpose of the GRM is to facilitate the resolution of disputes between community members and the Project without going into litigation. The proposed mechanism will be based on two Grievance Redress Committees (GRCs), one at village level and the other at the Project level. The proposed GRM will help achieve the objectives of sustainability by dealing with any environmental or social issues arising from Project activities in a timely manner.

The project proponent, MHL, will be responsible for establishing and implementing the GRM. MHL will facilitate the formation of GRCs at the village level with the help of community representatives, and will also form a GRC at the Project level. MHL will also be responsible for ensuring that information regarding the GRM is effectively disseminated to communities so that people potentially affected by the project are aware of the procedure for the registration and follow-up of complaints.

The GRM will be established and fully functional (including establishment of both GRCs) before any construction machinery or personnel are mobilized to the Project site.

8.1 Grievance Redress Committees

The GRCs will ensure that the process for redressing grievances remains accessible, fair and independent. The village–level Grievance Redress Committees (Village GRCs) will be established to engage village–level community members/leaders to participate in the decision–making processes and to have "voices" of the aggrieved person/communities in the grievance redress procedures. This will also enhance local ownership of the Project. Having members based in the village, the Village GRC will be helpful in resolving grievances quickly and often without requiring lengthy documentation. Local participation will further build local capacity in dispute resolution and decision–making and provide leadership support in the implementation of the Project. When cases are not satisfactorily resolved or affected persons remain aggrieved, the case will then be forwarded to the Project–level Grievance Redress Committee (Project GRC) as the prime floor for resolution of the grievances.

The decision of the Project GRC will be final within the GRM. However, if any disputant remains dissatisfied with GRM outcome, the disputant may seek redress from a court of law.

The composition of the two committees is shown in **Exhibit 8.1**.

Exhibit 8.1: Members of GRC

Organization	*Village GRC*	*Project GRC*
MHL	Field staff of MHL Chairperson	Representative from MHL Chairperson
Community	One or two elders nominated by the community	One or two elders nominated by the community

8.2 GRC's Scope of Work

The scope of work of the GRC shall include:

1. The village GRCs will ensure that all grievances related to social and environmental issues are registered, formally recorded, reviewed, resolved and the concerned person is informed in a timely manner.
2. The Project GRC will monitor the working of the Village GRCs and will work as a forum for appeal against the decision of the Village GRCs.
3. GRCs will not consider complaints related to procurements or with any matters pending in the court of law.
4. In resolving disputes, the GRCs would take into consideration the following:

- Merit of the complaints/case received for consideration;
- Evidence to take a decision on the complaint;
- Witness statements;
- Plausibility of the case in light of related project activity;
- Applicable laws, environmental guidelines of Pakistan, environmental and social impact assessment and environmental review document of the project, and the IFC's Sustainability Framework;
- Observations made on the field; and
- Available information on previous complaints of similar nature.

8.3 Approval and Orientation of GRC Members

GRC members from local communities will be selected based on their standing in the community and their personal integrity. Local members of the Village GRCs will be selected after consultation with the communities that are being represented. Local members of the Project GRC will be nominated by members of Project affected communities. All GRC members will be approved and notified by the MHL Environment and Social Unit.

All GRC members will attend a training and orientation meeting prior to commencement of their work. The training will be provided by competent technical experts in social/resettlement and environmental management. The training will address the policy aspects, compliance requirements, expectations of the community, and need for rapport

and communication with the affected communities, and finally the need for independence and transparent views in dealing with grievances.

8.4 Information Dissemination and Implementation

Establishment of the GRM will commence with the dissemination of information by the MHL Environment and Social Unit to concerned villages explaining how the process will work and the need to form Village and Project GRCs. Once the process has been explained the GRCs will be established and the GRM will go into the implementation phase. After notification of all the GRCs information regarding GRCs will be disseminated in all the concerned villages by MHL's Environment and Social Unit. Information dissemination will comprise the following;

- Information dissemination about GRM and GRCs to villages
- Establishment of GRCs
- Production of required documentation such as grievance registration forms and grievance logs
- Training of GRC members
- Second round of information dissemination to villages
- Implementation of GRM

8.5 Grievance Redress Procedure

The following procedure will be adopted to resolve grievances received by the GRCs. The grievance mechanism will be made public through public consultations by MHL's Environment and Social Unit and Consultant.

8.5.1 Filing of Grievances with Village GRC

For grievances related to social and environmental safeguards, the aggrieved person (or their authorized representatives) may file a grievance with the Village GRC in one of the following ways:

1. Submit a written complaint to any member of the Village GRC.
2. Given the local cultural context, any aggrieved women may submit complaints to GRCs directly or through the head of the household.

Complaint Registration Forms will be available with the secretary of the Village GRCs for registration of complaints. Complaints will be registered in the Grievance Log.

8.5.2 Hearing and Resolution of the Cases by Village GRC

The procedure for hearing and resolution of the complaint will be as follows:

1. On receipt of a complaint:

- The Secretary of the Village GRC will log the complaint in the Grievance Log.
- The Secretary will contact other members of the Village GRC to convene a meeting within 10 calendar days of the logging of the complaint.

- If needed, the complainant or his representative will be asked to meet the Village GRC on the appointed date to discuss the complaint.
- All the relevant information and documents relevant to the complaint will be prepared and compiled prior to the meeting and copies will be provided to all members.

2. The GRC will meet on the selected date during which it may:

- Deliberate on the nature and circumstances of the complaint;
- Investigate the complaint based on evidence provided by the complainant;
- Meet with the complainant and other persons;
- Visit the site; and
- Take a decision.

3. If the Village GRC needs extra time to investigate or deliberate on the complaint, the secretary will inform the complainant of the time when a decision is expected. In any case, all complaints shall be resolved within 30 calendar days of logging.
4. Once the complaint is resolved the secretary will document the decision and prepare full documentation on the process including minutes of meetings, photographs of visits, documents reviewed, and reasons for the decision.
5. The Village GRC will ensure that the complainant is fully informed of the decision and is also informed about his/her right to appeal to the Project GRC and to the court of law.
6. In case follow–up action is required, the chairperson of the Village GRC will ensure that all actions are taken and are documented.

8.5.3 Hearing and Resolution of Cases by Project GRC

The procedure for hearing and resolution of the complaint by the Project GRC will be as follows:

1. On receipt of a complaint form:

- The Secretary of Project GRC will request all the concerned documentation from the secretary of the concerned Village GRC.
- The Secretary will contact other members of the Project GRC to conduct a meeting within 15 calendar days of the logging of the complaint to the Project GRC.
- If needed, the complainant or his representative will be asked to meet the Project GRC on the appointed date and place to discuss the complaint.
- If needed, members of the Village GRC will be asked to meet the Project GRC on the appointed date and place.
- All relevant information and documents relevant to the complaint will be prepared and compiled prior to the meeting and copies will be provided to all members.

2. The Project GRC will meet on the appointed date during which it may:

- Deliberate on the nature and circumstances of the complaint;
- Investigate the complaint;
- Meet with the complainant and other persons;
- Visit the site; and
- Take a decision.

3. If the Project GRC needs extra time to investigate or deliberate on the complaint, the secretary will inform the complainant of the time when a decision is expected. In any case, all complaints shall be resolved within 45 calendar days of logging with the Project GRC.
4. Once the complaint is resolved the secretary will document the decision and prepare full documentation on the process including minutes of meetings, photographs of visits, documents reviewed, and reasons of the decision.
5. The Project GRC will ensure that the complainant is fully informed of the decision and is also informed about his/her right to appeal to the court of law.
6. In case follow–up action is required, the chairperson of the Project GRC will ensure that the actions are taken and are documented.

8.5.4 Collation and Evaluation of Data by MHL

The MHL Environment and Social Unit will ensure that it receives copies of all complaints, meeting notices, decisions, and documentation related to proceedings of the Village GRCs and Project GRC.

MHL will maintain a complete record of the complaints in a database or tabular form consisting of the following fields:

- Project name
- Village, union council, tehsil, and district
- Name of complainant
- Nature of complaint, for example environment (tree cutting, noise, dust, waste, air, water, soil pollution etc.), social (damage to infrastructure, land, privacy, favoritism/nepotism issues, etc.), gender (gender equality, empowerment, privacy etc.) and non–compliance to the Govt. /donor provided guidelines.
- Date of logging of complaint with Village GRC
- Date of first meeting of Village GRC
- Information on members who attended, number of meetings, meeting with complainant, and site visit.
- Date of decision of Village GRC
- Follow–up actions, responsibilities, and completion with dates
- Date of logging of complaint with Project GRC

- Date of first meeting of Project GRC
- Information on members who attended, number of meetings, meeting with complainant, and site visit.
- Date of decision of Project GRC
- Follow–up actions, responsibilities, and completion with dates

MHL will prepare periodic reports on the GRM, reporting on, for example:

- Number of complaints received and resolved by Village GRCs, Project GRC and the nature of complaints;
- The average time of it took to resolve complaints; and
- The percentage of complaints that were resolved at the Village GRC level.

9. Environmental Management Plan

9.1 Introduction

The Environmental Management Plan (EMP) summarizes the organizational requirements, management and monitoring plans to ensure that the necessary measures are taken by MHL to avoid potentially adverse effects and maximize potential benefits of the Project and to operate in conformance with applicable laws and regulations of KP, as well as the policies of international financial corporation such as IFC.

Due to the nature and applicability of the EMP, it will also be used for contractual purposes through its inclusion as a part of the bid documents for the EPC contractor who has to adhere to it along with other regulatory requirements. The strict implementation of the EMP and project management's strict enforcement of the adequate construction practices and standards will greatly reduce the negative impacts of the Project.

Having an effective and functioning Environmental and Social Management System (ESMS) is a pre-requisite for the implementation of the EMP. A framework for the ESMS is suggested in **Section 9.2**.

The EMP is based on the baseline conditions (see **Section 4**, *Description of the Environment*), the impact assessment (see **Section 7**, *Anticipated Environmental Impacts and Mitigation Measures*), and the results of discussions with the stakeholders (see **Section 6**, *Information Disclosure, Consultation, and Participation*). The EMP is prepared for all the identified environmental impacts during design, construction, and operation of various Project activities. The methodology followed for preparing the EMP includes the following:

- Deriving mitigation/protection measures for identified impacts using impact evaluation methodology.
- Rationalizing and combining series of mitigation, compensation and enhancement measures from each identified impact and risk to prepare overall measures.
- Developing a mechanism for monitoring the proposed mitigation measures.
- Estimating budget requirements for implementation, mitigation and monitoring measures.
- Identifying responsibilities of various agencies involved in the Project for implementation and monitoring of mitigation measures.

9.2 Environmental and Social Management System

This section describes the framework for the Environmental and Social Management System (ESMS) for the Project. It is the responsibility of each project company affiliated with the Project to establish its own ESMS to ensure implementation of the EMP.

The basic elements of the ESMS are outlined in **Exhibit 9.1** with more details on each element, and how it applies, given in the following sections. The elements of the ESMS

are discussed under the headings of the "plan-do-check-act" business performance improvement cycle. Emergency planning and response and stakeholder engagement are elements of the ESMS that apply to all steps of the "plan-do-check-act" cycle as shown in **Exhibit 9.1**.

9.2.1 Planning Elements

Leadership and Accountability

Policy

The Project is being undertaken in accordance with MHL's policies. MHL will periodically review the scope and effectiveness of these policies. The policies will be documented, maintained, implemented and communicated to MHL employees, contractors, suppliers and the public.

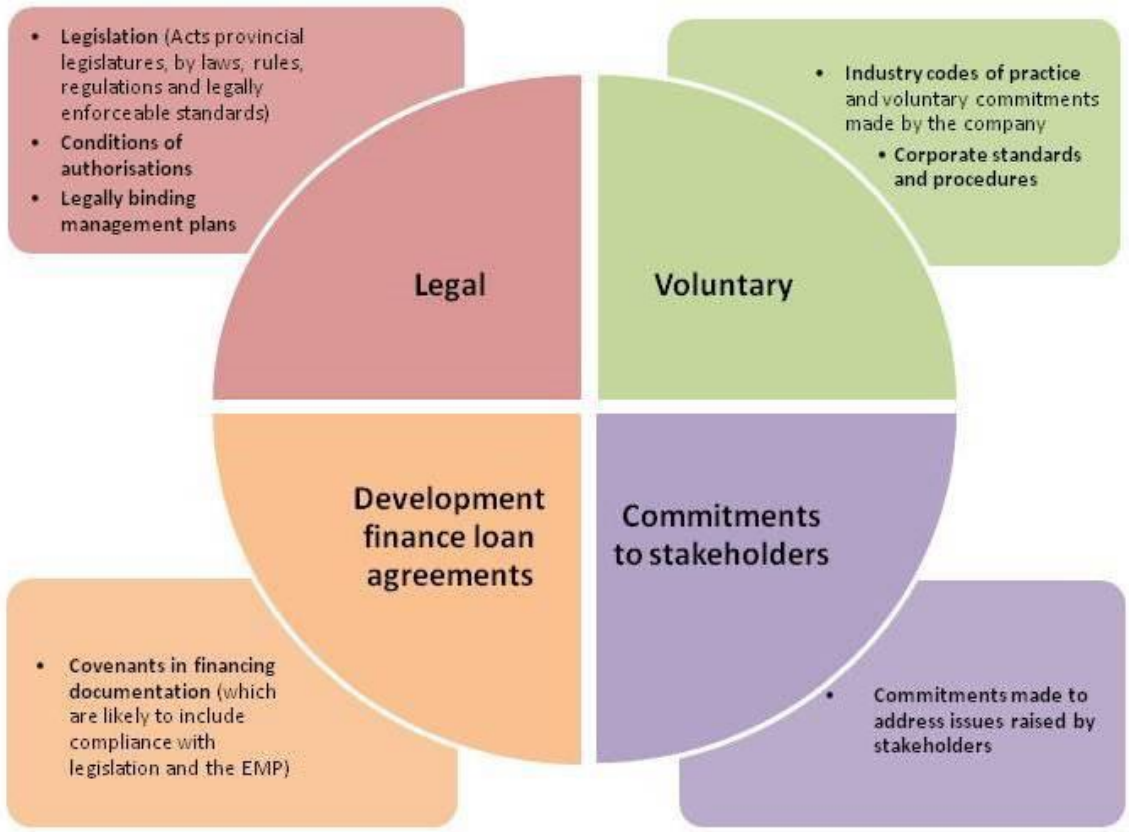
Legal Requirements and Other Obligations

The Project's ESMS takes into account of both legal and other obligations imposed on the Project. The various types of obligations that need to be considered are shown conceptually in **Exhibit 9.2**.

Exhibit 9.1: Elements of the ESMS for Arkari Gol HPP

Steps of the "plan-do-check-act" cycle	*Elements of the ESMS for the Project*		
	Elements	*Primary function*	*Elements applying to all steps of the cycle*
Plan (**Section 9.2.1**, *Planning Elements*)	Leadership and accountability	Produce and communicate a statement of MHL's commitment to environmental and social management Establish, document, implement, maintain and improve the Project ESMS	Stakeholder engagement An ongoing process, throughout the life of the project. Serves to build and maintain a constructive relationship with communities affected by the Project Emergency planning, response and recovery Maintain emergency response preparedness through the identification of potential environmental emergencies, development of response plans and allocation of response and recovery resources.
	Legal and other requirements	Identify and provide access to legal requirements and other obligations	
	Aspect identification and impact assessment	Identify aspects ("mechanisms" by which project activities impact on the environment) and assess associated impacts throughout the Project life (the ESIA falls under this element of the ESMS)	
	Objectives, targets and plans	Define objectives, targets, criteria and actions for the management of potential impacts (the EMP falls under this element of the ESMS)	
Do (**Section 9.2.2**, *Implementation Elements*)	Roles and responsibility	Provide sufficient management sponsorship of human and financial resources Establish roles and responsibilities for implementation	
	Contractors, suppliers and vendors	Consider environmental and social impact management and performance in the selection and management of third party services	
	Competence, training and awareness	Make personnel aware of their responsibilities and enable them to be capable and competent in meeting their responsibilities	
	Communication	Maintain internal and external communications to enable effective environmental management	
	Operational controls and maintenance	Implement operational controls and maintain equipment to uphold environmental performance and compliance and to manage impacts and risks	
	Documentation and record keeping	Control and maintain documents and records associated with environmental and social management	
Check (**Section 9.2.3**, *Check Elements*)	Assessing, correcting and improving performance	Monitor environmental and social management and performance and take measures to continually improve performance	
	Non-conformance and incident reporting	Promptly report non-conformances and incidents are promptly reported and take corrective and preventative actions to reduce the likelihood of recurrence	
	EMP and ESMS reporting	Report on compliance with the EMP and ESMS performance to senior management, regulatory authorities and affected communities	
Act (**Section 9.2.4**, *Act Elements*)	Governance/ management review	Require site, regional and senior management to review the suitability, adequacy and effectiveness of the ESMS and identify improvement actions to facilitate continuous improvement	
	Management of change	Modify the ESMS in response to changes in the Project and to changes in the organization, personnel, operations and processes	
⟷	The arrows show where there is integral relationship between stakeholder engagement and other elements of the ESMS.		

Exhibit 9.2: Types of Obligations Relevant to the ESMS



MHL will identify, document and maintain a register of legal requirements and other obligations applicable to the Project. It will also:

- manage recurring legal and other obligations (such as inspections, sampling, analysis and reporting);
- track developing legislation and regulations that may apply to operations and activities to anticipate and prepare for compliance;
- inform employees and others working on behalf of the company of existing and emerging obligations that apply to their job responsibilities; and
- consider the register in the setting and review of objectives, targets and plans for management of impacts.

Aspect Identification and Impact Assessment throughout the Project Life

A key element of ESMS is identification of aspects and assessment of impacts. The ESIA is a part of this element of the ESMS. The impacts identified in the ESIA in **Section 7** (*Anticipated Environmental Impacts and Mitigation Measures*) are addressed in this EMP

Procedures will be set up, implemented and maintained for identification of significant environmental aspects and undertaking of impact and risk assessments on an ongoing basis through the Project life. These will address:

- aspects not covered by this ESIA;
- any impact arising that was not predicted by the ESIA or did not develop as predicted by the ESIA; and
- any changes in the Project or new developments arising subsequent to the completion of this ESIA.

Objectives, Targets and Plans for Management throughout the Life of the Project

This element of the ESMS pertains to the setting of objectives and targets for environmental and social management, and plans for the achievement of these objectives and targets at corporate and Project levels. The EMP embodies this element of the ESMS at the Project level.

The primary purpose of the EMP is to guide environmental and social management throughout the life of the Project. The core of the EMP is a statement of environmental and social management objectives and associated management measures. The EMP will be supported by other documentation, such as the original Project design and specific management plans and operating procedures.

The preliminary EMP commitments are derived from the following sources:

- inherent design or management measures described in the ESIA and Project Feasibility Study;[1]
- mitigation and enhancement measures identified in the ESIA, which are required to manage identified impacts; and
- good practice management measures, which may not significantly alter the impact rating but are considered standard industry practice for the management of such impacts.

9.2.2 Implementation (do) Elements

Effective implementation and functioning of the EMP depends on adequate human and financial resources, clearly defined responsibilities for environmental and social management, appropriate training and good communication. An outline of how these features will be managed for the Project is presented below.

Roles and Responsibility

MHL will define, document and communicate the environmental and social management roles and responsibilities of Project personnel, including contractors, Owners Engineers, and others working on behalf of the company, in all phases of Project implementation from detailed design through to closure, before the start of each phase. Personnel with specific roles and responsibilities will have the authority, and be held accountable for, carrying out these.

The basic roles required to implement the EMP, and establish and maintain the ESMS, are shown in **Exhibit 9.3**. These roles need to be reviewed and incorporated into the

[1] Pakhtunkhwa Hydel Development Organization (PHYDO), Government of Khyber Pakhtunkhwa, March 2014, Feasibility Study for the Arkari Gol Hydropower Project, District Chitral, (Lower), Khyber Pakhtunkhwa, Volume 1, Main Report

organizational structures for the various phases of the Project from detailed design through to closure. A key requirement is for the senior environmental management professional to report directly to the on-site senior manager (the Operations/General Manager).

Exhibit 9.3: Key Roles for Environmental and Social Management

Roles	*Relevant Responsibilities*
Project Director for the Arkari Gol HPP Project Management Unit (PMU)	▶ Endorse the environmental and social management policy and require it to be communicated to the public ▶ Allocate adequate human and financial resources to enable effective functioning and continual improvement of the ESMS ▶ Establish and maintain a governance system
Project site management and PMU's senior management	**Compliance** ▶ Confirm necessary authorizations (licenses/ permits) have been obtained for the Project ▶ Confirm compliance with legal requirements and other obligations pertaining to environmental and social management ▶ Commit contractors and suppliers to meeting relevant environmental and social obligations by means of specific conditions in the contracts of appointment **Roles and responsibility** ▶ Define, document and communicate environmental and social management roles, responsibilities and authorities ▶ Provide sufficient appropriately trained human resources and adequate financial resources to enable effective functioning and continual improvement of the ESMS ▶ Hold personnel responsible for meeting their assigned responsibilities **Communication and reporting** ▶ Confirm there is adequate ongoing stakeholder engagement ▶ Confirm obligations for reporting to regulatory authorities, development financiers and affected communities are met **Management review** ▶ Provide leadership in the pursuit of environmental and social management ▶ Examine and review the ESMS periodically to determine its suitability, adequacy and effectiveness ▶ Support action to enhance the ESMS and make improvements in environmental and social management performance
Environmental management	**ESMS** ▶ Establish the ESMS, with assistance from the senior management, division managers and community relations managers

Roles	*Relevant Responsibilities*
	▶ Liaise with division managers regarding environmental management roles, responsibilities and authorities throughout operational divisions ▶ Coordinate monitoring and evaluation activities and confirm corrective actions (an action taken to address a non-conformance) are taken to address incidents and non-conformances (a failure to comply with the Project's ESMS) ▶ Report progress in implementation and functioning of the ESMS to senior management, development financiers, regulatory authorities and stakeholders **EMP** ▶ Keep the EMP up to date and confirm it addresses all relevant environmental and social obligations ▶ Present the EMP in an appropriate format for communication with regulatory authorities and other stakeholders ▶ Present the EMP in an appropriate format for communication with parties responsible for Project execution ▶ Compile EMP compliance reports ▶ "Sign-off" actions in the EMP and non-conformances once they have been completed
Community relations management	▶ Assist the Environmental Management team with ongoing reporting to stakeholders on EMP and supporting management plans, and progress with implementation of management measures ▶ Assist Environmental Manager and division managers with stakeholder communication where awareness and/ or co-operation of stakeholders are required to implement management measures ▶ Manage the community grievance mechanism
Division management (management that oversees certain specified sections in an organization)	▶ Confirm the ESMS and EMP are established, communicated, implemented and maintained in their respective areas ▶ Provide leadership in the pursuit of environmental and social management ▶ Identify ways to improve environmental and social performance through daily monitoring of their activities and evaluating implementation ▶ Review monitoring results, incidents and corrective actions taken ▶ Evaluate adequacy and effectiveness of awareness and skills training programs pertinent to environmental and social management ▶ Maintain internal communication of environmental and social matters between the Environmental Manager, Community Relations Manager and other personnel, and promote environmental and social awareness.

Roles	*Relevant Responsibilities*
	▶ Examples of key responsibilities of specific Division Managers include: ▷ Human resources—Organize in association with the Environment Manager and Community Relations Manager environmental and social related training, maintain linkages between the ESMS and human resources management systems, as necessary, and manage worker grievance mechanism. ▷ Finance—Track budget/spend data used in implementing and maintaining ESMS in association with the Environment Manager and Community Relations Manager ▷ Purchasing—With the support of environment and community relations teams, assess contractors' and suppliers' environmental and social compliance and control purchase and disposal of hazardous materials ▷ Maintenance—Implement preventive maintenance program for equipment ▷ Health, safety and security—With the support of community relations teams, confirm safeguarding of personnel and property is carried out without adverse impacts on local communities
All personnel and contractors	▶ Work in accordance with the EMP and supporting documents ▶ Report problems or deviations from the ESMS or EMP to division managers and/or environmental managers, as instructed.

Contractors, Suppliers and Vendors

Environmental and social performance, programs and risk management will be considered in the selection and management of contractors, suppliers and vendors. Contracts will address potential environmental and social liabilities and responsibilities including:

- use of competent, trained staff, including subcontractors;
- consequences for failing to meet obligations;
- monitoring of performance;
- required job-specific, site-specific training;
- compliance with MHL policies and site standards and applicable legal requirements;
- responsibility for chemicals brought on-site and wastes generated on-site, including closure activities where appropriate; and
- identification of a lead responsible person for both MHL and the contractor.

Contractors, including their employees and associated subcontractors, will be made aware of the environmental risks, associated controls, procedures and standards relevant to their

work on-site. The activities and performance of contractors will be monitored through Owner Engineer's Environmental & Social Development Cell (ESDC) against the terms of the contracts.

Training

Personnel, including contractors' personnel, working for or on behalf of the Project will receive training to maintain awareness of relevant environmental and social aspects, impacts and risks associated with the Project and corresponding controls. The training will also maintain awareness of the environmental benefits of improved personal performance and the potential consequences of departure from specified procedures. Visitors to Project sites will receive relevant environmental and social awareness training as part of site induction training.

Personnel, including contractors' personnel, will be made aware of the particular environmental and social management responsibilities that apply specifically to their jobs. Training needs analyses will be undertaken and personnel will be given adequate training to meet these responsibilities.

The training program comprises the following elements:

- identification of training needs for all employees specific to their varying responsibilities;
- development of a training plan and schedule to address defined needs;
- verification of training programs to confirm consistency with organizational requirements;
- training of employees and documentation of training received;
- evaluation of training effectiveness; and
- review and modification of training programs, as required.

Personnel with direct responsibility for implementation of the EMP and functioning of the ESMS will have additional training to:

- provide them with the knowledge and skills necessary to perform their work;
- maintain their knowledge of relevant environmental and social obligations; and
- enable them to implement specific measures required under the EMP in a competent and efficient manner.

Training requirements and completed training will be documented. Procedures to evaluate the effectiveness of such training will be implemented.

Communication

To effectively implement environmental and social management, the relevant managers will maintain lines of internal communication and provide information regarding the EMP, ESMS and environmental and social management performance, incidents, best practices, lessons learned and concerns to personnel electronically, on notice boards and/or in newsletters. Such communication will be used to inform the personnel of their individual responsibilities with respect to the ESMS and to raise awareness on specific

matters. External stakeholder engagement is discussed in **Section 6** *(Information Disclosure, Consultation, and Participation).*

A grievance redress mechanism will be established (see **Section 8**, *Grievance Redress Mechanism*) and will provide a means for Project personnel, including contractors' personnel, to anonymously raise environmental and social concerns (this grievance mechanism will be separate from the system dealing with employee grievances that need to be handled by the human resources department).

Operational Controls

Operational controls will be implemented to maintain performance and compliance, and to manage impacts and risks. Operational controls may include:

- administrative controls such as performance standards;
- standard operating procedures and work instructions; and
- engineered controls such as pollution control equipment.

Written operational controls are required where their absence could lead to deviation from environmental obligations or objectives and targets. Written operational controls will be part of the EMP supporting documentation.

The adequacy, suitability, and effectiveness of operational controls will be reviewed regularly.

Documentation on the design basis and operating criteria/limits for equipment having the potential to impact environmental performance will be maintained.

Operating equipment, as well as environmental monitoring and measurement devices, will be maintained consistent with manufacturers' specifications and best management practice to reduce the potential for environmental incidents and adverse environmental impacts.

Documentation and Record Keeping

Elements of the ESMS will be documented and controlled in accordance with a document control system. Records demonstrating compliance with legal requirements and conformance with the ESMS will also be maintained. MHL will establish, implement and maintain procedures for:

- ESMS document control detailing how the creation, review and updating of various types of documents will be managed and who will be responsible; and
- record identification, storage, protection, retrieval, retention and disposal.

Documentation and record keeping controls will include:

- measures to enable relevant documents (including those of external origin deemed necessary for planning and operation of the ESMS) and records to be readily available and identifiable (labelled, dated and properly filed), legible and protected from damage;
- review, revision and approval of documents for adequacy by authorized personnel at least once a year;

- making current versions of relevant documents available at locations where operations essential to the effective functioning of the ESMS are performed;
- suitably identifying obsolete documents retained for legal and knowledge preservation purposes; and
- identification and segregation of confidential and privileged information.

9.2.3 Check Elements

Checks are required to confirm the existence of an effective ESMS and compliance with the EMP. Checks includes monitoring, site inspections and formal audits. Linked to this, measures need to be taken to remedy non-conformances and to continually improve environmental performance. These are also classified as "check" elements of the ESMS.

Assessing, Correcting and Improving Performance

Monitoring Programs

The aim of monitoring programs are to:

- provide measurements of environmental and social impacts of the Project;
- ascertain and demonstrate compliance with conditions of approval and other legislation;
- provide sufficient evidence to address any claims made against the Project in respect of environmental and social matters;
- track performance of the ESMS and progress in the implementation of the EMP;
- track and measure key indicators and other performance measures over time to improve the Project's performance and reduce the likelihood of environmental incidents; and
- inform decision processes for determining management actions.

The monitoring programs cover the physical, biological and social components of the operation and are integrally linked with the assessment criteria stated in the EMP. Where appropriate and possible, the sampling parameters and locations used in the ESIA baseline studies have been retained to provide data continuity.

The monitoring program identifies monitoring parameters, sampling locations, sampling frequency and duration and detection limits (where appropriate). It includes control sites, where relevant. The focus and extent of monitoring is commensurate with the risk of impacts occurring, the sensitivity of the surrounding areas and the affected communities' perceptions of risks to their health and environment. For some types of monitoring, thresholds or targets are available, for example the emission and ambient limits. In other cases, the monitoring results will be compared to the baseline data set gathered as part of this ESIA. Lastly, where neither thresholds nor baseline data are available, the initial data collection may form the baseline for future data collection.

Data will be documented and interpreted. Temporal and spatial trends in the data will be discerned and compliance with relevant thresholds will be evaluated. Monitoring reports will be produced to meet internal and external reporting requirements. If monitoring

results indicate non-conformance with stipulated thresholds or if a significant deteriorating trend is observed, it will be recorded as a non-conformance and handled by the non-conformance and incident procedure.

Preliminary monitoring programs have been prepared and are presented in the EMP. These provide a framework of monitoring to evaluate performance and assist in predicting and managing impacts. In conjunction with the development of supporting documentation for the EMP, detailed monitoring plans, with appropriate sampling protocols where relevant, may need to be developed. These more detailed supporting documents would include the criteria against which the monitoring results will be compared and the actions required if the criteria or thresholds are exceeded. The supporting documents may also cover:

- sample or data collection methods;
- sample handling, storage and preservation;
- sample or data documentation;
- quality control;
- data reliability (calibration of instruments, test equipment, and software and hardware sampling);
- data storage and backup, and data protection;
- interpretation and reporting of results; and
- verification of monitoring information by qualified and experienced external experts.

The frequencies and locations of monitoring may need to be adjusted depending on final Project design and ongoing review of results obtained by the monitoring programs. Therefore the programs will be reviewed on a regular basis (at least annually) and adjusted, where necessary. Changes to the EMP or obligations register may also result in changes to the monitoring program.

Site Inspections

Site inspections will be undertaken regularly in relevant areas of the Project. The inspections will focus on compliance with the EMP and conformance with the ESMS. The inspections will play an important role in increasing awareness of EMP and ESMS requirements.

Continuous observation and monitoring by site and HSE managers and other responsible parties for compliance with the EMP and conformance with the ESMS will be part of their core responsibilities.

Minor non-conformances will be discussed during the inspection and recorded as a finding in the inspection report. Major non-conformances will be reported as incidents. Inspection results will be disclosed at management meetings.

Formal Audits

Formal audits will be undertaken at planned intervals in accordance with the requirements of MHL, MHL owners and regulatory authorities. Procedures for audits will be established, implemented and maintained. These will cover the audit criteria, scope, frequency and methods, and will address the responsibilities and requirements for planning and conducting audits, reporting results and retaining associated records.

Negative findings arising from an audit will be dealt with in accordance with the non-conformance and incident procedure. Results from audits and evaluations of compliance with legal requirements will be reported to site and senior management and subject to management reviews.

Non-conformances and Incident Reporting

Non-conformances include the following:

- exceedances of relevant thresholds as identified during routine monitoring;
- non-conformances with the requirements of the EMP or supporting documentation identified during an internal inspection;
- non-conformances identified during an audit or by regulatory authorities, including legal non-conformances;
- events, such as spills, resulting in potential or actual environmental harm;
- events that did or could result in injury to staff, visitors to site or surrounding communities; and
- significant complaints or grievances received from any source.

Corrective and preventive actions will be identified and implemented in response to these non-conformances. These actions will address the root cause of the non-conformance and will reduce or prevent repeated non-conformances.

A process will be established for the identification, investigation and tracking of non-conformances, including:

- prioritizing and classifying non-conformances based on the type and severity of the non-conformance;
- recording of non-conformances and the results of corrective and/or preventive actions, including the actions necessary to mitigate or remedy any associated impacts;
- defining results expected from the corrective and/or preventative actions;
- confirming the corrective and/or preventive actions taken to eliminate the causes of the non-conformance are appropriate to the magnitude of problem and commensurate with the impacts encountered;
- reviewing the effectiveness of the corrective and/or preventive actions taken; and
- implementing and recording required changes in the EMP or monitoring program resulting from corrective and preventive action.

Serious non-conformances will be classified as incidents. Incidents will be promptly reported to appropriate management. MHL will prepare a guideline on:

- the types of incidents reportable to internal management at the site, Project and corporate levels, as well as to regulatory authorities and other external stakeholders; and
- standards to be observed when reporting incidents.

The investigation of incidents and evaluation of effectiveness of existing controls and response actions will be undertaken at a level commensurate with the severity of the incident.

EMP and ESMS Reporting

Progress on compliance with the EMP and functioning of the ESMS (environmental and social performance) will be reported to:

- Project site and MHL senior management;
- development financiers, if required in terms of the loan agreement;
- regulatory authorities, as required; and
- affected communities and other stakeholders who have an interest in the Project.

9.2.4 Act Elements

Governance/ Management Review

MHL senior management will review the EMP and ESMS on a periodic basis to determine its suitability, adequacy and effectiveness. Each management review will initiate a new plan-do-check-act cycle with enhancement of the ESMS and continuous improvements in environmental and social management performance. The management review will cover:

- progress and closure of actions from previous management reviews;
- monitoring programs findings/ the extent to which objectives and targets have been met;
- findings of audits;
- incidents and the status of corrective and/or preventative actions;
- impact and risks assessments;
- changing circumstances, including changes to operations, Pakistan legislation or guidelines, ownership, socio-political circumstances;
- legal compliance and compliance with other obligations;
- stakeholder concerns, requests or complaints;
- adequacy of policies, EMP, monitoring plans, support documents and overall functioning of the ESMS to meet operational and corporate requirements; and
- recommendations for improvement.

Management of Change

Changes to the Project can be expected throughout the life of the Project. These can range from changes to operations and infrastructure, new developments (such as an expansion), changes to personnel and the Company, changes in legislation and changes to the environment of the Project (such as a new settlement established near Project infrastructure). These changes could result in changes to the significance of environmental and social impacts and risks. This may necessitate updates to existing authorizations/ permits, changes to the EMP, which may have to be approved by regulatory authorities, and general changes to the ESMS framework.

A procedure for the management of change will be established and maintained by MHL. This will:

- observe the corporate owners' requirements for the management of change;
- identify proposed changes that could alter environmental or social impacts and risks and/ or require new authorizations/ permits or changes to existing authorizations/ permits; and
- define the impact and risk assessments appropriate to different types of changes, which need to be undertaken by competent personnel.

Changes will not be made without the required authorizations/ permits in place. The measures identified as necessary to mitigate impacts and risks will be implemented. The various elements of the ESMS will be modified as required in response to the change,

A procedure specifically for changes to the policy/s, EMP, monitoring plans and supporting documentation will be established. This will detail:

- how the changes are to be recorded;
- who has responsibility for overseeing changes and checking they do not conflict with any planning conditions or other obligations;
- the process of review and sign off in response to changes; and
- how changes to the EMP should be communicated internally and externally.

9.3 Stakeholder Engagement

Stakeholder engagement provides stakeholders with opportunities to express their views on project risks, impacts and impact mitigation measures and involves appropriate consideration of the views and responses by project management. **Exhibit 9.4** shows stakeholder engagement applies to each of the steps of ESMS "plan-do-check-act" cycle and is an integral part of several ESMS elements. The relationship between stakeholder engagement and these elements is explained further in **Exhibit 9.4**.

Exhibit 9.4: General Overview of the Relationship between Stakeholder Engagement and the ESMS elements

Steps of the "plan-do-check-act" cycle	*ESMS Elements that Stakeholder Engagement is Integral to*	
	ESMS Elements	*Role of Stakeholder Engagement*
Plan	ESIA	During the ESIA, the focus of stakeholder engagement has been the involvement of stakeholders in project-planning and project-approval decision-making processes. It facilitated identification of stakeholder's concerns so they could be addressed in the Project design and/or EMP. It forms the basis for stakeholder engagement throughout the life of the Project.
	EMP	Stakeholders will be involved in the review and approval of the preliminary EMP. Throughout the life of the Project, there should be ongoing reporting to stakeholders on progress in the implementation of the EMP and supporting management plans that are of interest to them. The EMP and supporting management plans may need to be revised in response to stakeholders' concerns.
	SEP	A stakeholder engagement plan is to be developed. It will detail national regulation and good practices on stakeholder engagement, a summary of previous stakeholder engagement undertaken for this Project, required additional consultations, and the structure for future stakeholder engagement.
Do	Communication	Communication with stakeholders will be required to implement some management actions. The communication will be required to raise awareness and/or co-operation of potentially affected communities and other stakeholders. MHL will determine effective communication methods for making affected communities aware of actions they may need to take to avoid exposure to operation-related hazards and how they can maximize on opportunities resulting from the operation.
Check	Assessing, correcting and improving performance	Participatory monitoring is desirable. This entails involvement of stakeholders, particularly affected communities, in monitoring and verifying information to check that impact mitigation measures are appropriate.
		Grievances will be handled as incidents and managed through the incident procedure to enable the grievance to be received, documented, addressed and results fed back to the complainants. This procedure will protect the confidentiality of the persons raising the complaint, where necessary. The feedback will be easily accessible and understandable to members of the affected community and/or staff.
	Reporting	Stakeholders affected by the Project will be informed of progress in the implementation of the management plans and of the effectiveness of management measures.

MHL has established an initial program of stakeholder engagement for the Project and this will continue throughout the life of the Project. Currently, this program includes disclosure of information and consultation with stakeholders as part of the ESIA process.

When the Project enters the construction phase, and throughout the remaining life of the Project, stakeholder engagement will include:

- a grievance mechanism, for receiving concerns about the Project's environmental and social performance and for facilitating the resolution of the concerns (the grievance mechanism applies to Project stakeholders, including potentially affected communities and Project personnel.
- reporting on the implementation of the EMP and relevant supporting management plans;
- opportunities for stakeholders to respond to the information received; and
- constructive dialogue on environmental and social issues and performance.

The stakeholder engagement process will be documented, including:

- maintenance of a stakeholder database with stakeholder details;
- records of information disclosed to stakeholders;
- records of stakeholder engagements; and
- records of inputs from stakeholders and responses to these.

9.4 Roles and Responsibilities of Key Staff

To be effective, this EMP must be viewed as a tool reflecting to the contractors and sub-contractors overall commitment to environmental protection. This must start at the most senior levels in the organization. Contractor management must provide strong and visible leadership to promote a culture in which all employees share a commitment to environmental awareness and protection. The following are commitments to be achieved by the highest position in Pakistan from MHL:

- Putting environmental matters high on the agenda of meetings;
- Highlighting the importance of environmental issues in relation to the HSE considerations in business decisions and communication with stakeholders;
- Evaluating environmental aspects, before final decisions are reached;
- Being fully aware of the main environmental hazards associated with the Contractor and Sub Contractor activities and the systems, procedures and field practices in place to manage these hazards;
- Immediately and visibly responding and being involved in investigating incidents or other abnormal events related to environmental and HS issues;
- Seeking internal and external views on environmental issues; and recognizing their achievement.

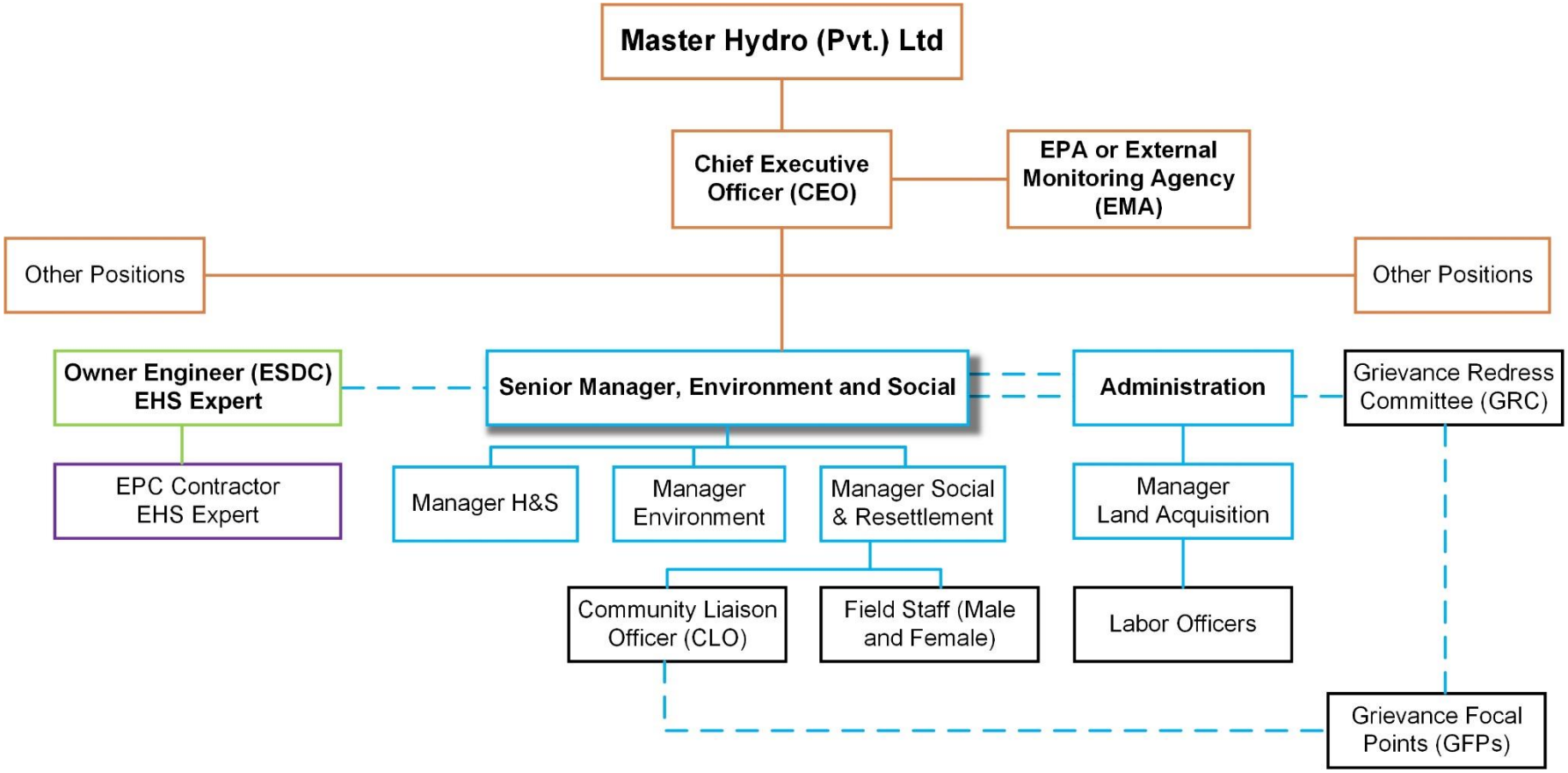
The organizational setup of MHL for implementation of the EMP is provided in **Exhibit 9.5**. Key roles and responsibilities are described below.

9.4.1 MHL

With overall responsibility for the Project, MHL will:

- Prepare the ESMS and implement the ESMS and EMP
- Minimize any impact the Project may have on the environment through preparation of this ESIA (as being carried out in the design stage)
- Appoint responsible contractors who will comply with this ESIA.
- Approve environmental safe materials for use on site in accordance with the ESIA
- Ensure all relevant parties receive a copy of the approved ESIA and that it is incorporated into all contractual documentation
- Obtain the relevant environmental permits, consents and authorizations prior to commencing site works
- Comply with all requirements of EPAs and obtain NOCs related to the Project.

Exhibit 9.5: Organizational Setup of MHL for EMP Implementation



9.4.2 Owner's Engineer

Hiring an owner's engineer (OE) in the power industry is a practice which is considered a standard since the last two decades.[2] The OE is a person or, more appropriately, a team of experts that serves as an independent advocate for the owner. The OE plays a supporting but a very critical role as he is the technically trained eyes and ears of the project proponents in the field. It is expected that an OE will also be hired for the Arkari Gol HPP construction and commissioning phases. The specific roles and responsibilities of the OE will be defined in their contract. Typically, there are several important environmental roles that the OE can undertake on behalf of MHL.

In general, following types of tasks can be assigned to the OE:

- Prepare technical specifications for design of environmental element
- Approval of technical design developed by the EPC Contractor of environmental elements of the Project
- Review and Approval of SSEMP
- Environmental Monitoring
- Review of the environmental monitoring reports and data produced by EPC.

Some role for the OE is suggested in this document. However, prior to commencement of construction a formal agreement will be reached between MHL and the OE on the latter's environmental role and responsibility.

9.4.3 Construction Contractor

The EPC or Construction Contractor will prepare a 'Construction Management Plan' (CMP) demonstrating the manner in which they will comply with the requirements of mitigation measures proposed in the EMP. After completion of the Construction Contractor's contract, MHL will be in charge of the operation and maintenance of the Project and will be responsible for compliance with the monitoring plan during operations. The Construction Contractor's general responsibilities will be to:

- Ensure the implementation of the ESIA/EMP throughout construction works by all contractor personnel and subcontractors
- Ensure that adequate resources are available to implement the requirements of this EMP
- Undertake quarterly environmental audits and report to MHL on regular basis
- To coordinate with MHL for all correspondence to EPAs
- Prepare a comprehensive legislation list and ensure compliance to these legislations.

[2] http://www.powermag.com/who-needs-an-owners-engineer/

9.4.4 Sub-Contractors

Any Sub Contractor hired directly or indirectly by the Construction Contractor to carry out Project related tasks will be designated as a subcontractor. It will be the responsibility of those sub-contractors, whose activities have at least one interface with identified key environmental aspects, to comply with the ESIA at all times. They must also designate sufficient competent resources to ensure all Sub-Contractor personnel receive the required training. Sub-Contractors directly in charge of activities shall be registered and approved. Registration documentation will be provided to MHL prior to commencement of any activities. Sub-Contractors will be expected to demonstrate a proactive behavior towards environmental concerns. It will be their responsibility to provide information requested by MHL with regard to their scope of activities and to demonstrate compliance with the applicable environmental requirements.

9.4.5 MHL Personnel

Chief Executive Officer

The Chief Executive Officer (CEO) will manage and superintend all office and site activities for the implementation of the Project. In relation to the ESIA and implementation of EMMS and EMP, the CEO's responsibilities will include:

- Overall responsibility for ensuring implementation of the EMP in compliance of all legal matters regarding the Project
- Development and establishment of adequate Environmental, Safety and Quality Management teams, who will ensure the development, communication and implementation of this ESIA across the entire Project, including all activities being undertaken by subcontractors and suppliers working on the site, and all personnel visiting the site
- Ensure that the Subcontractor has hired an environmental team (see **Exhibit 9.5**) to address environmental requirements in accordance with the ESIA.
- Develop and establish an organization structure adequate to oversee the whole of the works, including overseeing the appointment of an appropriate qualified HSE Manager and Environmental Manager
- Ensure that adequate resources are available to implement the requirements of this ESIA
- Ensure the ESIA is reviewed regularly to correspond with on-going construction activities
- Coordinate with government agencies and bodies regularly to discuss the Project's construction environmental issues and requirements
- Attend regular meetings with Manager EHS and CSR in order to discuss the site's environmental issues and requirements.

Chief Technical Officer

- Taking primary responsibility for all activities on site, including those undertaken by direct or indirectly employed personnel or agencies.
- Ensuring the issue of suitable procedures for the definition of working methods and site regulations that take into consideration the requirements within the ESIA.
- Ensuring that construction and erection works are performed in respect of the ESIA requirements.
- Attending regular meetings in order to discuss the site's environmental issues and requirements.

Manager HSE & CSR

The Manager HSE & CSR manages and supervises the Project activities relating to health, safety and environment. The HSE Manager will be responsible for:

- The overall responsibility for the development and implementation of the Project HSE policy/philosophy
- Coordinating weekly HSE meetings, during which any environmental issues will be discussed and minuted
- Reviewing and ensuring the implementation of Contingency and Emergency Response Procedure
- Providing specialized HSE input into engineering, construction and contracts, ensuring requirements are properly integrated into Project planning, design criteria, construction plans and specifications and contracts
- Supporting/leading incident investigations as per Project procedure and report to all concerned. Follow up and review the corrective and preventive action taken, and close-out the incidences
- Conducting HSE inspections of Project construction activities and monitoring compliance with requirements including contractual commitments, permits and projects HSE plan and other applicable HSE requirements and ensure that the Project HSE inspection plan is implemented
- Ensuring that all internal as well as external incidents and complaints are appropriately resolved with all applicable forms and records duly filled and maintained
- Coordinating and organizing regular meetings with the CEO, Construction Manager and Environmental Manager in order to discuss the site's HSE issues and requirements
- Coordinating the environmental activities with the higher management time to time
- Coordinating with the EPAs, other regulatory authorities and stakeholders on environmental issues related to construction of the Project

- Monitoring construction activities and performance to ensure compliance with the ESIA and effectiveness of control measures adopted
- Ensuring that no works are carried out outside the construction corridor as defined in the ESIA, especially within the protected areas (e.g. forests)
- Ensuring the issue and updating of the Project's environmental plans
- Coordinating Project document review activities from an environmental standpoint, assuring that the execution of these activities is compatible with development of the Project and reporting any discrepancies between the environmental requirements and other Project objectives to the Head Hydro Power and CEO
- Supplying essential information for the preparation of the environmental control plan for construction.
- Updating EPAs regularly on construction information
- Coordinate the development of environmental monitoring data relevant to construction activities
- Performing environmental checks and monthly internal audits of onsite activities, in coordination with the HSE Manager
- Supporting the higher management in relations with the governmental agencies and with the EPAs on environmental matters
- Implementing the environmental requirements of the project management system including inspection and reporting
- Monitoring construction activities and performance to ensure compliance with the Construction Management Plan and effectiveness of control measures adopted
- Developing and implementing of the environmental training program.
- Conducting staff environmental training, inductions and Tool Box Talks (TBT)
- Advise the Project Manager, or in his absence the relevant Construction Manager, to stop work which could, or is, causing unacceptable environmental impacts
- Communicate with internal and external parties as required
- Coordinating daily and weekly site inspections and approving the associated environmental inspection report
- Reviewing daily and weekly checklists to ensure that appropriate recording of site activities and observations
- Preparing of the monthly environmental reports, quarterly performance reports and incident reports
- Reporting of any environmental incidents to the higher management
- Ensuring that major environmental incidents are reported to KP-EPA within a maximum of 3 days
- Participating in environmental management reviews

- Reviewing environmental monitoring data
- Raise non-conformance and issue CAPs reports in coordination with the EHS Manager (MHL)
- Ascertaining that effective measures and relevant actions are undertaken to avoid or minimize adverse environmental impacts
- Attending regular meetings with the CEO and staff that reports to the Manger EHS and CSR (see **Exhibit 9.5**) in order to discuss the site's environmental issues and requirements
- Ensuring that all internal as well as external environmental incidents, emergencies and complaints are appropriately resolved with all applicable forms and records duly filled and maintained
- Regular reviewing of environmental plans and procedures to assess compliance and recommend revisions, where required
- Review reports provided by the Construction Contractor and submit periodic reports to EPAs

9.5 Mitigation and Management Plan

The first part of this section summarizes, as the mitigation and management plan, the mitigation measures for the Project as prescribed in the ESIA and divides the responsibilities for implementation of these measures. The second part describes additional management plans that must be developed to facilitate implementation.

9.5.1 Overall Mitigation Measures

The list of impacts is provided in **Exhibit 9.6**. Each impact is given a unique reference number so that, if required, the discussion in the **Section 7** (*Anticipated Environmental Impacts and Mitigation Measures*) can be referred back.

For the purpose of implementation, the measures are grouped as follows:

- Design Phase Mitigation Considerations (**Exhibit 9.7**) identifies the measures that need to be undertaken during detailed design of the project and during construction planning.
- Construction Phase Mitigation Plan (**Exhibit 9.8**) summarizes the mitigation measure that are required to be implemented during construction, the timing of implementation, responsibilities for implementation and monitoring indicators.
- Operation Phase Mitigation Plan (**Exhibit 9.9**) summarizes the mitigation measure that are required to be implemented during operation, the timing of implementation, responsibilities for implementation and monitoring indicators.

Exhibit 9.6: Impacts Assessed during the ESIA

Impact Reference	*Impact*
1	Loss of aquatic biodiversity due to creation of a low flow section downstream of the dam
2	Loss of aquatic biodiversity due to changes in ecological conditions downstream of the powerhouse as a result of release of water
3	Terrestrial habitat loss caused by construction of Project infrastructure
4	Decline in abundance and diversity of terrestrial flora and fauna caused by construction related activities.
5	Project operation leading to animal disturbance, displacement and decline.
6	Increase in ambient concentration of air pollutants from construction activities and vehicular movement may cause health impacts on the community.
7	Vibration from blasting during the construction phase may disturb local communities.
8	Blasting may pose a safety hazard due to flying debris.
9	Increase in ambient noise levels due to the operation of construction equipment, movement of construction traffic and blasting may create a nuisance for nearby communities and visiting tourists.
10	Alterations of natural passage of springs due to tunnel construction may disrupt the water availability at mountain springs for local community.
11	Damage to community irrigation channels may occur during construction especially during blasting of the headrace tunnel
12	Use of local water resources for construction activities may reduce the water availability for local communities.
13	Contamination of surface and groundwater due to discharge from the construction activities and sewage from the construction camps may affect agricultural productivity and human health.
14	Contamination of soil as a result of accidental release of solvents, oils, and lubricants can degrade soil fertility and agricultural productivity.
15	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.
16	Increased erosion and sediment load entering the river from bunds and sediment ponds during the construction phase and as a consequence of the failure of spoil dumping sites.
17	Deterioration of aesthetics and visual amenity of nearby receptors due to construction activities, including vehicular movement on roads, may cause a disturbance in aesthetics for nearby communities.
18	Permanent impact on aesthetics due to proposed developments.
19	Improved accessibility of locals due to construction of Project access roads.
20	Increase in congestion, due to increased traffic during construction will cause delays.
21	Increased risk to community safety due to increased traffic during the construction phase near communities.
22	Degradation of the pavement due to use by heavy construction traffic.
23	A potential flood and seismic hazard under natural extreme conditions for which the dam is not designed, albeit very unlikely, has potential to cause loss of life and damage to property.

Impact Reference	*Impact*
24	GHG emissions from dam construction will increase GHG concentration in the atmosphere thereby contributing to climate change
25	Direct, indirect and induced employment at the local level, resulting in increased prosperity and wellbeing due to higher and more stable incomes of people.
26	Increase in the stock of skilled human capital due to transfer of knowledge and skill under the Project resulting in enhanced productivity of local labor.
27	Decrease in productivity of agricultural fields due to unavailability of water for irrigation
28	Loss of assets and livelihood as a result of land acquired for the Project.
29	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.
30	Disputes over the distribution of Project employment within and between Study Area inhabitants and the in-migrants resulting in social unrest.
31	Potential social unrest in the Study Area due to conflicting socio-cultural norms amongst the inhabitants and in-migrants.
32	Religious conflicts due to different religious beliefs of workers and locals.

Exhibit 9.7: Design Phase Mitigation Considerations

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*
3	Terrestrial habitat loss caused by construction related activities	▶ Minimize disturbance to, or movement of, soil and vegetation ▶ Minimize project footprint. ▶ Retain as much natural vegetation as possible. ▶ Locate construction facilities based on a knowledge of the soil, slope and vegetation cover of the area to avoid disturbance to the natural environment.	During detailed design	EPC Contractor
4	Decline in abundance and diversity of terrestrial flora and fauna caused by construction related activities.	▶ Locate vehicle yards away from open soils and top soil stockyard ▶ Maximize use of locally-sourced aggregate and borrow material ▶ Minimize contact of non-local aggregate and borrow material with native soil. ▶ Minimize disturbance to, or movement of, soil and vegetation.	During detailed design	EPC Contractor
9	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.	▶ Use visual alarms in preference to audible alarms. ▶ Locate noisy equipment behind parking lots, parks or behind sound barriers or sound absorbers, for example, gravel stockpiles or constructed barriers. ▶ Maximize use of vibratory piling instead of impact piling. ▶ Erect earth mounds around the site boundary to provide acoustic as well as visual screening.	During detailed design	EPC Contractor
10	Alterations of natural passage of springs due to tunnel construction may disrupt the water availability at mountain springs for local community.	▶ Record location of the springs especially those in areas proximal to where the underground headrace tunnel will be closer to the ground level (see **Section 7.7** *Hydrology and Water Quality* for spring considered at risk).	During detailed design	Supervision Consultant
11	Use of local water resources for construction activities may reduce the	▶ Prepare a **Water Sourcing and Abstraction Plan** specifying the source, owner, total yield, current usage, allowable quantity and the duration for which water can be obtained.	During detailed design	EPC Contractor

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*
	water availability for local communities.	▶ To the extent possible avoid, and where unavoidable, minimize the use of water from local sources (springs) for the Project. Where local abstraction is unavoidable: ▷ Undertake an assessment of the local source identifying its total yield and current usage. If the abstraction from a single source extends three months, the assessment shall be repeated ▷ Fix the allowable quantity to not more than 50% of the available yield (total yield minus current usage) ▷ Enter into a formal agreement with the owner for the water source (or government if it is a public source).		
15	Increased erosion and sediment load entering river from bunds and sediment ponds during the construction phase and as a consequence of failure of spoil dumping sites.	▶ Dumping sites should not be in the path of 20-year return period flood. ▶ The EPC contractor should report the exact quantities of material to be dumped to the regulator ▶ the spoil dumping locations should be reported to the regulator ▶ The planning should accommodate dumping sites as close as possible to the construction area to avoid transport of spoil in large vehicles on public roads ▶ in case the spoil material is requested by private land owners for dumping on their land, the EPC Contractor should be able to negotiate with them to dump spoil	During detailed design	EPC Contractor
17	Permanent impact on aesthetics due to proposed developments.	▶ Develop and implement a Site Rehabilitation and Landscaping Plan. ▶ Use colors that better integrate with the landscape. ▶ Disguise elements with vegetation where possible. ▶ Retain as much natural vegetation as possible.	During detailed design	EPC Contractor
18	Improved accessibility of locals due to construction of Project access roads.	▶ Consult communities during final design and location of site access roads.	During detailed design	EPC Contractor

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*
19	Increase in congestion, due to increased traffic during construction will cause delays.	▶ Make roundabouts for the congestion points. ▶ Retain as much natural vegetation as possible to reduce the impact of smoke due to vehicles.	During detailed design	EPC Contractor
27	Decrease in productivity of agricultural fields due to unavailability of water for irrigation.	▶ Providing alternative source of water for irrigation, water flour mills and micro hydro power plant.	During detailed design	EPC Contractor
28	Loss of income from agricultural activity due to acquisition of agricultural land and assets for the Project.	▶ Implement Resettlement Action Plan (RAP)	Before construction	MHL
29	Increase in population due to in-migration of job seekers (in-migrants) leading to pressure on existing social infrastructure and services.	▶ Development of a Grievance Redressal Mechanism ▶ Encourage local communities to use the grievance procedure for concerns related to deterioration of local services. ▶ Support local government in the implementation of infrastructure projects. ▶ Support NGOs specializing in development of local infrastructure.	During construction	EPC Contractor
30	Disputes over distribution of Project employment within and between Study Area inhabitants and the in-migrants resulting in social unrest.	▶ Maintaining regular communication with local communities and other stakeholders to minimize tensions arising from Project activities; ▶ Maintaining a grievance procedure, and encourage and facilitate stakeholders to use the mechanism to express concerns; and ▶ Providing sufficient resources to the community relations officers to enable them to monitor negative perceptions and associated tensions, and to address them in a timely fashion.	During construction	EPC Contractor
31	Potential social unrest in the Study Area due to conflicting socio-cultural norms amongst the	▶ Development of a Grievance Redressal Mechanism ▶ Encourage local communities to use the grievance procedure for concerns related to deterioration of local services.		EPC Contractor

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*
	inhabitants and in-migrants	▶ A clause will be added in the contract that workers are to respect local norms and religious beliefs.		
32	Religious conflicts due to different religious beliefs of workers and locals.	▶ Development of a Grievance Redressal Mechanism ▶ Encourage local communities to use the grievance procedure for concerns related to deterioration of local services. ▶ A clause will be added in the contract that workers are to respect local norms and religious beliefs.		EPC Contractor
34	A potential flood and seismic hazard under natural extreme conditions for which the dam is not designed, albeit very unlikely, has potential to cause loss of life and damage to property.	The recommended mitigation and management measures include: ▶ Prepare an emergency preparedness and response plan for the Project that includes consideration of flooding, earthquake, evacuation procedure, co-ordination with local administration and communities. ▶ Maintain network of climate gauges in the Arkari catchment to monitor potential floods through WAPDA or in conjunction with other hydropower developers. ▶ Automated telemetric flow gauges can be installed upstream of the reservoir. This will allow the Arkari Hydropower operators to be well aware of any potential flooding conditions using upstream flow data, in addition to climatic conditions recommended above. ▶ Design Basis Earthquake included in the structural design for Powerhouse and weir. ▶ Design the river diversion facilities according to 10-years return period flood as per international practice. ▶ The design of the Project to be based on 1000 years return period flood.	During detailed design	MHL

Exhibit 9.8: Construction Phase Mitigation Plan

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
	Construction Impacts	► The **Site Specific Environmental Management Plan (SSEMP)** for each site will outline areas to be cleared, vegetated areas to be protected or fenced, slopes to be stabilized and solid waste disposal locations. ► Submit all SSEMP to Owner's Engineer for approval.	At start of construction	Site Managers of EPC	SSEMPs prepared before initiation of construction
1	Loss of aquatic biodiversity due to creation of a low flow section downstream of the dam	1. Maintain environmental flow as recommended in Project design 2. Regulate activities of the staff so that they do not engage in illegal exploitation of wildlife such as illegal fishing 3. Construction activities should be carried out whilst ensuring that there is no run-off of silt into the river and that the river is not contaminated to ensure that water quality is not affected 4. Limited subsistence fishing using rods and cast nets will be allowed through a permitting system.	During and after construction	EPC Contractor	Fish abundance and diversity
2	Loss of aquatic biodiversity due to changes in ecological conditions downstream of the powerhouse as a result of release of water	1. Design peaking operation to reduce impacts on aquatic ecology as recommended in the Eflow Assessment (see **Appendix M**) 2. Regulate activities of the staff so that they do not engage in illegal exploitation of wildlife such as illegal fishing 3. Construction activities should be carried out whilst ensuring that there is no run-off of silt into the river and that the river is not contaminated to ensure that water quality is not affected 4. The Project will help the Wildlife and Fisheries Departments by providing one field office, three motor cycles, 5 guards and 1 inspector to protect river biodiversity and terrestrial wildlife, subject to an agreement in which the responsibilities of the Project and the Departments are clearly defined and performance of the protections activities is independently monitored. Improvement in aquatic and terrestrial biodiversity through protection will partly offset the residual impacts of the Project on aquatic ecology 5. Limited subsistence fishing using rods and cast nets will be allowed through a permitting system.	During and after construction	EPC Contractor	Fish abundance and diversity

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
3	Terrestrial habitat loss caused by construction related activities	▶ Provide awareness training to staff and contractors on: prevention of injury of animals; identification of likely species (Snow Leopard, Himalayan Lynx, Grey Wolf, Asiatic Jackal, Red Fox, Flare-horned Markhor and Himalayan Ibex) found on site; identifications of animal hazards (such as venomous snakes); and what to do if dangerous animals are encountered. ▶ Solid waste should only be disposed of at designated sites and a Waste Management Plan developed and implemented. ▶ Prepare an Environmental Training Plan that contains awareness training to staff and contractors on: prevention of injury of animals; identification of likely species (Snow Leopard, Himalayan Lynx, Grey Wolf, Asiatci Jackal, Red Fox, Flare-horned Markhor and Himalayan Ibex) found on site; identifications of animal hazards (such as venomous snakes); and what to do if dangerous animals are encountered. Also see guidelines for the Environmental Training Plan in IR 5. ▶ Regulation of poaching of wildlife species (Snow Leopard, Himalayan Lynx, Flare-horned Markhor, Himalayan Ibex and other water fowls). ▶ Close coordination with the wildlife and fisheries departments ▶ Facilitating government department staff when they arrive at the site for example providing them accommodation and vehicles. ▶ Encourage personnel to report sightings of wildlife of conservation importance or incidents of poaching to MHL. MHL to report incidents of poaching and illegal fishing to concern government departments.	During construction	EPC Contractor	SSEMPs prepared before initiation of construction Visual confirmation of replantation Waste Management Plan Environmental Training Plan

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		▶ Minimize disturbance to, or movement of, soil and vegetation. ▶ Prevent soil damage and erosion. ▶ Prevent Alien Invasive Species (AIS) establishment on exposed stored soil (do not store bare soil near known sources of AIS). The habitat most at risk is the Riparian Habitat. The species that are highest risk include Marijuana, Strumarium and Castor Oil Plant. These invasive plant species are quite common in the lower parts of the Aquatic Study Area. ▶ Train and raise awareness regarding AIS among Project staff and contractors. ▶ Retain as much natural vegetation as possible. ▶ Solid waste should only be disposed of at designated sites. ▶ Minimize the project footprint, clearly delineate and restrict access beyond work sites and other areas to be disturbed. ▶ Within the quarry and borrow areas, activities will be restricted to areas at a distance from perennial water channels so as to avoid disturbances to them including the risk of siltation.			
4	Decline in abundance and diversity of terrestrial flora and fauna caused by construction related activities.	▶ Large flood lights should not be installed outside 50 m of the Project fence. ▶ Lights should be directed towards Project facilities and not towards the natural habitats. ▶ Regulations for Project staff and contractors to avoid illegal poaching to be incorporated in contract documents. ▶ Provide awareness training to staff and contractors on: prevention of injury of animals; identification of likely	Before and during construction	EPC Contractor	Environmental Training Plan Training Schedule Evidence of trainings and attendance lists Provision of required regulations in contract documents. Evidence of tree planting to required levels and yearly survival records.

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		species (Snow Leopard, Himalayan Lynx, Grey Wolf, Asiatic Jackal, Red Fox, Flare-horned Markhor and Himalayan Ibex) found on site; identifications of animal hazards (such as venomous snakes); and what to do if dangerous animals are encountered. ▶ Incorporate regulations for Project staff and contractors to avoid illegal poaching in contract documents. ▶ Provide adequate knowledge to the workers on relevant government regulations and punishments for illegal poaching. ▶ Encourage personnel to report sightings of wildlife of conservation importance or incidents of poaching to MHL ▶ Project staff and contractors to report kills of large mammals particularly designated species (Snow Leopard, Grey Wolf and Flare-horned Markhor) of conservation concern. ▶ Train and raise awareness regarding AIS among Project staff and contractors. ▶ The Contractor shall prepare an **Environmental Training Plan** for all construction workers: the Plan shall address the following items: ▶ All Contractor's employees shall be required to comply with environmental protection procedures and they shall be able to provide evidence that they attended the training sessions detailed in the Plan; ▶ The Plan shall educate all construction workers on the following issues but not limited to them: fire arm possession, traffic regulations, illegal logging and collection of non-timber forestry products, non-disturbance of resettlement communities, hunting and fishing restrictions, waste management, erosion control,			

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		health and safety issues, all prohibited activities, the Code of Conduct requirements and disciplinary procedures, and general information on the environment in which they will be working and living; ▶ Establishment of penalties for those who violate the rules; ▶ Proposed methods for conducting the training program, which shall include formal training sessions, posters, data in newsletters, signs in construction and camp areas and 'tool box' meetings. ▶ Equipment emitting excessive noise in comparison with other similar equipment will not be allowed to operate. ▶ Equipment under use will be regularly maintained, tuned, and provided with mufflers to minimize noise levels. ▶ Equipment in poor state of maintenance, particularly without effective noise control will be checked to determine if it can be improved, and replaced with less noisy equipment as soon as practicable. ▶ Blowing of horn will be prohibited on all sensitive areas except under emergency conditions. ▶ Enforce speed limits in ecologically sensitive areas if identified ▶ Compensatory trees will be planted. The EPC Contractor will plant a minimum of ten trees for each tree removed in acquired land. ▶ MHL will monitor and maintain the vegetation until it is established.			
6	Increase in ambient concentration of air pollutants from construction activities	▶ Develop and implement an **Air Pollution Control Plan**. ▶ Prepare a Site Specific Environmental Management Plan (SSEMP) for each construction site that must	Before and during construction	EPC Contractor	SSEMP documents prepared before initiation of construction

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
	and vehicular movement may cause health impacts on the community.	outline areas to be cleared, vegetated areas to be protected or fenced, solid waste disposal locations, and sprinkling locations. All appropriate measures indicated in Generic **Construction Site Environmental Management Plan** (CSEMP) (**Appendix N**) should be incorporated in the SSEMP. **Fugitive and exhaust emissions from transport vehicles** ▶ Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard (i.e., the minimum required space between the top of the load and the top of the trailer). ▶ Install and maintain appropriate emission control equipment on vehicles and machinery. ▶ Regularly maintain vehicles and equipment to keep emissions in check. ▶ Smoke from internal combustion engines should not be visible for more than ten seconds. ▶ Use new and low emission equipment and vehicles to the extent possible. ▶ Purchase best quality fuel and lubes and where possible use lead free oil and lubes. ▶ Sprinkle water on all unsealed roads used by Project vehicles that are within 200 m of any settlement. ▶ Cover loads and long-term piles of friable material to reduce fugitive dust emission. ▶ Reduce traffic speeds on all unpaved surfaces to 15 miles per hour or less to avoid dust emissions from vehicular movement. ▶ Paved roads shall be swept frequently if soil material has been carried onto adjacent paved, public thoroughfares from the Project site.			Air Pollution and Control Plan Continuous observation for non-compliance Vehicle and equipment maintenance logs

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		► Install wheel washers where vehicle exit onto paved road from unpaved and prior to each trip. **Fugitive dust emissions from blasting** ► Indicate the limits of a clearing land with highly visible markers. ► Leave a layer of about 5 m of undisturbed softs above the top of the overburden blasts. This will act as a blanket to contain air blast, dust and fly rock. ► Sprinkle water on the area where blasting is done to settle down the particulate matter emissions. **Fugitive dust emissions from quarry areas** ► Indicate the limits of a clearing land with highly visible markers. ► Avoid earth stripping or moving in periods of dry and windy weather. ► Carry out dust generating activities where maximum protection can be obtained through topography or in areas where prevailing winds will blow dust away from sensitive areas/uses. ► Water spraying of conveyors/conveyor transfer points, stockpiles and roads. ► Covering of fine dry loads or spraying of loads prior to exiting the site, and if necessary regular cleaning of public roads in the vicinity of the entrance. **Fugitive dust emissions from concrete batching plants** ► Suspend earthwork operation when wind speed exceeds 20 km per hour. ► The whole process of weighing and mixing would be performed in a fully enclosed environment. ► The mixers should be equipped with dust collectors.			

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		▶ Site the concrete batching plant out of prevailing high winds to minimize dust emissions. ▶ Consider the prevailing wind direction when siting the batching plant. ▶ Ensure that bunkers and conveyors are sited in the leeward direction to minimize the effects of the wind. ▶ Consider the natural wind barriers such as trees and landforms to help control the emission of dust from the batching plant. ▶ Batching plants should be sited on land that is not flood prone. **Fugitive dust emissions from aggregate production and handling system** ▶ Suspend operation when wind speed exceeds 20 km/hr. ▶ Consider prevailing wind direction to ensure that aggregate handling systems located in the leeward direction to minimize the effects of the wind. ▶ Sprinkle water on all exposed surfaces, particularly those close and up-wind of settlements. **Wind-blown dust from exposed surfaces such as bare land, stockpiles and waste dumping sites** ▶ Cover all exposed surfaces, particularly those close and up-wind of settlements. ▶ Suspend all grading operations on a Project when winds exceed 20 km per hour. ▶ Minimize disturbance to, or movement of, soil and vegetation. ▶ Sprinkle water on all exposed surfaces, particularly those close and up-wind of settlements. ▶ Retain as much natural vegetation as possible.			

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		▶ Cover on-site dirt piles or other stockpiled areas. ▶ Install wind breaks and employ water and/or soil stabilizers to reduce wind-blown dust emissions. ▶ Adequately wet, cover with plastic, or provide with wind shield all stockpiles to reduce dust emission.			
7	Vibration from blasting during the construction phase may disturb local communities including annoyance, sleep disturbance and potentially damage the structure.	▶ Develop a **Blasting and Explosives Management Plan** and Vibration Monitoring Plan. ▶ Conduct a pre-construction survey of structures at risk of vibration impacts households. ▶ In the initial stages, the blasting induced vibration shall be measured as a function of maximum instantaneous charge and distance from the blasting site. This data shall be then used to refine the Blasting Induced Vibration Risk Zones on the basis of the adopted criteria. ▶ Using, the refined Blasting Induced Vibration Risk Zones maps and the tunnel boring schedule, the Supervision Consultant in consultation with the MHL and the Construction Contractor, shall identify the houses that will be affected and the impact duration and schedule. ▶ For the houses that will fall in the Structural Damage Risk Zone, a temporary relocation plan will be developed. An amendment to the Resettlement Action Plan (RAP) will be commissioned for this purpose. Before start of blasting, all residents of houses in the Structural Damage Risk Zone will be relocated as per the RAP. Temporary relocation means relocation while blasting is being conducted while too close to the houses, and depends on the blasting schedule. It is likely that no houses are near enough to be classified as	During Construction	EPC Contractor	Blasting and Explosives Control Plan document Blasting timetable available in nearby villages Results of preconstruction survey Availability of GRM

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		within the Structural Damage Risk Zone due to the low population density in the area. ▶ A survey will be undertaken in both zones, to determine the pre-blasting conditions of the buildings. The survey will be commissioned by the Supervision Consultant and will identify and record any existing damage to the structures. The survey will cover the following aspects: ▷ Overall condition of the structures, both exterior and interior. ▷ Documentation of defects observed in the structure using digital imagery along with notes, measurements and sketches. ▷ Documentation of pre-existing cracks using digital imagery along with notes, measurements and sketches. ▶ Following completion of the blasting, the survey will be repeated in the Structural Damage Risk Zone to determine the condition of the buildings and verify that they are safe for re-occupation. If the buildings are safe, the residents will be allowed to return to their houses following any necessary damage repairs. If the buildings are damaged beyond repair, compensation will be paid to the owners as per the LARP. If there are any claims or reports of damage in the Cosmetic Damage Risk Zone, the affected house will be surveyed against the pre-Project survey and repairs will be undertaken as appropriate. ▶ Following are key mitigation measures for the management of blasting: ▷ Blasting will be scheduled during the day only. ▷ Local communities will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule. ▷ A Blasting Management Plan will be developed by the Construction Contractor. The Plan will be reviewed and			

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		approved by the Supervision Contractor before the initiation of the blasting work. ▷ Throughout the blasting activity, vibration sensors will be installed at strategic location to monitor the impact of blasting and to ensure that the vibration levels are within the adopted criteria. The monitoring plan will be part of the Blasting Management Plan. ▷ Unscheduled blasting will be strictly prohibited in any case. ► Meaningful contact with the community shall be maintained and their grievance shall be attended to in a timely manner. In this regard: ▷ A meaningful community engagement plan will be developed. The plan will cover identify the affected community; the key contact persons; frequency of engagement; the information to be shared; the responsibilities to manage the plan; and the notice period to be giving to the community for various blasting related generating activities. ▷ The Grievance Redress Mechanism will be used to record, investigate, and respond to any complaints. Investigation of the complaints will be undertaken by the Supervision Consultant. ► Develop a **Vibration Monitoring Plan** that will include monitoring of vibration levels and frequency around the blasting sites. The objectives of the monitoring will be to: ▷ Ensure that vibration levels in the communities are within the adopted criteria levels; ▷ Maintain record of vibration to settle any potential conflicts; and ▷ Monitor changes in the vibration levels due to possible changes in the rock formation and take appropriate corrective actions.			
8	Blasting may pose a health and safety	► A minimum buffer of 500 m should be provided between the settlements and point of blasting or if not possible then these settlements should be temporarily evacuated	During Construction	EPC Contractor	Blasting and Explosives Control Plan document

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
	hazard due to flying debris.	during blasting. Temporary relocation means relocation while blasting is being conducted while too close to the houses, and depends on the blasting schedule. ▶ Leave a layer of about 5 m of undisturbed softs above the top of the overburden blasts. This will act as a blanket to contain air blast, dust and fly rock. ▶ Ensure that the holes are correctly collared with respect to the back-break/inclination of the face and also that digging alongside the initiation face well controlled. ▶ Inadequate forward displacement of the front row burden arising out of the under charging of these holes will result in fly rock from vertical catering of the rear holes. ▶ Where fly rock possess a serious problem, the stemming length should not be less than the hole burden. Also an effective stemming material like crushed angular rock should be used to prevent premature venting of explosion gases through the stemming column. ▶ The forward fly rock could be fairly controlled to the commonly used 'inline open loop' pattern. The maximum inter-row delay interval consistent with the absence of cut off helped in minimizing the fly rock formation. As a thumb rule an inter-row delay of 4-8ms/m of burden could be used for this purpose. ▶ Adequate care should be taken while connecting the delay devices in the holes/rows and the initiation sequence properly checked before firing to avoid initiation of blast holes out of sequence. ▶ Blasts designed on a face length to width ratio in the range of 3 to 4 produces minimum fly rock.			Blasting timetable available in nearby villages Results of preconstruction survey Availability of GRM

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
9	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	► Develop a Noise and Vibration Control Plan **Noise generated from construction sites from construction activities** ► Select the quietest available plant and equipment that can economically undertake the work required. ► Undertake maintenance of the equipment as simple maintenance can reduce noise levels by as much as 50%. Parts may become loose, creating more noise because of improper operation or scraping against other parts. Grinding noises may also occur as the result of inadequate lubrication. ► Maintain equipment under use regularly. ► Install mufflers on the equipment to minimize noise levels. ► Use visual alarms in preference to audible alarms. ► Enclose noisy equipment. ► Provide noise attenuation screens, where appropriate. ► Build an enclosure around the noise source so that noise is contained. The enclosure should be free from gaps and made of dense material and be lined with noise-absorbing material like glass or polyester batts. ► Locate noisy equipment behind parking lots or parks. ► Close liaison with the community and regular monitoring of the noise levels in the community are key to successfully implementation of the above mitigation measures. Specifically, inform communities of all major construction activities three days in advance.	During Construction	EPC Contractor	Noise and Vibration Control Plan document Maintenance record of equipment Records of community meetings regarding noise. Noise level monitoring in nearby communities

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		Construction noise from traffic ► Install residential class mufflers and silencers to the mobile plants such as excavators, front-end loaders and other diesel-engine equipment as applicable. ► Construct paved Project access roads and locate where the gradient is low. ► Implement special noise reduction measures, such as erecting purpose-built acoustic barriers, restricting opening hours and maintaining transport vehicle. **Construction noise from on-site plant operations and equipment** ► Select plant equipment appropriately that required minimal mitigation. ► Install mufflers and silencers on the equipment and provide acoustical enclosures. ► Modify the equipment or the work area to make it quieter by substituting existing equipment with quieter equipment; retro-fitting existing equipment with damping materials, mufflers, or enclosures; erecting barriers; and maintenance. ► Shift to a quieter construction process for example pile driving is very loud as compared to boring which is a much quieter way to do the same work. ► Combine noisy operations to occur in the same time period. The total noise level produced will not be significantly greater than the level produced if the operations were performed separately. ► Maintain and monitor plant and equipment regularly. ► Move static plant and equipment as far as possible from sensitive boundaries, as work allows. A distance of four			

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		times further away lowers the noise by 12 dBA. A reduction of 10 dBA will sound half as loud. ▶ Provide baffles and specialized mufflers, and acoustic enclosures to the plant and equipment. ▶ Design and built acoustic barriers if needed. Vegetated buffer zones can also be planted to mitigate noise from operations using suitably selected native plantings local to the area. ▶ Reduce workers' exposure to high noise levels by keeping moving workers away from the noise source; restricting access to areas; rotating workers performing noisy tasks; and shutting down noisy equipment when not needed. ▶ Use earplugs to reduce workers' exposure to high noise levels. **Noise generated from the blasting in quarry areas** ▶ Use vibratory piling instead of impact piling. ▶ House conveyor belts and crushing/screening equipment to provide acoustic screening. ▶ Ensure that the noise-reduction equipment fitted to machinery is used and maintained properly. ▶ Erect earth mounds around the site boundary can provide acoustic as well as visual screening. **Noise emissions from concrete batching** ▶ Locate noisy equipment behind sound barriers or sound absorbers – for example, gravel stockpiles or constructed barriers. ▶ Install silencing devices to all pressure operated equipment.			

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
10	Alterations of natural passage of springs due to tunnel construction may disrupt the water availability at mountain springs for local community.	▶ Record location of the springs especially those in areas proximal to where the underground headrace tunnel will be closer to the ground level. ▶ Monitor flow for identified springs and maintain records and ensure the availability of water to the communities and the access of the communities to the water resources being used by them is not adversely affected. Provide water to communities where needed to offset any disturbance. ▶ Support the community in development of alternate water supply schemes through local NGOs	During construction	EPC Contractor	Flow records of identified springs
	Damage to community irrigation channels may occur during construction especially during blasting of the headrace tunnel	▶ Document the current status of the irrigation channels. Record location of the springs close to the Project construction site. ▶ Engage local communities through GRM for periodic monitoring of the status of the channels. ▶ If the channel is damaged, then provide support for fast and complete repair.	During construction	EPC Contractor	Monitoring records of the Irrigation Channels Presence of GRM
11	Use of local water resources for construction activities may reduce the water availability for the local communities.	▶ Develop a Water Sourcing and Abstraction Plan ▶ Source water for construction from authorized abstraction sources agreed between the local communities, local government and EPC contractor. ▶ Water conservation techniques will be developed and implemented by the EPC contractor. ▶ Access of community to water sources shall be kept clear so that the community's ability to meet its water requirements are not compromised. ▶ Exercise care while moving heavy machinery to avoid damage or blockage of natural waterways and channels.	Before and during construction	EPC Contractor	Agreements documents for water use. Water Sourcing and Abstraction Plan Water use record documents

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		▶ Maintain records of water usage in all Project activities. ▶ Incorporate the above measures in the Construction SSEMP			
12	Contamination of surface and groundwater due to discharge from the construction activities and sewage from the construction camps may affect agricultural productivity and human health.	▶ Develop and implement a Water Quality Management Plan. ▶ Develop and implement a Hazardous Material Management Plan. ▶ Prepare and implement a **Waste Management Plan**. ▶ Prepare and implement a **Spill Prevention and Response Plan** and inducted to the staff for any incident of a spill. ▶ Septic treatment facility will be developed at each camp and construction site to manage waste generated on-site. ▶ Provide and use spill prevention trays at refueling locations. ▶ Collect runoff from maintenance workshops using impervious channels and pass through oil water separators (OWS) before final disposal. Properly dispose of the sludge and oil collected at the OWS. ▶ Build separate impervious pits (with concrete walls and proper shed) at the construction sites for temporary handling and storage of contaminated soil and water if encountered during construction such as sludge from OWS. ▶ Keep all fuel storage tanks and lubricating oil drums in secondary containment impervious pits with impervious shed walls. ▶ Avoid on-site maintenance of construction vehicles and equipment, as far as possible.	During Construction	EPC Contractor	Water Quality Management Plan documents Spill Prevention and Response Plan document Visual implementation of mitigation measures such as use of spill prevention trays and proper storage of fuel storage. Record of spills and remedial actions taken

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		▶ Regularly inspect construction vehicles and equipment to detect leakages. ▶ Store fuels and lubricants in covered and dyked areas, underlain with impervious lining. ▶ Spill control kits (shovels, plastic bags, and absorbent materials) will be available near fuel and oil storage areas, vehicle parking, and vehicle maintenance areas as well as at construction sites. ▶ Remove contaminated soil from the site and dispose of in a manner to ensure the protection of water sources. ▶ Construct the bottom of any soak pit or septic tank at least 100 m away from springs and water bores. ▶ Maintain records of spills and volume of removed contaminated soil. ▶ Maintain a record of remedial measures taken. ▶ Use silt traps to prevent contamination of river and streams. ▶ Mechanical works and shops, secondary containment (>110% of volume) for storage and use of paints and other hazardous materials should be done over impermeable surfaces. ▶ Incorporate the above measures in the Construction Site Environmental Management Plan			
ee	Contamination of soil as a result of accidental release of solvents, oils and lubricants can degrade soil fertility and agricultural productivity.	▶ Prepare a **Spill Prevention and Response Plan** and induct to the staff for any incident of spill. ▶ Appropriately mark fuel tanks by content and store in dyked areas with an extra 10% of the storage capacity of the fuel tank. The area will be lined with an impervious base.	During Construction	EPC Contractor	Spill Prevention and Response Plan document Visual verification of conformance

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		▶ Install grease traps on the site, wherever needed, to prevent flow of oily water. ▶ Spill cleaning kit (shovels, plastic bags and absorbent materials) will be available near fuel and oil storage areas. ▶ Carry cleanup kits in all fuel trucks. ▶ Fueling should only take place over impermeable surfaces, other hazardous materials should be stored and used over impermeable surfaces. ▶ The bottom of any soak pit or septic tank shall be at least 10 m above the groundwater table. The distance can be reduced, based on the soil properties, if it is established that distance will not result in contamination of groundwater.			
14	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.	▶ Develop a Surface Runoff, Site Restoration and Erosion Control Plan. ▶ Limit vegetation loss to demarcated construction area. ▶ Cover areas such as muck disposal area, batching plant, labor camp and quarry sites after the closure shall with grass and shrubs. ▶ Adopt slope stabilization measures such as adequate vertical and horizontal drains, drainage along roadsides, cross drainage and retaining walls. ▶ Monitor slope movements around excavation work areas. ▶ Salvage, store, and reuse all topsoil at all construction sites. ▶ The height of the stockpile will be minimized to the extent possible by increasing the size of the land for the stockpile.	During Construction	EPC Contractor	Erosion Control Plan document

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		▶ Topsoil will be carefully stripped to ensure that it is not mixed with subsoil. The stockpiles will be revegetated to minimize loss of soil quality, minimizing weed infestation, maintaining soil organic matter levels, maintaining soil structure and microbial activity. ▶ Topsoil stockpiles will be clearly signposted for easy identification and to avoid any inadvertent losses. ▶ The establishment of declared plants on the stockpiles will also be monitored and control programs implemented as required. The topsoil will be treated with temporary soil stabilization and erosion control measures. ▶ During removal of topsoil stockpile for restoration of project affected areas, it is preferred that the soil is removed in layers (less than 0.5 m thick) under a gradual process. The top layer will be mixed with the remainder of the stockpile to ensure that living organisms are distributed throughout the topsoil material at the time of final placement. The use of micro-organism inoculates may be necessary to re-establish micro-organisms in topsoil material. ▶ Select local species for plantation to restore the biodiversity of the area in consultation with Forest Department after completion of respective activities.			
15	Increased erosion and sediment load entering river from bunds and sediment ponds during the construction phase and as a consequence of failure of spoil dumping sites.	**Mitigation measures:** 1. Design sedimentation ponds and dumping sites to a have a flood prevention design for a 20-year flood since the dumps will be left in place permanently. 2. Periodically remove sediments from bunds and sedimentation ponds before monsoon and after each large flood. 3. Maintain and monitor the sedimentation ponds to avoid sediment introduction in the river.	During construction	EPC Contractor	Spoil Disposal Plan Document

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		4. Undertake vegetation restoration works at all dumping sites including surface leveling, covering and forest/grass planting or agricultural land rehabilitation 5. Monitor slope movements excavation work areas. 6. Restore to the maximum extent possible the hydrological regime and reinstate natural drainage of the land (including provisions to maintain the water balance of the site and protect from flooding where appropriate) 7. Reinstate topsoil (in case it was stripped before construction activities) 8. Revegetate sites with suitable native plant species 9. Drain spoil piles to prevent the concentration of flow and to prevent rill and gully erosion 10. Separate organic material (e.g., roots, stumps) from the dirt fill and store separately. Place this material in long-term, upland storage sites, as it cannot be used for fill. 11. Store “clean” material in a short-term disposal site (stockpile) if it will likely be re-used for fill. 12. Recycle asphalt material in embankments and shoulder backing, where possible. Place these materials where they will not enter the stream system. Asphalt that is 5 years old is considered “inert” (that is, all oils washed off). 13. Do not add excess unusable material to permanently closed sites. 14. Spread material not to be re-used in compacted layers, generally conforming to the local topography. 15. Design the final disposal site reclamation topography to minimize the discharge of concentrated surface water and sediment off the site and into nearby watercourses. Cover the compacted surfaces with a 6-inch layer of organic or fine-grained soil, if feasible. 16. After placement of the soil layer, track walk the slopes perpendicular to the contour to stabilize the soil until vegetation is established. Track walking creates indentations that trap seed and decrease erosion of the reclaimed surfaces.			

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		17. Revegetate the disposal site with a mix of native plant species. Cover the seeded and planted areas with straw compost, mulched with straw at a rate of 1 to 1 ½ tons per netting or similar erosion control fabric on slopes greater than 1:2 if site is erosive. 18. Locate stockpiles away from drainage lines, at least 10 meters away from natural waterways and where they will be least susceptible to wind erosion. 19. Ensure that stockpiles and batters are designed with slopes no greater than 1:2 (vertical\ horizontal). 20. Regularly rehabilitate areas not in use for Project activities during construction to minimize erosion. This includes regrading and immediate revegetation (using fast-growing species and different functional groups of plants for keeping soil in place) of slopes to minimize erosion. 21. Install erosion and sediment control measures, if possible before construction commences. Identify drainage lines and install control measures to handle predicted storm water and sediment loads generated in the mini-catchment. 22. Establish an adequate inspection, maintenance and cleaning program for sediment runoff control structures. Ensure that contingency plans are in place for unusual storm events. 23. Continually assess the effectiveness of sediment control measures and make necessary improvements. 24. Keep temporary disposal sites out of wetlands, adjacent riparian corridors, and ordinary high water areas as well as high risk zones, such as 100-year floodplain and unstable slopes. 25. Anticipate sufficient storage area with no risk for sediment delivery for piles that may slump. Stress cracks indicate that the pile is at risk of slumping. ► Incorporate the above measures in the Spoil Disposal Plan			
16	Deterioration of aesthetics and visual amenity of nearby	► Minimize disturbance to, or movement of, soil and vegetation.	During detailed design	EPC Contractor	Covers used to disguise equipment.

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
	receptors due to construction activities, including vehicular movement on roads, may cause disturbance in aesthetics for nearby communities.	▶ Back fill to original levels. ▶ Reshaping to match in with surrounding topography. ▶ Reinstate vegetation around construction sites.			Visual compliance
17	Permanent impact on aesthetics due to proposed developments.	▶ Develop and implement a Site Rehabilitation and Landscaping Plan. ▶ Use colors that better integrate with the landscape. ▶ Disguise elements with vegetation where possible. ▶ Retain as much natural vegetation as possible.	During detailed design	EPC Contractor	Site Rehabilitation and Landscaping Plan
19	Increase in congestion, due to increased traffic during construction will cause delays.	▶ Make roundabouts for the congestion points. ▶ Retain as much natural vegetation as possible to reduce the impact of smoke due to vehicles. ▶ The vehicles going on the spoil routes and passing through the communities must be completely covered to avoid dust emissions. ▶ Strictly implement speed limits and defensive driving policies.	During construction	EPC Contractor	Traffic Management Plan
21	Increased risk to community safety due to increased traffic volume during the construction phase near communities.	▶ Develop and implement a Traffic Management Plan. ▶ Identify suitable times to transport equipment. ▶ Road safety awareness education will also be included during community visits or information sessions, so that communities can be familiarized with common road signs and the types of vehicles and equipment that will be moving through the area. ▶ Keep speeds slow (30 km/hr) where there is traffic exchange between roads. ▶ Make roundabouts for the congestion points.	During construction	EPC Contractor	Traffic Management Plan

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		▶ Designate traffic wardens at roads on the transport route to manage traffic during school hours. ▶ Construction traffic will not travel during school starting and ending hours on designated road segments in front of schools on the transport route. ▶ Strictly implement speed limits and defensive driving policies. ▶ Maintain vehicles especially brakes.			
22	Degradation of the pavement due to use by heavy construction traffic	Promptly and properly repair and maintain roads that are subject to damage by Project activities.	During construction	EPC Contractor	Number of observations of pavement damage in areas with heavy Project-related traffic.
	GHG emissions from dam construction will increase GHG concentration in the atmosphere thereby contributing to climate change.	1. Implement a Reservoir Clearing Plan	During construction	EPC Contractor	
25	Direct, indirect and induced employment at the local levels, resulting in increased prosperity and wellbeing due to higher and stable incomes of people.	**Enhancement measures**: ▶ Ensure preferential recruitment of local candidates provided they have the required skills and qualifications. ▶ Include an assessment of the contractor's demonstrated commitment to domestic and local procurement and local hiring in the tender evaluation process. ▶ Coordinate recruitment efforts related to non-skilled labor, including for non-skilled labor positions required by contractors. **Good practice measures**: ▶ Determine what is considered to be 'fair and transparent' in recruitment and in distribution of jobs	During construction	EPC Contractor	Contractual documents Number and ratio of local employees to non-local employees

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		between different community groups, in consultation with local communities and their leaders.			
26	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.	▶ Support a 'Vocational Training Program' to assist local people to qualify for semi-skilled positions focusing on issues such as procurement, involvement of vulnerable groups in Project opportunities and continual professional development of staff. ▶ Assist local people having practical skills but lacking qualifications to obtain their certificates and thus increase their employment opportunities. ▶ Support initiatives promoting a culture of learning in local communities. ▶ Plan and implement training program for vulnerable groups to encourage their participation in economic opportunities created by the Project. ▶ Assist employees and local communities to improve basic personal financial life skills through training and awareness campaigns, respectively. ▶ Consider further training programs to prepare retrenched workers to seek employment in sectors not related to dam construction.	During construction	EPC Contractor	Vocational Training Program document including annual schedule. Budget allocation for trainings. Documentary evidence including photographs and attendance lists of trainings.
27	Decrease in productivity of agricultural fields due to unavailability of water for irrigation	▶ Rehabilitation of Watercourses damaged or affected by the project.	During construction	MHL/ EPC Contractor	See RAP
28	Loss of assets and livelihood as a result of land acquired for the Project.	▶ Implement RAP	Before construction	MHL/Land Acquisition Collector	See RAP
29	Increase in population due to in-migration of job seekers (in-	▶ Develop an Influx Management Plan ▶ Development of a Grievance Redressal Mechanism	During construction	EPC Contractor	Grievance register and records Influx Management Plan

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
	migrants) leading to pressure on existing social infrastructure and services.	▶ Encourage local communities to use the grievance procedure for concerns related to deterioration of local services. ▶ Support local government in the implementation of infrastructure projects. ▶ Support NGOs specializing in development of infrastructure to assist local government.			
30	Disputes over distribution of Project employment within and between Study Area inhabitants and the in-migrants resulting in social unrest.	▶ Implement Stakeholder Engagement Plan including: ▷ maintaining regular communication with local communities and other stakeholders to minimize tensions arising from Project activities; ▷ maintaining a grievance procedure, and encourage and facilitate stakeholders to use the mechanism to express concerns; and ▷ providing sufficient resources to the community relations officers to enable them to monitor negative perceptions and associated tensions, and to address them in a timely fashion.	During construction	MHL/ EPC Contractor	Stakeholder Engagement Plan Minutes of community and stakeholder consultations Provision in budget for activities.
31	Potential social unrest in the Study Area due to conflicting socio-cultural norms amongst the inhabitants and in-migrants	▶ Development of a Grievance Redressal Mechanism ▶ Encourage local communities to use the grievance procedure for concerns related to deterioration of local services. ▶ A clause will be added in the contract that workers are to respect local norms and religious beliefs.	During construction	MHL/ EPC Contractor	Grievance register and records Influx Management Plan
32	Religious conflicts due to different religious beliefs of workers and locals.	▶ Development of a Grievance Redressal Mechanism ▶ Encourage local communities to use the grievance procedure for concerns related to deterioration of local services. ▶ A clause will be added in the contract that workers are to respect local norms and religious beliefs.	During construction	MHL/ EPC Contractor	Grievance register and records Influx Management Plan

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
24	GHG emissions from dam construction.	▶ Implement a Reservoir Clearing Plan ▶ Offsets for emissions from vehicles include: ▶ Make sure vehicles are maintained ▶ Regular inspection of vehicle exhaust emissions to meet required NEQS standard for exhaust emissions	During Construction	EPC Contractor	Reservoir Clearing Plan document Vehicle inspection log and results

Exhibit 9.9: Operation Phase Mitigation Plan

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
1	Loss of aquatic biodiversity due to creation of a low flow section downstream of the dam	▶ Maintain environmental flow as recommended in Project design ▶ Regulate activities of the staff so that they do not engage in illegal exploitation of wildlife such as illegal fishing and poaching ▶ Construction activities should be carried out whilst ensuring that there is no run-off of silt into the river and that the river is not contaminated to ensure that water quality is not affected ▶ The Project will help the Wildlife and Fisheries Departments by providing one field office, three motor cycles, 5 guards and 1 inspector to protect river biodiversity and terrestrial wildlife, subject to an agreement in which the responsibilities of the Project and the Departments are clearly defined and performance of the protections activities is independently monitored. Improvement in aquatic and terrestrial biodiversity through protection will partly offset the residual impacts of the Project on aquatic ecology. ▶ Limited subsistence fishing using rods and cast nets could be allowed through a permitting system.	Operation	MHL	Fish abundance and diversity
2	Loss of aquatic biodiversity due to changes in ecological conditions downstream of the powerhouse as a result of release of water	▶ Design peaking operation to reduce impacts on aquatic ecology as recommended in the Eflow Assessment (see **Appendix M**) ▶ Regulate activities of the staff so that they do not engage in illegal exploitation of wildlife such as illegal fishing ▶ Construction activities should be carried out whilst ensuring that there is no run-off of silt into the river and that the river is not contaminated to ensure that water quality is not affected ▶ The Project will help the Wildlife and Fisheries Departments by providing one field office, three motor cycles, 5 guards and 1 inspector to protect river biodiversity and terrestrial wildlife, subject to an agreement in which the responsibilities of the Project and the Departments are clearly defined and performance of the protections activities is independently monitored. Improvement in aquatic and	Operation	MHL	Fish abundance and diversity

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
		terrestrial biodiversity through protection will partly offset the residual impacts of the Project on aquatic ecology ▶ Limited subsistence fishing using rods and cast nets could be allowed through a permitting system.			
5	Project operation leading to animal disturbance, displacement and decline.	▶ Large flood lights should not be installed outside 50 m of the Project fence. ▶ Direct lights towards Project facilities and not towards the natural habitats. ▶ Dispose solid waste only at designated sites. ▶ Regulation of poaching of wildlife species (Snow Leopard, Flare-horned Markhor, Himalayan Ibex and other water fowls). ▶ Close coordination with the wildlife and fisheries departments. ▶ Facilitating government department staff when they arrive at the site for example providing them accommodation and vehicles. ▶ Incorporate regulations for Project staff and contractors to avoid illegal poaching in contract documents. ▶ Encourage personnel to report sightings of wildlife of conservation importance or incidents of poaching to MHL. MHL to report incidents of poaching and illegal fishing to concern government departments. ▶ Provide adequate knowledge to the workers on relevant government regulations and punishments for illegal poaching. ▶ Provide awareness training to staff and contractors on: prevention of injury of animals; identification of likely species (Snow Leopard, Grey Wolf, Asiatic Jackal, Red Fox, Flare-horned Markhor, Himalayan Ibex and other migratory water fowls) found on site; identifications of animal hazards (such as venomous snakes); and what to do if dangerous animals are encountered.	Operation	MHL	Terrestrial Flora and fauna relative abundance and diversity.
18	Improved accessibility of locals due to construction of Project access roads.	▶ Allow communities use of new site access roads.	Operation	MHL	

IR	*Impact*	*Mitigation Measure*	*When*	*Responsibility*	*Monitoring Indicators*
	A potential flood and seismic hazard under natural extreme conditions for which the dam is not designed, albeit very unlikely, has potential to cause loss of life and damage to property.	▶ Prepare an emergency preparedness and response plan for the Project that includes consideration of flooding, earthquake, evacuation procedure, co-ordination with local administration and communities. ▶ Maintain network of climate gauges in the Arkari catchment to monitor potential floods through WAPDA or in conjunction with other hydropower developers. ▶ Automated telemetric flow gauges can be installed upstream of the reservoir. This will allow the Arkari Hydropower operators to be well aware of any potential flooding conditions using upstream flow data, in addition to climatic conditions recommended above. ▶ Where climatic data and flow data indicate eminent floods, appropriate measures for management of reservoir level can be undertaken by the dam operators. This includes full opening of gates (including low level outlets) with aim of reducing water levels to below Normal Operating Level at Arkari reservoir	Operation	MHL	
25	Direct, indirect and induced employment at the local levels, resulting in increased prosperity and wellbeing due to higher and stable incomes of people.	**Enhancement measures:** ▶ Ensure preferential recruitment of local candidates provided they have the required skills and qualifications. **Good practice measures:** ▶ Determine what is considered to be 'fair and transparent' in recruitment and in distribution of jobs between different community groups, in consultation with local communities and their leaders.	Operation	MHL	Target documents
34	Project, as currently designed, may not sustain increase in extreme flood events, such as the Probable Maximum Flood, which is expected to increase in future.	▶ Develop a flood warning and flood hazard system as part of the Emergency preparedness and response plan to warn and evaluate downstream landholders and users, based on the flood warning gauge network operated by WAPDA will potentially reduce "magnitude of impact". ▶ Develop strategy to manage flood peaks and flows with other HPP developers.	Operation	MHL	Annual Evaluation.

9.5.2 Specific Environment Management Plans

Specific management plans that are to be developed to facilitate the implementation of the mitigation measures are mentioned as follows:

- Air Pollution Control Plan
- Blasting and Explosives Control Plan
- Construction Site Environmental Management Plan
- Emergency Preparedness and Response Plan
- Environmental Training Plan
- Hazardous Material Management Plan
- Noise and Vibration Control Plan
- Occupational Health and Safety
- Reservoir Clearing Plan
- Site Rehabilitation and Landscaping Plan
- Spill Prevention and Response Plan
- Spoil Disposal Plan
- Surface Run Off and Erosion Control Plan
- Traffic Management Plan
- Vocational Training Plan
- Waste Management Plan
- Water Sourcing and Abstraction Plan
- Worker Accommodation Management Plan

Additional plans may be developed on discretion to further facilitate other areas of mitigation.

It should be noted that these plans (and other required mitigation measures not included within these plans) will be operationalized via Site Specific Environmental Management Plans (SSEMP) that are discussed in detail in **Section 9.6.3**. All construction sites must have a SSEMP prepared by the EPC Contractor and approved by MHL before any major construction activity is started on the site.

Some of the required plans that have been developed as part of the ESIA are described in the following sections.

9.6 Implementation Plan

Effective implementation and functioning of the EMP depends on adequate human and financial resources, clearly defined responsibilities for environmental management, appropriate training and good communication. An outline of how these features will be managed for the Project is presented below.

9.6.1 Contractual Requirements

MHL will ensure that:

1. EMP is included in the bidding package for the EPC Contractor;
2. During the bid evaluation the environmental performance of the bidders are taken into consideration;
3. Environmental costs are included in the financial bid of the bidders;
4. The environmental requirements are included in the contract of the selected EPC Contractor. Any conditions of the environmental clearance from the EPAs and any subsequent licenses and approvals from EPAs are also included in the environmental requirements for the contractors.
5. The contract of the of the selected EPC Contractor provides for withholding payment for completion of specific works until E&S requirements for those works have been implemented satisfactorily, and penalties for unsatisfactory performance

9.6.2 Design

The approving authority for the detailed design will:

- Ensure that all environmental aspects are communicated to the EPC;
- The detailed design includes the environmental design;

9.6.3 Site Specific Environmental Management Plans

EPC's Contractor's managers during the construction phase will operationalize their responsibilities described in **Section 9.5** (*Mitigation and Management Plan*) by developing Site Specific Environmental Management Plans (SSEMP). These will mulled to the actual site where construction activities will occur. Ideally, the preparation of the SSEMP must occur before the contractor is given access to the project site. However, it can be prepared after the access is given but certainly *before* the initiation of site clearance and any major site construction or erection work. At a minimum the following sites should have an SSEMP prepared:

- Dam Site
- Spoil Disposal Sites
- Quarry Areas
- Workshops
- Batching Plants
- Labor Camp

Some of these sites, such as the headrace tunnel may require multiple SSEMPs to cover the entire spatial extent of the development.

All contract documents must include the requirement that SSEMPs be prepared by the contractor and reviewed by MHL and OE prior to commencement of construction activities.

Preparing an SSEMP

This section explains the following steps that should be followed while developing an SSEMP:

- Definition of boundaries
- Identification of environmental values and sensitive receptors of the site and its surrounds
- Definition of construction activities
- Assignment of environmental management measures
- Preparation of site plans
- Preparation of environment work plans

Definition of Boundaries

For megaprojects with multiple construction sites, such as a hydropower scheme, there will be a number of SSEMPs for each site. A hydropower scheme would need to have SSEMPs covering works at the dam site, the powerhouse, the switchyard, the downstream channel, headrace and tailrace tunnels, the intake structures, quarries that supply aggregate, the waste disposal areas, contractor's camps, equipment yards, workers' accommodations, etc. Generally, areas falling under the jurisdiction of a construction manager should have a separate SEMP.

Identification of Sensitive Receptors

Once the boundaries of a site to be covered by a SSEMP have been defined, the sensitive receptors surrounding the site and the environmental values of the area need to be confirmed.

Areas that can be considered sensitive receptors include

- Forested area
- Water bodies
- Communities (including schools, hospitals, homes)
- Agricultural areas

The physical, ecological and socioeconomic baselines in the **Section 4**, *Description of the Environment* provide the necessary details. The information is best presented as an overlay on the detailed engineering drawings or maps for the project.

Construction and Associated Mitigation Activities

A schedule of works for the Project will have been prepared during the detailed design phase. It is important to understand what the various phases of work are for each site, as different phases will include different activities and thus different environmental

management requirements. In this simplified example, the construction of a bridge across a river could have the following schedule of works:

- Site surveying, vegetation clearance
- Site establishment
- Soil stripping and earth movement
- Bridge construction
- Grading approaches
- Surfacing
- Painting and finishing structures
- Landscaping and signage

The planning of the environmental management requirements for the bridge must ensure that the necessary environmental management activities take place at the right time. For example, the site survey should markup areas of vegetation to be removed, trees that must be saved, and the locations of any species of importance. Soil stripping will need to be accompanied by the introduction of erosion-control measures to prevent sediment from entering the river. The concrete pouring and filling of the bridge abutments will require a large number of vehicle movements, so it may be necessary to develop a traffic management plan to ensure that the vehicles don't disrupt traffic on existing roads. If there are sensitive receptors nearby, there may be a requirement to limit working hours that will require a change in the work schedule. These measures are easy to plan for, but very hard to introduce once the project has started. This, again, emphasizes the need for effective planning of the environmental management measures.

Section 9.5 (*Mitigation and Management Plan*) provides a list of required mitigation measures that must be incorporated into the relevant SSEMPs. In addition all appropriate measures indicated in Generic Construction Site Environmental Management Plan (CSEMP) (**Appendix N**) should be incorporated in the SSEMP.

Site Plan

A site plan must cover the extent of the construction activity and should contain:

- Location and nature of planned work;
- Locations of sensitive receptors; and
- Locations of required mitigation activities.

Other important features may include:

- Indication of North, and scale;
- Existing and planned supporting infrastructure (e.g., access roads, water supplies, electricity supplies, etc.);
- Contours; and
- Drainage systems.

Work Plan

The completed SSEMP provides details of all the environmental management requirements for all stages of the construction process. For individual work teams responsible for only a small part of the overall construction work, it can be hard to understand what is required for their particular work components. For example, the work team responsible for stripping soil for the construction areas are not going to be interested in the requirements for pouring concrete for footings and foundations. However, it is essential that the soil stripping team know exactly what to clear, what to leave, and where to put stockpiles of soil for later use.

When different work activities are required at different times or at different locations, environmental work plans can be prepared. These are similar to the work method statements often produced for major construction projects.

9.6.4 Site Inspection

Site inspections will be undertaken regularly in relevant areas of the Project. The inspections will focus on compliance with the EMP. The inspections will play an important role in increasing awareness of EMP.

Minor non-conformances will be discussed during the inspection and recorded as a finding in the inspection report. Major non-conformances will be reported as incidents. Inspection results will be disclosed at management meetings.

9.6.5 Non Conformance and Incidents

Non-conformances include the following:

- exceedances of relevant thresholds as identified during routine monitoring;
- non-conformances with the requirements of the EMP or supporting documentation identified during an internal inspection;
- non-conformances identified during an audit or by regulatory authorities;
- events, such as spills, resulting in potential or actual environmental harm;
- events that did or could result in injury to staff, visitors to site or surrounding communities; and
- significant complaints or grievances received from any source.

Corrective and preventive actions will be identified and implemented in response to these non-conformances. These actions will address the root cause of the non-conformance and will reduce or prevent repeated non-conformances.

A process will be established for the identification, investigation and tracking of non-conformances, including:

- prioritizing and classifying non-conformances based on the type and severity of the non-conformance;

- recording of non-conformances and the results of corrective and/or preventive actions, including the actions necessary to mitigate or remedy any associated impacts;
- defining results expected from the corrective and/or preventative actions;
- confirming the corrective and/or preventive actions taken to eliminate the causes of the non-conformance are appropriate to the magnitude of problem and commensurate with the impacts encountered;
- reviewing the effectiveness of the corrective and/or preventive actions taken; and
- implementing and recording required changes in the EMP or monitoring program resulting from corrective and preventive action.

Serious non-conformances will be classified as incidents. Incidents will be promptly reported to appropriate management. A guideline will be prepared on:

- the types of incidents reportable to internal management at the site, Project and corporate levels, as well as to regulatory authorities and other external stakeholders; and
- standards to be observed when reporting incidents.

During construction, environmental monitoring will ensure the protection of air and noise pollution, community relations, and safety provisions. During operation, emissions, air, noise, and waste water quality monitoring and greenbelt development around the plant will be important parameter of the monitoring program.

The monitoring requirement can only be fulfilled by maintaining the proper documentation records of the findings. Daily checklists, weekly reports and monthly audit will be taken in accordance with construction management plan. Based on the ESIA approval a scheduled audit will be conducted by MHL and reports will be shared with the regulatory authority and funding agency if required.

9.6.6 Audits

Formal audits will be undertaken at planned intervals in accordance with the requirements of client and regulatory authorities. Procedures for audits will be established, implemented and maintained. These will cover the audit criteria, scope, frequency and methods, and will address the responsibilities and requirements for planning and conducting audits, reporting results and retaining associated records.

Any negative findings arising from an audit will be treated an incident and dealt with in accordance with the non-conformance and incident procedure. Results from audits and evaluations of compliance with legal requirements will be reported to site and senior management and subject to management reviews. Usually environmental regulatory authorities require a quarterly audit report for large scale projects.

The following audits will be carried out for:

- Labor
- Health and Safety

- Environment

9.7 Monitoring Plan

Monitoring of environmental components and mitigation measures during implementation and operation stages is a key component of the EMP to safeguard the protection of environment. The objectives of the monitoring are to:

- manage environmental issues arising from construction works through closely monitoring evidence for implementation of the mitigation measures and environmental compliance; and
- monitor changes in the environment during various stages of the Project life cycle with respect to baseline conditions.

A monitoring mechanism is developed for identified impact and includes:

- location of the monitoring (near the Project activity, sensitive receptors or within the Project influence area);
- means of monitoring, i.e. parameters of monitoring and methods of monitoring (visual inspection, consultations, interviews, surveys, field measurements, or sampling and analysis); and
- frequency of monitoring (daily, weekly, monthly, seasonally, annually or during implementation of a particular activity).

Monitoring program will include regular monitoring of construction and commissioning activities for their compliance with the environmental requirements as per relevant standards, specifications and EMP. The purpose of such monitoring is to assess the performance of the undertaken mitigation measures and to immediately formulate additional mitigation measures and/or modify the existing ones aimed at meeting the environmental compliance as appropriate during construction.

The monitoring program will be coupled with a series of supporting procedures, yet to be developed, covering:

- sample or data collection;
- sample handling, sample storage and preservation;
- sample or data documentation;
- quality control;
- data reliability (calibration of instruments, test equipment, and software and hardware sampling);
- data storage and backup, and data protection;
- interpretation and reporting of results; and
- verification of monitoring information by qualified and experienced external experts.

9.7.1 Specific Monitoring Plan

Environmental monitoring and reporting plan for the construction and operation phases are provided in **Exhibit 9.10**. Moreover each supporting plan (as described in **Section 9.5**) includes monitoring and documentation requirements; the same is also true of the SSEMP (as described in **Section 9.6.3**). Therefore the monitoring plan will also contain requirements of these additional plans once they have been developed.

9.7.2 Documentation and Reporting

Monitoring elements of the EMP will be documented and controlled in accordance with a document control system by the Senior Manager, Environmental and Social and communicated to MHL Records demonstrating compliance with legal requirements and conformance with the EMP will also be maintained. MHL through its Senior Manager, Environmental and Social will supervise, establish, implement and maintain procedures.

Documentation and record keeping controls will include:

- measures to enable relevant documents and records to be readily available and identifiable (labeled, dated and properly filed), legible and protected from damage;
- review, revision and approval of documents for adequacy by authorized personnel at least once a year;
- establishment of the electronic document control version as the ‘authorized version’;
- making current versions of relevant documents available at locations where operations essential to the effective functioning;
- suitably identifying obsolete documents retained for legal and knowledge preservation purposes; and
- identification and segregation of confidential and privileged information.

Monitoring data will be documented and analyzed to determine temporal and spatial trends and confirm compliance with relevant thresholds. Monitoring reports will be produced to meet internal and external reporting requirements. If monitoring results indicate non-conformance with stipulated thresholds or if a significant deteriorating trend is observed, it will be recorded as a non-conformance and handled by the non-conformance and incident procedure. The following reports will be produced:

- Based on reports provided by the Construction Contractor as listed in **Exhibit 9.10**, quarterly and annual reports will be reviewed by OE/ MHL for monitoring of the physical and social environment and shared with the EPAs.

Exhibit 9.10: Environmental Monitoring Program for Construction and Operation

Aspect	*Type of monitoring*	*Frequency of Monitoring*	*Location/s*	*Reporting Frequency*	*Monitoring and implementation Responsibility*	*Report Preparation Responsibility*	*Report Receiving Authority*
Construction Phase							
Soil Quality	Visual inspection for any oil and lubricant spills and leakages in the construction area and presence of oil in the drains at the construction site	Daily	Construction area and drains at the construction site	Quarterly	EPC Contractor, OE, MHL	EPC Contractor	MHL, OE and EPA
Soil Erosion	Visual inspection of soil erosion and land sliding, especially in the wet season	Once a month in dry season. Once a week in wet season.	Construction sites, rehabilitated areas and water release points	Quarterly	EPC Contractor, OE, MHL	EPC Contractor	MHL,OE and EPA
Waste Disposal	Inspection of waste disposal areas and channels	Weekly	Waste disposal sites,	Quarterly	EPC Contractor, OE, MHL	EPC Contractor	MHL, OE and EPA
Water Resource Depletion	Record of water used and source of water supply for construction, sprinkling and camp	Daily	Construction sites, truck filling points and water tanks at camp.	Quarterly	EPC Contractor, OE, MHL	EPC Contractor	MHL and EPA
Community Water Supplies	Monitor flow for springs identified as at risk from tailrace construction.	Monthly	Identified springs in communities.	Quarterly	EPC Contractor, OE, MHL	EPC Contractor	MHL and EPA
Fugitive Dust Emissions	Air quality sampling at social receptors in case any complaints regarding excessive particulate matter in ambient air are received.	As required, in case complaints are received	Social receptors	Report as required, in case complaints are received	EPC Contractor, OE, MHL	EPC Contractor	MHL and EPA
Vehicular and Machinery Exhaust Emissions	Visual checks of exhaust emissions from vehicles and batching plant machinery to ensure excess pollutants are not being released	Monthly	Construction sites and batching plant location	Quarterly	EPC Contractor, OE, MHL	EPC Contractor	MHL and EPA

Aspect	*Type of monitoring*	*Frequency of Monitoring*	*Location/s*	*Reporting Frequency*	*Monitoring and implementation Responsibility*	*Report Preparation Responsibility*	*Report Receiving Authority*
Noise Nuisance	Monitoring of the noise levels in the nearest communities against the baseline noise conditions	Once a month and when a complaint is received	Nearest settlements or area for which complaint is received	Quarterly	EPC Contractor, OE, MHL	EPC Contractor	MHL and EPAs
Traffic	Random speed checks and inspections and investigations in case of complaints by community	Once a month and in case complaints are received	Different location and different time	Quarterly	EPC Contractor, OE, MHL	EPC Contractor	MHL and EPAs
Vibration	Monitoring of vibration levels using vibration sensors	Once a month informed by the blasting schedule	Structures near blasting sites	Quarterly during blasting	EPC Contractor, OE, MHL	EPC Contractor	MHL and EPAs
Distribution of Project Employment	When complaint is received or an issue observed	When a complaint is received	Construction site, camp and nearby villages	Quarterly	EPC Contractor, OE, MHL	EPC Contractor	MHL and EPAs
Social Unrest due to Conflicting Social Norms	When complaint is received or an issue observed	When a complaint is received	Construction site, camp and nearby villages	Quarterly	EPC Contractor, OE, MHL	EPC Contractor	MHL and EPAs
Operation Phase							
Waste Disposal	Inspection of waste disposal areas and channels	Weekly	Dam and Powerhouse sites	Quarterly report	O&M Contractor	O&M	MHL and EPAs
Environmental Flow	Continuous record of downstream release into river by dam	Continuous	Dam site	Quarterly report	O&M Contractor	O&M	MHL and EPAs

9.8 Emergency Preparedness and Response

The Project will implement and maintain an Emergency Preparedness and Response Plan (EPRP).

9.8.1 Purpose and Applicability

This framework is intended to guide the means by which MHL and its contractors will ensure that they are prepared for emergency situations and can respond effectively should they arise. For each stage of a project's project life cycle, MHL and/or contractor will develop and implement an ERPR that meets the requirements of this framework. MHL will identify the party responsible for preparing the EPRP. It is expected that most emergencies during construction would take place on the site, so the Plan prepared for the construction period would primarily (but not exclusively) address on-site emergencies. During operation, on the other hand, dam failure or other emergencies could cause significant downstream impacts, so the Plan for the operations period would address a combination of on-site and off-site emergencies and actions.

9.8.2 Approach and Activities

EPRPs for new projects will initially be developed based on the Environmental and Social Impact Assessment or other assessment document that identifies on-site and off-site risks during the project life cycle that could result from an accident or other emergency situation, and on a detailed assessment of site activities. The ESIA and/or other documents would typically identify specific risk-reduction measures as well, which would become part of the EPRP. EPRPs for existing projects will initially be based on due diligence assessments that evaluate risks of ongoing construction and/or operations, and again will include a detailed assessment of site activities. EPRPs will also be informed by and based upon the best judgment of qualified professionals and the experience gained from ongoing activities. EPRPs will become part of the Project's Environmental Management Plan.

The EPRP will identify various emergency situations that could realistically occur, which could include:

- Fire or explosion
- Road or site traffic accident
- Spills of hazardous materials such as fuels, chemicals, oil, paint, etc.
- Landslides, mudslides, or rock falls
- Equipment failure
- Earthquakes (primarily during operation)
- Cofferdam failure
- Partial or complete dam failure
- Floods
- Turbine or blade failure.

- Site lockdown due to breach of security, external attack, or other event.

The EPRP will call for close coordination with local authorities regarding preparing and responding to emergencies that could affect local people or communities. Particularly if there could be serious off-site impacts, EPRPs will describe the coordination process, including MHL support for community emergency preparedness and response training.

EPRPs will include details for the following elements, which could be different for various types of accidents:

- Organizational and individual responsibilities for both emergency preparedness and for emergency response, which could be very different. This would include roles and responsibilities of responders and decision-makers.
- Measures that need to be taken to prepare for potential emergencies, including equipment, supplies, warning signals, dedicated communication lines, etc.
- Details on how relevant authorities, the public, and third-party emergency response agencies will be informed of potential risks due to emergency situations resulting from project activities, and on agreements that have been reached for cooperative responses to emergencies.
- Contact details of all dedicated and non-dedicated emergency response personnel on the site and personnel who are available off-site.
- Contact details of relevant authorities and third parties who will need to notified for various types of emergencies (nearby residents, landowners, fire brigades, local law enforcement, military, etc.).
- Detailed information on internal and external equipment, personnel, facilities, funding, expert knowledge, and materials that will be required to respond to specific types of emergencies. The EPRP will also need to identify the specialized expertise that may be needed to respond to specific emergencies.
- Procedures for using, inspecting, testing, and maintaining emergency response equipment, which may include equipment under the control of third parties (for example, the local fire brigade or emergency medical teams).
- Clear procedures and protocols for notifications and communications to and within the contractor (if any), local and other authorities, potentially affected people, and other parties.
- Emergency response procedures to be followed, and by whom, for various emergency situations.
- Locations of holding/areas for workers and off-site collection points for others, and conditions under which they would be used.
- Pro forma incident report forms.

The EPRP should call for a root-cause analysis following any emergency or near-emergency situation in order to identify improvements in future preparedness or response. The EPRP, or a separate planning process, should also include measures to ensure business continuity and contingency, including:

- Identifying and making contingency arrangements to exploit replacement supplies or facilities – which could include buildings, electricity, water supplies, equipment and vehicles, fuel, etc. -- to allow business continuity.
- Maintaining backups of critical information, including relevant EPRPs that form the EMP, in a secure but accessible location to ensure continuity or restoration of site activities, including implementation of mitigation measures.

9.8.3 Monitoring, Recordkeeping, and Reporting

The EPRP will describe records that must be kept to document various activities required to maintain emergency preparedness, and the person(s) responsible for maintaining the records. The EPRP will also describe how notice and details of any imminent or actual emergency will be communicated within the contractor (if any), local authorities, potentially affected people, and other parties.

The EPRP will require periodic inspection/monitoring of the Project site(s) and records, with a focus on areas where accidents or other occurrences could lead to emergency situations. The EPRP will need to specify:

- The locations, activities, and records that must be inspected.
- The frequency of inspection.
- The required qualifications of persons who will conduct the monitoring.
- Records that must be kept and the person responsible for keeping the records.
- Special hazards of inspection, including appropriate cross-references to the Occupational Health and Safety Plan for required and recommended risk reduction measures.
- Reports that will be prepared, to whom the reports are to be submitted for review, and the length of time records will be kept. This could include summary reports or detailed technical reports, and could be submitted to company or MHL management, government agencies, or lenders.

The EPRP will describe how remedial actions will be identified and implemented in the event that monitoring reveals shortcomings in emergency preparedness or in recordkeeping, and how follow-up monitoring will be implemented until the requirements of the EPRP are fully met.

9.8.4 Implementation

The EPRP will identify and describe the responsibilities of all parties, including MHL, contractors, and competent authorities. The EPRP must also identify the roles and responsibilities of individual positions within MHL and contractor. This will include the chain of command for directing response activities in case of various types of emergencies. This should be shown in an organogram that includes as much detail as possible, down to the individual person/position.

9.8.5 Training

The EPRP will identify training requirements for staff and managers of MHL and/or contractors, including who will be responsible for conducting the training and who must be trained in what skills. Training will also extend to third parties who may be called upon to respond to emergencies. Training will focus on the assigned responsibilities of the trainees in preparing for emergencies and for responding to emergencies if they occur, and will cover technical and administrative skills needed to perform assigned responsibilities. The EPRP will need to provide for emergency preparedness and response training should be closely coordinated with occupational health and safety training. The EPRP should call for at least the following topics to be part of emergency preparedness and response training.

- Providing information necessary for trainees to understand the possible effects of various types of emergencies and an opportunity to contribute effectively, as appropriate, to decisions concerning preparedness and response.
- Providing specific information on appropriate behavior and safety measures to be adopted in case of various types of emergencies.
- The specific responsibilities of the person being trained in case of various types of emergencies.
- Scheduled and unscheduled drills and practice in responding to various types of emergencies, including site evacuation, and procedures to monitor drills closely to verify that staff and managers are aware of their responsibilities and are able to complete them.

9.8.6 Relationship to other Plans

The emergency preparedness and response plan is related to the following plans:

- Spill Prevention and Response Plan
- Waste Management Plan
- Blasting and Explosives Control Plan
- Stakeholder Engagement Plan
- Dam Safety Review Procedure
- Site Security Plan
- Occupational Health and Safety Plan.

9.8.7 Revision

The EPRP will be reviewed, by MHL or the contractor as appropriate, at least annually, and whenever there is a significant change in project or site conditions, or when it is determined that any measure intended to prevent or reduce the probability of emergency situations is or may be insufficient to achieve its purpose. The EPRP will also be reviewed following the root-cause analysis that is completed after any emergency or near-emergency. It will be revised when necessary to update or improve emergency

preparedness and response, and when it is determined necessary to ensure compliance with applicable standards and good international industry practice.

9.9 Social Investment Program

As a Corporate Social Responsibility (CSR), the project implementation is expected to raise hopes of the project area population for their general welfare. It is therefore, necessary that the project sponsor may provide facilities in the form of education, health, improvement of existing access roads and development of parks to the people of the project area.

Considering the betterment of the local community and based on the consultations carried out with the local community and local administration (see **Section 6.4.1**, *Community Consultation*), the need for basic amenities i.e. health, education, roads, safe drinking water is proposed. MHL will finalize social investment program at the start of commercial operations.

The specific investment projects will be selected on the basis of a) community needs and aspirations, and b) the sustainability of the specific proposal.

9.10 Cost Estimate

Cost estimate for EMP implementation is presented in **Exhibit 9.11**.

Exhibit 9.11: Summary of Cost Estimates for EMP (USD) to be borne by MHL

No	*Item*	*Note*	*Pre-Construction*	*Construction Phase*			*Operation Phase (Annual)*
				Capital	*Recurring (Annual)*	*Total (for 4 years)*	
1	Biodiversity Protection Management Measures						
1.1	Guards (5)				10,500	42,000	10,500
1.2	Inspector (1)				3,200	12,800	3,200
1.3	Motorcycles (3)			2,800			
1.4	Field Office for Guards (1)			21,500			
1.5	Annual ecology field surveys to monitor aquatic and terrestrial ecological resources						
1.5.1	Aquatic ecology				13,000	52,000	13,000
1.5.2	Terrestrial ecology				7,000	28,000	7,000
1.6	Training for field staff on importance of biodiversity and environment protection				5,000		
2	EFlow Monitoring				15,000	15,000	
3	Land Acquisition and Resettlement Cost	In accordance with RAP/Government assessment.	5,715,686				
4	Social Investment Plan under CSR	To be finalized at the start of commercial operations					
5	Implementation of Stakeholders Engagement Plan						
5.1	Salary of CRO	Estimated at PKR 160,000 per month			16,500	65,900	16,500

No	*Item*	*Note*	*Pre-Construction*	*Construction Phase*			*Operation Phase (Annual)*
				Capital	*Recurring (Annual)*	*Total (for 4 years)*	
5.2	Salary of CLO (Male)	Estimated at PKR 65,000 per month			6,696	26,800	6,700
5.3	Salary of CLO (Female)	Estimated at PKR 65,000 per month			6,700	26,800	6,700
5.4	Vehicle for SEP Office (Two)			64,400	–	64,400	–
5.5	Fuel and Maintenance of Vehicle	Estimated at PKR 70,000 per month			7,200	28,850	7,200
5.6	Skill development trainings for affected communities (Trainer's cost, venue, refreshment, training material, and daily stipend)	Estimated at PKR 550,000.			56,650	226,629	56,657
6	Internal Environmental Management	Included in owners budget					
7	External monitoring	To be provided by EPC Contractor					
8	Instrumental monitoring and sampling						
8.1	Monitoring of vehicles for emissions and noise[3]	Monitoring of about 6[4]vehicles at 43.20 USD each		2,60		1,450	
8.2	Monitoring of ambient noise levels	Purchase of noise meter		2,200		2,200	
8.3	Monitoring of ambient dust levels	Purchase of dust meter		6,200		6,200	
9	Mitigation Measures						
9.1	Springs and water resources			25,800		25,800	
	Total		**5,715,686**	**122,900**	**147,446**	**624,829**	**127,457**

[3] The number of vehicles has been estimated based on the size and quantity of the material and equipment to be transported for Project activity and may be revised based on actual.

[4] Estimation of vehicle as peak is ~30 truck trips per day if one truck does 5 trips a day that would be 6 vehicles

10. Conclusion and Recommendations

The proposed Project, the 99 MW Arkari Gol HPP in KP was evaluated in this report by HBP and its associated team of experts. The proposed design and construction activities were assessed against the laws of KP, the GoP policies, and OPIC Guidelines. Mitigation and management measures were recommended and made part of the Project design to minimize adverse environmental impacts of the Project.

The aspects of the environment assessed were classified into physical, ecological and socioeconomic. In the physical environment the Project is expected to have significant impacts on water availability, water quality as well as soil, topography and land stability. Socioeconomically the most significant impacts are those associated with disturbances to the local communities especially during construction of the Project and related facilities. Ecologically the most significant impacts are on aquatic biodiversity as the flow of the river will be regulated. Although the Project's impacts are significant, the most important aspect is the impact of peaking on fish fauna downstream of the powerhouse. This will impact aquatic ecology including three fish species the Snow Trout which is Vulnerable on the IUCN Red List as well as the Himalayan Catfish and Chitral Loach.

The Project was assessed using IFC's PS6 on biodiversity. Based on this the Project is not located in a Critical Habitat, however, it is located in a Natural Habitat as the river is unregulated and unpolluted.

Impacts on fish fauna are unavoidable, however, the Project is not impacting Endangered, Critically Endangered or endemic species. It is impacting one long distance migratory species, the Snow Trout. To mitigate these impacts the ESIA suggests that the proponent support the government departments responsible for protecting fish habitat in order to make their efforts more effective within the Chitral valley. In addition a modified form of peaking is recommended which will reduce the impact on the fish fauna.

The cumulative impacts of the Project are also significant, however, they are dependent on future developments in the basin. The Arkari Gol HPP is one of the first in the Chitral Basin. The cumulative impacts of this and other planned projects in the basin will have the greatest impacts on long distance migratory species, for example, the Snow Trout as they will block the species' migratory routes. This will result in population declines due to creation of barriers and genetic isolation causing decline in genetic diversity. Impacts on terrestrial ecology will also be a concern as development of transmission lines and improved transport routes will open up the area for tourism and increased human-induced pressures. In view of this the ESIA recommends basin-wide measures to mitigate cumulative impacts. These include standardization of assessment methods using IFC Guidelines, active regulation by the KP EPA using World Bank Guidelines, increased support to the government departments involved in protection of biodiversity and habitat, greater coordination between developers for achieving synergistic benefits and a balance between environmental and energy requirements in the basin and to support research in the basin for advances in understanding of river ecology.

Socially, the greatest disturbance that will be caused by the Project will be land acquisition for Project infrastructure. Therefore, one of the most important aspects is resettlement. About 50 household are likely to lose their land and residences. A resettlement action plan has been prepared separately to undertake resettlement in a fair and open manner and to minimize social or economic impacts. The basic principles used for resettlement are derived from Pakistani laws and IFC PS5 so that the livelihoods and standards of living for all affected households are improved or at least restored.

All the affected households losing any asset will be compensated according to the replacement cost. Every Project Affected Person (PAP) losing their livelihood resources or places of income generation as a result of Project interventions will be supported with income and livelihood restoration assistance. Moreover eligible PAPs will also receive resettlement allowances like relocation allowance, vulnerable allowance, severe impact allowance etc. The Resettlement Action Plan also provides a grievance redress mechanism and a monitoring and evaluation system.

Measures to minimize impacts are recommended in the ESIA and are included in the EMP. If these measures are implemented, the significance of impacts will be reduced to within acceptable limits.

Appendix A: National Environmental Quality Standards

Exhibit A.1: NEQS for Municipal and Liquid Industrial Effluents
(mg/l, unless otherwise defined)

No.	*Parameter*	*Standards*		
		Into Inland Waters	*Into Sewage Treatment[1]*	*Into Sea[2]*
1.	Temperature increase[3]	=<3°C	=<3°C	=<3°C
2.	pH value	6 to 9	6 to 9	6 to 9
3.	Five-day bio-chemical oxygen demand $(BOD)_5$ at 20°C[4]	80	250	80[5]
4.	Chemical oxygen demand (COD)[1]	150	400	400
5.	Total suspended solids (TSS)	200	400	200
6.	Total dissolved solids (TDS)	3,500	3,500	3,500
7.	Grease and oil	10	10	10
8.	Phenolic compounds (as phenol)	0.1	0.3	0.3
9.	Chlorides (as Cl')	1,000	1,000	SC[6]
10.	Fluorides (as F')	10	10	10
11.	Cyanide total (as CN')	1.0	1.0	1.0
12.	Anionic detergents (as MBAS)[7]	20	20	20
13.	Sulfates (SO_4)	600	1,000	SC[6]
14.	Sulfides (s')	1.0	1.0	1.0
15.	Ammonia (NH_3)	40	40	40
16.	Pesticides[8]	0.15	0.15	0.15
17.	Cadmium[9]	0.1	0.1	0.1
18.	Chromium (trivalent and hexavalent)[9]	1.0	1.0	1.0
19.	Copper[9]	1.0	1.0	1.0
20.	Lead[9]	0.5	0.5	0.5
21.	Mercury[9]	0.01	0.01	0.01
22.	Selenium[9]	0.5	0.5	0.5
23.	Nickel[9]	1.0	1.0	1.0
24.	Silver[9]	1.0	1.0	1.0
25.	Total toxic metals	2.0	2.0	2.0
26.	Zinc	5.0	5.0	5.0
27.	Arsenic[9]	1.0	1.0	1.0

No.	*Parameter*	*Standards*		
		Into Inland Waters	*Into Sewage Treatment[1]*	*Into Sea[2]*
28.	Barium[9]	1.5	1.5	1.5
29.	Iron	8.0	8.0	8.0
30.	Manganese	1.5	1.5	1.5
31.	Boron[9]	6.0	6.0	6.0
32.	Chlorine	1.0	1.0	1.0

Explanations:

1. Applicable only when and where sewage treatment is operational and BOD = 80 mg/l is achieved by the sewage treatment system.
2. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.
3. The effluent should not result in temperature increase of more than 3ºC at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not define, use 100 m from the point of discharge
4. Assuming minimum dilution 1:10 discharge, lower ratio would attract progressively stringent standards to be determined by the Federal Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.
5. The value for industry is 200 mg/l
6. Discharge concentration at or below sea concentration (SC)
7. Methylene Blue Active substances assuming surfactant as biodegradable
8. Pesticides include herbicides, fungicides, and insecticides
9. Subject to total toxic metals discharge should not exceed level given at S. No. 25

Notes:

1. Dilution of liquid effluents to bring them to the NEQS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.
2. The concentration of pollutants in water being used will be subtracted from the effluent for calculating the NEQS limits.

Exhibit A.2: National Environmental Quality Standards for Gaseous Emissions (mg/Nm^3, unless otherwise defined)

No.	*Parameter*	*Source of Emission*	*Standards*
1.	Smoke	Smoke opacity not to exceed	40% or 2 on Ringlemann Scale or equivalent smoke number
2.	Particulate matter[1]	a. Boilers and furnaces:	
		i. Oil-fired	300
		ii. Coal-fired	500
		iii. Cement kilns	200
		b. Grinding, crushing, clinker coolers and related processes, metallurgical processes, converters, blast furnaces and cupolas	500
3.	Hydrogen chloride	Any	400
4.	Chlorine	Any	150
5.	Hydrogen fluoride	Any	150
6.	Hydrogen sulfide	Any	10
7.	Sulfur oxides[2, 3]	Sulfuric acid/sulfonic acid plants	5,000
		Other plants except power plants operating on oil and coal	1,700
8.	Carbon monoxide	Any	800
9.	Lead	Any	50
10.	Mercury	Any	10
11.	Cadmium	Any	20
12.	Arsenic	Any	20
13.	Copper	Any	50
14.	Antimony	Any	20
15.	Zinc	Any	200
16.	Oxides of nitrogen[3]	Nitric acid manufacturing unit	3,000
		Gas-fired	400
		Oil-fired	600
		Coal-fired	1,200

3. Based on the assumption that the size of the particulate is 10 micron or more.
4. Based on 1 percent sulfur content in fuel oil. Higher content of sulfur will cause standards to be pro-rated.
5. In respect of emissions of sulfur dioxide and nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to National Environmental Quality Standards (NEQS) above, comply with the standards stated in **Exhibit D.3** and **Exhibit D.4**.

Exhibit A.3: Sulfur Dioxide Standards for Power Plants Operating on Oil and Coal

Sulfur Dioxide Background Levels (μg/m³)			*Standards*	
			Criterion I	*Criterion II*
Background Air Quality (SO_2 basis)	*Annual Average*	*Maximum 24-Hour Interval*	*Max. SO_2 Emissions (TPD)*	*Max. Allowable 1-Year Average Ground Level Increment to Ambient (μg/m³)*
Unpolluted	< 50	< 200	500	50
Moderately Polluted[1]				
Low	50	200	500	50
High	100	400	100	10
Very polluted[2]	> 100	> 400	100	10

1. For intermediate values between 50 and 100 μg/m³ linear interpretation should be used.
2. No project with sulfur dioxide emissions will be recommended.

Exhibit A.4: Nitrogen Oxides Standards for Power Plants Operating on Oil and Coal

Annual arithmetic mean of ambient air concentrations of nitrogen oxides (expressed as NO_2) should not exceed	*100 μg/m³ (0.05 ppm)*
Maximum emission levels for stationary source discharges, before mixing with the atmosphere: For fuel-fired steam generators	
Liquid fossil fuel	130 ng/J of heat input
Solid fossil fuel	300 ng/J of heat input
Lignite fossil fuel	260 ng/J of heat input

Exhibit A.5: Standards for Motor Vehicle Exhaust and Noise

No.	*Parameter*	*Standards (Maximum Permissible Limit)*		*Measuring Method*
1.	Smoke	40% or 2 on the Ringelmann Scale during engine acceleration mode.		To compare with Ringlemann chart at a distance of 6 meters or more.
2.	Carbon Monoxide	Emission Standards:		
		New Vehicles	Used Vehicles	
		4.5%	6%	Under idling conditions: Nondispersive infrared detection through gas analyzer.
3.	Noise	85 dB (A)		Sound-meter at 7.5 meters from the source.

Exhibit A.6: Standards for Ambient Air Quality

Pollutants	*Time-weighted Average*	*Concentration in Ambient Air*		*Method of Measurement*
		Effective from 1st July 2010	*Effective from 1st January 2013*	
Sulfur Dioxide (SO_2)	Annual Average*	80 μg/m³	80 μg/m³	-Ultra Violet Fluorescence method
	24 hours**	120 μg/m³	120 μg/m³	
Oxide of Nitrogen as (NO)	Annual Average*	40 μg/m³	40 μg/m³	-Gas Phase Chemiluminescence
	24 hours**	40 μg/m³	40 μg/m³	
Oxide of Nitrogen as (NO_2)	Annual Average*	40 μg/m³	40 μg/m³	-Gas Phase Chemiluminescence
	24 hours**	40 μg/m³	80 μg/m³	
O_3	1 hour	180 μg/m³	130 μg/m³	-Non dispersive UV absorption method
Suspended Particulate Matter (SPM)	Annual Average*	400 μg/m³	360 μg/m³	-High Volume Sampling, (Average flow rate not less than 1.1 m³/min)
	24 hours**	550 μg/m³	500 μg/m³	
Respirable particulate Matter. PM 10	Annual Average*	200 μg/m³	120 μg/m³	-β Ray Absorption method
	24 hours**	250 μg/m³	150 μg/m³	
Respirable Particulate Matter. PM 2.5	Annual Average*	25 μg/m³	15 μg/m³	-β Ray Absorption method
	24 hours**	40 μg/m³	35 μg/m³	
	1 hour	25 μg/m³	15 μg/m³	
Lead (Pb)	Annual Average*	1.5 μg/m³	1 μg/m³	ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	2 μg/m³	1.5 μg/m³	
Carbon Monoxide (CO)	8 hours**	5 mg/m³	5 mg/m³	Non Dispersive Infra Red (NDIR) method
	1 hour	10 mg/m³	10 mg/m³	

* Annual arithmetic mean of minimum 104 instruments in a year taken twice a week 24 hourly at uniform interval

** 24 hourly /8 hourly values should be met 98% of the time in a year. 2% of the time, it may exceed but not on two consecutive days.

Exhibit A.7: Standards for Ambient Noise

No.	*Category of Area/Zone*	*Effective from Ist July, 2010*		*Effective from Ist July, 2012*	
		Day time	*Night time*	*Day time*	*Night time*
1.	Residential are (A)	65	50	55	45
2.	Commercial are (B)	70	60	65	55
3.	Industrial area (C)	80	75	75	65
4.	Silence zone (D)	55	45	50	45

Note:

1. Limit in dB(A) Leq*
2. Day time hours: 6 .00 am to 10.00 pm
3. Night Time hours: 10.00 pm to 6.00 am
4. Silence zone: Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts and courts.
5. Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.
6. dB(A) Leq: time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

Exhibit A.8: Standards for Drinking Water

Properties/ Parameters	*Standard Values For Pakistan*	*WHO Guidelines*	*Remarks*
Bacterial			
All water intended for drinking (e.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian Countries also follow WHO Standards.
Treated water entering the distribution system (E.Coli or thermotolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian Countries also follow WHO Standards.
Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Most Asian Countries also follow WHO Standards.

Properties/ Parameters	*Standard Values For Pakistan*	*WHO Guidelines*	*Remarks*
Physical			
Colour	≤ 15 TCU	≤ 15 TCU	
Taste	Non objectionable/Acceptable	Non objectionable/Acceptable	
Odour	Non objectionable/Acceptable	Non objectionable/Acceptable	
Turbidity	< 5 NTU	< 5 NTU	
Total hardness as CaCO3	< 500 mg/l	–	
TDS	< 1000	< 1000	
pH	6.5 – 8.5	6.5 – 8.5	
Chemical			
Essential Inorganic	mg/Litre	mg/Litre	
Aluminum (Al) mg/l	≤ 0.2	0.2	
Antimony (Sb)	≤ 0.005 (P)	0.02	
Arsenic (As)	≤ 0.05 (P)	0.01	Standard for Pakistan similar to most Asian developing countries
Barium (Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl)	< 250	250	
Chromium (Cr)	≤ 0.05	0.05	
Copper (Cu)	2	2	
Toxic Inorganic	**mg/Litre**	**mg/Litre**	
Cyanide (CN)	≤ 0.05	0.07	Standard for Pakistan similar to Asian developing countries
Fluoride (F)*	≤ 1.5	1.5	
Lead (Pb)	≤ 0.05	0.01	Standard for Pakistan similar to most Asian developing countries
Manganese (Mn)	≤ 0.5	0.5	
Mercury (Hg)	≤ 0.001	0.001	

Properties/ Parameters	*Standard Values For Pakistan*	*WHO Guidelines*	*Remarks*
Nickel (Ni)	≤ 0.02	0.02	
Nitrate (NO_3)*	≤ 50	50	
Nitrite (NO_2)*	≤ 3 (P)	3	
Selenium (Se)	0.01 (P)	0.01	
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	–	
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries
** indicates priority health-related inorganic constituents which need regular monitoring.*			
Organic			
Pesticides mg/L		PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20- 58 may be consulted.***	Annex II
Phenolic compounds (as Phenols) mg/L		< 0.002	
Polynuclear aromatic hydrocarbons (as PAH) g/L		0.01 (By GC/MS method)	
Radioactive			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

*** PSQCA: Pakistan Standards Quality Control Authority.

Proviso:

1. The existing drinking water treatment infrastructure is not adequate to comply with WHO guidelines. The arsenic concentrations in South Punjab and in some parts of Sindh have been found high then Revised WHO guidelines. It will take some time to control arsenic through treatment process. Lead concentration in the proposed standards is higher than WHO Guidelines. As the piping system for supply of drinking water in urban centres are generally old and will take significant resources and time to get them replaced. In the recent past, lead was completely phased out from petroleum products to cut down lead entering into environment. These steps will enable to achieve WHO Guidelines for Arsenic, Lead, Cadmium and Zinc. However, for the bottled water, WHO limits for Arsenic, Lead, Cadmium and Zinc will be applicable and PSQCA Standards for all the remaining parameters.

Appendix B: Ecology Field Survey Plan

See following pages.

Hagler Bailly Pakistan

99.0 MW Arkari Gol Hydropower Project

Ecology Field Survey Plan

HBP Ref.: D7SP1AGH

June 11, 2018

Master Hydro (Pvt.) Ltd (MHL)

Khyber Pakhtoonkhawa

Ecology Field Survey Plan

Master Hydro (Pvt.) Ltd. (MHL) is carrying out an Environmental and Social Impact Assessment (ESIA) and to develop Resettlement Action Plan (RAP) for developing the 99 megawatt (MW) Arkari Gol Hydropower Project (the "Project" or "AGHPP") on the Arkari Gol in Chitral District, Khyber Pakhtunkhwa (KP). The Project includes a weir, diversion tunnel and powerhouse on the Arkari Gol before its confluence. MHL wishes to carry out an ESIA and develop a RAP for the Project that complies with the applicable laws in Pakistan and Khyber Pakhtunkhwa, as well as the Performance Standards of the International Finance Corporation (IFC) and the Safeguards of the Asian Development Bank (ADB).

In order to assess the impacts of the Project on the surrounding environment, MHL acquired the services of Hagler Bailly Pakistan to carry out the ESIA of the proposed Project. The ecology field survey plan, developed as part of the ESIA of Arkari Gol HPP, is aimed at collecting data for establishing baseline conditions in the area to be impacted by the Project. The survey will be carried out during the last week of March.

Objectives

The objective of the surveys is to collect field data for establishing the ecological baseline for aquatic and terrestrial ecological resources in selected areas that will be impacted by the Project. These areas are delineated separately for aquatic and terrestrial ecological resources and are referred to as the Aquatic Study Area and Terrestrial Study Area respectively. The basis of determination of the Study Areas is explained below. Specifically the objectives include:

- Qualitative and quantitative assessment of fish fauna, periphyton, macro-invertebrates, riparian vegetation as well as terrestrial vegetation, herpetofauna, birds, and mammals
- Identification of key species, their relative abundances and their conservation status.
- Reports of wildlife sightings in the Terrestrial Study Area by the resident communities.
- Identification of any additional habitats, and microhabitats in the Study Areas.
- Analysis to further develop the basis for evaluating the potential impacts of Project-related activities on the biodiversity, specifically identification and evaluation of critical habitats and ecosystem services in the ecological Study Areas.

Study Areas and Sampling Sites

As described above, the Study Areas have been differentiated based on aquatic and terrestrial ecological resources – the Aquatic Study Area and the Terrestrial Study Area. The basis of determination of each and their delineation is described in this section.

Aquatic Study Area

The Aquatic Study Area will include the Arkari Gol (a stretch of 29 km from confluence with Lutkoh River), Lutkoh River (from Naizh Village to confluence of Mastuj River) and one km of the Mastuj River (downstream of the confluence of Lutkho and Mastuj River). This study area has been selected keeping in view the impacts of the project including peaking. Major Gols (tributaries) which drain in to the Arkari Gol and Lutkoh River are also included in the Aquatic Study Area. These include Shul Gol and Mazhigram Gol. **Exhibit 1** shows the Aquatic Study Area and Sampling Location for aquatic ecology.

The aquatic biological resources that will be studied include:

- Fish diversity, distribution, abundance, and breeding behavior
- Macro-invertebrates diversity and abundance
- Periphyton bio-mass
- Riparian vegetation diversity, abundance and distribution

Exhibit 2 shows the aquatic study area and provides justifications for selection of the aquatic sampling sites and **Exhibit 3** provides a list of tributaries in which sampling will be carried out.

Exhibit 1: Aquatic Study Area and Proposed Sampling Sites for Fish, Macro-invertebrates, Periphyton and Riparian Vegetation

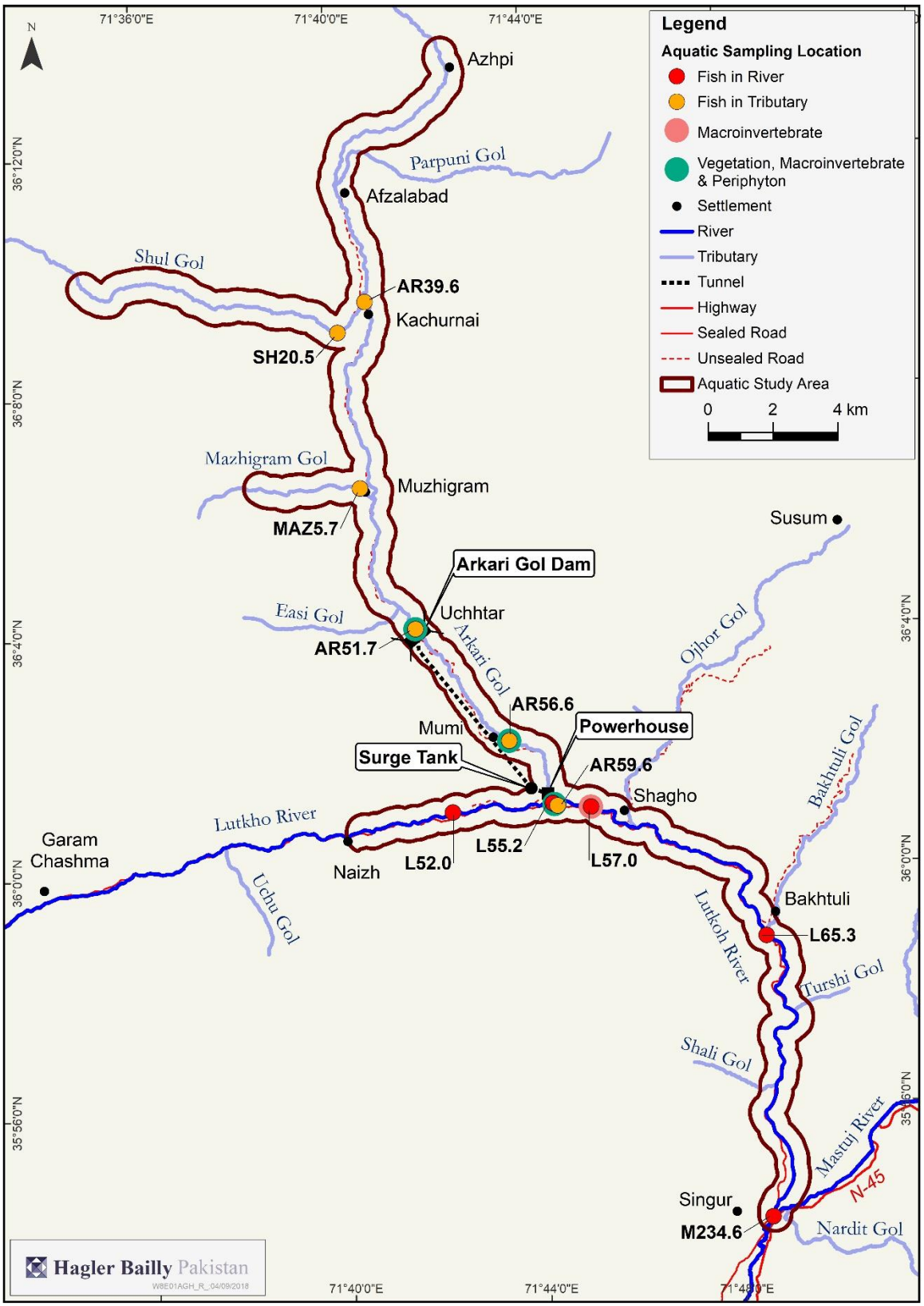


Exhibit 2: Justifications for Selection of Sampling Sites in the Aquatic Study Area

River Segment	*Sampling Site ID*	*Expected impacts from the Project*	*Expected variation in ecology triggered by variations in water temperature and flows*
Upstream of Dam	AR51.7 and AR39.6	The sites are located upstream of the reservoir of proposed dam and will be impacted by the barrier to migration created by the dam	Variations mainly in fish fauna especially migratory fish species due to the barrier created by the dam. Inundation at the reservoir will result in impacts on riparian vegetation
Downstream of Dam	AR56.6	The site will be impacted by the lower flows due to the diversion of the river flow into the power generation tunnel	Variations in macro-invertebrates, periphyton and fish fauna due to changes in flows caused by diversion tunnel that will result in changes in the temperature of the water
Downstream of Powerhouse	AR59.6, L65.3, and M234.6	Both temperature and flow of water in this segment will be impacted by variations in flow due to peaking of dam	Variations in macro-invertebrates, periphyton, riparian vegetation and fish fauna mainly due to changes in the temperature and flow of the water in the River

Exhibit 3: List of Sampling Sites for the Tributaries

Tributary (Local Name)	*Sampling Site ID*
Mazhigram Gol	MAZ5.7
Shul Gol	SH20.5

Terrestrial Study Area

The Terrestrial Study Area comprises the proposed Project facilities as well as a 1 km buffer around proposed Project-related facilities. **Exhibit 4** shows the Terrestrial Study Area and proposed sampling sites.

The locations of the terrestrial ecological sampling sites have been determined based on the two main terrestrial habitat types identified by ***Google Earth™*** satellite imagery and field site visit. The terrestrial habitats identified in the area include

- Barren Land
- Vegetation Cluster

Exhibit 5 provides the habitat type of each sampling site.

The terrestrial ecological resources which will be sampled will include

- Terrestrial vegetation -(diversity, abundance and distribution)
- Terrestrial fauna (mammals, avifauna and herpetofauna) - diversity, abundance, distribution and habitat affinities in the Study Area

Exhibit 4: Terrestrial Study Area Proposed Sampling Sites for Mammals, Birds, Herpetofauna and Terrestrial Vegetation

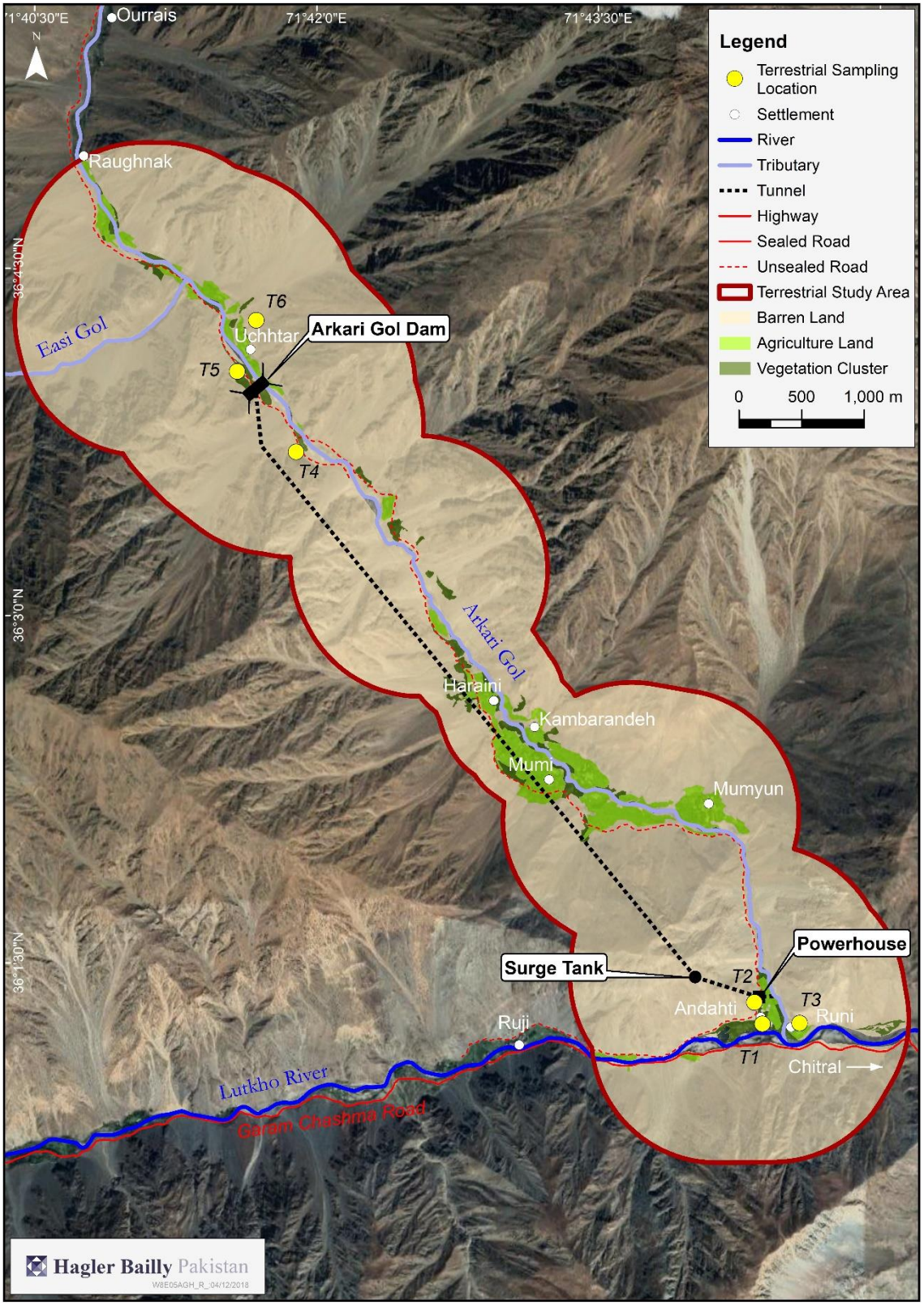


Exhibit 5: Habitat Types for the Terrestrial Sampling Sites

Relative Position of Sampling Site	*Sampling Sites*
Barren Land	T2, T3, T4 and T6
Vegetation Cluster	T1 and T5

Methodology

This section provides information about the materials and methods to be used for the aquatic and terrestrial surveys. The methodology for field data collection has been prepared to collect objective data to contribute towards the determination of baseline conditions for assessments of impacts of the Project. The methods proposed have been tested in similar conditions in baseline ecological surveys of Gulpur Hydropower Project on Poonch River, Kohala Hydropower Project, Azad Pattan Hydropower Project, Mahl Hydropower Project on Jhelum River and Balakot Hydropower Project on Kunhar River.

Aquatic Ecology

The methodology which will be used for collecting field data is outlined below.

Fish

Fish are important components of river ecosystems because they are long-lived and integral to aquatic food webs. They are considered key indicators of environmental change because of their varied life history strategies and their sensitivity to a wide range of hydrologic and water quality conditions.[1,2,3]

Methods for Data Collection

Fish sampling will be carried out in the last week of March 2018. Sampling will be conducted mainly in Arkari Gol, Lutkoh River and its main tributaries with appropriate depth and flow of water where fish are likely to be found. Methods for data collection of fish will include use of cast nets and electrofishing.

Cast Nets

Fish fauna will be collected using cast nets at selected sampling sites. Two types of cast nets will be used. Mesh sizes of 25 mm and 30 mm will be used. A total of 30 castings will be carried out, 15 castings per mesh size, spread over a distance of about 90 m, depending on site conditions.

Electrofishing

Electrofishing uses low pulses of electricity to stun fish before they are caught. Electrofishing is a common scientific survey method used to sample fish populations to

1 Kleynhans, C.J. 1999. The development of a fish index to assess the biological integrity of South African rivers. WATER SA-PRETORIA-, 25, 265-278.

2 Karr, J.R. 1981. Assessment of biotic integrity using fish communities. Fisheries, 6, 21-27.

3 FauscH, K.D., Lyons, J., Karr, J.R. and Angermeier, P.L. 1990. Fish communities as indicators of environmental degradation. In: Adams, S. M., ed. Biological indicators of fish stress. American Fisheries Society, Symposium 8, 1990 1990 Bethesda, Maryland.

determine abundance, density, and species composition. When performed correctly, electrofishing results in no permanent harm to fish, which return to their natural state in as little as two minutes after being stunned.[4]

Electrofishing will be employed for sampling in the main river and tributaries where water levels are low and wading is possible. It is proposed that the LR-24 be used for electrofishing.[5] Electrofishing will be carried out in a 150 m^2 area. **Exhibit 6** shows the fish sampling form.

Statistical Analysis

Statistical analysis will be applied to determine fish community structure and species diversity.

Fish Community Composition

The surveys will produce a list of species at each sampling site plus related information such as relative abundance (Catch per Unit Effort), fish size and weight.

Species Diversity

The species diversity will be assessed using the total number of species

[4] Fishery Research - Electrofishing National Park Service, US Department of the Interior.

[5] Available at Smith Root, http://www.smith-root.com/electrofishers/lr-24/

Exhibit 6: Survey Form - Fish

Sampling Method	☐ Gill Net		☐ Cast Net		☐ Fyke Net		☐ Electrofishing	
ID		W P		Observer(s)				
Date		Start Time		End Time				
	[dd/mm/yy]		[HH:MM]		[HH:MM]			
Direction**	**Starting Coordinates**	**End Coordinates**	Cloud Cover	**%**				
Latitude	N	N	Wind	☐ Light	☐ Moderate	☐ Strong		
Longitude	E	E	Precipitation	☐ Light	☐ Moderate	☐ Heavy		
[Deg Min Sec]			Water Temperature					
River Habitats	☐ Riffles ☐ Pools ☐ Glides ☐ Rapids ☐ Others/Special Habitats _____			Locality				
Riverbed	☐ Sand ☐ Silt ☐ Small Cobbles ☐ Large Cobbles			Mesh Size (mm)				
Depth of Riverbed	☐ Boulders ☐ Boulders _____							
(Please select only one box for Habitat)								
Elevation (m)		**Temp. (oC)**		**pH**		**DO**		**Turbidity**

No.	*Species Name*	*Fish Size (cm)*	*Fish Weight (gms)*	*Tag Color ID*	
				Applied	*Recovered*
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					

Macro-invertebrates

Benthic macro-invertebrates are an important part of the food chain in aquatic ecosystems, especially for fish. Many invertebrates feed on algae and bacteria, which are at the lower end of the food chain. Some scrap and eat leaves and other organic matter that enters or is produced in the water. Because of their abundance and position as 'intermediaries' in the aquatic food chain, benthos plays a critical role in the natural flow of energy and nutrients.[6]

Methods for Data Collection

Macro-invertebrates will be sampled by adopting the standardized rapid biological assessment sampling techniques (using multi-habitat approach) developed by Barbour et al 1999.[7] A Surber Sampler or D frame kick net will be used for sampling. Twenty efforts will be taken at each sampling site based on percent availability of each biotope. For example if a sampling site comprises of 80% riffle and 20% pool habitat, then 16 efforts of the Surber Sampler will be conducted in the riffles and 4 efforts in pool (ratio of 80% to 20%).

At each sampling site, the collected material will be rinsed using running clean stream water through the net two to three times. The material will be transferred into a large (white) tray or a bucket. The sample will then be transferred to a container and covered with 10% formalin.

In the laboratory, each sample will be put into a sieve of 500 μm mesh size and rinsed with running water (to remove traces of formalin). Macro-invertebrates will then be sorted from the samples and identified using a Kyowa Stereozoom Microscope and the identification keys given in Edmondson, 1959[8]; Ali 1967[9], Ali 1970[10], Bouchard 2004.[11]

The abundance of macro-invertebrates per square meter will be calculated and the pollution tolerance of the identified taxa will be taken from HKH bios scoring list (Hindukush Himalayan Score Bio-assessment) (Hartmann *et al.*, Deliverable 10).[12] The Functional Feeding Group of each taxon will be identified.

Exhibit 7 shows the survey form for macro-invertebrates sampling.

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6 Williams D. D. and Feltmate, B. W. 1992. Aquatic Insects. CAB International Wallingford, Oxon. 360 pp.

7 Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

8 Fresh-Water Biology Fresh-Water Biology, Second Edition. By hb Ward and gc Whipple (wt Edmondson, Editor). John Wiley and Sons, New York. 1959.

9 Ali, S.R. 1967. The Mayflies (Order: Ephemeroptera) of Rawalpindi District. Pak. J. Sci. 19 (3): 73-86.

10 Ali, S.R. 1970. Certain Mayflies of West Pakistan. Pak. J. Sci. 22 (3 & 4): 118-124.

11 Bouchard, R.W. Jr. 2004. Guide to Aquatic Macroinvertebrates of Upper Midwest. Water Resources Center, University of Minnesota, St. Paul, Minnesota. 208pp.

12 Hartmann, A., O. Moog, T. Ofenböck, T. Korte, S. Sharma and D. Hering. Deliverable No. 10. ASSESS-HKH Methodology Manual describing fundamentals a application of three approaches to evaluate river quality based on benthic macroinvertebrates: HKH screening, HKH score bioassessment & HKH multimatric bioassessment. 80pp. www.assess-hkh.at

Exhibit 7: Survey Form – Macro-invertebrates

ID		W P		Observer(s)							
Date			Start Time		End Time						
	[dd/mm/yy]			[HH:MM]		[HH:MM]					
	Starting Coordinates		End Coordinates	Cloud Cover	%						
Latitude	N		N	Wind	☐ Light ☐ Moderate ☐ Strong						
Longitude	E		E	Precipitation	☐ Light ☐ Moderate ☐ Heavy						
[Deg Min Sec]				Temperature							
River Habitats Riverbed Depth of Riverbed	☐ Riffles ☐ Pools ☐ Glides ☐ Rapids ☐ Sand ☐ Silt ☐ Small Cobbles ☐ Large Cobbles ☐ Boulders _____ ☐ Others/Special Habitats_____ _____				Locality						
(Please select only one box for Habitat)											
Elevation (m)		Temp. (oC)		pH		DO		Turbidity		No. of kick nets	

No.	*Taxa/Species*	*Count*	*Comments*
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			

Periphyton

The term periphyton refers to the film of living matter coating almost all surfaces in streams. It is usually dominated by benthic algae, but also includes diatoms, bacteria, fungi and other organic matter. Benthic algae are the primary producers in rivers, providing food for macro-invertebrates and fish. They respond rapidly to changing conditions, and they are often the first organisms to respond to and to recover from stress. **Exhibit 1** shows sampling locations for Periphyton**.**

Methods for Data Collection

Collection of five stones of similar size from slow-flowing areas of the run will be carried out at each sampling site. All five stones will be collected from locations with almost similar water depths. Only stones with the following measures will be used: the long axis of each selected stone is between 150 mm and 250 mm; a depth is between 20 cm and 40 cm.

It will be ensured that:

- the algal sampling area is kept separate from the macro-invertebrate sampling area as the kick sampling technique used for macro-invertebrate sampling dislodges the periphyton;
- only those stones are taken which are from the part of the channel that is inundated all year around.

The sampling protocol that will be used for each stone is as follows:

- Measure water depth *in situ* at each stone location prior to its removal from the river bed.
- Place a stone in a sampling tray and remove the periphyton by scrubbing and rinsing with clean water (sediment –free) brought to site, and until no change in the rinsing water is evident.
- Extract a sub-sample of 30 ml from the sample and preserve in 1 ml Lugol's solution for further identification of algal species.
- The remainder of the sample slurry should be stored on ice in a cooler box in the field, and frozen within 12 hours of collection, for determination of periphyton biomass (ash free dry weight).
- Measure the dimensions of each stone as the longest axis (i.e. x), the longest horizontal axis perpendicular to x, (i.e. y) and the longest vertical axis of the stone (i.e. z) and note in the format.

Exhibit 8 shows the survey form for periphyton sampling.

Exhibit 8: Survey Form – Periphyton

ID		W P		Observer(s)			
Date		Start Time		End Time			
	[dd/mm/yy]		[HH:MM]		[HH:MM]		
			Cloud Cover	%			
Direction	**Starting Coordinates**		**End Coordinates**				
Latitude	N		N				
Longitude	E		E				
[Deg Min Sec]			Temperature				
Type of River Habitat	☐ Pools ☐ Glides ☐ Riffles ☐ Rapids ☐ Sand ☐ Silt ☐ Small Cobbles ☐ Large Cobbles ☐ Boulders_____ ☐ Others/Specieal Habitats ☐ Nature of river bed _____ Other_____			Water Depth			
(Please select only one box for Habitat)							
Water Attributes				Locality			
Elevation (m)		**Temp. (oC)**		**pH**		**DO**	
Turbidity		**Others**					

Rock	*Rock Dimensions (xyz)*	*Depth (cm) at each stone*
1		
2		
3		
4		
5		

Methods for Sample Analysis

When defrosted, each sample will be mixed for the measurement of two periphyton biomass indicators (normalized to mg /m^2) i.e. total dry mass, (ash free dry weight (AFDW).

The method for determination of AFDW is as follows:

- Measure total dry weight by filtering the sub-sample portion through Whatmann GFF 4 glass fibre filter papers which are then dried at 60oC overnight. Then ash the samples in an oven at 400oC for 4 hours. The difference between the dry weight and the weight of the ash is the organic component (i.e. AFDM) of the periphyton.
- AFDW values for each subsample should be adjusted by dividing by 30 and multiplying by the total slurry volume to obtain AFDM values for each stone.

Calculate the surface area of each stone using the following equation:

$$\text{Stone Surface Area} = \frac{0.014(xy+xz+yz) + 33.819}{10{,}000}$$

where stone surface area is in m^2 and x, y, z are the measured stone dimensions in mm.

- Multiply AFDM values for each stone by the surface area of that stone to obtain a density per unit stone surface area.

Riparian Vegetation

Riparian vegetation is the plant community sustained by river flow, groundwater or generally moist conditions along river margins, and is typically distinct in species composition from adjacent terrestrial communities.[13]

Riparian vegetation plays a central role in the functioning of riverine ecosystems: bank erosion is reduced through armoring; water quality is maintained through trapping of sediment, nutrients and other contaminants, and shading regulates river water temperature and thus primary productivity; food is provided for riparian animals in the form of fruits, nuts and leaves, and for aquatic macro-invertebrates in the form of leaf litter; the plants themselves offer a diverse array of habitats as well as a corridor for the movement of migratory terrestrial and semi-aquatic animals.[14]

Methods for Data Collection

The usual means of sampling vegetation for floristic composition is the quadrat. The vegetation in the marginal zone and flood plain in the Study Area will be sampled by the quadrate method, taking 3 quadrates of 5m x 5m at each sampling site. The first quadrat will be taken at the beginning of the transect, the second at 250 meters and the third at 500 m. Plants from each quadrate will be noted and collected for the assessment of the plant species if required. Additional plant species in the area adjacent to the quadrate will also be noted down. Cover, relative cover, density, relative density, frequency, relative frequency percentages and Importance Value Index (IVI) for each species from the study will be calculated by using the following formulae:

The Cover and Relative Cover of species will be calculated using the following formula:

$$\text{Cover} = \frac{\text{Total cover (cm) of a specie}}{\text{Number of plants of a species}}$$

$$\text{Relative Cover} = \frac{\text{Total cover (sq cm) of all plants of a species x 100}}{\text{Total cover (sq cm) of plants of all species}}$$

The Density and Relative Density of the species in the area will be calculated using the following formulae:

$$\text{Density} = \frac{\text{Total number of individuals of a species in all quadrats taken}}{\text{Total number of quadrats taken}}$$

[13] Parkyn, Stephanie. (2004). *Review of Riparian Buffer Zone Effectiveness*. Ministry of Agriculture and Forestry (New Zealand), www.maf.govt.nz/publications.

[14] PROSSER, I.P. 1999. Identifying priorities for riparian restoration aimed at sediment control. Second Australian stream management conference, 8-11 February. Adelaide, South Australia. Pg 511-516.

$$\text{Relative Density} = \frac{\text{Total number of individuals of a species in all quadrats x 100}}{\text{Total number of individual of all species in all quadrats}}$$

The Frequency and Relative Frequency percentages of the species will be determined using the following formulae:

$$\text{Frequency} = \frac{\text{Number of quadrats of occurrence of a species x 100}}{\text{Total number of quadrats lay out}}$$

$$\text{Relative Frequency} = \frac{\text{Frequency of a species x 100}}{\text{Total Frequency of all species}}$$

Importance Value Index (IVI) of all the recorded species will be calculated using the following formulae:

$$\text{IVI} = \frac{\text{Relative cover + Relative frequency + Relative density}}{3}$$

Plants collected will be identified following the nomenclature from Flora of Pakistan (Nasir and Ali 1972-1994[15], Ali and Qaiser, 1995-to date[16]).

Local people will be consulted to gather information about local names, uses, value and cultural values of the plants of the area.

The locations for sampling of riparian vegetation will be the same as for aquatic ecological resources shown in **Exhibit 1**.

The riparian vegetation survey form is included in **Exhibit 9**.

Terrestrial Ecology

Line transect method of different design will be used for the terrestrial ecological resources including terrestrial vegetation, mammals, avifauna and herpetofauna. A brief description of the methodology that is to be used for different terrestrial ecological resources is described below;

Terrestrial Vegetation

Terrestrial vegetation refers to the plant species that grow on land and are not directly dependent on the river.

Methods for Data Collection

The usual means of sampling vegetation for floristic composition is the quadrat. The vegetation in the marginal zone, flood plain and terrestrial habitats in the Study Area was sampled by the quadrat method, taking 3 quadrats of 5m x 5m at each sampling site. The

[15] S. I. and Nasir. 1972-1994. Flora of Pakistan Fascicles. Islamabad

[16] Ali, S. I. and Qaiser, M. 1995 to date. Flora of Pakistan Fascicles. Karachi

first quadrat was taken at the beginning of the transect, the second at 250 meters and the third at 500 m. Plants from each quadrat were noted and collected for the identification of the plant species if required. Additional plant species in the area adjacent to the quadrat will also be noted down. Cover, relative cover, density, relative density, frequency, relative frequency percentages and Importance Value Index (IVI) for each species from the study were calculated by using the following formulae:

The Cover and Relative Cover of species and other indices will be calculated using the formulas listed for riparian vegetation. **Exhibit 9** shows the terrestrial vegetation survey forms.

Exhibit 9: Survey Form – Riparian Vegetation/Terrestrial Vegetation

ID		W P		Observer(s)		
Date			Start Time		End Time	
	[dd/mm/yy]			[HH:MM]		[HH:MM]
	Starting Coordinates			**End Coordinates**		
Latitude	N			N		
Longitude	E			E		
[Deg Min Sec]				[Deg Min Sec]		
Habitat	☐ Riparian ☐ Agricultural Fields ☐ Pine Forest ☐ Scrub Forest ☐ Others/Special Habitats _____			Locality		
(Please select only one box for Habitat)						

No.	*Species Name*	*Circumference (Inches)*						
		Count	*1*	*2*	*3*	*4*	*5*	*6*
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								
13.								
14.								
15.								
16.								
17.								
18.								
19.								
20.								

Note: Quadrate size will be5 m X 5 m. Three quadrates will be placed. The first will be taken at 0 m, second at 250 m and third at 500 m.

Mammals

Line transects (500 m by 20 m) will be placed at each sampling site to record all animals or their signs detected. All the animals sighted, or their signs (foot marks, droppings, dens) will be recorded. GPS coordinates of the location and habitat type will also be documented. Transects will be started as early as possible in the day and will cover all possible habitat types in order to avoid bias of stratification.

In addition, incidental sightings of all mammals will be recorded; number of individuals, location and habitat type will be recorded for each sighting. Anecdotal information regarding specific mammals will be collected from the local people and relevant literature will also consult.

Exhibit 10 shows the survey form for mammals sampling.

Exhibit 10: Survey Form –Mammals

ID		W P		Observer(s)		
Date		Start Time		End Time		
	[dd/mm/yy]			[HH:MM]		[HH:MM]
	Starting Coordinates			**End Coordinates**		
Latitude	N			N		
Longitude	E			E		
[Deg Min Sec]				[Deg Min Sec]		
Habitat	☐ Riparian ☐ Agricultural Fields ☐ Pine Forest ☐ Scrub Forest ☐ Others/Special Habitats_____			Locality		
(Please select only one box for Habitat)						

No.	*Species Name*	*Distance* (m)*	*Sighting*	*Type of Sign*			*Comments*
				Tracks	*Scats*	*Den*	

* Record Mammal 10 m on each side of transect line, 500 m long

** Direction of transect towards South

Avifauna

The methods for data collection and analysis are given in this section.

Methods for Data Collection

Line transects (500 m by 50 m) will be used. Line transects will be placed at each sampling site to record all birds observed. Transects will be started as early as possible in the morning and in late afternoon and will cover all possible habitats. The start time and coordinates of the starting point will be recorded. The bird species will be identified using the most recent keys available in literature.[17] Density and diversity of birds will be calculated.

Exhibit 11 shows the survey form for avifauna sampling.

[17] Grimmett, R., Roberts, T., and Inskipp, T. 2008. Birds of Pakistan, Yale University Press.

Exhibit 11: Survey Form – Birds

ID		W P		Observer(s)	
Date			Start Time		End Time
	[dd/mm/yy]			[HH:MM]	[HH:MM]
Direction**	**Starting Coordinates**		**End Coordinates**	Cloud Cover	**%**
Latitude	N		N	Wind	☐ Light ☐ Moderate ☐ Strong
Longitude	E		E	Precipitation	☐ Light ☐ Moderate ☐ Heavy
[Deg Min Sec]				Temperature	
Habitat	☐ Riparian ☐ Agricultural Fields ☐ Pine Forest ☐ Scrub Forest ☐ Others/Special Habitats_____			Locality	
(Please select only one box for Habitat)					

No.	*Species Name*	*Distance* (m)*	*Count*	*Comments*
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				

Note:

* Record birds 25 m on each side of transect line, 500 m long

**Direction of transect towards South

Methods for Data Analysis

The species richness (number of species observed) and abundance (number of individuals of each species observed) at the specified sampling sites will be calculated.

Herpetofauna

The methods for data collection and analysis for herpetofauna are given in this section.

Methods for Data Collection

Line transects 500 m long and 20 m wide will be placed systematically at each sampling site in the Study Area.

An effective way to survey reptiles is by active searching, particularly during the daytime. This method is equally applicable to both nocturnal and diurnal species. The sampling sites will be actively searched for all types of reptiles and amphibians along the line transects. Active searching will also carried out in sampling areas with a focus on suitable microhabitats. The species collected or observed during the survey will photograph with a digital camera and necessary field data will be recorded. The coordinates and elevations will be recorded using GPS, and other features of interest like habitat type will be documented.

The presence of signs such as an impression of body, tail or footprints, fecal pellets, tracks, dens or egg laying excavations will also be recorded.

Samples will be collected and preserved for identification purposes where the species cannot be identified in the field for any reason. Hand picking (using bare hands or with the help of long forceps or a snake clutch) is the most efficient way of collecting different species of reptiles. For handling snakes, especially poisonous ones, snake clutches/sticks will be used.

Preservatives such as 10% formalin solution or 50-70% alcohol or methylated spirits solution in water will be added to just cover the specimens, and the container will be covered and left until the specimens are set. In the case of larger specimens, a slit will be made in the belly and preservative will be injected to preserve the internal organs.

The specimens will be stored in the same preservative in a watertight jar. A waterproof label will be added to the jar, giving details of habitat, date and collector's name. A label will be tied to the specimen written with permanent Indian ink or simple carbon pencil.

The specimens will be identified with the help of the most recent keys available in literature (Khan, 2006)[18].

Exhibit 12 shows the survey form for herpetofauna sampling.

[18] Muhammad Sharif Khan. 2006. Amphibians and Reptiles of Pakistan. Krieger Publishing Company, Malabar, Florida, pp. 311.

Exhibit 12: Survey Form – Herpetofauna

ID		W P		Observer(s)	
Date			Start Time		End Time
	[dd/mm/yy]			[HH:MM]	[HH:MM]
Direction**	**Starting Coordinates**		**End Coordinates**	Cloud Cover	**%**
Latitude	N		N	Wind	☐ Light ☐ Moderate ☐ Strong
Longitude	E		E	Precipitation	☐ Light ☐ Moderate ☐ Heavy
[Deg Min Sec]				Temperature	
Habitat	☐ River Bank ☐ Agricultural Fields ☐ Forest ☐ Range Land ☐ Others/Special Habitats_____			Locality	
(Please select only one box for Habitat)					

No.	*Species Name*	*Distance* (m)*	*Count*	*Comments*
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				

Note: See attached list for names of some of the reptile species found in the study area. Please name properly

* Record reptile on the 10 m on each side of transect line, 500 m long

**Direction of transect towards South

Methods for Data Analysis

Density and diversity of herpetofauna at each sampling site will be calculated.

Equipment Required

The following equipment will be required for the field surveys:

- 1 GPS
- 1 Cameras
- 2 Measuring Tapes
- 10 Sampling Collection Bags
- 40 Sherman Traps
- 1 Pair of Binoculars

Schedule

The aquatic and terrestrial ecological field surveys will be carried out at the end of March 2018. Terrestrial fauna will also be active at this time, with an increase in vegetation growth and abundance due to advent of spring.

Exhibit 13 shows the field plan for aquatic and terrestrial ecological surveys in March 2018**.**

Exhibit 13: Proposed Field Plan for Aquatic and Terrestrial Ecology Surveys

Day	*Date*	*Activity*
Day 1	March 28, 2018	Travelling from Islamabad to Chitral
Day 2	March 29, 2018	AR59.6, AR56.6, and L52
Day 3	March 30, 2018	AR71.7, MAZ5.7, SH20.5 and AR39.6
Day 4	March 31, 2018	L55.2, L65.3, M234.6 and L57.0
Day 5	April 01, 2018	T1, T2, and T3
Day 6	April 02, 2018	T4, T5 and T6
Day 7	April 03, 2018	Travel back to Islamabad

Team

The team for the ecology field survey will consist of the following members:

Team Member	*Responsibility*
Vaqar Zakaria	Quality Control
Dr. M Rafique	Supervisor and Specialist Team Leader: aquatic survey
Ahmad Shoaib	Specialist: aquatic survey; data entry and reporting, field logistics and coordination
Shakeel Ahmad	Aquatic and Terrestrial surveys; data entry and reporting
Mishkatullah	Macro-invertebrate survey; data entry and reporting
Kamran Minai	Reporting

Appendix C: Summary of Fish Field Data

See following page.

Sampling ID	*Location*	*Total Specimen Captured*	*Total Species Captured*	*Most Abundant Species*		*2nd Most Abundant Species*	
				Name	*Number*	*Name*	*Number*
AR39.6	Arkari Gol near Kachurnai Village	–	–	–	–	–	–
AR51.7	Arkari Gol near Dam site	–	–	–	–	–	–
AR56.6	Arkari Gol near Momi Village	6	2	*Triplophysa choprai*	5	*Glyptosternum reticulatm*	1
AR59.6	Arkari Gol near to Powerhouse	26	2	*Triplophysa choprai*	18	*Triplophysa choprai*	7
L52.0	Lutkoh river near Ruji Village	12	2	*Glyptosternum reticulatm*	6	*Triplophysa choprai*	6
L55.2	Lutkoh River near to Powerhouse	51	2	*Triplophysa choprai*	30	*Triplophysa choprai*	14
L57.0	Lutkoh River, Downstream of Powerhouse	32	2	*Triplophysa choprai*	20	*Schizothorax richardsonii*	12
L65.3	Lutkoh river near Bakhtoli Village	17	3	*Triplophysa choprai*	7	*Schizothorax richardsonii*	5
M234.6	Chitral River, downstream of the confluence of Chitral and Lutkoh River	15	2	*Triplophysa choprai*	10	*Triplophysa choprai*	4
Total		**159**	**3**				
MAZ5.7	Mazhigram Nullah near Dam site	–	–	–	–	–	–
SH20.5	Shul Nullah near to Kachurnai Village	–	–	–	–	–	–
Total		–	–				
Grand Total		**159**	**3**				

Appendix D: Species List

Vegetation

No.	*Species Observed*	*IUCN Status*	*Invasive*	*Endemic*	*CITES Appendices*
1.	*Salix acmophylla*	Least Concern			
2.	*Ailanthus altissima*	Not Assessed			
3.	*Artemisia maritima*	Not Assessed			
4.	*Ficus carica*	Least Concern			
5.	*Juniper spp*	Not Assessed			
6.	*Mentha longifolia*	Not Assessed			
7.	*Morus nigra*	Not Assessed			
8.	*Pistacia khinjuk*	Least Concern			
9.	*Platanus orientalis*	Data Deficient			
10.	*Populus ciliata*	Not Assessed			
11.	*Robinia pseudoacacia*	Least Concern			
12.	*Rumex hastatus*	Not Assessed	✓		
13.	*Salix viminalis*	Least Concern			
14.	*Sisymbrium irio*	Not Assessed			

Large Mammals

No	*Scientific Name*	*Common Name*	*IUCN Status*	*Endemic*	*CITES Appendices*
1.	*Panthera uncial*	Snow Leopard	**Vulnerable**		I
2.	*Canis lupus*	Grey Wolf	Least Concern		II
3.	*Canis aureus*	Asiatic Jackal	Least Concern		III
4.	*Vulpes vulpes*	Red Fox	Least Concern		III
5.	*Capra falconeri*	Flare-horned Markhor	**Near Threatened**		I

Birds

No	*Scientific Name*	*Common Name*	*IUCN Status*	*Migratory/Congregatory*
1.	*Gypaetus barbatus*	Bearded Vulture	Near Threatened	Not a migrant
2.	*Milvus migrans*	Black Kite	Least Concern	Full migrant
3.	*Pica hudsonia*	Black-billed Magpie	Least Concern	Not a migrant
4.	*Myophonus caeruleus*	Blue Whistling Thrush	Least Concern	Not a migrant

No	*Scientific Name*	*Common Name*	*IUCN Status*	*Migratory/Congregatory*
5.	*Cinclus pallasii*	Brown Dipper	Least Concern	Not a migrant
6.	*Acridotheres tristis*	Common Myna	Least Concern	Not a migrant
7.	*Aythya nyroca*	Ferruginous Duck	Near Threatened	Full migrant / congregatory and dispersive
8.	*Motacilla cinerea*	Grey Wagtail	Least Concern	Not a migrant
9.	*Pycnonotus leucogenys*	Himalayan Bulbul	Least Concern	Not a migrant
10.	*Passer domesticus*	House Sparrow	Least Concern	Not a migrant
11.	*Corvus macrorhynchos*	Jungle Crow	Least Concern	Not a migrant
12.	*Anas platyrhynchos*	Mallard	Least Concern	Full migrant / congregatory and dispersive
13.	*Rhyacornis fuliginosa*	Plumbeous Water Redstart	Least Concern	Not a migrant
14.	*Prunella strophiata*	Rufous-breasted accentor	Least Concern	Not a migrant
15.	*Saxicola rubicola*	Stone Chat	Least Concern	Not a migrant
16.	*Trochalopteron lineatum*	Streaked Laughing Thrush	Least Concern	Not a migrant
17.	*Motacilla alba*	White Wagtail	Least Concern	Not a migrant
18.	*Chaimarrornis leucocephalus*	White-capped Redstart	Least Concern	Not a migrant
19.	*Motacilla flava*	Yellow Wagtail	Least Concern	Not a migrant

Herpetofauna

No.	*Scientific Name*	*Common English Name*	*IUCN status*	*Endemic*	*CITES Appendices*
1.	*Bufotes pseudoraddei*	Swat Green Toad	Least Concern		
2.	*Bufotes baturae*	Batura Glacier Toad	Not Assessed		
3.		Bufotes spp.	Not Assessed		
4.	*Paralaudakia caucasia*	Caucasian Agama	Not Assessed		

Appendix E: Ecology Field Data

Exhibit E.1: Riparian Vegetation

Location ID	*Coordinates*		*Date*	*Habitat*	*Salix viminalis*		*Ficus carica*		*Rubus ellipticus*		*Ailanthus altissima*		*Artemisia maritima*		*Robinia pseudoacacia*		*Populus ciliata*	
	Latitude	*Longitude*			*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*
AR51.7	36 02 9.32	71 43 26.51	4/1/2018	Riparian	–	0%	–	0%	–	0%	–	0%	–	0%	3	0.37%	–	0%
AR56.6	36 02 9.1	71 43 26.3	4/1/2018	Riparian	6	0.74%	1	0.12%	1	0.12%	–	0%	–	0%	–	0%	1	0.12%
AR59.6	36 01 4.87	71 44 20.06	4/1/2018	Riparian	–	0%	–	0%	–	0%	4	0.50%	3	0.37%	–	0%	1	0.12%
					6	**0.74%**	**1**	**0.12%**	**1**	**0.12%**	**4**	**0.50%**	**3**	**0.37%**	**3**	**0.37%**	**2**	**0.25%**

Location ID	*Coordinates*		*Date*	*Habitat*	*Juniper spp*		*Sisymbrium irio*		*Platanus orientalis*		*Rumex hastatus*		*Salix acmophylla*		***Total count***	***Total Cover***	***Species Count***
	Latitude	*Longitude*			*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*			
AR51.7	36 02 9.32	71 43 26.51	4/1/2018	Riparian	3	0.37%	3	0.37%	–	0%	–	0%	2	0.25%	**11**	**1.36%**	**4**
AR56.6	36 02 9.1	71 43 26.3	4/1/2018	Riparian	–	0%	–	0%	1	0.12%	–	0%	3	0.37%	**13**	**1.61%**	**6**
AR59.6	36 01 4.87	71 44 20.06	4/1/2018	Riparian	–	0%	4	0.50%	–	0%	4	0.50%	5	0.62%	**21**	**2.60%**	**6**
					3	**0.37%**	**7**	**0.87%**	**1**	**0.12%**	**4**	**0.50%**	**10**	**1.24%**	**45**	**5.57%**	**12**

Exhibit E.2: Terrestrial Vegetation

Location ID	Coordinates		Date	Habitat	*Salix viminalis*		*Ficus carica*		*Mentha longifolia*		*Morus nigra*		*Ailanthus altissima*		*Artemisia latifolia*		*Robinia pseudoacacia*		*Populus ciliata*		*Juniper spp*		*Sisymbrium irio*	
	Latitude	*Longitude*			*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*
T2	36 01 13.6	71 44 11.5	4/1/2018	Barren Land	–	0%	–	0%	–	0%	–	0%	–	0%	7	0.87%	–	0%	–	0%	–	0%	–	0%
T4	36 03 48.0	71 41 44.7	4/2/2018	Barren Land	–	0%	–	0%	–	0%	–	0%	–	0%	5	0.62%	–	0%	–	0%	–	0%	3	0.37%
T6	36 04 18.0	71 41 21.0	4/2/2018	Barren Land	–	0%	–	0%	6	0.74%	–	0%	–	0%	15	1.86%	–	0%	–	0%	–	0%	6	0.74%
T3	36 01 08.6	71 44 25.5	4/6/2018	Barren Land	–	0%	–	0%	–	0%	–	0%	2	0.25%	5	0.62%	2	0.25%	–	0%	2	0.25%	–	0%
T1	36 01 06.0	71 44 19.2	4/1/2018	Vegetation Cluster	9	1.11%	2	0.25%	–	0%	1	0.12%	2	0.25%	–	0%	–	0%	–	0%	–	0%	–	0%
T5	36 04 1.76	71 41 31.18	4/2/2018	Vegetation Cluster	–	0%	–	0%	–	0%	–	0%	1	0.12%	2	0.25%	2	0.25%	2	0.25%	–	0%	5	0.62%
					9	**1.11%**	**2**	**0.25%**	**6**	**0.74%**	**1**	**0.12%**	**5**	**0.62%**	**34**	**4.21%**	**4**	**0.50%**	**2**	**0.25%**	**2**	**0.25%**	**14**	**1.73%**

Location ID	Coordinates		Date	Habitat	*Platanus orientalis*		*Pistacia khinjuk*		*Rumex hastatus*		*Salix acmophylla*		*Total count*	*Total Cover %*	*Species Count*
	Latitude	Longitude			*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*	*Count*	*Cover %*			
T2	36 01 13.6	71 44 11.5	4/1/2018	Barren Land	–	0%	–	0%	4	0.50%	–	0%	11	**1.36%**	**2**
T4	36 03 48.0	71 41 44.7	4/2/2018	Barren Land	–	0%	–	0%	–	0%	–	0%	8	**0.99%**	**2**
T6	36 04 18.0	71 41 21.0	4/2/2018	Barren Land	–	0%	–	0%	–	0%	–	0%	27	**3.34%**	**3**
T3	36 01 08.6	71 44 25.5	4/6/2018	Barren Land	–	0%	–	0%	8	0.99%	–	0%	19	**2.35%**	**5**
T1	36 01 06.0	71 44 19.2	4/1/2018	Vegetation Cluster	1	0.12%	–	0%	–	0%	3	0.37%	18	**2.23%**	**6**
T5	36 04 1.76	71 41 31.18	4/2/2018	Vegetation Cluster	–	0%	5	0.62%	–	0%	2	0.25%	19	**2.35%**	**7**
					1	**0.12%**	**5**	**0.62%**	**12**	**1.49%**	**5**	**0.62%**	**102**	**12.63%**	**14**

Exhibit E.3: Mammals

Transect ID	*Date*	*Coordinates*		*Habitat*	*Canis aureus*			*Vulpes vulpes*			*Canis lupus*			*Capra falconeri*			*Panthera uncia*			***Sighting***		***Signs***	
		Latitude	*Longitude*		Asiatic Jackal			Red Fox			Grey Wolf			Flare–horned Markhor			Snow Leopard						
					Sighting	*Signs*	***Total***	*Sighting*	*Signs*	***Total***	*Sighting*	*Signs*	***Total***	*Sighting*	*Signs*	***Total***	*Sighting*	*Signs*	***Total***	***Total***	***Species Count***	***Total***	***Species Count***
T3	7/27/17	33 46 49.90	73 34 08.90	Barren Land	–	1	**1**	–	1	**1**	–	–	**–**	–	–	**–**	–	–	**–**	**–**	**–**	**2**	**2**
T6	7/27/17	33 54 27.30	73 35 32.60	Barren Land	1	1	**2**	–	2	**2**	–	1	**1**	–	–	**–**	–	–	**–**	**1**	**1**	**4**	**3**
T4	7/29/17	33 56 53.60	73 33 27.40	Barren Land	–	–	–	–	–	**–**	–	1	**1**	–	–	**–**	–	1	**1**	**–**	**–**	**2**	**2**
T2	7/26/17	33 26 53.80	73 33 33.30	Barren Land	–	–	–	–	1	**1**	–	–	**–**	55	–	**55**	–	–	**–**	**55**	**1**	**1**	**1**
T5	7/27/17	33 51 39.10	73 35 40.90	Vegetation Cluster	–	–	–	–	2	**2**	–	–	**–**	–	–	**–**	–	–	**–**	**–**	**–**	**2**	**1**
T1	7/27/17	33 52 17.50	73 35 47.40	Vegetation Cluster	–	–	–	–	2	**2**	–	–	**–**	–	–	**–**	–	–	**–**	**–**	**–**	**2**	**1**
					1	**2**	**3**	**–**	**8**	**8**	**–**	**2**	**2**	**55**	**–**	**55**	**–**	**1**	**1**	**56**	**2**	**13**	**10**

Exhibit E.4: Birds

Location ID	*Date*	*Starting*		*Habitat*	*Gypaetus barbatus*	*Milvus migrans*	*Pica hudsonia*	*Myophonus caeruleus*	*Cinclus pallasii*	*Acridotheres tristis*	*Aythya nyroca*	*Motacilla cinerea*	*Pycnonotus leucogenys*	*Passer domesticus*	*Corvus macrorhynchos*	*Anas platyrhynchos*	*Rhyacornis fuliginosa*	*Prunella strophiata*	*Saxicola rubicola*	*Trochalopteron lineatum*	*Motacilla alba*	*Chaimarrornis leucocephalus*	*Motacilla flava*	***Total***	***Species Count***	***Percentages***
		Latitude	*Longitude*		Bearded Vulture	Black Kite	Black–billed Magpie	Blue Whistling Thrush	Brown Dipper	Common Myna	Ferruginous Duck	Grey Wagtail	Himalayan Bulbul	House Sparrow	Jungle Crow	Mallard	Plumbeous Water Redstart	Rufous–breasted accentor	Stone Chat	Streaked Laughing Thrush	White Wagtail	White–capped Redstart	Yellow Wagtail			
T3	4/1/2018	36 01 08.6	71 44 25.5	Barren Land	–	–	6	2	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	**10**	**4**	**7.41**
T2	4/1/2018	36 01 13.6	71 44 11.5	Barren Land	1	2	–	–	–	–	–	–	–	–	6	–	–	–	–	–	10	–	–	**19**	**4**	**14.07**
T6	4/12/2018	36 04 18.0	71 41 21.0	Barren Land	–	–	–	2	–	–	–	–	2	–	–	–	–	–	–	–	3	1	–	**8**	**4**	**5.93**
T4	4/12/2018	36 03 48.0	71 41 44.7	Barren Land	–	–	–	3	–	–	–	–	–	–	–	–	–	4	–	–	3	–	–	**10**	**3**	**7.41**
T1	4/1/2018	36 01 06.0	71 44 19.2	Vegetation Cluster	–	2	8	4	2	1	10	3	–	2	6	20	2	–	2	2	10	3	3	**80**	**16**	**59.26**
T5	4/2/2018	36 04 1.76	71 41 31.1	Vegetation Cluster	–	–	–	4	3	–	–	–	–	–	–	–	1	–	–	–	–	–	–	**8**	**3**	**5.93**
					1	**4**	**14**	**15**	**5**	**2**	**10**	**3**	**2**	**3**	**12**	**20**	**3**	**4**	**2**	**2**	**26**	**4**	**3**	**135**	**19**	**100**

Exhibit E.5: Herpetofauna

Location ID	*Date*	*Coordinates*		*Habitat*	*Paralaudakia caucasia*	*Bufotes baturae*	*Hoplobatrachus tigerinus*	*Bufotes pseudoraddei*	***Total***	***Species Count***	***Percentage***
		Latitude	*Longitude*		Caucasian Agama	Batura Glacier Toad	Swat Green Toad	Btura spps.			
T6	4/1/2018	36 04 18.0	71 41 21.0	Barren Land	6	–	–	1	**7**	**2**	**10.94**
T3	4/1/2018	36 01 08.6	71 44 25.5	Barren Land	5	–	–	–	**5**	**1**	**7.81**
T2	4/1/2018	36 01 13.6	71 44 11.5	Barren Land	10	–	–	–	**10**	**1**	**15.63**
T4	4/2/2018	36 03 48.0	71 41 44.7	Barren Land	30	–	–	–	**30**	**1**	**46.88**
T1	4/1/2018	36 01 06.0	71 44 19.2	Vegetation Cluster	–	2	4	–	**6**	**2**	**9.38**
T5	4/2/2018	36 04 1.76	71 41 31.18	Vegetation Cluster	3	–	3	–	**6**	**2**	**9.38**
					54	**2**	**7**	**1**	**64**	**4**	**100**

Appendix F: Physical Environment Survey Plan

F.1 Physical Environment Study Area

The Study Area takes account sensitive receptors[1] that are most likely to be impacted by the Project's development activities. The area of influence for physical environment is generally within the valley around the Project Dam and Powerhouse sites.

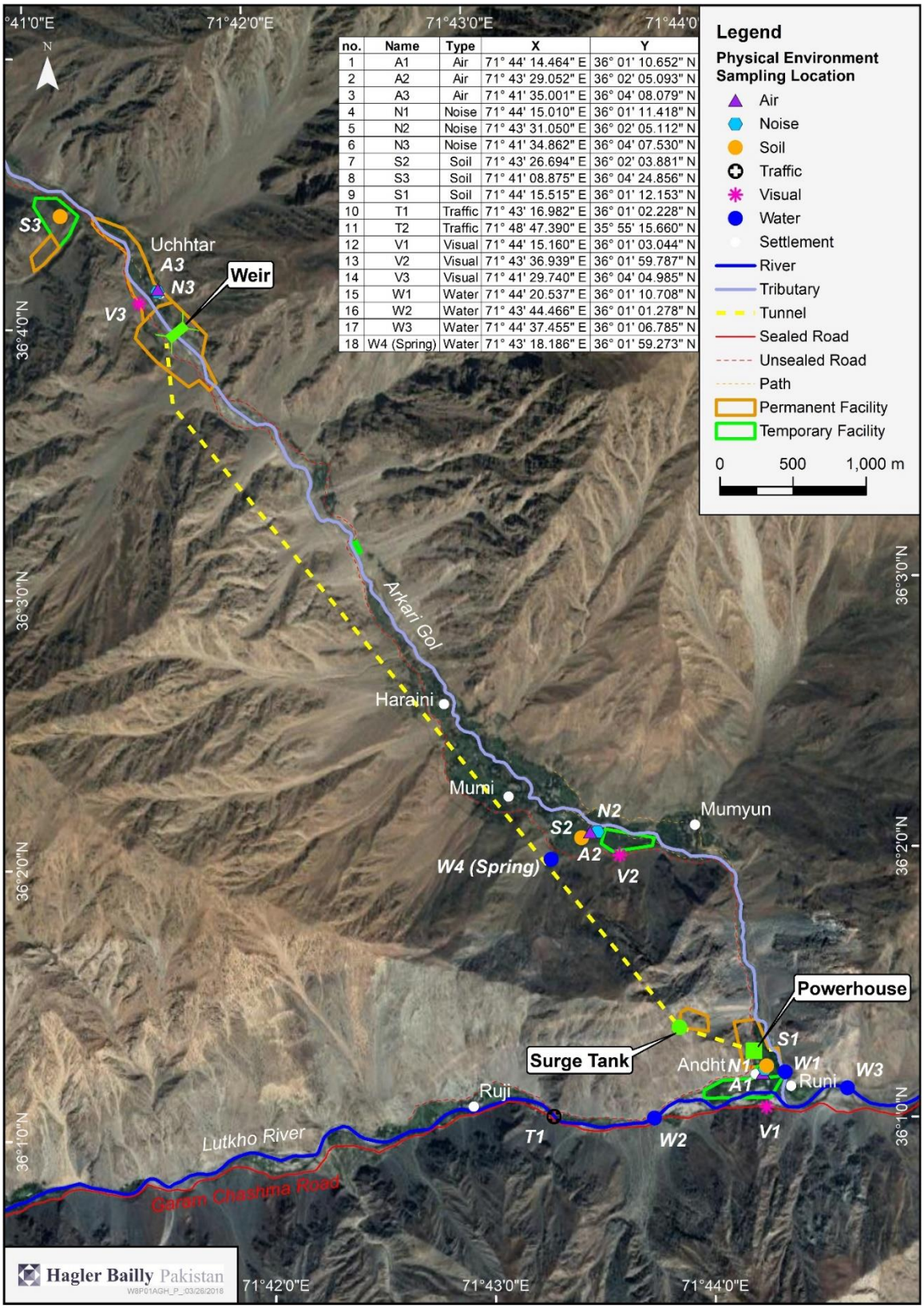
The following surveys are planned:

- Visual Character
- Air Quality
- Noise
- Traffic
- Water
- Soil
- Hydro-Census

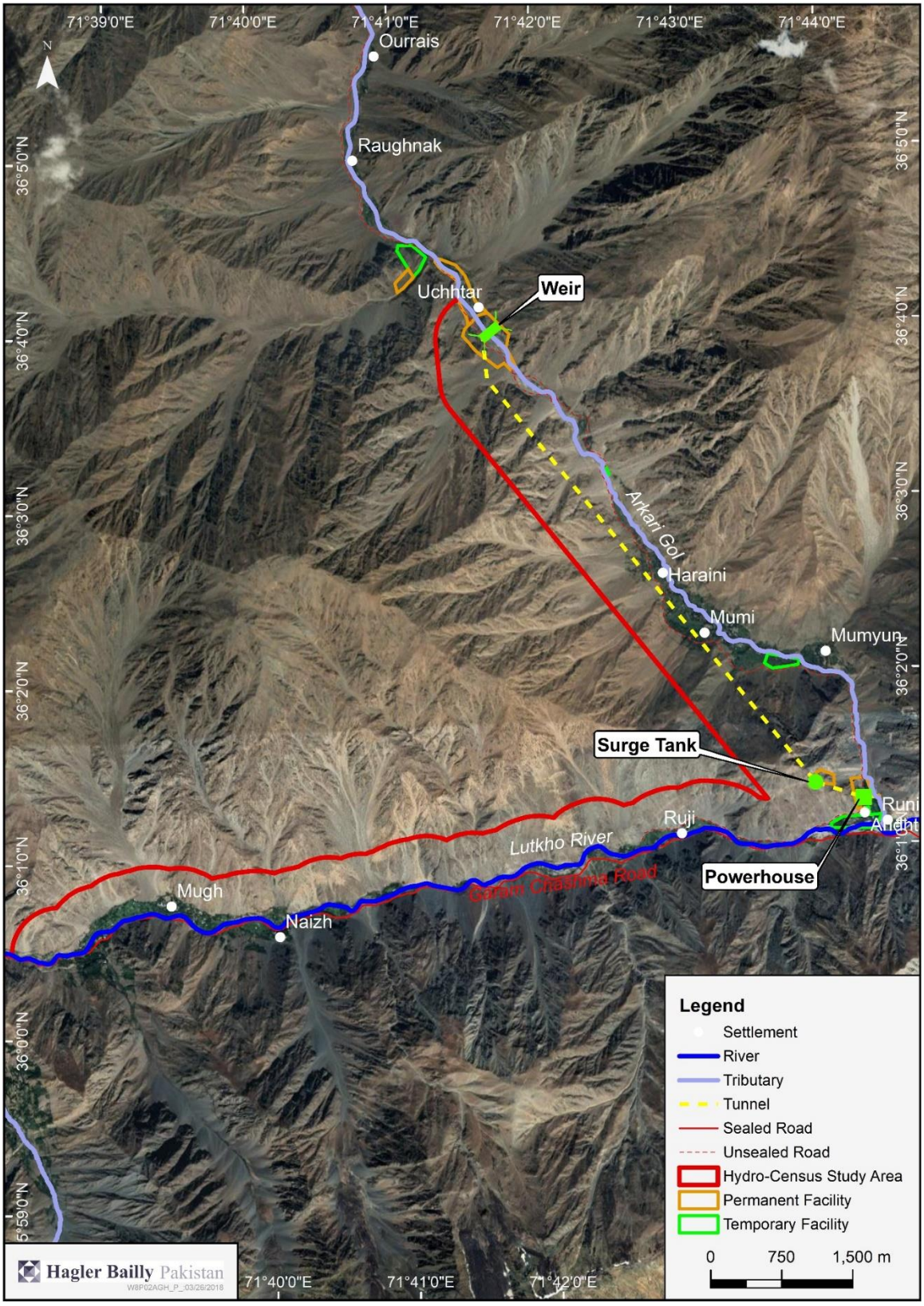
The Project location is shown in **Exhibit F.1**.

[1] Sensitive receptors include, but are not limited to, residential areas, schools, places of worship etc. These are areas where the occupants are more susceptible to the adverse effects of an anthropogenic activity such as noise, air emissions, traffic influx, privacy issues etc.

Exhibit F.1: Project Sampling Location



no.	Name	Type	X	Y
1	A1	Air	71° 44' 14.464" E	36° 01' 10.652" N
2	A2	Air	71° 43' 29.052" E	36° 02' 05.093" N
3	A3	Air	71° 41' 35.001" E	36° 04' 08.079" N
4	N1	Noise	71° 44' 15.010" E	36° 01' 11.418" N
5	N2	Noise	71° 43' 31.050" E	36° 02' 05.112" N
6	N3	Noise	71° 41' 34.862" E	36° 04' 07.530" N
7	S2	Soil	71° 43' 26.694" E	36° 02' 03.881" N
8	S3	Soil	71° 41' 08.875" E	36° 04' 24.856" N
9	S1	Soil	71° 44' 15.515" E	36° 01' 12.153" N
10	T1	Traffic	71° 43' 16.982" E	36° 01' 02.228" N
11	T2	Traffic	71° 48' 47.390" E	35° 55' 15.660" N
12	V1	Visual	71° 44' 15.160" E	36° 01' 03.044" N
13	V2	Visual	71° 43' 36.939" E	36° 01' 59.787" N
14	V3	Visual	71° 41' 29.740" E	36° 04' 04.985" N
15	W1	Water	71° 44' 20.537" E	36° 01' 10.708" N
16	W2	Water	71° 43' 44.466" E	36° 01' 01.278" N
17	W3	Water	71° 44' 37.455" E	36° 01' 06.785" N
18	W4 (Spring)	Water	71° 43' 18.186" E	36° 01' 59.273" N


71°39'0"E
71°40'0"E
71°41'0"E
71°42'0"E
71°43'0"E
71°44'0"E
N
Ourrais
Raughnak
Uchhtar
Weir
Arkari Gol
Haraini
Mumi
Mumyun
Surge Tank
Runi
Ruji
Lutkho River
Powerhouse
Mugh
Naizh
Gahami Chashma Road
36°5'0"N
36°4'0"N
36°3'0"N
36°2'0"N
36°1'0"N
36°0'0"N
5°59'0"N
Legend
Settlement
River
Tributary
Tunnel
Sealed Road
Unsealed Road
Hydro-Census Study Area
Permanent Facility
Temporary Facility
0
750
1,500 m
Hagler Bailly Pakistan

F.2 Visual Character

A visual baseline survey will be carried out to establish the current aesthetic and visual conditions. The visual survey will cover the following Project components:

- Power House
- Temporary Facility
- Dam and Reservoir

The visual survey will be conducted at locations listed in **Exhibit F.2** and shown in **Exhibit F.3**.

Exhibit F.2: Visual Survey Locations

Sample ID	*Coordinates*	*Location Description*
V1	36° 01' 03.044" N 71° 44' 15.160" E	View of Powerhouse
V2	36° 01' 59.787" N 71° 43' 36.939" E	View of Temporairy Facility No. 2
V3	36° 04' 04.985" N 71° 41' 29.740" E	View of Weir Site and reservoir

Note: Actual locations will vary slightly based on site conditions

F.2.1 Equipment and Methods

The photographs will cover a 180 degree view in the direction of the Project activities. Data collection will include:

- Photographs from at least three locations at each site using a tripod, covering a 180 degree view from each location.
- Record of bearings using a compass, in degrees, for the photographs.
- GPS coordinates of the locations, and marking of locations on a map.
- Height and distance of significant topographical features, if any, will be estimated using Google Earth.

The following materials and equipment will be utilized:

- Camera
- Map
- Compass (with correction for magnetic north vs map north)
- GPS
- Tripod
- Visual Survey Form (see **B.7,** *Survey Forms*)

F.3 Traffic

The baseline traffic survey will be undertaken to evaluate the current traffic conditions on the routes that could be used for Project-related transportation of goods and services during construction and operation.

The traffic counts will be conducted on the Choitral route as on all the Project facilities are located along this route. The details of sampling locations are given in **Exhibit F.3.** At each sampling site (**Exhibit F.3**), two persons will be stationed to count the traffic in all directions. The traffic survey form (see **A.7**, *Survey Forms*) will be utilized in this.

Exhibit F.3: Proposed Traffic Count Locations

Sample ID	*Coordinates*	*Notes and Justification*
T1	36° 01' 02.228" N 71° 43' 16.982" E	Pre-project traffic at intersection between Chitral, Garam Chashma and Project Site
T2	35° 55' 15.960" N 71° 48' 47.390" E	Pre-project traffic at intersection between Chitral and Garam Chashma near Lasht Village

Note: Actual locations will vary slightly based on site conditions

F.4 Air Quality

Air quality survey will be carried out to establish the current ambient air quality conditions. The pollutants selected for the survey are PM_{10} and $PM_{2.5}$. The selection for evaluation is based on the expected emissions from the planned operations and the level of risk to human health posed by these pollutants.

The details of sampling locations are given in **Exhibit F.4** and they are shown in **Exhibit F.3.** A portable weather meter will be used on site to measure local weather conditions during the monitoring period.

Exhibit F.4: Proposed Air Quality Sampling Locations

Sample ID	*Coordinates*	*Parameters*	*Notes and Justification*
A1	36° 01' 10.652" N 71° 44' 14.464" E	PM_{10} and $PM_{2.5}$	Near powerhouse
A2	36° 02' 05.093" N 71° 43' 29.052" E	PM_{10} and $PM_{2.5}$	Near Temporairy Facility No. 2
A3	36° 04' 08.079" N 71° 41' 35.001" E	PM_{10} and $PM_{2.5}$	Near Weir Site and reservoir

Note: Actual locations will vary slightly based on site conditions

F.4.1 Equipment and Methods

The following materials and equipment will be utilized:

- Low volume air sampler
- Particulate matter forms (see **B.7**, *Survey Forms*)

The method, duration of sampling and lab for analysis is given in **Exhibit F.5**.

Exhibit F.5: Air Quality Sampling Equipment and Parameters

Parameter	*Equipment*	*Duration of Sampling*	*Expected Lab for Analysis*
PM_{10}	Low Volume Sampler	24 Hours	HBP Lab
$PM_{2.5}$	Low Volume Sampler	24 Hours	HBP Lab

F.5 Noise

Noise surveys will be carried out to document the current ambient noise levels in the vicinity of the Project area. The details of sampling locations are given in **Exhibit F.6** and shown in **Exhibit F.3.** Ambient noise levels will be recorded for 24 hours duration at each location.

Exhibit F.6: Proposed Noise Level Sampling Locations

Sample ID	*Coordinates*	*Duration*	*Notes and Justification*
N1	36° 01' 11.418" N 71° 44' 15.010" E	24-hour	Near powerhouse
N2	36° 02' 05.112" N 71° 43' 31.050" E	24-hour	Near Temporairy Facility No. 2

Sample ID	*Coordinates*	*Duration*	*Notes and Justification*
N3	36° 04' 07.530" N 71° 41' 34.862" E	24-hour	Near Weir Site and reservoir

Note: Actual locations will vary slightly based on site conditions

F.5.1 Equipment and Methods

Cirrus Research plc.'s sound level meter, Model CR: 1720 will be used for recording noise levels. The instrument meets the International standards IEC 61672-1:2002, IEC 660651:1979, IEC 60804:2001, IEC 61260:1995, IEC 60942:1997, IEC 61252:1993, ANSI S1.4-1983, ANSI S1.11-1986, ANSI S1.43-1997 where applicable. The instrument has a resolution of 0.1 dB.

A calibrator will be used to ensure calibration of the instrument before use, each time. A wind shield will be used for all measurements. Measurements will be for a continuous 24 hour period.

The following materials and equipment will be utilized:

- Noise Meter
- Tripod
- Calibrator
- Wind Shield
- Noise Survey Form (see **B.7**, *Survey Forms*)

F.6 Water

A baseline survey will be carried out to establish the river water quality within the Study Area. Water quality sampling for lab analysis will be carried in the Study Area. On-site water quality testing will be carried out alongside the water quality sampling. **Exhibit F.7** describes the sample locations and rationale for their selection. **Exhibit F.8** details the water quality parameters that will be tested.

Exhibit F.7: Water Sampling Locations

Sample ID	*Coordinates*	*Location Description*
W-1	36° 01' 10.708" N 71° 44' 20.537" E	Nullah water (Tributary)
W-2	36° 01' 01.278" N 71° 43' 44.466" E	River (Lutkho) water before Influence
W-3	36° 01' 06.785" N 71° 44' 37.455" E	River water after Influence
W-4	36° 01' 59.273" N 71° 43' 18.166" E	Spring near Temporary Facility No. 2

Sample ID	*Coordinates*	*Location Description*
W-5	36° 01' 59.273" N 71° 43' 18.166" E	Duplicate of W4
W-6		Field blank

Exhibit F.8: Water Quality Testing Parameters

Parameters	*Lab*
On-site testing:	
pH, electrical conductivity (EC), dissolved oxygen (DO), temperature	HBP Personnel (on site)
Lab analysis:	
General: turbidity, total suspended solids (TSS), total dissolved solids (TDS), hardness, BOD_5, COD,	Sampling and analysis will be carried out by HBP and PINSTECH
Major ions: NO_3, PO_4	
Metals (Total): Aluminum, Antimony, Arsenic, Barium, Boron, Cadmium, Chromium, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc	

Equipment and Methods

The following materials and equipment will be utilized:

- Field water quality testing meters (pH, electrical conductivity, dissolved oxygen, temperature)
- Water sampling containers
- Field parameters record form
- Packing and handling materials
- Water Quality Survey Forms (see **B.8,** *Survey Forms*)

Quality Assurance and Quality Control

- Quality Control (QC) samples will include:
  - 1 field blank
  - 1 field duplicate

The complete analytical suite[2] of EPA approved methodologies will be used. The parameters that will be analyzed will depend on the concerns associated with the water sample. These will be selected before submission of the samples for testing.

[2] Selected based on National Standards for Drinking Water Quality, National Environmental Quality Standards for Municipal and Liquid Industrial Effluents and Previous similar studies in the region.

F.7 Soil

A baseline survey will be carried out to establish the soil quality within the Study Area. Soil quality sampling for lab analysis will be carried in the Study Area. **Exhibit F.9** describes the sample locations and rationale for their selection. **Exhibit F.10** details the water quality parameters that will be tested.

Exhibit F.9: Soil Sampling Locations

Sample ID	*Coordinates*	*Location Description*
S-1	36° 01' 12.153" N 71° 44' 15.515" E	Agricultural land near powerhouse
S-2	36° 02' 03.881" N 71° 43' 26.694" E	Agricultural land near Temporary Facilty No. 2
S-3	36° 04' 24.856" N 71° 41' 08.875" E	Barren land near Weir Site and Reservoir

Exhibit F.10: Soil Quality Testing Parameters

Parameters	*Lab*
General: pH, EC, Organic matter, Organic carbon	Sampling and analysis will be carried out by HBP and PINSTECH
Major ions: NO_3, PO_4	
Metals (Total): Arsenic, Barium, Boron, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Zinc	

F.8 Hydro-census

A groundwater well census will be carried out to map the water resources within the Study Area as springs may be impacted (drying and impact to water quality) due to tunnel boring which.

Equipment and materials:

The following equipment will be required

Hydro-census form (see **B.9,** *Survey Forms*)

F.9 Team and Timeline

This section presents the responsibilities (**Exhibit F.11**) for the various components of the proposed field survey and the timeline (**Exhibit F.12**).

Exhibit F.11: Team and Responsibilities

Name	*Responsibility*	*Advisor*
Saeed Nawaz	Survey Methodology and Plan	Aziz Karim
	Air Quality Survey	
	Noise Survey	
	Visual Survey	
	Water Sampling	
	Soil Sampling	
	Traffic Survey	

Exhibit F.12: Timeline

Day	*Date*	*Activity*
Day 1		Travelling from Islamabad to Chitral
		Travelling from Chitral to Project site
Day 2		Air 1
		Noise 1
		Weather 1
		Arrangements for Traffic Surveys
Day 3		Air 2
		Noise 2
		Weather 2
		Visual
		Traffic 1
		Traffic 2
Day 4		Air 3
		Noise 3
		Weather 3
Day 5		Hydro census
Day 6		Hydro census
		Soil Sampling
Day 7		Water Sampling
Day 8		Travel back to Islamabad

F.10 Survey Forms

Survey forms are as follows:

Visual Survey Form

Location ID: _____

Village Name: _____

Location description: _____

	Coordinates		*Marked on Map (Y/N)*	*Picture IDs*			*Comments*
	Northing	*Easting*		*Mid-point direction*	*Bearing left*	*Bearing right*	
Location 1							
Location 2							
Location 3							
Location 4							

Particulate Matter Field Survey Form

ID	*Location*	*Filter ID*	*PM Type*	*Coordinates*		*Start*			*End*			*Run Time (hrs)*	*Flow (L/min)*
				Northing	*Easting*	*Date*	*Time*	*Meter*	*Date*	*Time*	*Meter*		

Noise Monitoring Form

Location		Latitude		Longitude	
Date	dd/mm/yy	Monitoring Period		Start Time _____ End Time _____	
Weather Condition		Wind Speed and Direction			
Name and Model of Device					
Calibration Date and Method		(dd/mm/yy and method)			
Picture ID					
Name of Field Operator:					
Wind Shield	y/n	Tripod	y/n	Distance from: ground	m	Nearest reflector	m

Details of barriers between noise source and monitoring location; details of reflective surfaces near monitoring device.

Name/Type	*Height (meters)*	*Length (meters)*	*Width (meters)*	*Location (with respect to both, noise source and sound meter)*	*Picture ID*

Additional Verified Sources of Noise during the Monitoring Period

No	*Name of Source*	*Distance from the monitoring device*	*Direction from the monitoring device*
1			
2			
3			
4			

Additional Comments:

Traffic Survey Form

Location _____ Direction _____

Date MM/DD/YY Time: From HH : MM am/pm To HH : MM am/pm

Cars																	
Pick-ups																	
Bikes																	
Buses																	
Trucks	Truck (2 Axle)																
	Truck (3 Axle)																
	Truck (4 Axle)																
	Truck (5 Axle)																
	Truck (6 Axle)																
Tractor																	
Trailer																	
Others																	

Water Quality Survey Form

SR	*ID*	*Date*	*Time*	*Location*	*Coordinates*		*Field Testing parameters*				*Lab*	*Comments*
					N	*E*	*pH*	*Temp*	*EC*	*DO*		
1												
2												
3												
4												
5												
6												
7												

Hydro-census Survey Form

Water Source	*ID*	*Date*	*Time*	*GPS ID*	*WP*	*Latitude*	*Longitude*	*Altitude (m)*	*Village*	*Owner*	*pH*	*Conductivity (□S)*	*Temp. oC*	*Human Drinking*	*Human Other Use*	*Livestock use*	*Livestock*	*Total Households*	*Water Use per HH (Liters)*	*Aprox. amount of extraction (Liters per day)*	*Status*	*Active From*	*Extraction Method*	*Comments*

Appendix G: Lab Results

Soil

Environmental Monitoring & Analysis

Hagler Bailly Pakistan

Sample:	Soil
Sampling Coordinates:	36 01 11.9, 71 44 15.5
Project:	AGH
Sample ID:	S-1
Sample Collected From:	Agricultural Land, Powerhouse Site
Sampling Date:	March 31, 2018
Sampling Time:	11:55
Sampling Method:	Grab

Parameter	*Analytical Method*	*Unit*	*LOR*	*Analysis Results*
pH	CSSS		0.10	7.08
EC	CSSS	µS/cm	1.00	343.00
Organic Matter	CSSS	%	0.10	2.57
Organic Carbon	CSSS	%	0.05	1.48

CSSS: Canadian Society of the Soil Science

µS/cm: Microsiemens Per Centimeter

EC: Electrical Conductivity

LOR: Level of Reporting

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

Air Quality

Environmental Monitoring & Analysis
Hagler Bailly Pakistan

Particulate Matter Results

Sampling Point	*Sampling Location*	*Coordinates*		*Sampling Date*		*PM Type*	*Total PM (µg/m³)*
		Northing	Easting	*From*	*To*		
A1	Power House	36°01'11.6"N	71°44'16.1"E	Mar 29, 2018	Mar 30, 2018	PM_{10}	77.90
						$PM_{2.5}$	25.96
A2	Temporairy Facility 2	36°02'07.5"N	71°43'22.7"E	Mar 30, 2018	Mar 31, 2018	PM_{10}	117.33
						$PM_{2.5}$	65.17
A3	Dam Site	36°04'10.5"N	71°41'32.9"E	Mar 31, 2018	Apr 01, 2018	PM_{10}	95.21
						$PM_{2.5}$	39.26

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

Water Quality

Environmental Monitoring & Analysis

Hagler Bailly Pakistan

Sample: River Water

Depth of Water Sample: 0.2 meter below water level

Sampling Coordinates: 36 04 27.7, 71 41 08.1

Project: AGH

Sample ID: W-3

Sample Collected From: Lutkho River (After Influence)

Sampling Date: April 02, 2018

Sampling Time: 18:30

Sampling Method: Grab

Parameter	*Analytical Method*	*Unit*	*LOR*	*NSDW*	*WHO Guideline*	*NEQS*	*Analysis Results*
Temperature	US EPA 170.1	ºC	1.0	-	-		12.60
DO	US EPA 360.1	mg/l	0.1	-	-	-	11.01
EC	US EPA 120.1	µS/cm	1.0	-	-	-	290.00
TDS	US EPA 160.1	mg/l	10.0	<1,000	<1,000	3,500	198.00
pH	US EPA 150.1		0.1	6.5 – 8.5	6.5 – 8.5	6.0 – 9.0	8.09
TSS	US EPA 160.2	mg/l	4.0	-	-	200	17.00
BOD	US EPA 405.1	mg/l	5.0	-	-	80	ND
COD	US EPA 410.2	mg/l	5.0	-	-	150	ND
Turbidity	HACH 8037	FAU	0	<5	<5	-	12.00
Nitrate	US EPA 352.1	mg/l	0.1	<50	50	-	ND
Phosphate	SMEW	mg/l	0.1	-	-	-	ND
Manganese	SMEW	mg/l	0.1	<0.5	0.5	1.5	ND
Zinc	SMEW	mg/l	0.1	5	3	5	ND

NEQS: National Environmental Quality Standards 2000 for discharge of effluent inland water

NSDW: National Environmental Quality Standards for Drinking Water (S.R.O 1062 (1) 2010)

WHO: World Health Organization (WHO Drinking Water Standards 2011, 4th Edition)

USEPA: United States Environmental Protection Agency

µS/cm: Micro Siemens per Centimeter

BOD: Biochemical Oxygen Demand

COD: Chemical Oxygen Demand

FAU: Formazln Attenuation Units

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

TSS: Total Suspended Solids

TDS: Total Dissolved Solids

EC: Electrical conductivity

mg/l: Milligram Per Liter

DO: Dissolved Oxygen

ND: Not Detected

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

Environmental Monitoring & Analysis

Hagler Bailly Pakistan

Sample: Spring Water

Depth of Water Sample: Surface/Sub Surface

Sampling Coordinates: 36 02 02.5, 71 43 41.6

Project: AGH

Sample ID: W-4

Sample Collected From: Community Spring near Mumi Village

Sampling Date: April 02, 2018

Sampling Time: 14:50

Sampling Method: Grab

Parameter	*Analytical Method*	*Unit*	*LOR*	*NSDW*	*WHO Guideline*	*NEQS*	*Analysis Results*
Temperature	US EPA 170.1	^{o}C	1.0	-	-		15.80
DO	US EPA 360.1	mg/l	0.1	-	-	-	8.43
EC	US EPA 120.1	µS/cm	1.0	-	-	-	353.00
TDS	US EPA 160.1	mg/l	10.0	<1,000	<1,000	3,500	243.00
pH	US EPA 150.1		0.1	6.5 – 8.5	6.5 – 8.5	6.0 – 9.0	7.74
TSS	US EPA 160.2	mg/l	4.0	-	-	200	ND
BOD	US EPA 405.1	mg/l	5.0	-	-	80	ND
COD	US EPA 410.2	mg/l	5.0	-	-	150	ND
Turbidity	HACH 8037	FAU	0	<5	<5	-	3.00
Nitrate	US EPA 352.1	mg/l	0.1	<50	50	-	ND
Phosphate	SMEW	mg/l	0.1	-	-	-	ND
Manganese	SMEW	mg/l	0.1	<0.5	0.5	1.5	ND
Zinc	SMEW	mg/l	0.1	5	3	5	ND

NEQS: National Environmental Quality Standards 2000 for discharge of effluent inland water

NSDW: National Environmental Quality Standards for Drinking Water (S.R.O 1062 (1) 2010)

WHO: World Health Organization (WHO Drinking Water Standards 2011, 4th Edition)

USEPA: United States Environmental Protection Agency

µS/cm: Micro Siemens per Centimeter

BOD: Biochemical Oxygen Demand

COD: Chemical Oxygen Demand

FAU: FormazIn Attenuation Units

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

TSS: Total Suspended Solids

TDS: Total Dissolved Solids

EC: Electrical conductivity

mg/l: Milligram Per Liter

DO: Dissolved Oxygen

ND: Not Detected

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

Environmental Monitoring & Analysis

Hagler Bailly Pakistan

Sample: Spring Water

Depth of Water Sample: Surface/Sub Surface

Sampling Coordinates: 36 02 12.1, 71 43 14.3

Project: AGH

Sample ID: W-5

Sample Collected From: Community Spring near Mumi Village

Sampling Date: April 02, 2018

Sampling Time: 16:10

Sampling Method: Grab

Parameter	*Analytical Method*	*Unit*	*LOR*	*NSDW*	*WHO Guideline*	*NEQS*	*Analysis Results*
Temperature	US EPA 170.1	°C	1.0	-	-		15.20
DO	US EPA 360.1	mg/l	0.1	-	-	-	8.56
EC	US EPA 120.1	µS/cm	1.0	-	-	-	319.00
TDS	US EPA 160.1	mg/l	10.0	<1,000	<1,000	3,500	220.00
pH	US EPA 150.1		0.1	6.5 – 8.5	6.5 – 8.5	6.0 – 9.0	7.74
TSS	US EPA 160.2	mg/l	4.0	-	-	200	ND
BOD	US EPA 405.1	mg/l	5.0	-	-	80	ND
COD	US EPA 410.2	mg/l	5.0	-	-	150	ND
Turbidity	HACH 8037	FAU	0	<5	<5	-	0
Nitrate	US EPA 352.1	mg/l	0.1	<50	50	-	ND
Phosphate	SMEW	mg/l	0.1	-	-	-	ND
Manganese	SMEW	mg/l	0.1	<0.5	0.5	1.5	ND
Zinc	SMEW	mg/l	0.1	5	3	5	ND

NEQS: National Environmental Quality Standards 2000 for discharge of effluent inland water

NSDW: National Environmental Quality Standards for Drinking Water (S.R.O 1062 (1) 2010)

WHO: World Health Organization (WHO Drinking Water Standards 2011, 4th Edition)

USEPA: United States Environmental Protection Agency

µS/cm: Micro Siemens per Centimeter

BOD: Biochemical Oxygen Demand

COD: Chemical Oxygen Demand

FAU: Formazln Attenuation Units

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

TSS: Total Suspended Solids

TDS: Total Dissolved Solids

EC: Electrical conductivity

mg/l: Milligram Per Liter

DO: Dissolved Oxygen

ND: Not Detected

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

Environmental Monitoring & Analysis

Hagler Bailly Pakistan

Sample: River Water

Depth of Water Sample: 0.2 meter below water level

Sampling Coordinates: 36 04 32.6, 71 40 58.3

Project: AGH

Sample ID: W-6

Sample Collected From: Arkari Tributary (1Km upstream of Dam site)

Sampling Date: April 02, 2018

Sampling Time: 13:30

Sampling Method: Grab

Parameter	*Analytical Method*	*Unit*	*LOR*	*NSDW*	*WHO Guideline*	*NEQS*	*Analysis Results*
Temperature	US EPA 170.1	°C	1.0	-	-		12.30
DO	US EPA 360.1	mg/l	0.1	-	-	-	11.21
EC	US EPA 120.1	µS/cm	1.0	-	-	-	399.00
TDS	US EPA 160.1	mg/l	10.0	<1,000	<1,000	3,500	290.00
pH	US EPA 150.1		0.1	6.5 – 8.5	6.5 – 8.5	6.0 – 9.0	7.85
TSS	US EPA 160.2	mg/l	4.0	-	-	200	16.66
BOD	US EPA 405.1	mg/l	5.0	-	-	80	ND
COD	US EPA 410.2	mg/l	5.0	-	-	150	ND
Turbidity	HACH 8037	FAU	0	<5	<5	-	7.00
Nitrate	US EPA 352.1	mg/l	0.1	<50	50	-	ND
Phosphate	SMEW	mg/l	0.1	-	-	-	ND
Manganese	SMEW	mg/l	0.1	<0.5	0.5	1.5	ND
Zinc	SMEW	mg/l	0.1	5	3	5	ND

NEQS: National Environmental Quality Standards 2000 for discharge of effluent inland water

NSDW: National Environmental Quality Standards for Drinking Water (S.R.O 1062 (1) 2010)

WHO: World Health Organization (WHO Drinking Water Standards 2011, 4th Edition)

USEPA: United States Environmental Protection Agency

µS/cm: Micro Siemens per Centimeter

BOD: Biochemical Oxygen Demand

COD: Chemical Oxygen Demand

FAU: Formazln Attenuation Units

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

TSS: Total Suspended Solids

TDS: Total Dissolved Solids

EC: Electrical conductivity

mg/l: Milligram Per Liter

DO: Dissolved Oxygen

ND: Not Detected

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

Environmental Monitoring & Analysis

Hagler Bailly Pakistan

Sample: River Water

Depth of Water Sample: 0.2 meter below water level

Sampling Coordinates: 36 03 11.3, 71 42 25.6

Project: AGH

Sample ID: W-7

Sample Collected From: Arkari Tributary (2 Km downstream of Dam site)

Sampling Date: April 02, 2018

Sampling Time: 14:10

Sampling Method: Grab

Parameter	*Analytical Method*	*Unit*	*LOR*	*NSDW*	*WHO Guideline*	*NEQS*	*Analysis Results*
Temperature	US EPA 170.1	ºC	1.0	-	-		12.80
DO	US EPA 360.1	mg/l	0.1	-	-	-	11.07
EC	US EPA 120.1	µS/cm	1.0	-	-	-	402.00
TDS	US EPA 160.1	mg/l	10.0	<1,000	<1,000	3,500	294.00
pH	US EPA 150.1		0.1	6.5 – 8.5	6.5 – 8.5	6.0 – 9.0	7.91
TSS	US EPA 160.2	mg/l	4.0	-	-	200	17.00
BOD	US EPA 405.1	mg/l	5.0	-	-	80	ND
COD	US EPA 410.2	mg/l	5.0	-	-	150	ND
Turbidity	HACH 8037	FAU	0	<5	<5	-	7.00
Nitrate	US EPA 352.1	mg/l	0.1	<50	50	-	ND
Phosphate	SMEW	mg/l	0.1	-	-	-	ND
Manganese	SMEW	mg/l	0.1	<0.5	0.5	1.5	ND
Zinc	SMEW	mg/l	0.1	5	3	5	ND

NEQS: National Environmental Quality Standards 2000 for discharge of effluent inland water

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µS/cm: Micro Siemens per Centimeter

BOD: Biochemical Oxygen Demand

COD: Chemical Oxygen Demand

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

FAU: Formazln Attenuation Units

TSS: Total Suspended Solids

TDS: Total Dissolved Solids

EC: Electrical conductivity

mg/l: Milligram Per Liter

DO: Dissolved Oxygen

ND: Not Detected

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

Environmental Monitoring & Analysis

Hagler Bailly Pakistan

Sample: Spring Water

Depth of Water Sample: Surface/Sub Surface

Sampling Coordinates: 36 02 13.3, 71 43 11.8

Project: AGH

Sample ID: W-10

Sample Collected From: Community Spring near Mumi Village

Sampling Date: April 02, 2018

Sampling Time: 15:45

Sampling Method: Grab

Parameter	*Analytical Method*	*Unit*	*LOR*	*NSDW*	*WHO Guideline*	*NEQS*	*Analysis Results*
Temperature	US EPA 170.1	^{o}C	1.0	-	-		13.70
DO	US EPA 360.1	mg/l	0.1	-	-	-	8.51
EC	US EPA 120.1	µS/cm	1.0	-	-	-	337.00
TDS	US EPA 160.1	mg/l	10.0	<1,000	<1,000	3,500	224.00
pH	US EPA 150.1		0.1	6.5 – 8.5	6.5 – 8.5	6.0 – 9.0	7.50
TSS	US EPA 160.2	mg/l	4.0	-	-	200	ND
BOD	US EPA 405.1	mg/l	5.0	-	-	80	ND
COD	US EPA 410.2	mg/l	5.0	-	-	150	ND
Turbidity	HACH 8037	FAU	0	<5	<5	-	3.00
Nitrate	US EPA 352.1	mg/l	0.1	<50	50	-	ND
Phosphate	SMEW	mg/l	0.1	-	-	-	ND
Manganese	SMEW	mg/l	0.1	<0.5	0.5	1.5	ND
Iron	SMEW	mg/l	0.1	-	-	8	ND
Zinc	SMEW	mg/l	0.1	5	3	5	ND

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µS/cm: Micro Siemens per Centimeter

BOD: Biochemical Oxygen Demand

COD: Chemical Oxygen Demand

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

FAU: Formazln Attenuation Units

TSS: Total Suspended Solids

TDS: Total Dissolved Solids

EC: Electrical conductivity

mg/l: Milligram Per Liter

DO: Dissolved Oxygen

ND: Not Detected

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

Environmental Monitoring & Analysis

Hagler Bailly Pakistan

Sample: Spring Water

Depth of Water Sample: Surface/Sub Surface

Sampling Coordinates: 36 02 13.3, 71 43 11.8

Project: AGH

Sample ID: W-10D (Duplicate of W-10)

Sample Collected From: Community Spring near Mumi Village

Sampling Date: April 02, 2018

Sampling Time: 15:50

Sampling Method: Grab

Parameter	*Analytical Method*	*Unit*	*LOR*	*NSDW*	*WHO Guideline*	*NEQS*	*Analysis Results*
Temperature	US EPA 170.1	^{o}C	1.0	-	-		13.70
DO	US EPA 360.1	mg/l	0.1	-	-	-	8.50
EC	US EPA 120.1	µS/cm	1.0	-	-	-	338.00
TDS	US EPA 160.1	mg/l	10.0	<1,000	<1,000	3,500	226.00
pH	US EPA 150.1		0.1	6.5 – 8.5	6.5 – 8.5	6.0 – 9.0	7.50
TSS	US EPA 160.2	mg/l	4.0	-	-	200	ND
BOD	US EPA 405.1	mg/l	5.0	-	-	80	ND
COD	US EPA 410.2	mg/l	5.0	-	-	150	ND
Turbidity	HACH 8037	FAU	0	<5	<5	-	3.00
Nitrate	US EPA 352.1	mg/l	0.1	<50	50	-	ND
Phosphate	SMEW	mg/l	0.1	-	-	-	ND
Manganese	SMEW	mg/l	0.1	<0.5	0.5	1.5	ND
Iron	SMEW	mg/l	0.1	-	-	8	ND
Zinc	SMEW	mg/l	0.1	5	3	5	ND

NEQS: National Environmental Quality Standards 2000 for discharge of effluent inland water

NSDW: National Environmental Quality Standards for Drinking Water (S.R.O 1062 (1) 2010)

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µS/cm: Micro Siemens per Centimeter

BOD: Biochemical Oxygen Demand

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Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

FAU: Formazln Attenuation Units

TSS: Total Suspended Solids

TDS: Total Dissolved Solids

EC: Electrical conductivity

mg/l: Milligram Per Liter

DO: Dissolved Oxygen

ND: Not Detected

Analyst

Saeed Nawaz

Checked By

Asif Mahmood
Manager, EMA Services

Appendix H: Traffic Survey

See following pages.

Direction	*Time*	*Cars*	*Pick-up*	*Bikes*	*Buses*	*Trucks*					*Tractors*	*Trailor*	***Total***
						(2 AX)	*(3 AX)*	*(4 AX)*	*(5 AX)*	*(6 AX)*			
Chitral to Garam Chashma	07:00 to 08:00	11	7	5	–	1	–	–	–	–	–	–	**24**
Chitral to Garam Chashma	08:00 to 09:00	6	8	5	–	–	–	–	–	–	–	–	**19**
Chitral to Garam Chashma	09:00 to 10:00	13	5	8	1	–	–	–	–	–	–	–	**27**
Chitral to Garam Chashma	10:00 to 11:00	17	5	8		1	–	–	–	–	–	–	**31**
Chitral to Garam Chashma	11:00 to 12:00	12	13	13	1		–	–	–	–	–	–	**39**
Chitral to Garam Chashma	12:00 to 13:00	14	16	18		1	–	–	–	–	–	–	**49**
Chitral to Garam Chashma	13:00 to 14:00	30	22	13	1	–	–	–	–	–	–	–	**66**
Chitral to Garam Chashma	14:00 to 15:00	28	14	20	1	–	–	–	–	–	–	–	**63**
Chitral to Garam Chashma	15:00 to 16:00	30	26	18		–	–	–	–	–	–	–	**74**
Chitral to Garam Chashma	16:00 to 17:00	15	30	13	1	1	–	–	–	–	–	–	**60**
Chitral to Garam Chashma	17:00 to 18:00	20	15	30	–	–	–	–	–	–	–	–	**65**
Chitral to Garam Chashma	18:00 to 19:00	16	16	42	–	–	–	–	–	–	–	–	**74**
Chitral to Garam Chashma	19:00 to 20:00	3	8	14	–	–	–	–	–	–	–	–	**25**
Chitral to Garam Chashma	20:00 to 21:00	1	6	3	–	–	–	–	–	–	–	–	**10**
Chitral to Garam Chashma	21:00 to 22:00	2	5	–	–	–	–	–	–	–	–	–	**7**
		218	**196**	**210**	**5**	**4**	–	–	–	–	–	–	**633**
Garam Chashma to Chitral	07:00 to 08:00	68	54	27	–	–	–	–	–	–	–	–	**149**
Garam Chashma to Chitral	08:00 to 09:00	41	51	26	–	–	–	–	–	–	–	–	**118**
Garam Chashma to Chitral	09:00 to 10:00	11	27	14	1	–	–	–	–	–	–	–	**53**
Garam Chashma to Chitral	10:00 to 11:00	14	10	6	–	–	–	–	–	–	–	–	**30**

Direction	*Time*	*Cars*	*Pick-up*	*Bikes*	*Buses*	*Trucks*					*Tractors*	*Trailor*	***Total***
						(2 AX)	*(3 AX)*	*(4 AX)*	*(5 AX)*	*(6 AX)*			
Garam Chashma to Chitral	11:00 to 12:00	7	14	13	1	1	–	–	–	–	–	–	**36**
Garam Chashma to Chitral	12:00 to 13:00	10	8	7	–		–	–	–	–	–	–	**25**
Garam Chashma to Chitral	13:00 to 14:00	11	8	8	–	2	–	–	–	–	–	–	**29**
Garam Chashma to Chitral	14:00 to 15:00	8	9	9	2	1	–	–	–	–	–	–	**29**
Garam Chashma to Chitral	15:00 to 16:00	10	9	13	–	2	–	–	–	–	–	–	**34**
Garam Chashma to Chitral	16:00 to 17:00	11	15	13	–	1	–	–	–	–	–	–	**40**
Garam Chashma to Chitral	17:00 to 18:00	10	12	24	–	–	–	–	–	–	–	–	**46**
Garam Chashma to Chitral	18:00 to 19:00	13	10	23	–	–	–	–	–	–	–	–	**46**
Garam Chashma to Chitral	19:00 to 20:00	9	7	12	–	1	–	–	–	–	–	–	**29**
Garam Chashma to Chitral	20:00 to 21:00	1	8	3	–	6	–	–	–	–	–	–	**18**
Garam Chashma to Chitral	21:00 to 22:00	3	7	1	–	–	–	–	–	–	–	–	**11**
		227	**249**	**199**	**4**	**14**	–	–	–	–	–	–	**693**
Chitral to Garam Chashma	07:00 to 08:00	3	5	7	–	–	–	–	–	–	–	–	**15**
Chitral to Garam Chashma	08:00 to 09:00	3	5	2	–	1	–	–	–	–	–	–	**11**
Chitral to Garam Chashma	09:00 to 10:00	3	7	2	1	1	–	–	–	–	–	–	**14**
Chitral to Garam Chashma	10:00 to 11:00	5	8	5	–	1	–	–	–	–	–	–	**19**
Chitral to Garam Chashma	11:00 to 12:00	3	9	–	–	4	–	–	–	–	–	–	**16**
Chitral to Garam Chashma	12:00 to 13:00	8	9	2	–	–	–	–	–	–	–	–	**19**
Chitral to Garam Chashma	13:00 to 14:00	6	1	5	–	–	–	–	–	–	–	–	**12**
Chitral to Garam Chashma	14:00 to 15:00	8	14	11	–	–	1	–	–	–	–	–	**34**
Chitral to Garam Chashma	15:00 to 16:00	10	7	18	–	–	–	–	–	–	–	–	**35**

Direction	*Time*	*Cars*	*Pick-up*	*Bikes*	*Buses*	*Trucks*					*Tractors*	*Trailor*	***Total***
						(2 AX)	*(3 AX)*	*(4 AX)*	*(5 AX)*	*(6 AX)*			
Chitral to Garam Chashma	16:00 to 17:00	3	12	9	–		–	–	–	–	–	–	**24**
Chitral to Garam Chashma	17:00 to 18:00	3	8	3	1	1	–	–	–	–	–	–	**16**
Chitral to Garam Chashma	18:00 to 19:00	2	1	3	1		–	–	–	–	–	–	**7**
Chitral to Garam Chashma	19:00 to 20:00	2	3	6	–	–	–	–	–	–	–	–	**11**
Chitral to Garam Chashma	20:00 to 21:00	2	1	–	–	–	–	–	–	–	–	–	**3**
Chitral to Garam Chashma	21:00 to 22:00	–	2	–	–	–	–	–	–	–	–	–	**2**
		61	**92**	**73**	**3**	**8**	**1**	**–**	**–**	**–**	**–**	**–**	**238**
Garam Chashma to Chitral	07:00 to 08:00	12	18	14	–	–	–	–	–	–	–	–	**44**
Garam Chashma to Chitral	08:00 to 09:00	11	11	10	–	–	–	–	–	–	–	–	**32**
Garam Chashma to Chitral	09:00 to 10:00	2	10	9	–	–	–	–	–	–	–	–	**21**
Garam Chashma to Chitral	10:00 to 11:00	2	2	5	–	1	–	–	–	–	–	–	**10**
Garam Chashma to Chitral	11:00 to 12:00	4	8	3	1	–	–	–	–	–	–	–	**16**
Garam Chashma to Chitral	12:00 to 13:00	3	6	1		2	–	–	–	–	–	–	**12**
Garam Chashma to Chitral	13:00 to 14:00	–	5	2	1	–	–	–	–	–	–	–	**8**
Garam Chashma to Chitral	14:00 to 15:00	11	10	8	–	3	–	–	–	–	–	–	**32**
Garam Chashma to Chitral	15:00 to 16:00	2	7	4	–	–	–	–	–	–	–	–	**13**
Garam Chashma to Chitral	16:00 to 17:00	–	3	1	–	–	–	–	–	–	–	–	**4**
Garam Chashma to Chitral	17:00 to 18:00		3	5	–	1	–	–	–	–	–	–	**9**
Garam Chashma to Chitral	18:00 to 19:00	2	2	6	–	1	–	–	–	–	–	–	**11**
Garam Chashma to Chitral	19:00 to 20:00	–	4	–	–	5	–	–	–	–	–	–	**9**
Garam Chashma to Chitral	20:00 to 21:00	1	2	1	–	–	–	–	–	–	–	–	**4**

Direction	*Time*	*Cars*	*Pick-up*	*Bikes*	*Buses*	*Trucks*					*Tractors*	*Trailor*	***Total***
						(2 AX)	*(3 AX)*	*(4 AX)*	*(5 AX)*	*(6 AX)*			
Garam Chashma to Chitral	21:00 to 22:00	1	–	2	–								**3**
		51	**91**	**71**	**2**	**13**	**–**	**–**	**–**	**–**	**–**	**–**	**228**
Chitral to Arkari	07:00 to 08:00	–	–	–	–	–	–	–	–	–	–	–	**0**
Chitral to Arkari	08:00 to 09:00	–	1	2	–	–	–	–	–	–	–	–	**3**
Chitral to Arkari	09:00 to 10:00	1	–	–	–	–	–	–	–	–	–	–	**1**
Chitral to Arkari	10:00 to 11:00	–	–	2	–	–	–	–	–	–	–	–	**2**
Chitral to Arkari	11:00 to 12:00	–	1	1	–	–	–	–	–	–	–	–	**2**
Chitral to Arkari	12:00 to 13:00	–	–	3	–	–	–	–	–	–	–	–	**3**
Chitral to Arkari	13:00 to 14:00	–	1	–	–	–	–	–	–	–	–	–	**1**
Chitral to Arkari	14:00 to 15:00	4	5	3	–	–	–	–	–	–	–	–	**12**
Chitral to Arkari	15:00 to 16:00	–	2	–	–	–	–	–	–	–	–	–	**2**
Chitral to Arkari	16:00 to 17:00	–	5	4	–	–	–	–	–	–	–	–	**9**
Chitral to Arkari	17:00 to 18:00	1	4	1	–	–	–	–	–	–	–	–	**6**
Chitral to Arkari	18:00 to 19:00	–	1	3	–	–	–	–	–	–	–	–	**4**
Chitral to Arkari	19:00 to 20:00	–	–	3	–	–	–	–	–	–	–	–	**3**
Chitral to Arkari	20:00 to 21:00	–	–	–	–	–	–	–	–	–	–	–	**–**
Chitral to Arkari	21:00 to 22:00	–	–	1	–	–	–	–	–	–	–	–	**1**
		6	**20**	**23**	–	–	–	–	–	–	–	–	**49**
Arkari to Chitral	07:00 to 08:00	1	20	7	–	–	–	–	–	–	–	–	**28**
Arkari to Chitral	08:00 to 09:00	–	–	4	–	–	–	–	–	–	–	–	**4**
Arkari to Chitral	09:00 to 10:00	–	–	2	–	–	–	–	–	–	–	–	**2**

Direction	*Time*	*Cars*	*Pick-up*	*Bikes*	*Buses*	*Trucks*					*Tractors*	*Trailor*	***Total***
						(2 AX)	*(3 AX)*	*(4 AX)*	*(5 AX)*	*(6 AX)*			
Arkari to Chitral	10:00 to 11:00	1	–	2	–	–	–	–	–	–	–	–	**3**
Arkari to Chitral	11:00 to 12:00	–	–		–	–	–	–	–	–	–	–	**–**
Arkari to Chitral	12:00 to 13:00	–	1	1	–	–	–	–	–	–	–	–	**2**
Arkari to Chitral	13:00 to 14:00	–	1		–	–	–	–	–	–	–	–	**1**
Arkari to Chitral	14:00 to 15:00	–	–	–	–	–	–	–	–	–	–	–	**–**
Arkari to Chitral	15:00 to 16:00	–	–	–	–	–	–	–	–	–	–	–	**–**
Arkari to Chitral	16:00 to 17:00	–	–	–	–	–	–	–	–	–	–	–	**–**
Arkari to Chitral	17:00 to 18:00	1	–	–	–	–	–	–	–	–	–	–	**1**
Arkari to Chitral	18:00 to 19:00	–	–	1	–	–	–	–	–	–	–	–	**1**
Arkari to Chitral	19:00 to 20:00	1	–	–	–	–	–	–	–	–	–	–	**1**
Arkari to Chitral	20:00 to 21:00	–	1	–	–	–	–	–	–	–	–	–	**1**
Arkari to Chitral	21:00 to 22:00	–	1	1	–	–	–	–	–	–	–	–	**2**
		4	**24**	**18**	–	–	–	–	–	–	–	–	**46**
Garam Chashma to Akari	07:00 to 08:00	–	1	–	–	–	–	–	–	–	–	–	**1**
Garam Chashma to Akari	08:00 to 09:00	1	2	–	–	–	–	–	–	–	–	–	**3**
Garam Chashma to Akari	09:00 to 10:00	–	–	1	–	–	–	–	–	–	–	–	**1**
Garam Chashma to Akari	10:00 to 11:00	–	–	–	–	–	–	–	–	–	–	–	**–**
Garam Chashma to Akari	11:00 to 12:00	–	–	–	–	–	–	–	–	–	–	–	**–**
Garam Chashma to Akari	12:00 to 13:00	–	–	–	–	–	–	–	–	–	–	–	**–**
Garam Chashma to Akari	13:00 to 14:00	–	–	2	–	–	–	–	–	–	–	–	**2**
Garam Chashma to Akari	14:00 to 15:00	–	–	1	–	–	–	–	–	–	–	–	**1**

Direction	*Time*	*Cars*	*Pick-up*	*Bikes*	*Buses*	*Trucks*					*Tractors*	*Trailor*	***Total***
						(2 AX)	*(3 AX)*	*(4 AX)*	*(5 AX)*	*(6 AX)*			
Garam Chashma to Akari	15:00 to 16:00	–	1	–	–	–	–	–	–	–	–	–	**1**
Garam Chashma to Akari	16:00 to 17:00	–	–	1	–	–	–	–	–	–	–	–	**1**
Garam Chashma to Akari	17:00 to 18:00	1	1	–	–	–	–	–	–	–	–	–	**2**
Garam Chashma to Akari	18:00 to 19:00	–	–	2	–	–	–	–	–	–	–	–	**2**
Garam Chashma to Akari	19:00 to 20:00	1	–	–	–	–	–	–	–	–	–	–	**1**
Garam Chashma to Akari	20:00 to 21:00	–	1	1	–	–	–	–	–	–	–	–	**2**
		3	**6**	**8**	–	–	–	–	–	–	–	–	**17**
Arkari to Garam Chashma	07:00 to 08:00	1	–	1	–	–	–	–	–	–	–	–	**2**
Arkari to Garam Chashma	08:00 to 09:00	–	–	1	–	–	–	–	–	–	–	–	**1**
Arkari to Garam Chashma	09:00 to 10:00	–	–	2	–	–	–	–	–	–	–	–	**2**
Arkari to Garam Chashma	10:00 to 11:00	–	–	1	–	–	–	–	–	–	–	–	**1**
Arkari to Garam Chashma	11:00 to 12:00	–	–	1	–	–	–	–	–	–	–	–	**1**
Arkari to Garam Chashma	12:00 to 13:00	–	–	2	–	–	–	–	–	–	–	–	**2**
Arkari to Garam Chashma	13:00 to 14:00	–	–	1	–	–	–	–	–	–	–	–	**1**
Arkari to Garam Chashma	14:00 to 15:00	1	–	–	–	–	–	–	–	–	–	–	**1**
Arkari to Garam Chashma	15:00 to 16:00	–	–	2	–	–	–	–	–	–	–	–	**2**
Arkari to Garam Chashma	16:00 to 17:00	–	2	–	–	–	–	–	–	–	–	–	**2**
Arkari to Garam Chashma	17:00 to 18:00	–	–	1	–	–	–	–	–	–	–	–	**1**
		2	**2**	**12**	–	–	–	–	–	–	–	–	**16**

Appendix I: Background Information Document (BID) English and Urdu

See following pages.

March, 2018

Background Information Document for Environmental and Social Assessment of Arkari Gol Hydropower Project

Introduction

Master Hydro (Pvt.) Ltd. (MHL) is carrying out an Environmental and Social Impact Assessment (ESIA) and to develop Resettlement Action Plan (RAP) for developing the 99 megawatt (MW) Arkari Gol Hydropower Project (the "Project" or "AGHPP") on the Arkari River in Chitral District, Khyber Pakhtunkhwa (KP). The Project includes a weir, diversion tunnel and powerhouse on the Arkari River before its confluence.

The Project is currently the subject of a feasibility study, which will evaluate the technical, environmental and socioeconomic factors influencing and arising from the Project. MHL has acquired the services of Hagler Bailly Pakistan to carry out Environmental and Social Impact Assessment (ESIA) and to develop Resettlement Action Plan (RAP) for the AGHPP that meets with the applicable laws in Pakistan and Khyber Pakhtunkhwa, as well as the Performance Standards of the International Finance Corporation (IFC) and the Safeguards of the Asian Development Bank (ADB).

As part of the ESIA process, consultations will be carried out with communities and institutions that may have an interest in the Project or may be affected by the Project (the "Stakeholders"). This stakeholder consultation exercise is being conducted to provide stakeholders with information on the Project and to record their concerns, so that any issues can be addressed during the Project design phase.

During the consultations, background information on the Project will be made available to the stakeholders in the form of the Background Information Document (BID).

Project Setting

The proposed Project is planned to be built on the Arkari River in Chitral District, Khyber Pakhtunkhwa (KP). The proposed project location is given in **Exhibit 1** and a layout, along with key features of the Project, are reproduced in **Exhibit 2**.

Project Outline

The Project is estimated to involve acquisition of about **112.9** acres of land which includes, **43.71** acres of cultivated land and **69.2** barren land including river bed.

Out of total required land 103.3 acers of land will be required permanently and **9.2** acre for temporary purpose (Contractor's camps, crushing plant etc.) for 05 years.

Exhibit 1: Project Location

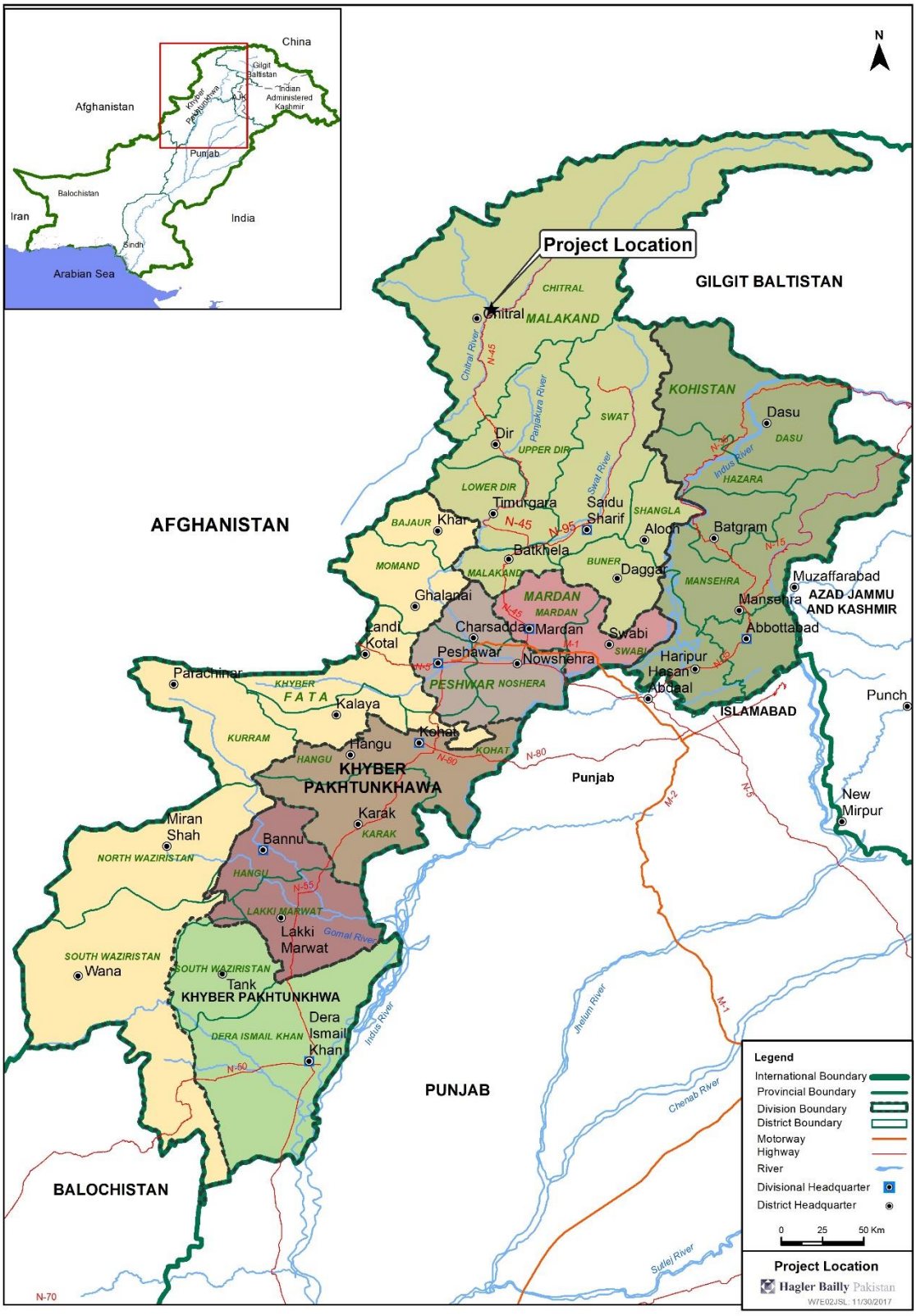
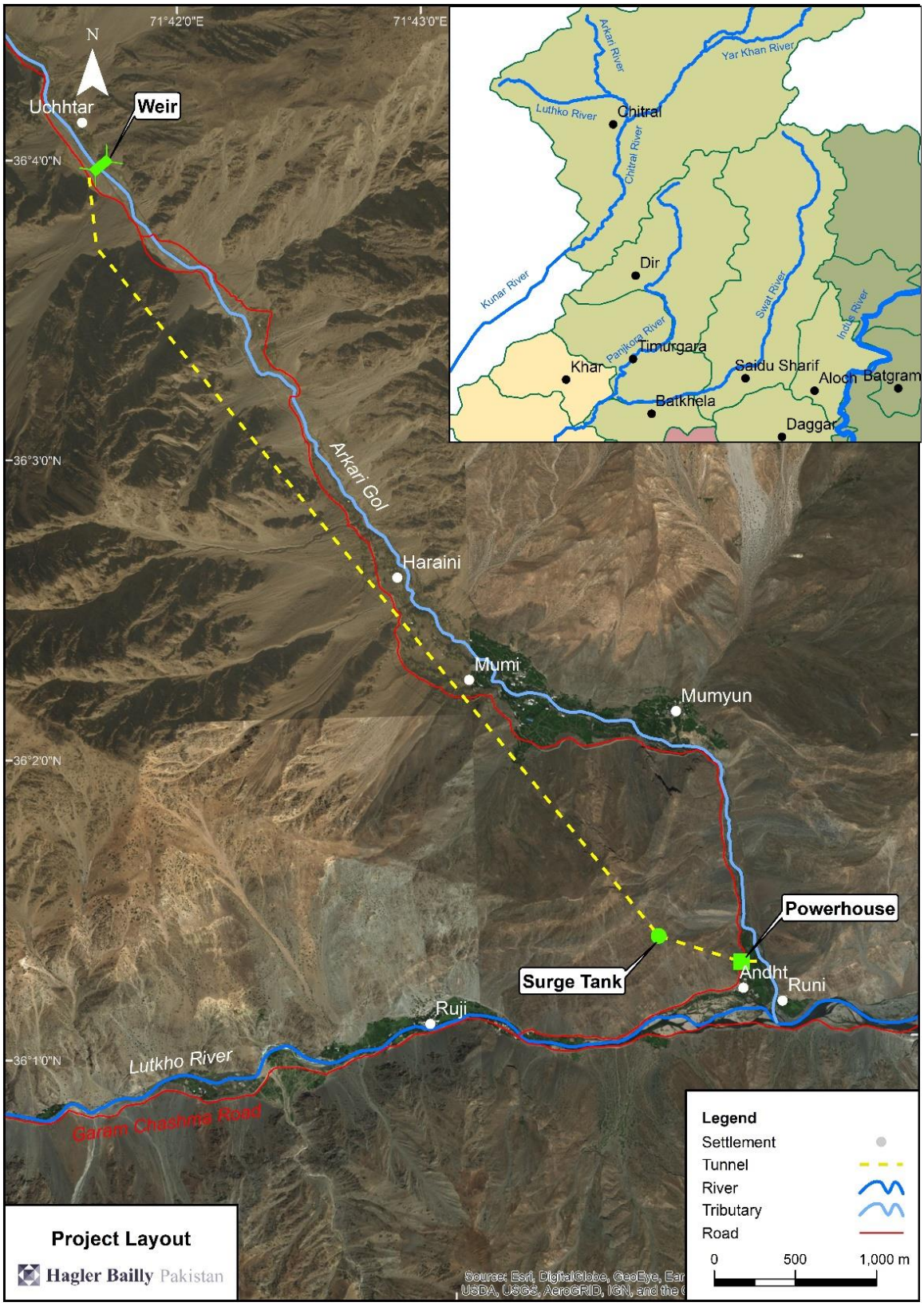


Exhibit 2: Project Layout



Approach to ESIA

The ESIA will be undertaken in compliance with relevant national legislation and keeping in view the World Bank guidelines. The major components of the study include:

- baseline studies to characterize the existing physical, socioeconomic and ecological environment in the project area;
- a public consultation process to ensure that project stakeholders are informed of the project development plan and have an opportunity to influence it;
- an analysis of the physical, ecological and socioeconomic impacts of the project, both negative and positive and their evaluation against significance criteria (applicable national and international standards, guidelines, performance standards, and good industry practices); and,
- Suggested mitigation measures to address the identified adverse impacts.

Separate to the ESIA settlement level consultations and surveys, household level consultations and surveys, of land owners and households, will be carried out in the areas identified for land acquisition to develop the RAP for the Project.

A brief overview of the conceptual components of an ESIA process is given in **Exhibit 3.**

Exhibit 3: Conceptual Framework of ESIA Figure.

Component	*Main purpose*	*Activities related to Stakeholder Consultations*
Scoping	▶ Identify the issues on which the ESIA should focus. ▶ Identify project alternatives that should be evaluated during the course of the ESIA.	▶ Identify institutional and community stakeholders ▶ Engage stakeholders and record issues raised ▶ Provide feedback to the ESIA team to incorporate stakeholders' concern in baseline investigations and impact assessment
Baseline investigations	▶ Collect background information on the environmental and social setting of the project.	▶ Incorporate additional issues raised during the baseline survey
Impact assessment, studies	▶ Define the potential impacts of the project ▶ Undertake specialist investigations to predict changes to environment due to the project ▶ Determine the significance of the potential impacts ▶ Identify measures for the management of the impacts ▶ Determine the residual impacts of the project after incorporation of the management measures. ▶ Evaluate the overall acceptability of the project (from environmental and social perspectives).	▶ Assess issues raised by stakeholders

Component	*Main purpose*	*Activities related to Stakeholder Consultations*
Mitigation Measures and management plan	▶ Environmental mitigation and monitoring plan will describe the measures proposed to ensure implementation of the mitigation measures identified during the impact assessment. It will include, for example, specific designs and plans, training requirements, resource requirements, monitoring details (sampling locations, methodology, and frequency), review and reporting requirements and budget.	▶ Assess the acceptability and practicability of the proposed mitigation measures
ESIA Report Preparation	▶ After the studies, the ESIA team will pull together the detailed assessment of impacts and mitigation measures. This may involve liaison with various specialists to ensure correct interpretation of information and compile ESIA report.	▶ Provide stakeholders with a feedback on the ESIA specifically communicate how the project proponent proposes to address the issues raised by the stakeholders.
ESIA submittal to regulatory authorities and decision making	▶ Submittal and review of the ESIA report by regulatory authorities and other interested stakeholders. The reviewers will inform about their decision on the acceptability of the Project from environmental and social perspectives and the conditions of approval for the development.	▶ Attend the public hearings and respond to the issues raised during the public hearings.

Preliminary list of potential environmental and social impacts of the Project that will be investigated during the ESIA are as follows:

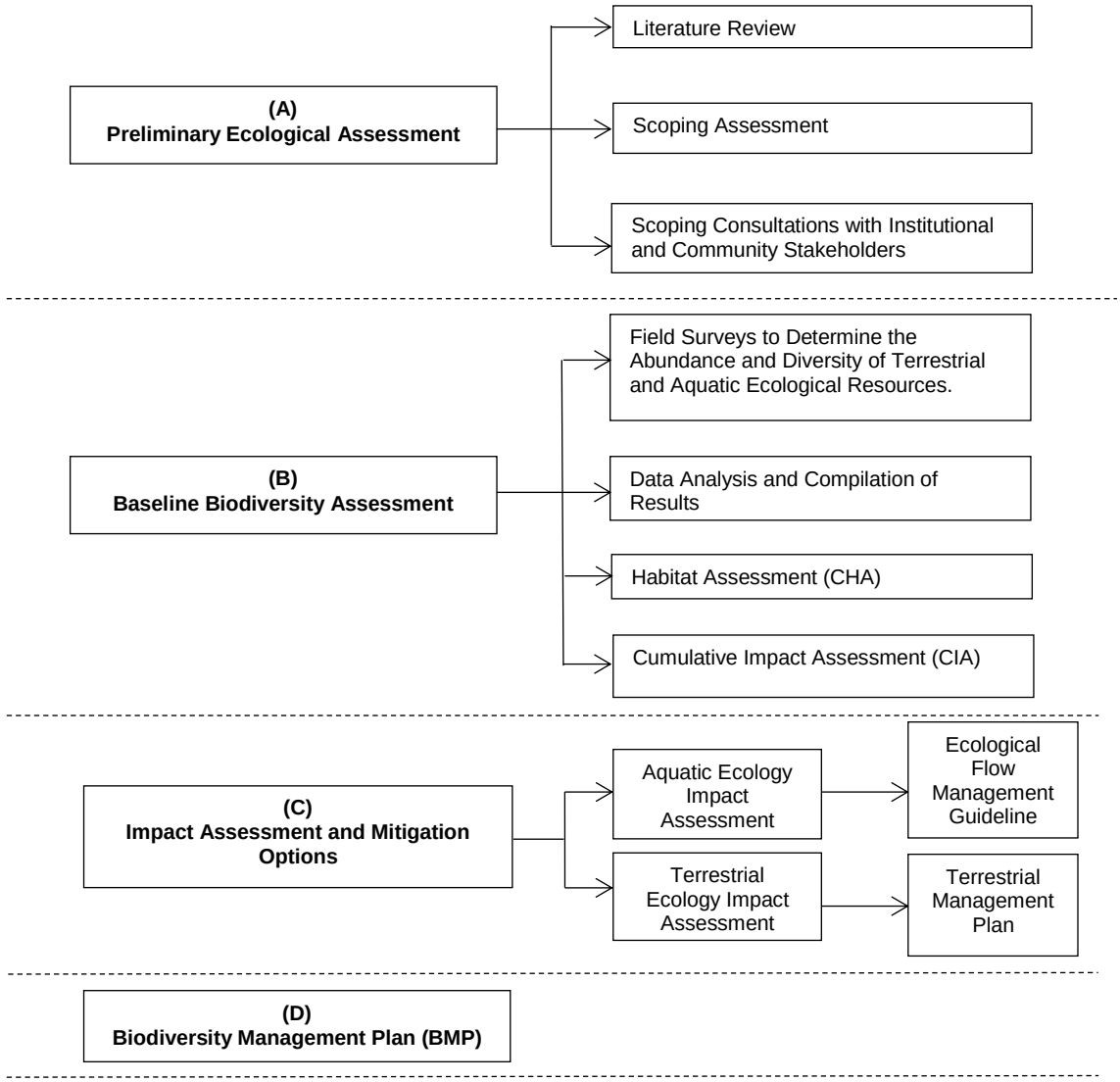
- Provision of employment to people
- Creation of service-sector jobs, procurement of consumables and the outsourcing to local service providers.
- Construction related impacts such as noise and dust
- Reduction in power outages and revival of the affected economies
- Increase in traffic due to Project related transportation
- Disturbance due to blasting, dust, noise, vibration, road congestion, and safety hazard from heavy traffic
- Damage to infrastructure due to blasting and noise nuisance due to blasting, drilling and batching plant
- Changes to existing social and cultural norms
- Pressure on existing infrastructure as a result of influx of job seekers
- Impact on sand mining and gravel extraction
- Contamination of soil
- Transformation of landscape
- Physical displacement of some households resulting in disruption of existing socioeconomic setup

As impacts on the aquatic ecology due to the Project are of importance, HBP will draw on the results of a holistic environmental flow assessment conducted for a similar project downstream using Downstream Implications of Flow Transformation("**DRIFT**") Decision Support System ("**DSS"**) approach to assess the changes in flow regime of the river on fish and other river dependent wildlife. The list of potential biodiversity issues that will be investigated are as follows:

- Reduction in water quality and quantity
- Changes in sediment load of river
- Changes in the geomorphology of the river
- Fragmentation of fish habitat
- Damage to natural flora and fauna and river ecosystem
- Impact on endangered and migratory species

The detailed process to be followed for the study of ecological impacts of the Project is provided in **Exhibit 5**.

Exhibit 5: Biodiversity Assessment and Management Process



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آرکاری گول ہائیڈرو پاور پراجیکٹ
ماحول پر اثرات کا جائزہ، بنیادی معلومات

تعارف:

ماسٹر ہائیڈرو (پرائیویٹ) لمیٹڈ (کمپنی) دریائے آرکیاری پر 99 میگاواٹ کا آرکیاری گول ہائیڈرو پاور پراجیکٹ بنانا چاہتی ہے، جو کہ خیبر پختونخواہ، کے ضلع چترال میں دریائے آرکیاری اور لتکھو کی سنگم پر بنے گا۔ پراجیکٹ کا محلِ وقوع **شکل نمبر 1** میں دکھایا گیا ہے، اس پراجیکٹ میں پاور ہاوس، بند اور سرنگ شامل ہے، پروجیکٹ فی الحال ایک ممکنہ مطالعہ کا موضوع ہے، جس سے پروجیکٹ سے متاثر اور پیدا ہونے والی تکنیکی، ماحولیاتی اور سماجی اقتصادی عوامل کا اندازہ کیا جائے گا،

کمپنی نے منصوبہ کی ماحولیاتی اور سماجی اثرات کا جائزہ اور دوبارہ دوبارہ منتقلی کا پلان ملکی اور بین الاقوامی قوانین کے تحت کرنے کے لئے ہیگلر بیلی پاکستان کی خدمات حاصل کیں ہیں۔

ماحول پر اثرات کے جائزے کے عمل کا ایک بنیادی جزو منصوبے سے ممکنہ طور پر متاثر ہونے والے اور منصوبے میں دلچسپی رکھنے والے افراد (یعنی سٹیک ہولڈرز) سے مشاورت کرنا، ان کے خدشات کو قلمبند کرنا اور ان کو حل کرنا ہے۔ یہ دستاویز مشاورت کے لئے سٹیک ہولڈرز کو منصوبے سے متعلقہ بنیادی معلومات فراہم کرنے کے لئے تیار کی گئی ہے۔ موجودہ سٹڈی کے لئے اسٹیک ہولڈرز سے مشاورت کی جارہی ہے۔ اس لیئے اسٹیک ہولڈرز کے ساتھ مشاورت کے لئے، یہ بنیادی معلومات کی دستاویز (Basic Information Document) تیار کی گئی ہے۔

منصوبے کا محل وقوع

منصوبہ کا مقام خیبر پختونخواہ، کے ضلع چترال میں دریائے آرکیاری پر بنے گا ڈیم آرکیاری وادی پر اور پاور ہاؤس شاگور گاؤں سے مغرب کی طرف (تقریبا 2.45 کلو میٹر) دریائے آرکیاری اور لوٹخو کی سنگم پر بنے گا جس میں تقریبا 5.8 (کلو میٹر) طویل سرنگ بنے گی، پراجیکٹ کا محلِ وقوع **شکل نمبر 1** میں دکھایا گیا ہے، مجوزہ منصوبہ کے کوآرڈینیٹس

ڈیم (N"57'03 ° 36،E"37'41 ° 71)

پاور ہاؤس (N"10'01 ° 36،E"11'44 ° 71) ہیں۔ منصوبے کی اہم خصوصیات اور ترتیب **شکل نمبر 2** میں دکھایا گیا ہے

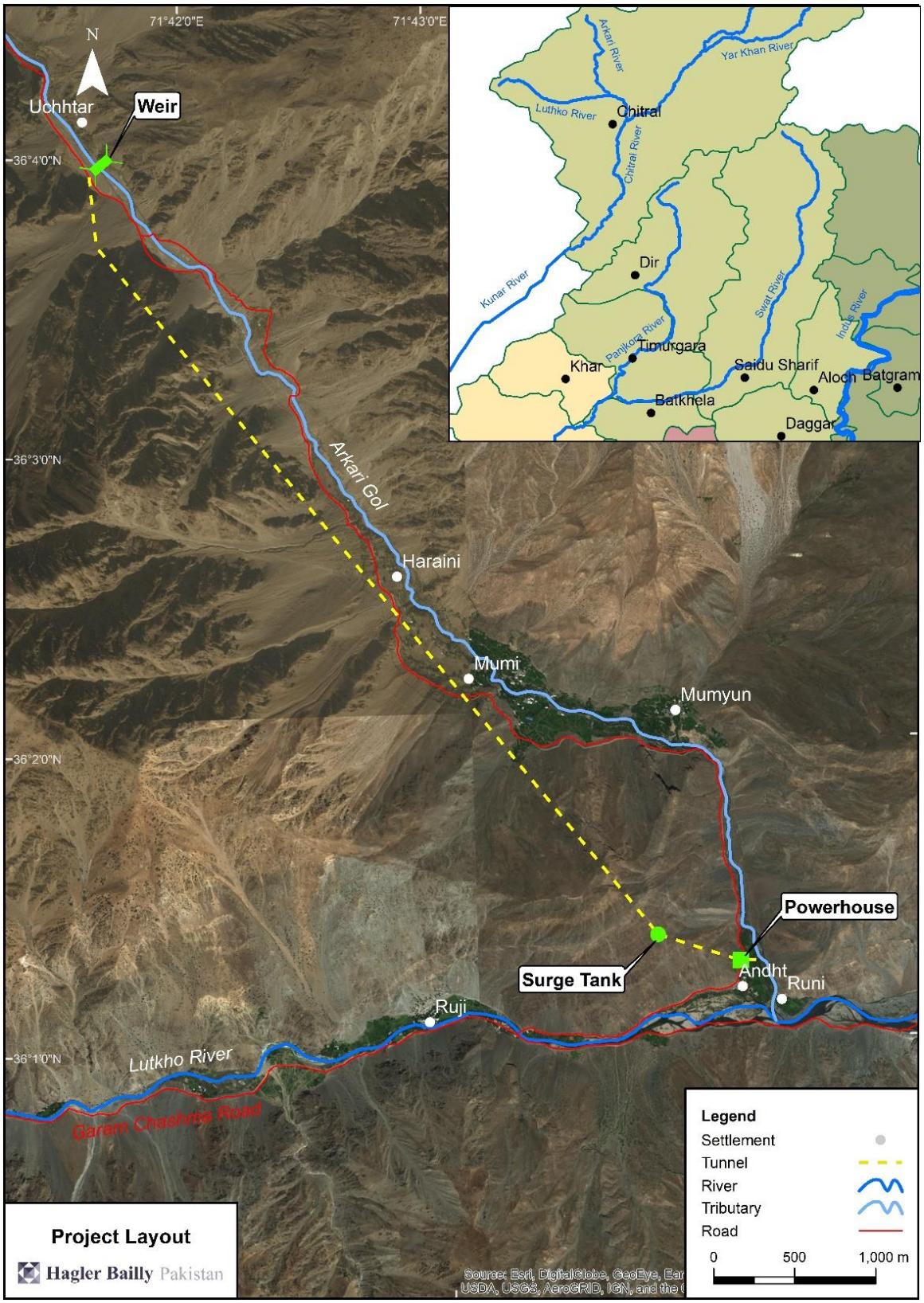
منصوبہ کا خاکہ

منصوبے کے اہم اجزاء مندرجہ ذیل ہیں:

- زمین کی حصول
- ہائیڈرو پاور پلانٹ کی تعمیر؛
- ہائیڈرو پاور پلانٹ کا آپریشن
- ایسوسی ایٹ سرگرمیاں

شکل نمبر1: منصوبے کا محل وقوع

شکل نمبر2: منصوبے کا خاکہ



ماحولیاتی تجزیئے کا طریقہ کار

یہ منصوبہ متعلقہ ملکی ماحولیاتی قوانین اور ورلڈ بینک کے معیار کے مطابق تیار کیا جائے گا۔اس منصوبے کے اہم جزو مندرجہ ذیل ہیں۔

- منصوبے کے ارد گرد موجودہ ماحول کا ایک جامع مطالعہ
- سماجی اقتصادی اور ماحولیاتی ماحول کا ایک جامع مطالعہ ؛
- مشاورت کا عمل تاکہ لوگوں اور اداروں کو منصوبے کے بارے میں آگاہ کیا جاسکے اور ان کو اپنے تاثرات بیان کرنے کا موقعہ دیا جاسکے
- منصوبے کے منفی اور مثبت ماحولیاتی، سماجی اقتصادیات کے اثرات کا تجزیہ
- شناخت شدہ مضر اثرات سے نمٹنے کے لئے تجویز کردہ اقدامات

ماحولیاتی تجزیہ کے علاوہ زمین کے مالکان اور گھرانوں کے مالکان کے ساتھ مشاورت کر کے سروے کیا جائے گا۔گھروں اور زمین کے مالکان کے لئے زمین کی نشاندہی کی جائے گی منتقلی کا منصوبہ بنایا جائے گا۔

ESIA کے تصوراتی اجزا کا مختصر جائزہ **شکل نمبر** 3 میں دیا گیا ہے۔

شکل نمبر 3 ESIA **کے عمل کا طریقہ کار**

جزو	بنیادی مقصد	اسٹیک ہولڈرز سے مشاورت کی سرگرمیاں
	◄ ان مسائل کا تعین کرنا جن پر EIA میں خصوصی توجہ مرکوز کرنے کی ضرورت ہے ◄ پراجیکٹ کے متبادلات کا تعین جن کا جائزہ EIA کے عمل کے دوران لیا جائے گا۔	◄ پراجیکٹ سے متاثر ہونے والے افراد اور اداروں (سٹیک ہولڈرز) کا تعین ◄ سٹیک ہولڈرز سے رابطہ کرنا اور ان کی طرف سے اٹھائے گئے مسائل کا اندراج کرنا ◄ ESIA ٹیم کو اس ردِ عمل سے آگاہ کرنا تاکہ بنیادی تحقیقی سرگرمیوں اور اثرات کے جائزے میں ان آراء کو شامل کیا جاسکے
سرگرمیاں	◄ پراجیکٹ کے ماحولیاتی اور معاشرتی محلِ وقوع سے متعلق پس منظری معلومات کی جمع آوری	◄ بنیادی سروے کے دوران سامنے آنے والے مسائل کو شامل کیا جائے
مطالعات	◄ پراجیکٹ کے ممکنہ اثرات کا تعین جو کہ سٹیک ہولڈرز نے مشاورت کے دوران اٹھائے ◄ ممکنہ اثرات کی اہمیت کا تعین اور اثرات سے حل کے لیے اقدامات کی شناخت ◄ انتظامیہ کے ساتھ یا انتظامیہ کے بغیر ممکنہ اثرات کی اہمیت کا تعین کرنا ◄ پراجیکٹ کے (ماحولیاتی اور معاشرتی لحاظ سے) مجموعی طور پر قابل قبول ہونے کا جائزہ لینا	◄ سٹیک ہولڈرز کی طرف سے سامنے لائے گئے مسائل کا جائزہ

جزو	بنیادی مقصد	اسٹیک ہولڈرز سے مشاورت کی سرگرمیاں
اثرات کو کم کرنے کے اقدامات اور ان کی منصوبہ بندی	◄ اثرات کے جائزے کے دوران ان کو کم کرنے کے اقدامات کا تعین اور ان پر عمل درآمد کو یقینی بنانے کے لیے مجوزہ اقدامات کی تفصیل ماحولیاتی اثرات سے نمٹنے اور ان کی نگرانی کے منصوبے میں دی جائے گی اور پلانٹ کو ایشیائی ترقیاتی بینک کے SPS 2009 اور قومی قوانین وضوابط کے مطابق لانا۔ مثال کے طور پر اس میں مخصوص ڈیزائنز اور منصوبے، تربیتی تقاضے، ذرائع کی فراہمی کے تقاضے، نگرانی کی تفصیلات (محلِ وقوع کی نمونہ بندی، طریقہ کار اور تعدّد وغیرہ)، جائزے اور رپورٹس کے تقاضے اور بجٹ	◄ مخصوص طریقہ کار یا تخفیف کے اقدامات پر بحث جو اثرات کے جائزے کے دوران ظاہر ہوتے ہیں
تیاری	◄ جائزے کے عمل کی تکمیل کے بعد EIA ٹیم اثرات اور تخفیف کے اقدامات کی تفصیلی تشخیص کرے گی۔ اس میں معلومات کی درست تشریح کو یقینی بنانے کے لیے مختلف ماہرین کے ساتھ رابطہ اور EIA کی رپورٹ مرتب کرنا ہے	◄ سٹیک ہولڈرز کو EIA کی طرف سے جواباً بتایا جائے کہ منصوبے کے تجویز کار کس طرح ان کی طرف سے سامنے لائے گئے مسائل کا حل تلاش کریں گے۔
اداروں کو پیش کیا جانا اور فیصلہ سازی	◄ EIA رپورٹ کا انتظامی اداروں، اور دیگر دلچسپی رکھنے والے افراد یا اداروں کو پیش کیا جانا۔ جائزہ لینے والے افراد اور ادارے بتائیں گے کہ ماحولیاتی اور معاشرتی لحاظ سے پراجیکٹ کے قابلِ قبول ہونے سے متعلق ان کا فیصلہ کیا ہے اور منظوری کن شرائط پر دی جارہی ہے۔	◄ ادارہ ماحولیات تحفظ ایک عوامی اجتماع منعقد کرے گا جس میں دیکھا جائے گا کہ سٹیک ہولڈرز کے کوئی ایسے خدشات تو باقی نہیں رہ گئے جن کو فیصلہ لینے سے پہلے نہ پرکھا گیا ہو

ممکنہ سماجی، ماحولیاتی اور حیاتیاتی اثرات جن کی چھان بین ESIA کے دوران کی جائے گی، درج ذیل ہیں۔

- ◄ لوگوں کو ملازمت کی فراہمی
- ◄ سروس کے شعبے کی ملازمتوں، استعمال ہونے والی اشیا کی پروکیورمنٹ اور مقامی سروس فراہم کرنے والوں کیلئے نوکریوں کی تخلیق
- ◄ تعمیراتی کام کے اثرات مثلاً شور اور دھول
- ◄ لوڈشیڈنگ میں کمی اور ملک کی متاثرہ معیشت کی بحالی
- ◄ پراجیکٹ سے متعلقہ نقل وحمل کی وجہ سے ٹریفک میں اضافہ
- ◄ بلاسٹنگ سے پیدا ہونے والا خلل، شور، دھول، vibration، سڑکوں پر بھیڑ اور زیادہ ٹریفک کی وجہ سے حادثات کا خطرہ
- ◄ بلاسٹنگ سے عمارات کو نقصان اور دھماکے، ڈرلنگ اور batching plant کی وجہ سے شور
- ◄ موجودہ ثقافتی اور سماجی طور طریقوں میں ردوبدل
- ◄ موجودہ سہولیات پر کام کرنے کے لئے علاقے میں آنے والوں کا بوجھ
- ◄ دریا سے ریت اور پتھر حاصل کرنے میں ممکنہ مشکلات
- ◄ گرد سے آلودگی

- قدرتی نظارے میں تبدیلی
- گھروں کی منتقلی سے معاشی اور سماجی نظام پر اثرات

جیسا کہ آبی حیات پر منصوبے کے اثرات کی اہمیت ہے، ہیگلر بیلی پاکستان اسی طرح کے منصوبے کے لئے مجموعی ماحولیاتی بہاؤ کے جائزے کے نتائج استعمال کرے گا جو کا طریقہ استعمال کرتے ہوئے پانی کے بہاؤ میں تبدیلی کے مچھلیوں اور دوسرے دریا پر انحصار کرنے **DSS** اور **DRIFT** کہ اس منصوبے سے نیچے ہے۔ یہ جائزہ والے دوسرے جانوروں پر اثرات کا تجزیہ کرتا ہے۔ ممکنہ حیاتیاتی اثرات جن کی جانچ پڑتال کی جانی ہے، درج ذیل ہیں۔

- ڈیم کے بعد دریا میں پانی کے معیار اور مقدار میں کمی
- پانی میں موجود ریت میں کمی
- دریا کی شکل اور راستے میں ممکنہ تبدیلی
- دریا میں مچھلیوں پر منفی اثرات
- پانی کے قدرتی ماحول اور آبی حیات کو نقصان
- خطرے سے دوچار (Endangered) حیات اور دور سے آنے والے آبی پرندوں پر اثرات

مزید معلومات کے لئے رابطہ :

عزیز کریم، ہیگلر بیلی پاکستان	**شکیل احمد ہیگلر بیلی پاکستان**
بلاک 1، کمرشل ایریا، گلی نمبر 21، F-8/2 ، اسلام آباد،	بلاک 1، کمرشل ایریا، گلی نمبر 21، F-8/2 ، اسلام آباد،
فون: 7200-07 285 (51) 92+	فون: 7200-07 285 (51) 92+
فیکس: 7208-09 285 (51) 92+	فیکس: 7208-09 285 (51) 92+
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ای میل: AKarim@haglerbailly.com.pk	ای میل: SAhmad@haglerbailly.com.pk

Appendix J: Community Consultation Logs

Stakeholder/s or Settlement	**Raughnak**	
Consultation		
Date:	April 5, 2018	
Time:	1100hrs	
Meeting Venue:	Raughnak	
Attended by and contact details:	Name	Contact Number
	Tariq Muhammad	0343-2898066
	Ghuzna Khan	
	Muhammad Khan	
	Didar Murad	0348-2202088
Conducted by:	Khurram Sarwar, Yasar Asad	
Recorded by:	Khurram Sarwar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ People of the area expressed their happiness regarding Dam Construction. ▶ They said due to project they will be facilitated with latest opportunities of job, education and health. ▶ They used forest wood as fuel, they said if LGP gas is supplied in the area on subsidized rates, it will help them and forest trees will also be saved. ▶ Due to blasting nearby houses may be affected. ▶ Outsiders employed in the Project area may breach the privacy of locals especially women.	

Stakeholder/s or Settlement	**Mumyun**	
Consultation		
Date:	April 7, 2018	
Time:	1400hrs	
Meeting Venue:	Mumyun	
Attended by and contact details:	Name	Contact Number
	Washa Khan	0348-8027379
	Amjad Ali	0349-4973638
	Bahadar Khan	0340-9860326
	Sher Nawaz	0345-6433018
	Muzaffar Khan	0340-9480487
	Wazir Muhammad	0349-9325762
	Gul Nayab Khan	0345-2225094
	Sohrab Khan	0341-9594119
Conducted by:	Khurram Sarwar, Yasar Asad	
Recorded by:	Khurram Sarwar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ People of the area expressed their happiness regarding Dam Construction. ▶ They said due to project they will get opportunities of job, education and health. ▶ On the Other hand they have also some issue due to construction of the project, firstly they said their big source of water is river but due Dam construction level of water will decrease in the river and their livelihood will be affected. ▶ Heavy traffic in the area will create difficulties for locals especially for school-going children. ▶ Community demanded basic amenities such as safe drinking water and basic education. It should be included in the planning documents as part of the Project design. Because they have no college and hospital in their village. ▶ Due to land sliding on the road every year they lose their school going children and animals, community demanded a new road to save their lives and also for transportation.	

Stakeholder/s or Settlement	**Kambarandeh**	
Consultation		
Date:	April 6, 2018	
Time:	1400hrs	
Meeting Venue:	Kambarandeh	
Attended by and contact details:	Name	Contact Number
	Habibullah	0340-5413743
	Nazur Shah	0340-6088842
	Iqbal Zain	0340-9302411
	Iqbaluddin	0340-6088892
	Sher Azam	0340-9360310
	Shujauddin	0348-2331370
	Iqbal Shah	0344-5919403
	Sultan Zareen	0343-2810912
	Rashid Khan	0340-5413743
Conducted by:	Khurram Sarwar, Yasar Asad	
Recorded by:	Khurram Sarwar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ People were happy to hear about the Dam construction in their area. Some of them have some land and fruit orchards at Dam site so they demand market rates against their loss. ▶ They said their livelihood depends upon river water and agriculture after dam construction water will decrease and it will create problems for them. ▶ In construction activities heavy traffic, noise and air pollution will create difficulties for them. ▶ Labor and other job opportunities will be provided by the locals in the project. ▶ Some people said their irrigation system depends upon the water channels, so in construction process that system should not be damaged. ▶ People said their main problem was the damaged road, project developers should make new road before start of the construction work. ▶ They used forest wood as fuel, they said if LGP gas can be supplied to them on subsidized rates it will help them as well as forest trees will also be saved.	

Stakeholder/s or Settlement	**Haraini**	
Consultation		
Date:	April 8, 2018	
Time:	1400hrs	
Meeting Venue:	Haraini	
Attended by and contact details:	Name	Contact Number
	Sirajuddin	0340-8644924
	Muhammad Sharif	0345-1404655
	Doulat Baig	0348-2047922
	Shah Aziz Khan	0344-1126832
	Abdul Haq	0348-4622595
	Akbar Khan	
Conducted by:	Khurram Sarwar, Yasar Asad	
Recorded by:	Khurram Sarwar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ They said they are willing to leave their houses and land for the project but Government should compensate them on market rates and also give them relocation allowances. ▶ Some of them also demand that project developers should pay them complete compensation amount before they leaving their houses. ▶ Their jamat khana (place of Prayer) will also be affected by the road construction and they demanded Government should also build new jamat khana for them after project construction. ▶ Affected households should be properly compensated or Government should build houses for them. ▶ Grazing area for livestock will be reduced due to decrease in water in the river. ▶ Water springs may become dry due to blasting.	

Stakeholder/s or Settlement	**Andhati / Runi**	
Consultation		
Date:	Aril 8, 2018	
Time:	1100hrs	
Meeting Venue:	Andhati / Runi	
Attended by and contact details:	Name	Contact Number
	Ahmad Faraz	0345-9138868
	Naeemuddin	0343-9995862
	Sirajuddin	0348-9390284
	Muhammad Imran	0345-6797276
	Shahzada Zeeshan	0346-3614750
	Habib ur Rehman	0340-9864539
	Muhammad Sharif Khan	0344-1037621
	Maqsood Ali	0347-0058954
	Iqbaluddin	0343-9865482
	Mohsin Badshah	0340-9864779
Conducted by:	Khurram Sarwar, Yasar Asad	
Recorded by:	Khurram Sarwar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ People were not happy to hear about the project and especially about the construction of power house in their village. ▶ They said their location and land were very fruitful and important for them, and they also have graves of their forefathers nearby, due to the construction of power house they will loss all of their houses and land. ▶ Some said project developers should change the location of the power house. ▶ If land acquisition was unavoidable then all of the affected households should be compensated on market price and government should make sure that all the payments should be made before they leave their houses and land. ▶ They said not only their houses and land will be affected, their fruit trees will also be affected so Government should also compensate them against all their fruit trees on market price. ▶ Project developers should build a colony for affected people and they demand alternative land against their affected land. ▶ They said they were the major affectees of the project losing all their houses, land and fruit trees so priority will be given to locals especially Andhati village people in terms of jobs	

	and labor work. ▶ Electricity should be provided to them as free of cost. ▶ Affected School, Mosque and Jamat khana should also be construct by the Government for locals after dam construction.

Stakeholder/s or Settlement	**Uchhtar**	
Consultation		
Date:	April 7, 2018	
Time:	1000hrs	
Meeting Venue:	Uchhtar	
Attended by and contact details:	Name	Contact Number
	Rashid Ali	0342-9539686
	Jannat Ali	0343-4070538
	Sher Wali	0340-9864943
	Murad Ali	0340-2849402
	Zard Ali	0344-0929379
	Fatela Baig	0342-9539686
	Mast Khan	0340-2348653
	Adina Khan	0346-2539516
Conducted by:	Khurram Sarwar, Yasar Asad	
Recorded by:	Khurram Sarwar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ People expressed their happiness regarding the project, they all belong to one clan and they demand project developers should construct a colony for them where they all will live together as they are living now. ▶ They said they use electricity almost free but after Dam construction Government should provide them electricity free of cost. ▶ They said that have a fear that they will be kicked out from their houses and nobody will listen to them. So Government should pay the entire compensation amount before leaving their houses. ▶ They said, Government should provide them alternate land if it is not available then compensates them on market rates. ▶ People said almost their whole village will be affected so job opportunities should be given to them on priority bases. ▶ Road, School, College, Hospital and other Recreation facilities should be provide to the locals during the construction activities. ▶ They said they also expecting that this Dam will control flood, because due to previous flood in 2015 they lost many lives and infrastructure. ▶ Due to blasting nearby houses may be affected. ▶ Water springs may become dry due to blasting. ▶ Eligible men and women residents of the area should also be employed in the Project. ▶ People said their main problem was the damaged road project developers should make new road before start of the construction work.	

Stakeholder/s or Settlement	**Mumi**	
Consultation		
Date:	April 6, 2018	
Time:	1100hrs	
Meeting Venue:	Mumi	
Attended by and contact details:	Name	Contact Number
	Zarmast Khan	0341-5569852
	Boojan	0340-5419617
	Rehmatuddin	0346-2300916
	Saifullah Jan	0340-5830918
	Usman Uddin	0332-5391041
	Akbar Wali Shah	0340-9862268
	Abdul Kareem	0347-9612882
	Kiwah Khan	
Conducted by:	Khurram Sarwar, Yasar Asad	
Recorded by:	Khurram Sarwar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ People expressed happiness regarding Dam construction. Their major issue is the agriculture land which will be affected by the project construction. ▶ They said they were ready to cooperate with Government in every way but they must be compensated on market rates against their affected land. ▶ In construction activities heavy traffic, noise and air pollution will create difficulties for them. ▶ Labor and other job opportunities will be provided by the locals in the project. ▶ Some people said their irrigation system depends upon the water channels, so in construction process that system may be damaged. ▶ People said their main problem was the damaged road project developers should make new road before start of the construction work.	

Stakeholder/s or Settlement	**Mumi**	
Consultation		
Date:	April 6, 2018	
Time:	1100hrs	
Meeting Venue:	Mumi	
Attended by and contact details:	Name	Contact Number
	Gulsana Bibi	
	Yasmin Bibi	
	Nasreen Bibi	
	Nasim Bibi	0346-2300916
	Hanifa Bibi	
	Sarat Begum	
	Bibi Jamila	
Conducted by:	Rehana Akhtar	
Recorded by:	Rehana Akhtar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ Women of the area expressed happiness regarding the project; they said this project will open the door of new life where they have good health facilities, batter education facilities for their children. ▶ They also mentioned that jobs should also be provided to the educated ladies in the project. ▶ Some women said government should establish some vocational centers for their girls and house ladies. ▶ Women also said flood was the big issue for them and this Dam will control floods. ▶ Road was the main problem for them, Government should make a batter road for us then start the construction work.	

Stakeholder/s or Settlement	**Kambarandeh**	
Consultation		
Date:	April 6, 2018	
Time:	1400hrs	
Meeting Venue:	Kambarandeh	
Attended by and contact details:	Name	Contact Number
	Nasim Akhtar	0340-9852212
	Sardar Bibi	0340-5829622
	Gul Naz	0344-1996432
	Mumtaz Bibi	0348-8144947
	Buhar	0340-8930970
	Shahida Bibi	0348-5220651
	Bibi Hoor	0344-3871148
	Zar Bibi	0349-7871161
	Nazuk Bibi	0340-9852212
	Razia Sultana	0344-9469732
Conducted by:	Rehana Akhtar	
Recorded by:	Rehana Akhtar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ Women said they have no concern no abjection on the construction of the project. ▶ Community demanded basic amenities such as safe drinking water and basic education be included as part of the contribution of the Project to the community. ▶ Affected households should be properly compensated. ▶ During construction dust and noise will create problems for locals. ▶ Women said education for their children is their basic need project developers should build new school in their village. ▶ They said they use river water for their livestock and also for irrigation their crops due to Dam construction water level will decrease it creates many problems for them because their crops and fruits was only source of their earning.	

Stakeholder/s or Settlement	**Mumyun**	
Consultation		
Date:	April 7,2018	
Time:	1400hrs	
Meeting Venue:	Mumyun	
Attended by and contact details:	Name	Contact Number
	Niyal Gul	0341-6968370
	Merun Nisa	0340-9860320
	Sifal Nisa	
	Dana Bibi	
	Bibi Zakira	
	Bibi Gul	
	Hania Bibi	
	Bibi Har	
	Farida Bibi	
Conducted by:	Rehana Akhtar	
Recorded by:	Rehana Akhtar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ Water supply from the springs and streams may dry out as result of Dam construction. ▶ Women expressed their fear that due to crushing of tunnel their houses can be affected, land slide will increase and there will be more earthquake in their area. ▶ Some women said government should establish some vocational centers for their girls and house ladies. ▶ Some women said special old age allowance should be given to the old women. ▶ Heavy machinery used for the Project will damage road network in the area.	

Stakeholder/s or Settlement	**Andahti / Runi**	
Consultation		
Date:	April 8, 2018	
Time:	1100hrs	
Meeting Venue:	Andahti / Runi	
Attended by and contact details:	Name	Contact Number
	Rashida Kanwal	0340-8898931
	Misro Khonza	
	Bibi Haj	
	Mohsina Bibi	
	Noor Jahan	
	Khonza Gul	
	Rabia Gul	
	Noshaba Bibi	
	Mehtab Bibi	
	Farida Bibi	
	Naveeda Bibi	
	Aysha Bibi	
	Sonia Gulfam	
Conducted by:	Rehana Akhtar	
Recorded by:	Rehana Akhtar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ Women suggested if government wants to construct this dam government should select any other place without disturbing the residential settlements. ▶ Women expressed their fear that due to crushing of tunnel their houses can be affected, land slide will increase and there will be more earthquake in their area. ▶ Affected households should be properly compensated. ▶ During construction dust and noise will create problems for locals. ▶ Free electricity should be provided to the local communities. ▶ Due to influx of outsiders free mobility of women in the settlements will be affected. ▶ Women said they want alternative land and houses against their land and houses.	

Stakeholder/s or Settlement	**Haraini**	
Consultation		
Date:	April 8, 2018	
Time:	1400hrs	
Meeting Venue:	Haraini	
Attended by and contact details:	Name	Contact Number
	Nila Amjad	0345-6997340
	Samina Bibi	0344-9309752
	Sabez Pari	0340-9852402
	Zubaida Bibi	0348-2947705
	Sultana Bibi	
	Zahira Bibi	
	Sabur Nisa	
	Hamida Bibi	
	Gulistan Bibi	
	Percham Bibi	
	Shahmila Bibi	
Conducted by:	Rehana Akhtar	
Recorded by:	Rehana Akhtar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ Women expressed their fear that due to crushing of tunnel their houses can be affected, land slide will increase and there will be more earthquake in their area. ▶ Affected households should be properly compensated. ▶ During construction dust and noise will create problems for locals. ▶ Water supply from the springs and streams may dry out as result of Dam construction. ▶ They said they use river water for their livestock and also to irrigate their crops, due to Dam construction water level will decrease, it will create many problems for them because their crops and fruits are only source of their earning.	

Stakeholder/s or Settlement	**Uchhtar**	
Consultation		
Date:	April 7, 2018	
Time:	1000hrs	
Meeting Venue:	Uchhtar	
Attended by and contact details:	Name	Contact Number
	Rozbia Bibi	0332-2996747
	Khosh Begum	0348-0012246
	Zarina Bibi	0340-4539930
	Shahida Tabsum	0340-5829923
	Jahan Nisa	0340-9864943
	Niyat Begum	0340-9865126
	Rwehsana Bibi	
	Shahmim Akhtar	
	Bibi Sharifa	
	San Khan Bibi	
	Khonza Begum	
Conducted by:	Rehana Akhtar	
Recorded by:	Rehana Akhtar	
Language:	Khowar, Urdu	
Issues, Concerns and Suggestions:	▶ Community demanded basic amenities such as safe drinking water and basic education as part of the project execution. ▶ Affected households should be properly compensated. ▶ During construction dust and noise will create problems for locals. ▶ Women said education for their children is their basic need project developers should build new school in their village. ▶ They said they use river water for their livestock and also to irrigate their crops, due to Dam construction water level will decrease and it will creates many problems for them because their crops and fruits are the only of earning for them. ▶ Their jamat khana will also be affected due to the road construction and they demanded Government to build new jamat khana for them after project construction. ▶ Affected households should be properly compensated or Government should build houses for them.	

Appendix K: Institutional Consultation Logs

Stakeholder/s or Settlement	**Wildlife Department**	
Consultation		
Date:	April 10, 2018	
Time:	1000hrs	
Meeting Venue:	Wildlife Office Chitral	
Attended by and contact details:	Name	Contact Number
	Ijaz Ahmad (DFO)	0343-0934263 / 0943-412101
Conducted by:	Yasar Asad	
Recorded by:	Yasar Asad	
Language:	Urdu	
Issues, Concerns and Suggestions:	▶ He said, they were happy to hear about the project and they are in favor of the project. ▶ He said, they are ready to provide full support during construction period of the project. ▶ More he added, that land sliding may be increased due to blasting for the tunnel.	

Stakeholder/s or Settlement	**Forest Department**	
Consultation		
Date:	April 10, 2018	
Time:	1300hrs	
Meeting Venue:	Forest Office Chitral	
Attended by and contact details:	Name	Contact Number
	Shaukat Fiaz (DFO)	0333-9155993 / 0943-413381
Conducted by:	Yasar Asad	
Recorded by:	Yasar Asad	
Language:	Urdu	
Issues, Concerns and Suggestions:	▶ He expressed happiness regarding the project, He said this project will bring a positive change in the lives of the affected people of the area. ▶ He said, they are facing many problems due to sliding so if possible make only one big transmission line and connect all power houses from District Chitral to national grid station. ▶ He said, all type of compensation regarding fruit and other tress should be paid as per market rates.	

Stakeholder/s or Settlement	**DC Office**	
Consultation		
Date:	April 11, 2018	
Time:	1000hrs	
Meeting Venue:	DC Office Chitral	
Attended by and contact details:	Name	Contact Number
	Zahir Shah (Assistant Commissioner)	0345-1560937 / 0943-412946
Conducted by:	Yasar Asad	
Recorded by:	Yasar Asad	
Language:	Urdu	
Issues, Concerns and Suggestions:	▶ He said, they warmly welcome the project in their area and he will also cooperate on every stage with the project developers and Government. ▶ He said, selected area for dam construction is called flood zone, and people have only river water and agriculture land as source of livelihood, project developers should compensate by the affected people on market rates and also give them job opportunities in the project. ▶ Free electricity should be provided to the local communities. ▶ Due to influx of outsiders free mobility of women in the settlements will be affected.	

Stakeholder/s or Settlement	**Fisheries Department**	
Consultation		
Date:	April 11, 2018	
Time:	1400hrs	
Meeting Venue:	Fisheries Department Chitral	
Attended by and contact details:	Name	Contact Number
	Gul Raheem (Inspector)	0345-2211777 / 0943-412540
Conducted by:	Yasar Asad	
Recorded by:	Yasar Asad	
Language:	Urdu	
Issues, Concerns and Suggestions:	▶ He said, they have no issue with the project. They were in the favor of the project. ▶ Fish will be affected and fish population may decrease due to dam construction. ▶ River as well as the major tributaries with a significant perennial flow that support breeding of fish will also be affected due to dam construction.	

Stakeholder/s or Settlement	**Sarhad Rural Support Programme (SRSP)**	
Consultation		
Date:	April 12, 2018	
Time:	1030hrs	
Meeting Venue:	SRSP Office Chitral	
Attended by and contact details:	Name	Contact Number
	Tariq Ahmed (DPM)	033-5062833 / 0320-9002565 0943-412918
Conducted by:	Yasar Asad	
Recorded by:	Yasar Asad	
Language:	Urdu	
Issues, Concerns and Suggestions:	▶ He was very happy and he strongly agreed for construction of the Dam in their area. ▶ He said, water springs may become dry due to blasting and people should face problems for drinking water. ▶ During construction dust and noise will create problems for locals.	

Stakeholder/s or Settlement	**Aga Khan Rural Support Programme (AKRSP)**	
Consultation		
Date:	April 12, 2018	
Time:	1230hrs	
Meeting Venue:	AKRSP Office Chitral	
Attended by and contact details:	Name	Contact Number
	Engr: Sardar Ayub (RPM)	0302-5949314 / 0943-412736 0943-412720 / 0943-412727
Conducted by:	Yasar Asad	
Recorded by:	Yasar Asad	
Language:	Urdu	
Issues, Concerns and Suggestions:	▶ He expressed happiness regarding Dam construction. ▶ In 2015, flood damage the road network of that area, Government should make a good road for public. ▶ Labor and other job opportunities should be provided to the locals in the project. ▶ Electricity should be provided to them free of cost in all affected areas.	

Stakeholder/s or Settlement	**Helping Hand**	
Consultation		
Date:	April 13, 2018	
Time:	0930hrs	
Meeting Venue:	Helping Hand NGO Office Chitral	
Attended by and contact details:	Name	Contact Number
	Sadiq Hussain (DC)	0344-9444815 / 0943-414808
Conducted by:	Yasar Asad	
Recorded by:	Yasar Asad	
Language:	Urdu	
Issues, Concerns and Suggestions:	▶ He was very happy and he strongly agreed for construction of the Dam in their area. ▶ He said after construction of the project tourism will increase in the area and job opportunities also increase for locals. ▶ Road network, batter health and education facilities will also increase in the area. ▶ On the other hand affected people should be compensated at market rates.	

Stakeholder/s or Settlement	**Justice Aid and Development Foundation (JAD)**	
Consultation		
Date:	April 13, 2018	
Time:	1100hrs	
Meeting Venue:	JAD NGO Office Chitral	
Attended by and contact details:	Name	Contact Number
	Syed Harir Shah (CEO)	0334-9534503 / 0943-412461
	Irfan Aziz (PO)	0306-8022149
Conducted by:	Yasar Asad	
Recorded by:	Yasar Asad	
Language:	Urdu	
Issues, Concerns and Suggestions:	▶ Water supply from the springs and streams may dry out as result of Dam construction. ▶ People are poor and their livelihood depends upon river water and agriculture after dam construction water will decrease and it will create problems for them. ▶ In construction activities heavy traffic, noise and air pollution create difficulties for them. ▶ Labor and other job opportunities will be provided by the locals in the project.	

Appendix L: Stakeholder Engagement Plan

See following pages.

Hagler Bailly Pakistan

Arkari Gol Hydropower Project

Stakeholder Engagement Plan

HBP Ref.: D8SP1AGH

VERISION 1

June 11, 2018

Master Hydro (Pvt.) Ltd.

Contents

Exhibits

1. Introduction

Master Hydro (Pvt.) Ltd. (MHL) intends to develop the 99 megawatt (MW) Arkari Gol Hydropower Project (the Arkari HPP or the Project) on the Arkari GolGol, about 8 kilometer (km) upstream of the confluence of Arkari GolGol with Lutkho River in the Chitral District of Khyber Pakhtunkhwa (KP). The dam is located 370 km from Peshawar. The location of the Project is shown in Error! Reference source not found.. he dam and powerhouse are at a distance of 7.5 km. The Project is required to comply with the laws of KP. It has been planned to add low-cost electricity to the national grid. The Project will help in meeting the current shortfall and an increasing demand for electricity in the region through economical and sustainable means.

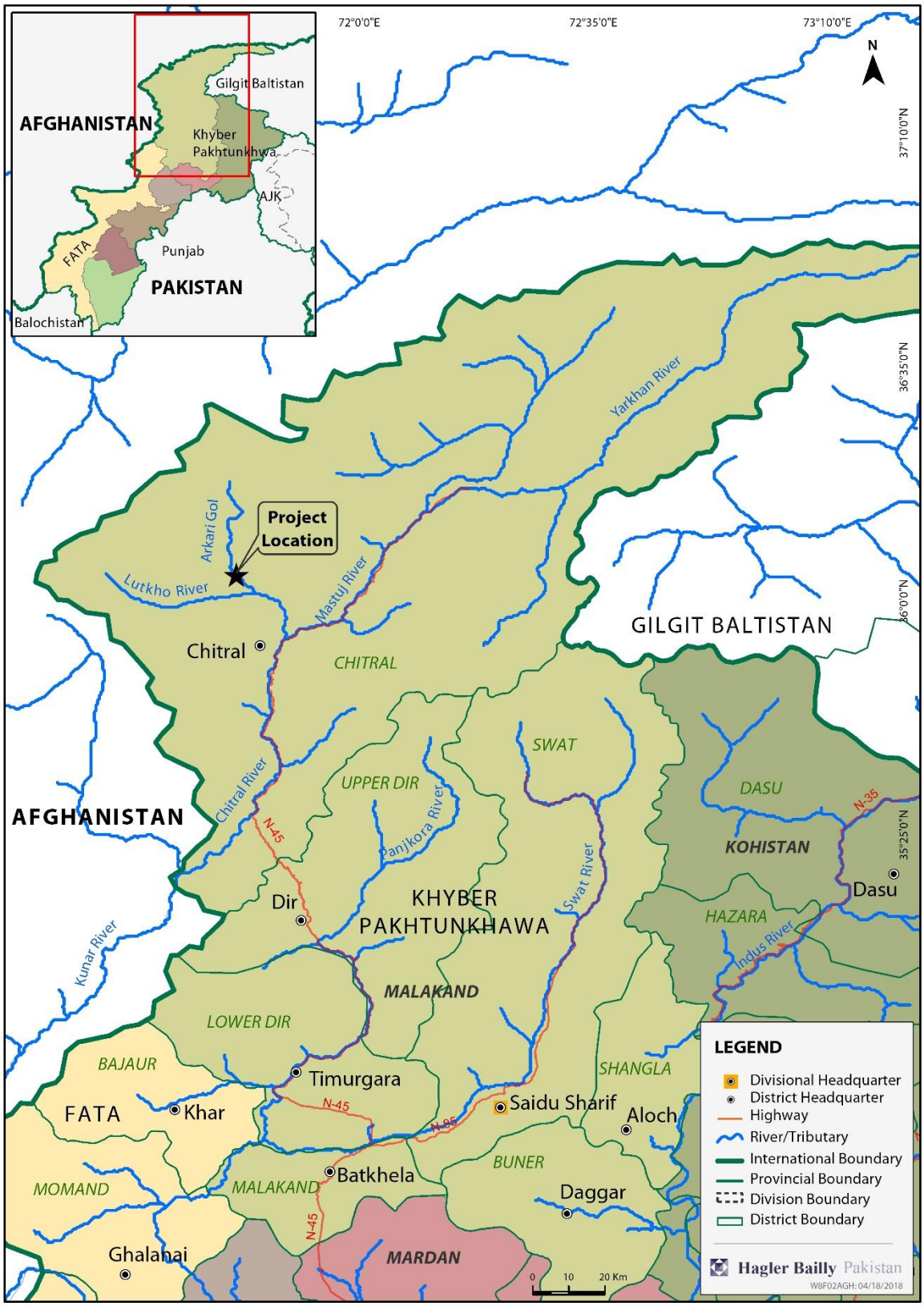
A Feasibility Study of the Project[1] (FS) was released in March 2014. MHL has contracted the services of Hagler Bailly Pakistan (Pvt.) Ltd. (HBP) to carry out an ESIA of the Project which meets the performance standards and guidelines prescribed by the Overseas Private Investment Corporation (OPIC), and conforms to the environmental legislation of KP, Pakistan.

This document describes the Stakeholder Engagement Plan (SEP) for the Project and also covers stakeholder engagement relevant to the ESIA. The purpose of the SEP is to define a technically sound and culturally appropriate approach to engage stakeholders at the early stage of the planned developments. The SEP is designed to ensure:

- adequate and timely information is provided to stakeholders, and
- stakeholders have sufficient opportunity to voice their opinions and concerns.

[1] Pakhtunkhwa Hydel Development Organization (PHYDO), Government of Khyber Pakhtunkhwa, not dated, Feasibility Study for the Arkari Gol Hydropower Project, District Chitral, (Lower), Khyber Pakhtunkhwa, Volume 1, Main Report

Exhibit 1.1: Project Location



Stakeholder engagement will act as a bridge between proposed development proponents (MHL) and key stakeholders (government and regulatory authorities, affected communities, business owners and developers in the area).

Stakeholder engagement will be an ongoing exercise that will start with the commencement of fieldwork associated with the ESIA study. The SEP will be a dynamic document and will be updated as more information on proposed developments becomes available or additional stakeholders are identified.

Initially, the SEP will be used for the involvement of known stakeholders during the ESIA; however, it is the intention that this document will be developed further by MHL, to include some of the wider aspects of stakeholder engagement going forward including involvement of stakeholders in monitoring the impacts of the development should decisions to proceed be favorable.

1.1 Objectives of Stakeholder Engagement Plan

The objectives of ESIA stakeholder engagement are to:

- inform stakeholders of the future developments and their consequences;
- aid in the identification of key impacts associated with the development;
- seek input from key stakeholders on planned activities to increase its positive outcomes and avoid or mitigate negative impacts;
- involve stakeholders in the decision-making of the ESIA and development activities;
- identify appropriate grievance mechanisms; and
- determine how stakeholders can be involved in the monitoring of environmental and social impacts of the Project should it proceed.

1.2 Regulatory Controls and Good Practice Guidelines

This section describes the applicable national regulation and standards that the stakeholder engagement will comply with and good practice guidelines by the IFC that will be kept in view.

1.2.1 Applicable National Regulation

The national environmental laws require that only one round of consultations be conducted during the scoping phase of the Project. However, the World Bank Group (WBG) requires two rounds of consultations during the entire ESIA process, during the scoping phase and a feedback consultation before finalization of the Project's environmental design.

Pakistan Environmental Law

The Review of the Initial Environmental Examination and Environmental Impact Assessment Regulations 2000 (IEE-EIA Regulations) provide the necessary details on the preparation, submission, and review of IEE and EIA in Pakistan. Under Regulation 6 of the IEE-EIA Regulations, a set of guidelines have been issued for general applicability

and sectoral guidelines produced indicating specific assessment requirements. This includes the Guidelines for Public Consultation, 1997 (the 'Guidelines') summarized below:

- *Objectives of Public Involvement:* To inform stakeholders about the proposed Project, to provide an opportunity for those otherwise unrepresented to present their views and values, providing better transparency and accountability in decision making, creating a sense of ownership with the stakeholders.
- *Stakeholders:* **'**people who may be directly or indirectly affected by a proposal will clearly be the focus of public involvement. Those who are directly affected may be Project beneficiaries, those likely to be adversely affected, or other stakeholders. The identification of those indirectly affected is more difficult, and to some extent, it will be a subjective judgment. For this reason, it is good practice to have a very wide definition of who should be involved and to include any person or group who thinks that they have an interest. Sometimes it may be necessary to consult with a representative from a particular interest group. In such cases, the choice of representative should be left to the group itself. Consultation should include not only those likely to be affected, positively or negatively, by the outcome of a proposal, but should also include those who can affect the outcome of a proposal.

The range of stakeholders typically includes local people, other affected communities, proponents, government agencies and local councils, Non-Governmental Organizations (NGOs) and other influential people.

- *Mechanism:* provide sufficient relevant information in a form that is easily understood by non-experts (without being simplistic or insulting); allow sufficient time for stakeholders to read, discuss, consider the information and its implications and to present their views; responses should be provided to issues and problems raised or comments made by stakeholders; selection of venues and timings of events should encourage maximum attendance.
- *Timing and Frequency:* planning for the public consultation program needs to begin at a very early stage; ideally it should commence at the screening stage of the proposal and continue throughout the ESIA process.
- *Consultation Tools:* some specific consultation tools that can be used for conducting consultations include focus group meetings, needs assessment, semi-structured interviews; village meetings and workshops.
- *Important Considerations:* The development of a public involvement program would typically involve consideration of the following issues; objectives of the proposal and the study; identification of stakeholders; identification of appropriate techniques to consult with the stakeholders; identification of approaches to ensure feedback to involved stakeholders; and mechanisms to ensure stakeholders' consideration are taken into account.

1.2.2 OPIC Guidelines

The Overseas Private Investment Corporation (OPIC) is the United States Government's development finance institution. Its role is to mobilize private capital to help address critical development challenges. OPIC has an Environmental and Social Policy Statement (ESPS) which details the organization's policy and guidelines on environmental and social issues including environmental and social impacts of development projects and their management. OPIC's ESPS adopts as a standard for the environmental and social review process, the IFC's PSs on Social and Environmental Sustainability and Industry Sector Guidelines and any subsequent revisions to those standards

The International Finance Corporation (IFC) is the private-sector wing of the World Bank Group (WBG). The IFC Performance Standards (IFC PS) and 'IFC Stakeholder Engagement: Good Practice Handbook for Companies doing Business in Emerging Markets' layout the objectives and approach for modern stakeholder engagement. This handbook has been taken into consideration in drafting this SEP. Stakeholder involvement is good practice for modern development initiatives that lead to environmental and social impacts. Some of the main principles laid out for consultations include:[2,3,4,5]

- *Stakeholder identification:* Stakeholders include individuals and/or groups that can be affected by or are interested in the development initiative. Consultations should be held with the stakeholders engaging all types of stakeholders, which can include potentially affected communities, local government and regulatory authorities, regulatory institutions, NGOs, academia and other civil society bodies.
- *Selection of consultation techniques:* Sufficient information should be shared with the stakeholders in a timely and effective manner, with consideration for stakeholder interests, linguistic and educational backgrounds, and socio-cultural setting.
- *Arrangements for consultations:* Venue and timing for consultation meetings should be chosen in a manner that encourages maximum participation on behalf of stakeholders.
- *Stages of consultation:* Consultations should be conducted during the early cycle of project development (scoping stage) so that the results and outcomes of the consultations can contribute to the design process. Following this, stakeholders should be provided feedback before finalization of the project's environmental

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2 International Finance Corporation. January 2012. *Performance Standard 1*, Washington, DC: World Bank Group.

3 Davis, Shelton H. and Nightingale Rukuba–Ngaiza. September 1998. Based on the World Bank's Operational Directive 4.01 on Environmental Assessments Meaningful Consultations in Environmental Assessment.

4 International Finance Corporation. May 2007. Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets. Washington, D.C: World Bank Group

5 The World Bank Operational Manual. September 1991. *Operational Directive OD 4.20.* Washington, D.C: World Bank Group

design (feedback stage) on how their concerns, raised at the scoping stage, were addressed through suitable mitigation or design changes.

- *Stakeholder feedback and use of results:* The views of stakeholders should be documented and then analyzed for use in more effective decision-making.

1.2.3 Good Practice Principles

The consultations will be undertaken in good faith while remaining impartial. The good practice principles which will be observed during the consultations are as follows:[6]

- *Cultural sensitivity* – this requires respect, understanding, and appreciation for the customs, institutions, values, and norms of the communities affected by a project.
- *Interactive approach* – stakeholder engagement should not be limited to the one-way dissemination of information by the project proponent but should include stakeholder input into decision-making processes for the proposed Project.
- *Open, transparent and informative* – Project stakeholders should have access to relevant information, in a simple and understandable format.
- *Inclusive and equitable* – ensure all stakeholder groups are represented, including less represented groups such as women, children, elderly and the poor.
- *Appropriateness and flexibility* – stakeholder engagement techniques (surveys, interviews, workshops etc.) must be appropriate to the specific phase of the ESIA study (scoping consultations, feedback consultations) and the stakeholder groups identified.
- *Capacity building* – capacity building should be a part of the interaction with stakeholders, wherever appropriate and practicable.

1.3 Development of SEP

It is expected that in the long term the SEP will provide the basis for strengthening the planning process of MHL. in general and will become a platform through which MHL can:

- identify and address the concerns, suggestions, and interests of the stakeholders in the planning, design and implementation of the Project;
- collect vital information to assess the cumulative impacts of the Project;
- identify appropriate management measures;
- coordinate decisions with other regulatory authorities and institutional stakeholders on whether to approve the future developments and corresponding conditions of approval;
- provide a means of receiving any grievances of the public in a timely manner and addressing them to the satisfaction of the community; and

[6] These good practice principles are drawn from WBG Stakeholder Engagement Good Practice Handbook

- involve stakeholders in monitoring the impacts of the current and future developments.

In summary, the SEP will be updated and designed to integrate the stakeholder engagement into the core business activities of MHL. It is envisaged that the SEP will help in developing a broad, inclusive, and continuous communication path between MHL and its stakeholders.

This plan will be updated at the completion of the ESIA to provide a coordinated strategy for ongoing consultations by MHL.

2. Engagement Activities and Steps

The stakeholders for the Project will be involved and consulted, during the course of the ESIA and various phases of the Project development activities, in compliance with the standards and guidelines provided above. The key steps to be followed for the proposed Project's stakeholder engagement are provided in **Exhibit 2.1.** Additional details are provided in **Section 4** and **5**.

Given previous consultations as part of the March 2014 Feasibility Study, verification consultations will be carried out for the ESIA. These will include:

- Community consultations in at least 30% of river-dependent communities within the Socioeconomic Study Area, along with the socioeconomic surveys.
- Community consultations in more than 50% of communities within a 500 m buffer of Project facilities.
- River dependent businesses (including sand mining, fishing, and recreation) covered along with the socioeconomic surveys.
- All concerned institutional stakeholders, including government departments will be consulted.

Exhibit 2.1: Summary of Stakeholder Engagement Activities and Steps

Steps	*Description*
Stakeholder identification and analysis	▶ Identification of government bodies, regulatory agencies, non-governmental organizations, other investors and communities which are associated with or have a stake in the Project, or, in general, in development of hydropower projects in the area. ▶ Analysis of how the identified stakeholders will be affected by or can affect the Project. ▶ Over the course of the ESIA, and following completion of the ESIA, this will remain an on-going task. See **Annexure A**.
Information disclosure	▶ A Background Information Document (BID) in English and Urdu will be prepared to keep in mind the linguistic limitations of local communities. The document will be shared with the identified stakeholders providing them information about the Project, the purpose of engaging them and key issues within the area. The BID will be updated, as required, throughout the duration of the ESIA. ▶ Following completion of the ESIA, an updated BID will be kept by MHL for any additional stakeholders that request information about the Project. See **Annexure B**.
Stakeholder consultation	▶ Stakeholders will be informed prior to the consultations. The time and venue for the consultations will be shared and agreed with the stakeholders.

Steps	*Description*
	▶ Consultations with the communities will be held within the settlements, to the extent possible. Where, due to logistic or security concerns, it is not possible to hold consultations with the community, a nearby community or location will be selected, to facilitate maximum participation. Separate consultations with the female members of the community will be held. ▶ The consultations will be targeted and meaningful i.e. directly related to the proposed Project, while also aiming to distinguish between impacts of development activities of the Project and other nearby developments. ▶ The proceedings of the consultation meetings will be recorded.
Reporting to Stakeholders	▶ Feedback consultations will be held to inform the stakeholders about the results of the ESIA and the recommendations for actions to address their concerns and to manage the impacts associated with the proposed developments. ▶ Following feedback consultations for the ESIA, this will remain an on-going task by MHL.
Ongoing Engagement	▶ MHL will continue engagement and grievance redress throughout the life of the Project.

3. Proposed Structure for Stakeholder Engagement and Grievance Redressal

In this section the proposed structure for stakeholder engagement within MHL is provided. This will be discussed with MHL to further develop and finalize.

It is proposed that MHL sets it as a policy to effectively engage stakeholders during the entire life of the Project. In this regard, it shall constitute the following entities:

- **Public Coordination Unit (PCU)**, which will be responsible to proactively engage stakeholders during the course of the Project development and possible operation, proactively inform stakeholders on developments and changes, and receive suggestions/complaints, maintain logs and resolve complaints.
- **Stakeholder Engagement Committee (SEC)**, responsible to oversee the functioning of the PCU as well as the final non-judicial authority on resolving grievances that cannot be resolved by PCU.
- **Coordination Focal Points (CFPs)**, which will include educated people from each community that can be approached by the PCU to help in engagement and disseminate information, and can be approached by the community members to assist in providing feedback, and communicating their grievances to the Project. The CFPs will be provided training by the Project in facilitating grievance redress.

3.1 Function and Structure of Public Coordination Unit

The structure of the SEC and PCU is described below.

The PCU will be set up as part of the MHL Project Team. A Community Relations Officer (CRO) of MHL will lead the unit. During the Project development and construction period, it is proposed at least two Community Liaison Officers (CLOs), one male and one female, will be responsible for coordinating correspondence and assisting the (CRO). The CLOs will be responsible for preparation of documentation including complaint/suggestion/request for information logs and providing community feedback on the company's response to the communities' issues.

Given the female community members may have restricted mobility outside of their villages and homes, the female CLO will be required to undertake visits to the local communities. The frequency of visits will depend on the nature and magnitude of activity in an area and the frequency of grievances.

Initially, MHL may wish to hire a single CLO to represent and report directly to senior MHL management. During this period CLOs will not enter negotiations or make commitments on behalf of MHL, and the senior MHL management will carry out all other functions described below.

3.2 Function and Structure of the Stakeholder Engagement Committee

The SEC will function as an independent body that will regulate the PCU and the grievance redress process. It will comprise:

- An environmental and social team of MHL;
- MHL's senior management responsible for overseeing contractors;
- Two, or more, representatives from the communities residing near the Project location; and
- A representative of the local government (if required).

The SEC will meet once every three months to review the performance of the PCU; the frequency can be changed depending on the nature and frequency of issues received. The performance will be gauged in terms of the effectiveness and the timeliness with which community issues are managed. In case there are any unresolved or pending issues, the SEC will deliberate on mechanisms to resolve those and come up with solutions acceptable to everyone.

3.3 Coordination Focal Points

The coordination focal points (CFPs) will be literate people from each community that will facilitate their community members in reporting grievances to the Project. The CFPs will be provided training by the Project in facilitating grievance redress. Each community will have a male and female CFP appointed for this purpose. However, the CFPs will not be the only community members that can register a grievance; and this facility will be available to every individual in the communities.

3.4 Advisory Support to MHL

Stakeholder identification will be carried out as part of the ESIA process. Stakeholders likely to be affected by the Project have been identified through an understanding of the potential impacts that may arise from the development activities of the Project and through:

- review of existing published environmental and other studies conducted in the area; experience gained by HBP during previous ESIA studies conducted in the area; and
- satellite imagery for identification of settlements within the Study Area and the wider area.

3.5 Framework for On-going Engagement and Grievance Redress by MHL

On-going engagement will be carried out by MHL in the construction phase and throughout the life of the Project. The stakeholder engagement is expected to include:

- reporting on the implementation of any management plans;
- opportunities for stakeholders to respond to the information received; and
- constructive dialogue on environmental and social issues and performance.

The stakeholder engagement process will be documented, including:

- maintenance of a stakeholder database with stakeholder details;
- records of information disclosed to stakeholders;
- records of stakeholder engagements;
- records of inputs from stakeholders and responses to these; and
- grievance redress records and documentation.

Grievance Redress Mechanism Framework

The redress of stakeholder grievances through mechanisms that provide an effective avenue for expressing and achieving resolution of stakeholder concerns is critical for the maintenance of good relations between the Project proponent and stakeholders and for the avoidance of potential sources of tension and conflict. In this context, the SEP will help in forming and strengthening relationships between MHL management and the stakeholder groups, and in bridging any gaps to provide MHL management a 'social license' to operate in the area.

A framework mechanism to handle grievances and complaints from stakeholders is provided below and will be subsequently updated during various phases of the Project development and operation. The purpose of the complaints procedure will be to ensure that complaints from Project affected communities and representatives of their interests are dealt with appropriately, with corrective actions being implemented where needed and the complainants being informed of the outcome. The SEP will aim to ensure grievances are treated without prejudice.

Step 1: Receive and Acknowledge Complaint

Once the PCU receives a complaint, which could be the complainant giving it in person, via letter or email, through a phone call, or through a CFP, an acknowledgment of receipt of the complaint will be sent within two working days to the complainant. The complainant will be issued a unique complaint tracking number for their and PCU's record.

Step 2: Investigation

The PCU will work to understand the cause of the grievance for which it may need to contact the complainant again for details. The PCU will be required to complete preliminary investigations within five working days of receiving the complaint and send a response to the complainant documenting the results of investigations and what the PCU plans to do in response.

Step 3: Resolution through PCU

Once the PCU has investigated a grievance, it will share with the complainant the proposed course of action to resolve the complaint. If the complainant considers the grievance to be satisfactorily resolved, the PCU will log the complaint as resolved in its record.

For minor or less complex grievances, Steps 1, 2 and 3 or Steps 2 and 3 can be merged.

Step 4: Resolution through SEC

In case the PCU is unable to resolve the grievance, the matter will be referred to the SEC. Complaints that cannot be resolved within four weeks of filing will by default be referred to SEC. However, the complainant or the PCU can convene the SEC at any point in time, depending on the nature and urgency of the issue.

Operating Principles for PCU

The PCU will operate on the principles of transparency, approachability, and accountability. To achieve these, the PCU will be required to:

- be equipped to handle grievances in the local languages;
- be equipped to work through multiple modes of communication, such as, emails, by-post and face-to-face meetings at plant site or requiring visits;
- employ female staff, preferably from the nearby communities, to oversee complaints and issues of the female community members;
- maintain a log of grievances, with a record of the date and time of the complaint logged and stakeholder information, such as name, designation and contact details;
- provide an opportunity to the stakeholder to revert with their comments on the proposed plan of action;
- keep the stakeholder informed of the progress in grievance resolution;
- obtain stakeholder consent on the mechanism proposed to redress the grievance and document consent; and
- maintain the confidentiality of the stakeholder, if requested so.

Stages of Grievances

Once a grievance is logged with the PCU, it could reach the following stages:

Stage 1: It is resolved by the PCU or if not PCU, by the SEC.

Stage 2: If the SEC cannot resolve the issue, it will inform MHL's senior management accordingly and senior management will organize a special mission to address the problem and identify a solution.

Stage 3: If the stakeholders are still not satisfied with the reply in Stage 3, they may go through local judicial proceedings.

Stakeholder Awareness

The stakeholders will be informed of the establishment of the PCU and grievance redress mechanism through a short and intensive awareness campaign. MHL will share the following with the stakeholders as a part of the awareness campaign:

- objective, function and the responsibilities of the PCU;
- means of accessing the PCU and the mechanics of registering a grievance at the PCU;
- operating principles of the PCU; and

- contact details.

Additional awareness campaigns may be organized, if necessary.

4. Stakeholder Identification and Analysis

Initial stakeholder identification has been carried out as part of the ESIA process and presented in **Annexure A**. The initial list developed as part of the ESIA will be further updated throughout the duration of the ESIA by HBP, and by MHL as part of ongoing engagement after completion of the ESIA. Stakeholders likely to be affected by the Project have been identified initially through an understanding of the potential impacts that may arise from the development activities of the Project and through:

- review of existing published environmental and other studies conducted in KP;
- experience gained by HBP during previous ESIA studies conducted in KP and nearby areas; and
- satellite imagery for identification of settlements within the Socioeconomic Study Area and the wider area.

On the basis of the above, the following groups are identified as those which may have an interest in the Project or may be impacted by the Project development activities:

- Communities within the Socioeconomic Study Area (**Exhibit 4.1**) that are likely to be directly impacted by the Project development activities resulting in emissions, dust, noise, vibrations and possible relocation.
- Key owners and developers of other projects in the vicinity.
- Business owners within the Socioeconomic Study Area, and other suppliers or service providers in the vicinity.
- Government and regulatory authorities directly or indirectly connected to or overseeing the activities of the Project.
- Non-governmental organizations that can affect or influence the Project.

Exhibit 4.1 illustrates the Socioeconomic Study Area for the ESIA which will be the focus of the community consultations.

4.1 Community Stakeholders

The stakeholders within the community that have been identified are divided into the following categories:

- Business Owners within Socioeconomic Study Area.
- Communities within a 500 m buffer of the River (being relocated and likely having river-dependent livelihoods).
- Communities within a 500 m buffer of the River (not relocated but likely having river-dependent livelihoods).
- Communities within 1 km buffer of Project infrastructure.

Their relevance to the Project, its ESIA and RAP is provided in **Annexure A**.

4.2 Institutional Stakeholders

The institutional stakeholders have been identified in the following categories:

- Regulatory Agencies
- Government Departments
- Non-governmental Organizations active in the area

The information for representatives in each of the identified stakeholders within each of category is provided in **Exhibit 4.2**, along with the stakeholder's relevance to the Project.

Exhibit 4.1: Socioeconomic Study Area

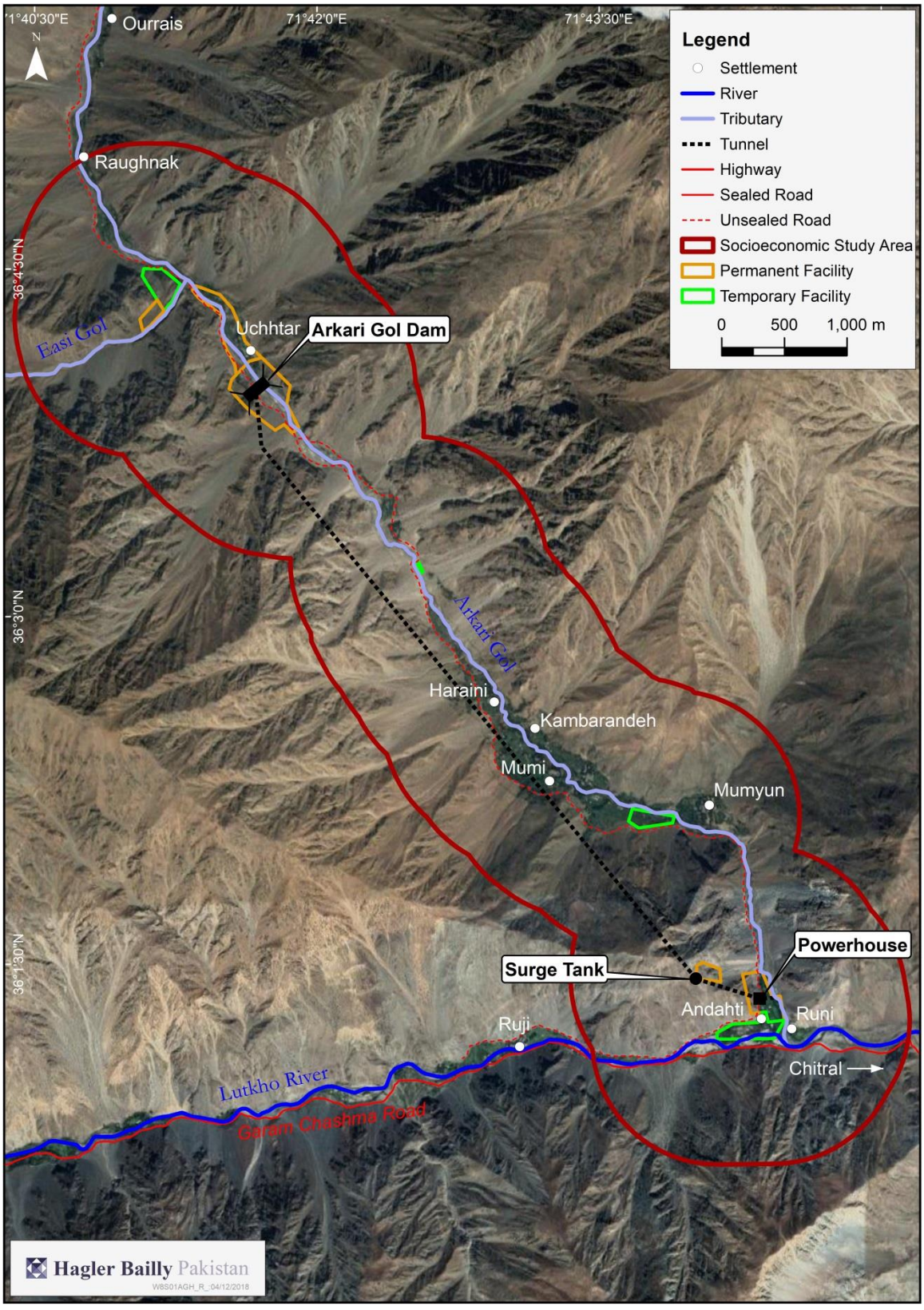


Exhibit 4.2: Identified Stakeholders and their Relevance

Stakeholder/Groups	*Name*	*Position*	*Relevance to the Project*
Government Departments			
Forest Department, KP	Shaukat Fiaz	Divisional Forest Officer	Interested in the loss of forested area as a result of the Project and compensatory afforestation. Interest in the terrestrial flora that can be impacted by the Project and associated regulation.
Deputy Commissioner Office (DCO), KP	Zahir Shah	Assistant	Interest in the fish fauna that can be impacted by the Project and associated regulation.
Wildlife Department, KP	Ijaz Ahmad	Divisional Forest Officer (Wildlife)	Interest in the fish fauna and terrestrial wildlife that can be impacted by the Project and associated regulation.
Fisheries Department, KP	Gul Rahim	Inspector	Interest in the fish fauna that can be impacted by the Project and associated regulation.
Non-Government Organizations			
Sarhad Rural Supprot Programme (SRSP), Chitral	Tariq Ahmed	District Program Manager	Interested in the impact of the Project on rural communities and support for rural communities in the area.
Aga Khan Rural Support Programme (AKRSP), Chitral	Engr: Sardar Ayub	Regional Programme Manager	
Helping Hand, Chitral	Sadiq Hussain	District Coordinator	
Justice Aid and Development Foundation (JAD), Chitral	Syed Harir Shah	CEO	

5. Consultation Approach and Mechanism

This section describes the stakeholder consultation approach and mechanism.

Consultations will focus on identifying key environmental and social impacts associated with the Project development activities. The recorded concerns of the stakeholders will be addressed in the ESIA through proposing appropriate management measures.

Project stakeholders will be informed about the Project development activities through the dissemination of a BID. The document will be shared with institutional stakeholders prior to the consultation, while the document will be shared with the communities during the consultation visit. The BID will be prepared in English and Urdu to match the language requirements of the consulted stakeholders. The BID is attached as **Annexure B**. It will be updated after finalization of the Project design, on an as-needed basis thereafter by MHL.

The consultation mechanism to engage industrial, institutional and community stakeholders has been provided below. Consultations will be carried out in four different phases during the ESIA as described below:

Initial Engagement and Scoping Consultations with Community within the Socioeconomic Study Area	The HBP consultation team, comprising of both male and female consultation specialists will visit communities within the Socioeconomic Study Area for initial engagement and scoping consultations. Separate consultations will be conducted with male and female members of the communities in recognition of the cultural gender sensitivities within Pakistan. The consultations will focus on communicating the Project development activities to be carried out. A Background Information Document (BID) will be shared with the communities providing them the most up to date information on the key Project development activities and location of the Project facilities. In addition to scoping consultations, a needs assessment is included as part of the socioeconomic survey carried out as part of the ESIA.
Additional On-Going Consultations with Community within the Socioeconomic Study Area and Outside it	Depending on the outcomes of the initial engagement and scoping consultations, additional consultations will be carried out with communities within the Study Area. Scoping consultations will also be carried out with additional communities identified as important (see **Annexure B**). Following finalization of the Project layout, updated BIDs will be shared with relevant communities in the Study Area. In order to ensure maximum participation, field staff will visit or call the communities in advance to inform the residents about the upcoming consultations.

Institutional Consultations	Institutional consultations will be carried out with key institutions identified, as high or medium priority on the basis of stakeholder analysis, with respect to the ESIA (see **Annexure A**). The provision of background information to key institutional stakeholders (see **Annexure A**) will be undertaken in advance of the consultations through visits, letters, emails or telephone. During the consultations, HBP's consultation team will present information related to Project development and the stakeholder engagement process, and respond to and record any comments and queries from the participants. Wherever possible, combined consultations will be held with institutional stakeholders through representative organizations such that the stakeholders can hear the concerns expressed by others and responses provided if any and make the consultation more interactive.
Feedback Consultations	Feedback Consultations will have a broad spatial coverage. Communities within the Socioeconomic Study Area and institutional stakeholders will be provided feedback during this phase of consultations. Posters and presentations will be utilized as visual aids for these consultations. Feedback Consultations will focus on communicating the outcome of the ESIA process and specifically highlight the expected impacts and proposed management measures. It will aim to address the concerns of stakeholders raised during previous consultations. Feedback consultations will help in confirming the acceptableness and likely effectiveness of the proposed management measures. This feedback consultation will progress in the following manner: Participants will be provided an overview of the process adopted for the ESIA study and its key outcomes. Participants will be provided an overview of key issues raised by them and how these have been addressed in the ESIA. The consultation team will answer any queries and record any additional concerns. A non-technical summary of the ESIA (in English) will be provided to institutional stakeholders.

The HBP consultation team will keep a record of the discussions during the consultation meetings. HBP will report the meeting minutes in the form of a table logging the stakeholder issues with names of stakeholders and dates of consultations. A template of the consultation log is provided as **Annexure C** of this document.

6. Consultation Schedule

The tentative schedule for the community consultations is provided in **Exhibit 6.1**.

Exhibit 6.1: Tentative Schedule for the community consultations

Consultation Phase	*Who*	*Planned*
Initial Engagement and Issues Scoping Consultations	Communities inside and outside the 1 km buffer	March 29, 2018 onwards
Additional Ad-Hoc Consultations	As required	On-going following initial engagement and scoping consultations
Institutional and Business Consultations	Government Departments, Regulatory Agencies Local businesses in Study Area that may be affected	April 3, 2018 onwards
Feedback Consultations	Concerned stakeholders	After completion of draft ESIA
Grievance Redress	All stakeholders	On-going by MHL
On-going consultations	As required	Following ESIA completion by MHL

The tentative schedule for institutional consultations is provided in **Exhibit 6.2**, organized by location. In some cases, information is missing. These stakeholders will be located once in the field.

Exhibit 6.2: Tentative Schedule for institutional consultations

No.	*Name*	*Representative*	*Position*	*Tentative Date of Consultation*
1.	Forest Department, KP	Shaukat Fiaz	Divisional Forest Officer	Between March 30, and April 13, 2018
2.	Fisheries Department, KP	Gul Rahim	Inspector	
3.	Wildlife Department, KP	Ijaz Ahmad	Divisional Forest Officer (Wildlife)	
4.	Deputy Commissioner Office (DCO), Chitral	Zahid Shah	Assistant	
1.	Sarhad Rural Support Programme (SRSP), Chitral	Tariq Ahmed	District Program Manager	
2.	Aga Khan Rural Support Programme (AKRSP), Chitral	Engr: Sardar Ayub	Regional Programme Manager	
3.	Helping Hand, Chitral	Sadiq Hussain	District Coordinator	
4.	Justice Aid and Development Foundation (JAD), Chitral	Syed Harir Shah	CEO	

Annexure A: Initial Stakeholder List and Initial Analysis

The following list will be continually updated based on field information.

Exhibit A.1: List of Institutional Stakeholders and their Relevance for the ESIA, the RAP and the Project

Stakeholder Group	*Stakeholder*	*Relevance to ESIA*[7]	*Relevant to RAP*	*Relevance to Project Development and Implementation*
Regulatory Institutions	Environmental Protection Agency, Punjab Environmental Protection Agency, AJK	The EPAs are the regulatory authorities that are mandated to protect the environment and approve or reject Project ESIAs.	The EPAs are key institutions involved in the granting of approval for the communities that are being resettled and the areas being used for resettlement	
Government Institutions	Forest Department, KP Fisheries Department, KP Wildlife Department, KP Deputy Commissioner Office (DCO), Chitral	The organizations associated with natural resources are important in terms of informing about the important natural resources in the area as well as highlighting the key issues associated with them. The organizations associated with infrastructure are important in terms of Project impacts on their work and relevant infrastructures in the area.	The resettlement may result in the exploitation of natural resources elsewhere, in areas where the communities are resettled.	
Non-Governmental Organizations and Civil Society Organizations	Sarhad Rural Support Programme (SRSP), Chitral Aga Khan Rural Support Programme (AKRSP), Chitral Helping Hand, Chitral Justice Aid and Development Foundation (JAD), Chitral	The NGOs operating in the Study Area have influence within the communities and can appeal decisions of the regulatory authorities. A number of them have carried out development work which may be impacted due to the Project. The NGOs that are actively working in the Study Area will be consulted as part of the ESIA consultations.	The NGOs are involved in community development and can work in the areas to which communities are resettled provided there is effective coordination with them regarding the RAP.	Synergy between work being carried out by NGOs and CSR activities by MHL can be achieved by collaborating with reputable NGOs that are engaged in the Study Area.
Business Owners within Study Area	Shopkeepers within the vicinity Businesses that rely on ecosystem services related to the river	Shopkeepers within the vicinity of the Project will be affected due to the Development. Businesses that rely on ecosystem	Certain shopkeepers and local businessmen may have to relocate their businesses.	

[7] Stakeholders that can appeal decision of delegated authority with relevance to ESIA approvals.

Stakeholder Group	*Stakeholder*	*Relevance to ESIA*[7]	*Relevant to RAP*	*Relevance to Project Development and Implementation*
		services related to the river may be affected. Potential service providers that may be affected due to the development.		
Communities within a 500 m buffer of the River (being relocated and likely having river-dependent livelihood)	Communities with river-dependent livelihoods and being relocated/resettled	Community stakeholders within the Study Area are priority communities because they have river-dependent livelihoods. They can appeal decisions of regulatory authorities, and may be affected by the Project, more so than institutional stakeholders. They are a priority and key stakeholders as they: ▶ Will be resettled ▶ May be vulnerable due to their dependence on natural resources that the Project may impact ▶ May be impacted through Project impacts on air, water, noise and traffic and related secondary impacts.	Relevant to the RAP because they will be relocated (household consultations to be carried out during RAP surveys for resettlement)	Over the course of implementation, the community stakeholders can be considered as partners in development and can help the owners fulfill their social obligations and responsibilities. They may also have grievances that need to be addressed by the Project owner.
Communities within a 500 m buffer of the River (not relocated but likely having river-dependent livelihood)	Communities with river-dependent livelihoods	Community stakeholders within the Study Area are priority communities because they have river-dependent livelihoods. They can appeal decisions of regulatory authorities, and may be affected by the Project, more so than institutional stakeholders. They are a priority and key stakeholders as they: ▶ May be vulnerable due to their high dependence on natural resources that the	Not relevant to the RAP because they will not be relocated.	Over the course of implementation, the community stakeholders can be considered as partners in development, and can help the owners fulfill their social obligations and responsibilities. They may also have grievances that need to be addressed by the Project owner.

Stakeholder Group	*Stakeholder*	*Relevance to ESIA*[7]	*Relevant to RAP*	*Relevance to Project Development and Implementation*
		Project may impact ▶ Concerned about other impacts that may affect them such as potential impacts on air, water, noise and traffic and related secondary impacts.		
Communities within 1 km buffer of Project infrastructure	Communities that may be directly impacted by the Project	These communities may be impacted directly by the Project, particularly during the construction period. Impacts include traffic related incidents, health impacts due to air quality, noise related issues, etc.		Over the course of implementation, the community stakeholders can be considered as partners in development and can help the owners fulfill their social obligations and responsibilities. They may also have grievances that need to be addressed by the Project owner.

Annexure B: Background Information Document

A background information document (BID) is given below:

March, 2018

Background Information Document for Environmental and Social Assessment of Arkari Gol Hydropower Project

Introduction

Master Hydro (Pvt.) Ltd. (MHL) is carrying out an Environmental and Social Impact Assessment (ESIA) and to develop Resettlement Action Plan (RAP) for developing the 99 megawatt (MW) Arkari Gol Hydropower Project (the "Project" or "AGHPP") on the Arkari Gol in Chitral District, Khyber Pakhtunkhwa (KP). The Project includes a weir, diversion tunnel and powerhouse on the Arkari Gol before its confluence.

The Project is currently the subject of a feasibility study, which will evaluate the technical, environmental and socioeconomic factors influencing and arising from the Project. MHL has acquired the services of Hagler Bailly Pakistan to carry out Environmental and Social Impact Assessment (ESIA) and to develop Resettlement Action Plan (RAP) for the AGHPP that meets with the applicable laws in Pakistan and Khyber Pakhtunkhwa, as well as the Performance Standards of the International Finance Corporation (IFC) and the Safeguards of the Asian Development Bank (ADB).

As part of the ESIA process, consultations will be carried out with communities and institutions that may have an interest in the Project or may be affected by the Project (the "Stakeholders"). This stakeholder consultation exercise is being conducted to provide stakeholders with information on the Project and to record their concerns, so that any issues can be addressed during the Project design phase.

During the consultations, background information on the Project will be made available to the stakeholders in the form of the Background Information Document (BID).

Project Setting

The proposed Project is planned to be built on the Arkari Gol in Chitral District, Khyber Pakhtunkhwa (KP). The proposed project location is given in **Exhibit 1** and a layout, along with key features of the Project, are reproduced in **Exhibit 2**.

Project Outline

The Project is estimated to involve acquisition of about **112.9** acres of land which includes, **43.71** acres of cultivated land and **69.2** barren land including river bed.

Out of total required land 103.3 acers of land will be required permanently and **9.2** acre for temporary purpose (Contractor's camps, crushing plant etc.) for 05 years.

Exhibit 1: Project Location

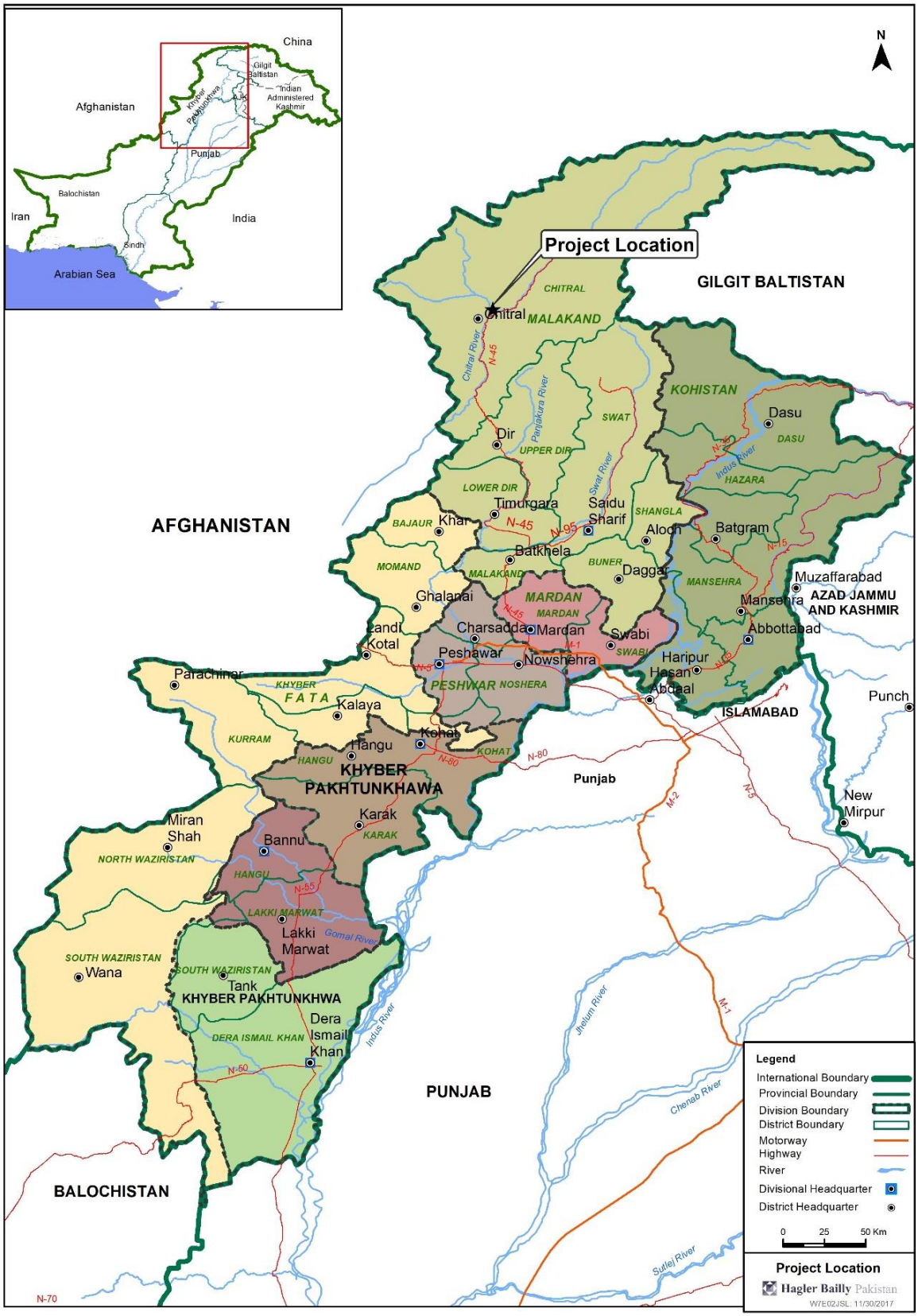
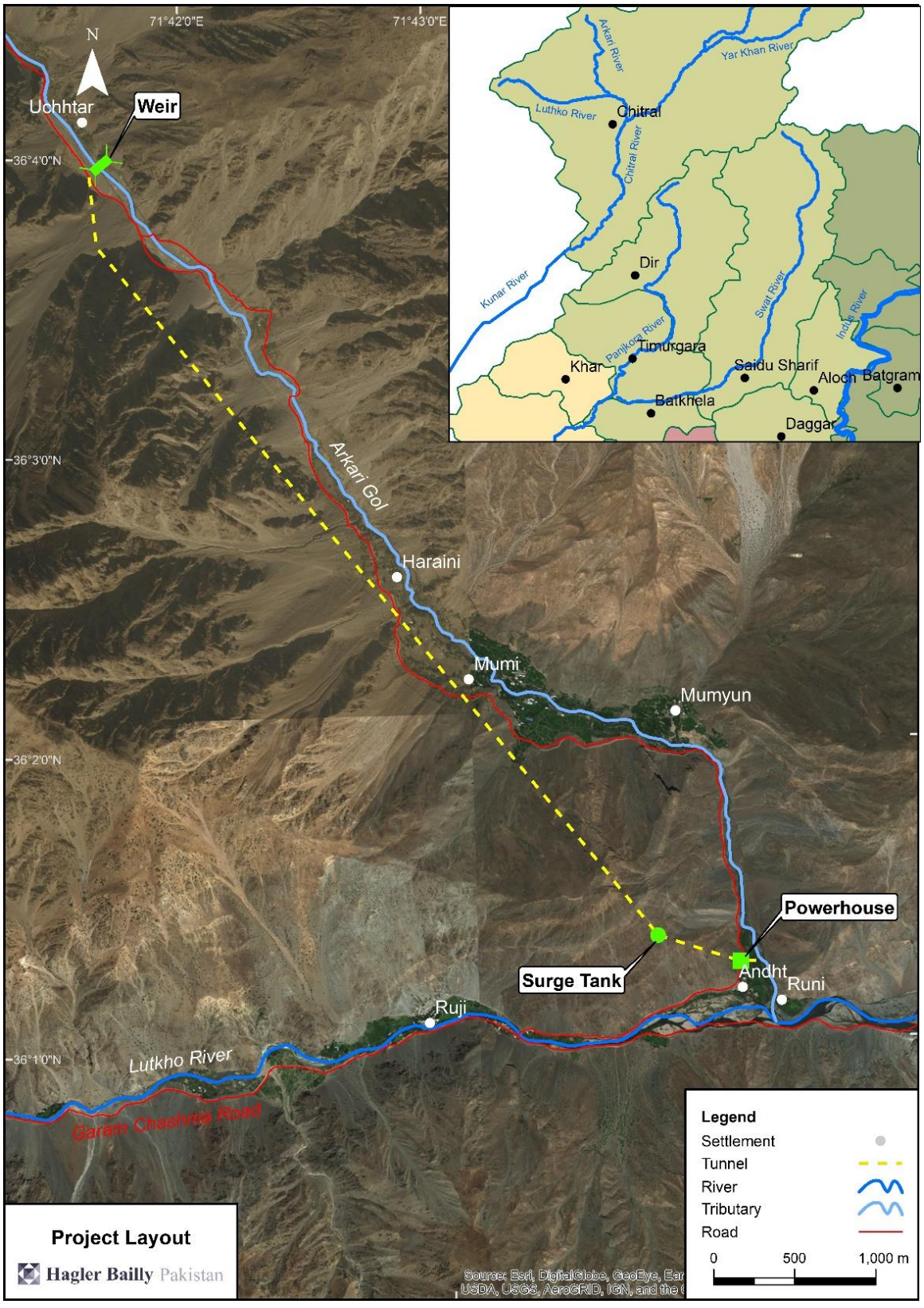


Exhibit 2: Project Layout



Approach to ESIA

The ESIA will be undertaken in compliance with relevant national legislation and keeping in view the World Bank guidelines. The major components of the study include:

- baseline studies to characterize the existing physical, socioeconomic and ecological environment in the project area;
- a public consultation process to ensure that project stakeholders are informed of the project development plan and have an opportunity to influence it;
- an analysis of the physical, ecological and socioeconomic impacts of the project, both negative and positive and their evaluation against significance criteria (applicable national and international standards, guidelines, performance standards, and good industry practices); and,
- Suggested mitigation measures to address the identified adverse impacts.

Separate to the ESIA settlement level consultations and surveys, household level consultations and surveys, of land owners and households, will be carried out in the areas identified for land acquisition to develop the RAP for the Project.

A brief overview of the conceptual components of an ESIA process is given in **Exhibit 9.**

Exhibit 9: Conceptual Framework of ESIA Figure.

Component	*Main purpose*	*Activities related to Stakeholder Consultations*
Scoping	▶ Identify the issues on which the ESIA should focus. ▶ Identify project alternatives that should be evaluated during the course of the ESIA.	▶ Identify institutional and community stakeholders ▶ Engage stakeholders and record issues raised ▶ Provide feedback to the ESIA team to incorporate stakeholders' concern in baseline investigations and impact assessment
Baseline investigations	▶ Collect background information on the environmental and social setting of the project.	▶ Incorporate additional issues raised during the baseline survey
Impact assessment, studies	▶ Define the potential impacts of the project ▶ Undertake specialist investigations to predict changes to environment due to the project ▶ Determine the significance of the potential impacts ▶ Identify measures for the management of the impacts ▶ Determine the residual impacts of the project after incorporation of the management measures.	▶ Assess issues raised by stakeholders

Component	*Main purpose*	*Activities related to Stakeholder Consultations*
	▶ Evaluate the overall acceptability of the project (from environmental and social perspectives).	
Mitigation Measures and management plan	▶ Environmental mitigation and monitoring plan will describe the measures proposed to ensure implementation of the mitigation measures identified during the impact assessment. It will include, for example, specific designs and plans, training requirements, resource requirements, monitoring details (sampling locations, methodology, and frequency), review and reporting requirements and budget.	▶ Assess the acceptability and practicability of the proposed mitigation measures
ESIA Report Preparation	▶ After the studies, the ESIA team will pull together the detailed assessment of impacts and mitigation measures. This may involve liaison with various specialists to ensure correct interpretation of information and compile ESIA report.	▶ Provide stakeholders with a feedback on the ESIA specifically communicate how the project proponent proposes to address the issues raised by the stakeholders.
ESIA submittal to regulatory authorities and decision making	▶ Submittal and review of the ESIA report by regulatory authorities and other interested stakeholders. The reviewers will inform about their decision on the acceptability of the Project from environmental and social perspectives and the conditions of approval for the development.	▶ Attend the public hearings and respond to the issues raised during the public hearings.

Preliminary list of potential environmental and social impacts of the Project that will be investigated during the ESIA are as follows:

- Provision of employment to people
- Creation of service-sector jobs, procurement of consumables and the outsourcing to local service providers.
- Construction related impacts such as noise and dust
- Reduction in power outages and revival of the affected economies
- Increase in traffic due to Project related transportation
- Disturbance due to blasting, dust, noise, vibration, road congestion, and safety hazard from heavy traffic
- Damage to infrastructure due to blasting and noise nuisance due to blasting, drilling and batching plant
- Changes to existing social and cultural norms
- Pressure on existing infrastructure as a result of influx of job seekers
- Impact on sand mining and gravel extraction

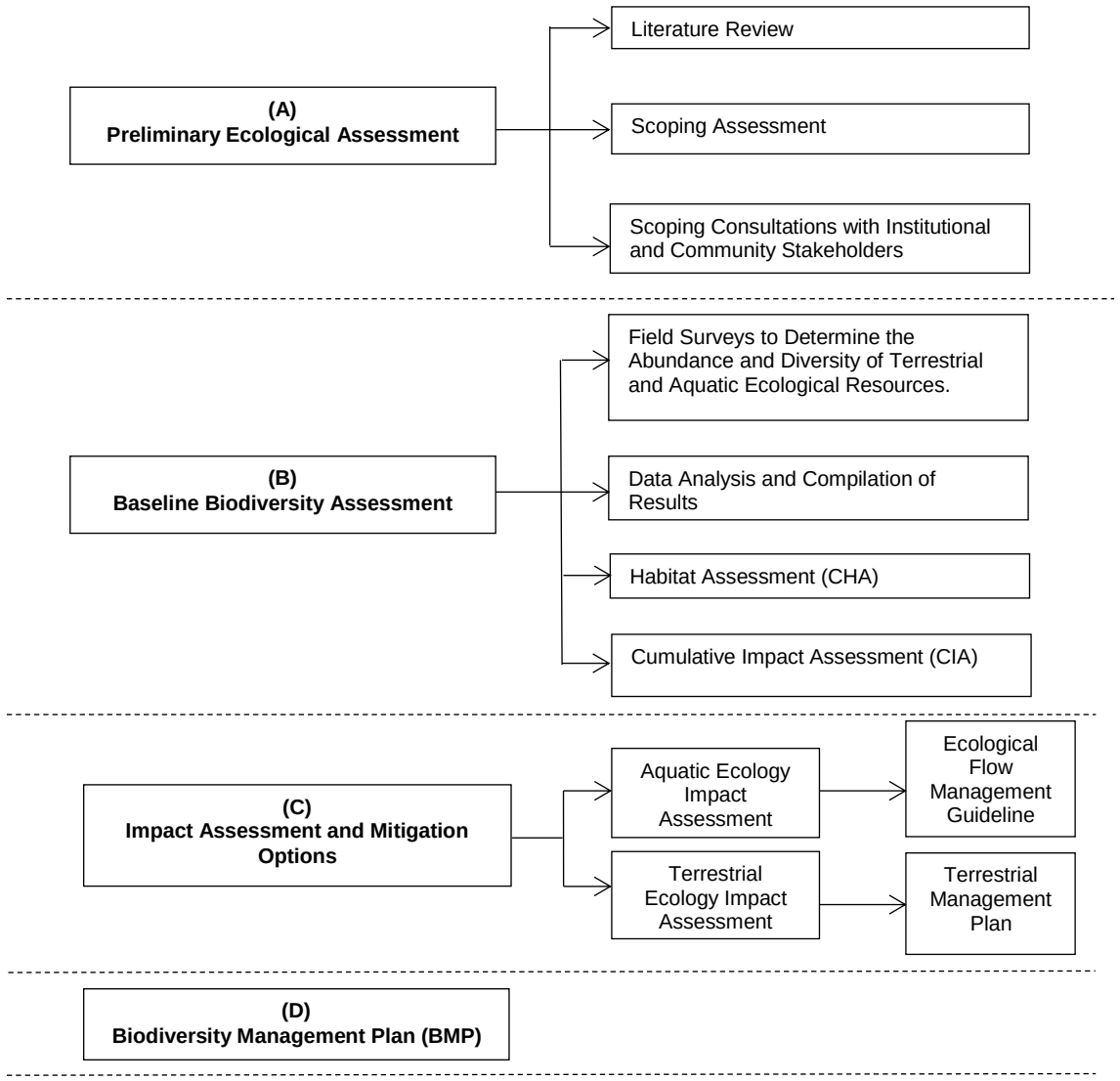
- Contamination of soil
- Transformation of landscape
- Physical displacement of some households resulting in disruption of existing socioeconomic setup

As impacts on the aquatic ecology due to the Project are of importance, HBP will draw on the results of a holistic environmental flow assessment conducted for a similar project downstream using Downstream Implications of Flow Transformation("**DRIFT**") Decision Support System ("**DSS"**) approach to assess the changes in flow regime of the river on fish and other river dependent wildlife. The list of potential biodiversity issues that will be investigated are as follows:

- Reduction in water quality and quantity
- Changes in sediment load of river
- Changes in the geomorphology of the river
- Fragmentation of fish habitat
- Damage to natural flora and fauna and river ecosystem
- Impact on endangered and migratory species

The detailed process to be followed for the study of ecological impacts of the Project is provided in **Exhibit 5**.

Exhibit 5: Biodiversity Assessment and Management Process



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آرکاری گول ہائیڈرو پاور پراجیکٹ
ماحول پر اثرات کا جائزہ، بنیادی معلومات

تعارف:

ماسٹر ہائیڈرو (پرائیویٹ) لمیٹڈ (کمپنی) دریائے آرکیاری پر 99 میگاواٹ کا آرکیاری گول ہائیڈرو پاور پراجیکٹ بنانا چاہتی ہے، جو کہ خیبر پختونخواہ، کے ضلع چترال میں دریائے آرکیاری اور لتکھو کی سنگم پر بنے گا۔ پراجیکٹ کا محلِ وقوع **شکل نمبر 1** میں دکھایا گیا ہے، اس پراجیکٹ میں پاور ہاوس، بند اور سرنگ شامل ہے، پروجیکٹ فی الحال ایک ممکنہ مطالعہ کا موضوع ہے، جس سے پروجیکٹ سے متاثر اور پیدا ہونے والی تکنیکی، ماحولیاتی اور سماجی اقتصادی عوامل کا اندازہ کیا جائے گا،

کمپنی نے منصوبہ کی ماحولیاتی اور سماجی اثرات کا جائزہ اور دوبارہ دوبارہ منتقلی کا پلان ملکی اور بین الاقوامی قوانین کے تحت کرنے کے لئے ہیگلر بیلی پاکستان کی خدمات حاصل کیں ہیں۔

ماحول پر اثرات کے جائزے کے عمل کا ایک بنیادی جزو منصوبے سے ممکنہ طور پر متاثر ہونے والے اور منصوبے میں دلچسپی رکھنے والے افراد (یعنی سٹیک ہولڈرز) سے مشاورت کرنا، ان کے خدشات کو قلمبند کرنا اور ان کو حل کرنا ہے۔ یہ دستاویز مشاورت کے لئے سٹیک ہولڈرز کو منصوبے سے متعلقہ بنیادی معلومات فراہم کرنے کے لئے تیار کی گئی ہے۔ موجودہ سٹڈی کے لئے اسٹیک ہولڈرز سے مشاورت کی جارہی ہے۔ اس لیئے اسٹیک ہولڈرز کے ساتھ مشاورت کے لئے، یہ بنیادی معلومات کی دستاویز (Basic Information Document) تیار کی گئی ہے۔

منصوبے کا محل وقوع

منصوبہ کا مقام خیبر پختونخواہ، کے ضلع چترال میں دریائے آرکیاری پر بنے گا ڈیم آرکیاری وادی پر اور پاور ہاؤس شاگور گاؤں سے مغرب کی طرف (تقریبا 2.45 کلو میٹر) دریائے آرکیاری اور لوٹخو کی سنگم پر بنے گا جس میں تقریبا 5.8 (کلو میٹر) طویل سرنگ بنے گی، پراجیکٹ کا محلِ وقوع **شکل نمبر 1** میں دکھایا گیا ہے، مجوزہ منصوبہ کے کوآرڈینیٹس

ڈیم (N"57'03 ° 36،E"37'41 ° 71)

پاور ہاؤس (N"10'01 ° 36،E"11'44 ° 71) ہیں۔ منصوبے کی اہم خصوصیات اور ترتیب **شکل نمبر 2** میں دکھایا گیا ہے

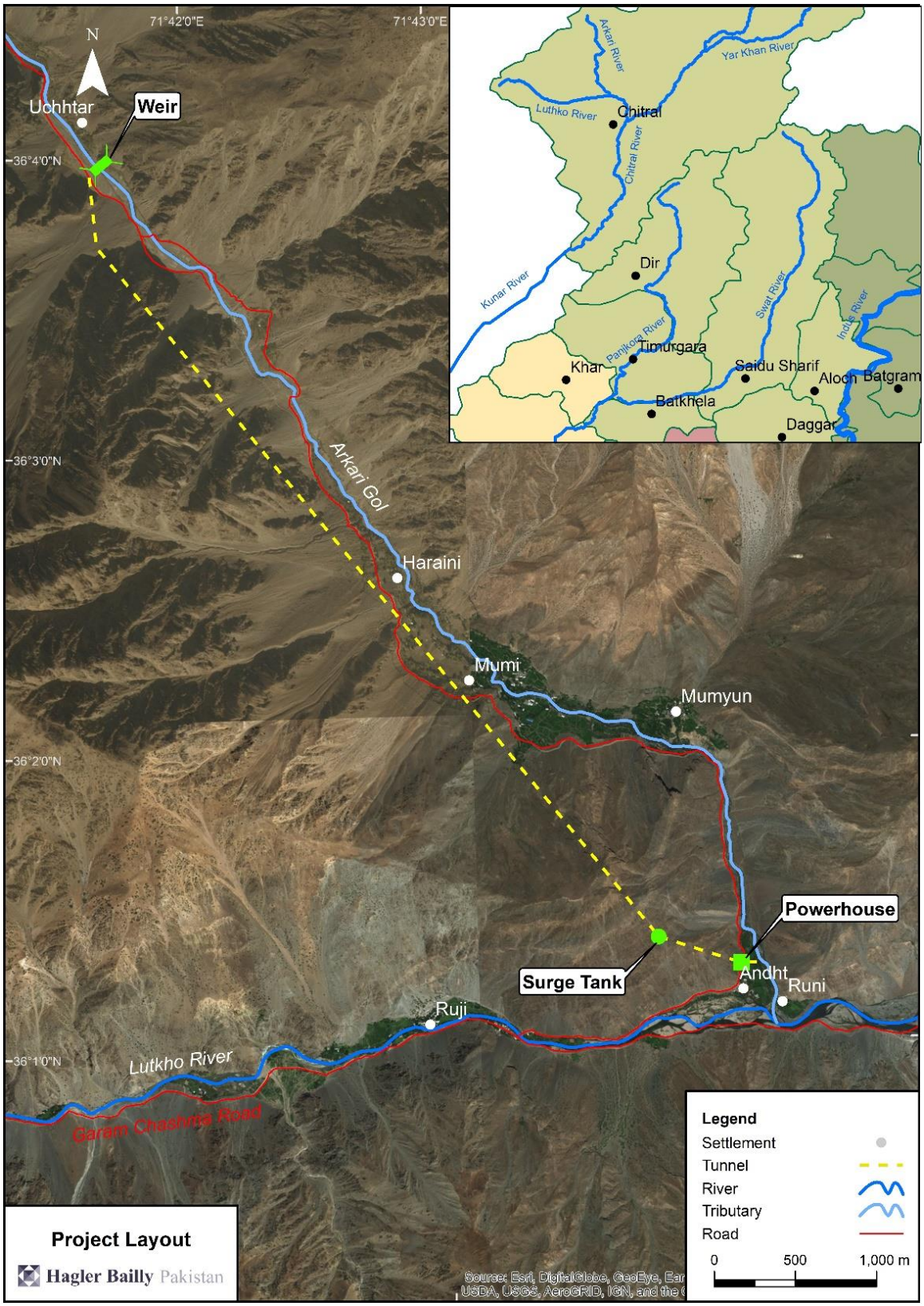
منصوبہ کا خاکہ

منصوبے کے اہم اجزاء مندرجہ ذیل ہیں:

- زمین کی حصول
- ہائیڈرو پاور پلانٹ کی تعمیر؛
- ہائیڈرو پاور پلانٹ کا آپریشن
- ایسوسی ایٹ سرگرمیاں

شکل نمبر1: منصوبے کا محل وقوع

شکل نمبر2: منصوبے کا خاکہ



ماحولیاتی تجزیئے کا طریقہ کار

یہ منصوبہ متعلقہ ملکی ماحولیاتی قوانین اور ورلڈ بینک کے معیار کے مطابق تیار کیا جائے گا۔ اس منصوبے کے اہم جزو مندرجہ ذیل ہیں۔

- منصوبے کے ارد گرد موجودہ ماحول کا ایک جامع مطالعہ
- سماجی اقتصادی اور ماحولیاتی ماحول کا ایک جامع مطالعہ ؛
- مشاورت کا عمل تاکہ لوگوں اور اداروں کو منصوبے کے بارے میں آگاہ کیا جاسکے اور ان کو اپنے تاثرات بیان کرنے کا موقعہ دیا جاسکے
- منصوبے کے منفی اور مثبت ماحولیاتی، سماجی اقتصادیات کے اثرات کا تجزیہ
- شناخت شدہ مضر اثرات سے نمٹنے کے لئے تجویز کردہ اقدامات

ماحولیاتی تجزیہ کے علاوہ زمین کے مالکان اور گھرانوں کے مالکان کے ساتھ مشاورت کر کے سروے کیا جائے گا۔ گھروں اور زمین کے مالکان کے لئے زمین کی نشاندہی کی جائے گی منتقلی کا منصوبہ بنایا جائے گا۔

ESIA کے تصوراتی اجزا کا مختصر جائزہ **شکل نمبر 3** میں دیا گیا ہے۔

شکل نمبر 3 ESIA کے عمل کا طریقہ کار

جزو	بنیادی مقصد	اسٹیک ہولڈرز سے مشاورت کی سرگرمیاں
	◄ ان مسائل کا تعین کرنا جن پر EIA میں خصوصی توجہ مرکوز کرنے کی ضرورت ہے ◄ پراجیکٹ کے متبادلات کا تعین جن کا جائزہ EIA کے عمل کے دوران لیا جائے گا۔	◄ پراجیکٹ سے متاثر ہونے والے افراد اور اداروں (سٹیک ہولڈرز) کا تعین ◄ سٹیک ہولڈرز سے رابطہ کرنا اور ان کی طرف سے اٹھائے گئے مسائل کا اندراج کرنا ◄ ESIA ٹیم کو اس ردِ عمل سے آگاہ کرنا تاکہ بنیادی تحقیقی سرگرمیوں اور اثرات کے جائزے میں ان آراء کو شامل کیا جاسکے
سرگرمیاں	◄ پراجیکٹ کے ماحولیاتی اور معاشرتی محلِ وقوع سے متعلق پس منظری معلومات کی جمع آوری	◄ بنیادی سروے کے دوران سامنے آنے والے مسائل کو شامل کیا جائے
مطالعات	◄ پراجیکٹ کے ممکنہ اثرات کا تعین جو کہ سٹیک ہولڈرز نے مشاورت کے دوران اٹھائے ◄ ممکنہ اثرات کی اہمیت کا تعین اور اثرات سے حل کے لیے اقدامات کی شناخت ◄ انتظامیہ کے ساتھ یا انتظامیہ کے بغیر ممکنہ اثرات کی اہمیت کا تعین کرنا ◄ پراجیکٹ کے (ماحولیاتی اور معاشرتی لحاظ سے) مجموعی طور پر قابل قبول ہونے کا جائزہ لینا	◄ سٹیک ہولڈرز کی طرف سے سامنے لائے گئے مسائل کا جائزہ
اثرات کو کم کرنے کے اقدامات اور ان کی منصوبہ بندی	◄ اثرات کے جائزے کے دوران ان کو کم کرنے کے اقدامات کا تعین اور ان پر عمل درآمد کو یقینی بنانے کے لیے مجوزہ اقدامات کی تفصیل ماحولیاتی اثرات سے نمٹنے اور ان کی نگرانی کے منصوبے میں دی جائے گی اور پلانٹ کو ایشیائی ترقیاتی بینک کے 2009 SPS اور قومی قوانین وضوابط کے مطابق لانا۔ مثال کے طور پر اس میں مخصوص	◄ مخصوص طریقہ کار یا تخفیف کے اقدامات پر بحث جو اثرات کے جائزے کے دوران ظاہر ہوتے ہیں

جزو	بنیادی مقصد	اسٹیک ہولڈرز سے مشاورت کی سرگرمیاں
	ڈیزائنز اور منصوبے، تربیتی تقاضے، ذرائع کی فراہمی کے تقاضے، نگرانی کی تفصیلات (محلِ وقوع کی نمونہ بندی، طریقہ کار اور تعدّد وغیرہ)، جائزے اور رپورٹس کے تقاضے اور بجٹ	
تیاری	◄ جائزے کے عمل کی تکمیل کے بعد EIA ٹیم اثرات اور تخفیف کے اقدامات کی تفصیلی تشخیص کرے گی۔ اس میں معلومات کی درست تشریح کو یقینی بنانے کے لیے مختلف ماہرین کے ساتھ رابطہ اور EIA کی رپورٹ مرتب کرنا ہے	◄ سٹیک ہولڈرز کو EIA کی طرف سے جواباً بتایا جائے کہ منصوبے کے تجویز کار کس طرح ان کی طرف سے سامنے لائے گئے مسائل کا حل تلاش کریں گے۔
اداروں کو پیش کیا جانا اور فیصلہ سازی	◄ EIA رپورٹ کا انتظامی اداروں، اور دیگر دلچسپی رکھنے والے افراد یا اداروں کو پیش کیا جانا۔ جائزہ لینے والے افراد اور ادارے بتائیں گے کہ ماحولیاتی اور معاشرتی لحاظ سے پراجیکٹ کے قابلِ قبول ہونے سے متعلق ان کا فیصلہ کیا ہے اور منظوری کن شرائط پر دی جارہی ہے۔	◄ ادارہ ماحولیات تحفظ ایک عوامی اجتماع منعقد کرے گا جس میں دیکھا جائے گا کہ سٹیک ہولڈرز کے کوئی ایسے خدشات تو باقی نہیں رہ گئے جن کو فیصلہ لینے سے پہلے نہ پرکھا گیا ہو

ممکنہ سماجی، ماحولیاتی اور حیاتیاتی اثرات جن کی چھان بین ESIA کے دوران کی جائے گی، درج ذیل ہیں۔

- ◄ لوگوں کو ملازمت کی فراہمی
- ◄ سروس کے شعبے کی ملازمتوں، استعمال ہونے والی اشیا کی پروکیورمنٹ اور مقامی سروس فراہم کرنے والوں کیلئے نوکریوں کی تخلیق
- ◄ تعمیراتی کام کے اثرات مثلاً شور اور دھول
- ◄ لوڈشیڈنگ میں کمی اور ملک کی متاثرہ معیشت کی بحالی
- ◄ پراجیکٹ سے متعلقہ نقل و حمل کی وجہ سے ٹریفک میں اضافہ
- ◄ بلاسٹنگ سے پیدا ہونے والا خلل، شور، دھول، vibration، سڑکوں پر بھیڑ اور زیادہ ٹریفک کی وجہ سے حادثات کا خطرہ
- ◄ بلاسٹنگ سے عمارات کو نقصان اور دھماکے، ڈرلنگ اور batching plant کی وجہ سے شور
- ◄ موجودہ ثقافتی اور سماجی طور طریقوں میں ردوبدل
- ◄ موجودہ سہولیات پر کام کرنے کے لئے علاقے میں آنے والوں کا بوجھ
- ◄ دریا سے ریت اور پتھر حاصل کرنے میں ممکنہ مشکلات
- ◄ گرد سے آلودگی
- ◄ قدرتی نظارے میں تبدیلی
- ◄ گھروں کی منتقلی سے معاشی اور سماجی نظام پر اثرات

جیسا کہ آبی حیات پر منصوبے کے اثرات کی اہمیت ہے، ہیگلر بیلی پاکستان اسی طرح کے منصوبے کے لئے مجموعی ماحولیاتی بہاؤ کے جائزے کے نتائج استعمال کرے گا جو کہ اس منصوبے سے نیچے ہے۔ یہ جائزہ **DRIFT** اور **DSS** کا طریقہ استعمال کرتے ہوئے پانی کے بہاؤ میں تبدیلی کے مچھلیوں اور دوسرے دریا پر انحصار کرنے والے دوسرے جانوروں پر اثرات کا تجزیہ کرتا ہے۔ ممکنہ حیاتیاتی اثرات جن کی جانچ پڑتال کی جانی ہے، درج ذیل ہیں۔

- ڈیم کے بعد دریا میں پانی کے معیار اور مقدار میں کمی
- پانی میں موجود ریت میں کمی
- دریا کی شکل اور راستے میں ممکنہ تبدیلی
- دریا میں مچھلیوں پر منفی اثرات
- پانی کے قدرتی ماحول اور آبی حیات کو نقصان
- خطرے سے دوچار (Endangered) حیات اور دور سے آنے والے آبی پرندوں پر اثرات

مزید معلومات کے لئے رابطہ :

عزیز کریم، ہیگلر بیلی پاکستان	شکیل احمد ہیگلر بیلی پاکستان
بلاک 1، کمرشل ایریا، گلی نمبر 21، F-8/2 ، اسلام آباد،	بلاک 1، کمرشل ایریا، گلی نمبر 21، F-8/2 ، اسلام آباد،
فون: 07-7200 285 (51) 92+	فون: 07-7200 285 (51) 92+
فیکس: 09-7208 285 (51) 92+	فیکس: 09-7208 285 (51) 92+
موبائل: 9000 502 (345) 92+	موبائل: 9813640 (343) 92+
ای میل: AKarim@haglerbailly.com.pk	ای میل: SAhmad@haglerbailly.com.pk

Annexure C: Consultation Log Template

Record of the Consultation

Stakeholder/s or Settlement		
Consultation	ESIA Consultation or Feedback Consultation	
Date:		
Time:		
Meeting Venue:		
Attended by and contact details:	Name	Contact Number
Conducted by:		
Recorded by:		
Reviewed by:		
Language:		
Preamble:		
Picture/s:		

No.	*Issues, Concerns, and Suggestions*	*By*	*Response Provided*

Additional comments:

No.	*Issues, Concerns, and Suggestions*	*By*	*Response Provided*

Annexure D: Greivance Redress Log

Complaint No.: _____Settlement: _____Village: _____

Name of Complainant: _____

Father/ Husband Name _____

NIC Number: _____

Contact Address: _____

_____

Contact Number: _____

Nature of Grievance or Complaint:

Environmental: **Social:** **Gender:**

Details:

_____

_____

_____

_____

_____

_____

Complainant		Recipient	
Signature:	_____	Signature:	_____
Name:	_____	Name:	_____
Dated:	_____	Dated:	_____

Appendix M: Environmnetal Flow Assessment

M.1 Introduction

The Chitral River, which is the principal river of the Chitral Valley, is formed by the union of two sub rivers, the Lutkho River from the north-west and the Mastuj River from the north-east. A total of six fish species are reported from Chitral River and its tributaries, including Snow Trout *Schizothorax richadsonii*, Kunar Snow Trout *Schizothorax labiatus*, Chirruh Snow Trout *Schizopyge esocinus*, Chitral Loach *Triplophysa choprai*, Himalayan Catfish *Glyptosternum reticulatum* and Khyber Loach *Schistura prashari*.

The Arkari Gol, where the Project is located, mainly originates from the Arkari Glacier at an altitude of 5,065 m. Many smaller tributaries connect with the Arkari Gol including Parpuni Gol, Shul Gol, Mazhigram Gol, and Easi Gol. A total of four fish species have been reported from the Arkari Gol i.e. Snow Trout, Himalayan Catfish, Chitral Loach and Khyber Loach.

During the March 2018 survey a total of three fish species were collected including the Snow Trout, Chitral Loach and Himalayan Catfish. The most abundant and widely distributed species was Chitral Loach followed by Snow Trout and Himalayan Catfish. The abundance and diversity of fish was highest in the Lutkho River compared to the Chitral River and Arkari Gol.

In the context of EFlow assessment, the ecological sensitivity of the Ecological Study Area can be classified in the following manner (see **Exhibit M.1**):

- Arkari Gol, Upstream of its Confluence with Lutkho River: **Exhibit M.2** shows photographs of the river in this segment. As illustrated in **Exhibit 4.88** in **Section 4** of the ESIA report the riverbed in this segment has a relatively higher slope resulting in higher water velocities and frequent rapids and falls. The valley is V shaped with relatively steep and narrow. The migratory Snow Trout was not recorded in this segment. No fish were recorded above the water fall (Segment 1 in **Exhibit M.1**) which presents a barrier to upstream movement of the Snow Trout. Relative abundance of fish in river below the waterfall (Segment 2 in **Exhibit M.1**) is apparently low (see **Section 4.1.4** of the ESIA), and the habitat is least conducive to supporting fish populations relative to that in other segments in the Ecological Study Area.
- Lutkho River: **Exhibit M.2** shows photographs of habitats in this segment (Segment 3 in **Exhibit M.1**). With a slope of the riverbed that is lower in comparison to that in Arkari Gol (**Exhibit 4.88** in **Section 4** of the ESIA), the habitat in this segment is comparatively stable with sequences of pools and rapids. The valley is U shaped with gentle slopes. Diversity and abundance of fish is relatively higher with existence of the three species namely the Snow Trout, the Himalayan Catfish, and the Chitral Loach, and breeding of Snow Trout (**Exhibit 4.10** in **Section 4** of the ESIA). A flow downstream of confluence with

Arkari Gol also increases, increasing the extent of habitats. Sediment loads are low (about 4% of sediment in Chitral River, see **Section 4.2.7** of the ESIA), and abundance of macroinvertebrates is relatively high due to well armored cobble beds.

- Mastuj/Chitral River: Flow as well as sediment loads in this segment (Segment 4 in **Exhibit M.1**) are substantially higher. Suitable fish habitats exist in side channels where flow is moderate. Diversity is expected to be higher as there are number tributaries that feed into this river. Habitat conditions are not likely to be suitable for breeding as compared to those in Lutkho River, and food availability for fish, mainly macroinvertebrates, is also likely to be lower as the river bed would consist of sand and boulders as compared to predominantly cobbles in the Lutkho River and Arkari Gol. During summer months the river carries a very large amount of silt in suspension giving the water a distinctly reddish color on account of the color of the soil over which it flows. Photographs of the Mastuj River is provided in **Exhibit M.2.**

Exhibit M.1: Sensitivity base Classification of the Aquatic Study Area

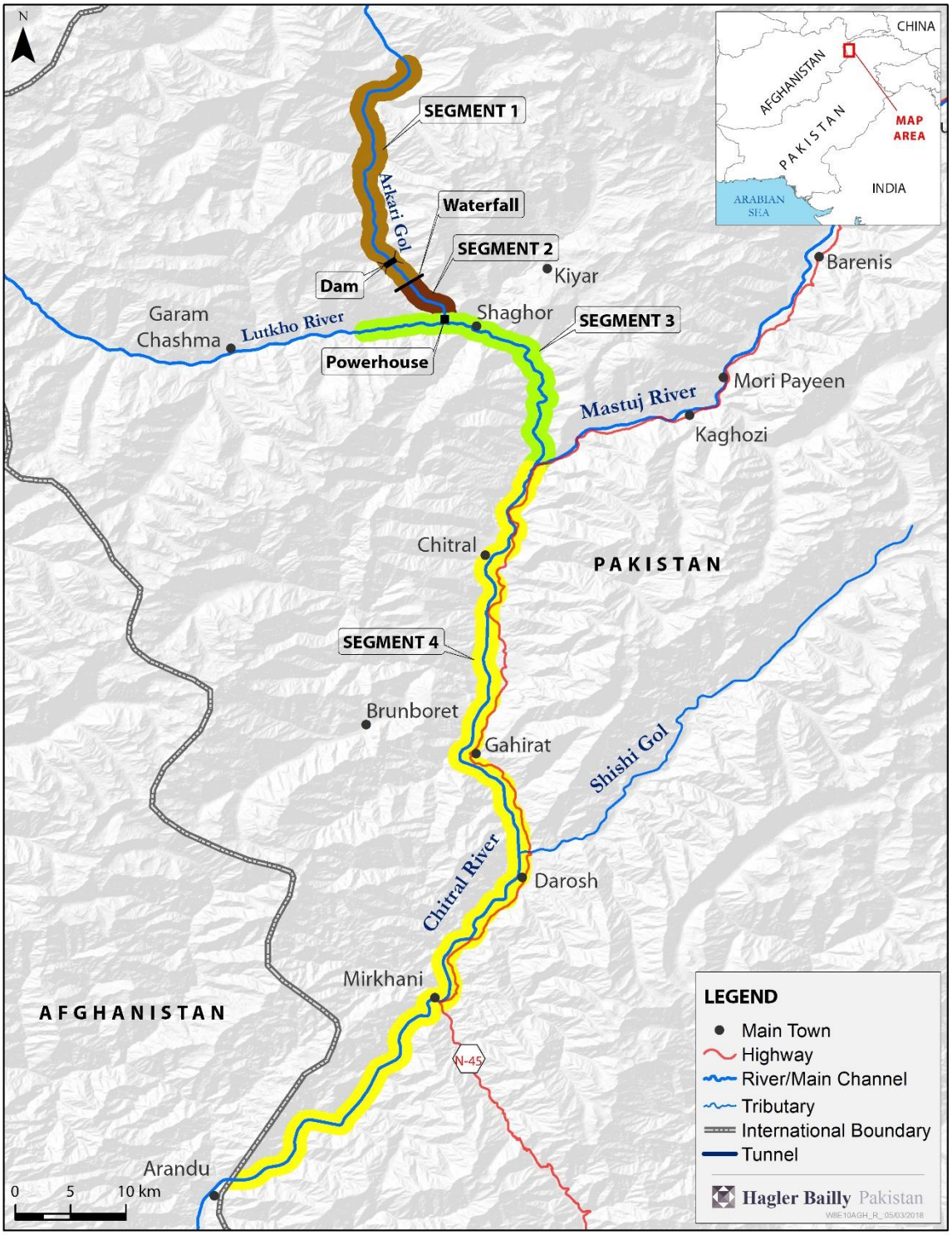
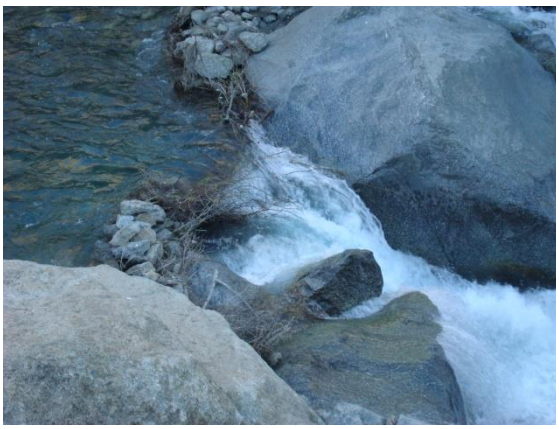


Exhibit M.2: Photographs of River Habitats (March 2018 Survey)

a) Lutkho River

b) Lutkho River

c) Arkari Gol



d) Arkari Gol

e) Chitral River

f) Chitral River

M.2 Methodology

M.2.1 Selection of EFlow Assessment Method

The guidelines presented in the World Bank Group's Good Practice Handbook for Environmental Flow Assessment for Hydropower Projects[1] were followed for selection

[1] Environmental Flow for Hydropower Projects, The World Bank Group, February 2018. **Figure 7.1**, Decision Tree for Selection of EFlows Method.

of EFlow assessment method. The following are the steps and outcomes of determination:

Assuming 'Other design and operation' (as opposed to 'Low impact design or operation', in view of presence of the Vulnerable and migratory Snow Trout), assessment of downstream impact of peaking is required.

Transboundary issues are not expected to be significant as the Project is located upstream in a tributary of Chitral River, which is one of the three or four significant tributaries before the river crosses into Afghanistan about 102 km downstream of the point where the Lutkho River into which Arkari Gol flows joins Chitral River.

There is no trans-basin diversion, and ecosystems other than river such as estuaries and wetlands are not affected.

There is no significant dependence on the river ecosystem, and the Project is not located in Critical Habitat as per IFC PS6. It is, however, located in Natural Habitat (not Modified Habitat) therefore a 'Medium Resolution' EFlow assessment would suffice, inclusive of connectivity assessment and sediment assessment.

Connectivity assessment is not considered as important as the Project inclusive of the low flow section is not a significant habitat for the migratory Snow Trout. The Snow Trout is not found upstream of a waterfall located about three kilometers downstream of the dam, which presents a migratory barrier to the fish. The dam therefore does not present a barrier to fish migration. Snow Trout was also not observed upstream of the confluence of Arkari Gol with Lutkho River in sampling conducted in April 2018.

The sediment levels in the Arkari Gol as well as Lutkho River are low (about 4% of sediment in Chitral River, see **Section 4.2.7**) due to location at altitude where snow melt contributes significantly to the flow of water, as opposed to rainfall. The impacts of sediments were therefore not accounted for in the EFlow assessment.

The requirement for 'Medium Resolution' notwithstanding, holistic high resolution models developed for similar rivers in the region with comparable biodiversity including presence of the migratory Snow Trout were adapted for use in the EFlow assessment for the Project. Results of EFlow assessments conducted for hydropower projects located in the Jhelum Basin and for Trishuli River in Nepal using the Downstream Response to Instream Flow Transformations (DRIFT) model were used to develop the predictions for impact on fish populations and macroinvertebrates, which are part of the food chain of the fish found in Arkari Gol, the Snow Trout, the Himalayan Catfish, and the Chitral Loach.

The DRIFT model has been widely applied in South Africa, Southeast Asia, and has been used in Pakistan for EFlow assessment of the 330 MW Kishenganga Hydroelectric Project (KHEP) and 969 MW Neelum-Jhelum Hydropower Project (NJHP) on the Neelum River, the 100 MW Gulpur HPP (GHPP) on Poonch River, and the 720 MW Karot Hydropower Project (KAHPP), the 1,100 MW Kohala Hydropower Project (KHPP) on the Jhelum River, and 300 MW Balakot Hydropower Project (BHPP) on the Kunhar River, and Upper Trishuli-1 Hydroelectric Project (UT-1HP) on the Trishuli River in Nepal. Of these, the results from the following assessments were used as a reference for this study:

1. EFlow assessment of the 300 MW Balakot Hydropower Project: The Kunhar River where this study was conducted has comparable hydrology and temperatures. However, there were some key difference between the baseline conditions (regarding nutrient and sediment) and dam operational scenarios. Modifications were made to this model before its use to calculate the impact of the Project on river ecology in the low flow section of the Arkari Gol.
2. EFlow assessment of the Upper Trishuli-1 Hydroelectric Project in Nepal: This project is designed for a peaking operation. The results of assessment for this project were used to estimate the impacts of peaking operations on the population of indicator fish species.[2]

The following were the key steps in assessment of impacts:

1. An Area of Impact (AoI) was first defined where the impacts of the Project on aquatic ecology are likely to occur.
2. Operational scenarios were defined as follows:
    i. Environmental Flow as described in the Feasibility Study,
    ii. Peaking, modified peaking with ramp up and ramp down, as well as a baseload or true Run of the River operation,
3. Fish populations with Project were predicted assuming design of the Project with the predicted river condition after 31 years.[3]

Details of assessment are provided in the following sections.

M.2.2 Area of Impact

The Area of Impact (AoI) includes reaches of the river where the aquatic ecological resources are likely to be impacted by the Project. It extends from the dam site on the Arkari Gol, past the confluence with the Lutkho River to the confluence with the Chitral River. The river section upstream of the Arkari Dam site was not considered as the waters are too cold for the fish found downstream of the dam, and Snow Trout is blocked by a natural barrier downstream of the dam. The Aquatic Study Area (see **Section 4.1.2**, *Ecology Baseline*) presents a detailed description of the ecological resources in these reaches.

M.2.3 EFlow Sites

An EFlow assessment site ('EF Site') represents a river reach that is sufficiently uniform such that it can reasonably be represented by a single site. The sites are selected to characterize the present flow regimes, and that would best describe future changes due to construction and operation of the Project. Each EFlow site represents the entire reach. Hydrology is determined based on the specific location of the site. **Exhibit M.3** provides the coordinates of the selected EF sites. **Exhibit M.6** shows the map of the location of the EF Sites used in the assessment. EFlow Site 2 is representative of the low flow being created by the Project, while EFlow Site 3 represents the Lutkho River after its

[2] Peaking effects were not studied in the EFlow assessment for KHEP and BHPP.

[3] This is the period of the historical hydrological record that was used in the assessment, and provides a reasonable picture of terminal impacts of the project on river ecology including fish populations.

confluence with the Arkari Gol which will be impacted due to the Project if it operates in peaking mode. The 400 meter section between the tailrace of the Arkari Gol HPP to the confluence with the River was not considered due to its short length.

Exhibit M.3: Selected EFlow Sites for the EFlow Assessment of Arkari Gol HPP

Site ID	*Site Name*	*Coordinates*	
		Latitude	*Longitude*
EF Site 2	Downstream Dam – Low flow section	36°02'19.44"N	71°43'07.53"E
EF Site 3	Downstream Tailrace	36°00'41.05"N	71°45'49.52"E

M.2.4 Baseline Hydrology

Hydrological data for a ten year period, from 2006 to 2015, was available from the gauging station on the Arkari Gol. Based on a catchment ratio flows at EF Site 2, EF Site 3 and contributions from the Lutkho River were calculated. The catchment ratios are presented in **Exhibit M.4** and a map of the catchment areas is included in **Exhibit M.5**. Baseline hydrology is presented in **Section 4.2.7**.

Exhibit M.4: Catchment Areas Compared Catchment at Arkari Gol Guaging Station

	Dam Site	*Powerhouse Site*	*Arkari Gol Gauging Station*	*Lutkho River*
Catchment Area (km^2)	989	1019	1050	1077
Catchment Ratio	0.94	0.97	1.00	1.03

Exhibit M.5: Regional Catchments

M.2.5 Indicator Species

Three fish species are found in the AoI (see **Section 4.1.4**, *Ecology Baseline* for details). Of these, the Snow Trout and the Chitral Loach were selected as indicator fish species. The Snow Trout is the long distance migratory fish which is a column dwelling species, and is an omnivore. The Chitral Loach is a non-migratory carnivore fish that has habitat in river bed where it feeds on macroinvertebrates and protects itself from higher flows as well as predation by taking refuge in boulders and cobbles. These two fish therefore present a range of response to changes in flow.

The Snow Trout, although a migratory fish, is not present beyond the dam wall and therefore it will not be impacted due to the barrier effect. Moreover, it was not found in any portion of the Arkari Gol in the sampling survey (see **Section 4.1.4**). Nevertheless, because of its migratory behavior and vulnerable classification in the IUCN Red List, it is still included as an indicator species due to this river being potential habitat for the fish based on the observed physical characteristics. Reponses Curves (see explanation in **Annexure A** below**)** of the Snow Trout were available from the previous studies conducted in the adjacent Jhelum Basin.

The Chitral Loach is the non-migratory species of fish found in the AoI. However, the Chitral Loach has not been simulated in previous DRIFT EFlow models developed for the region. Instead, information and Response Curves of a very similar fish, the Kashmir Hillstream Loach (*Triplophysa kashmirensis)* of the same family and with similar behavior were used as a proxy.

Exhibit M.7 shows the list of indicators fish species and **Exhibit M.8** presents their photographs.

Exhibit M.6: EFlow Sites

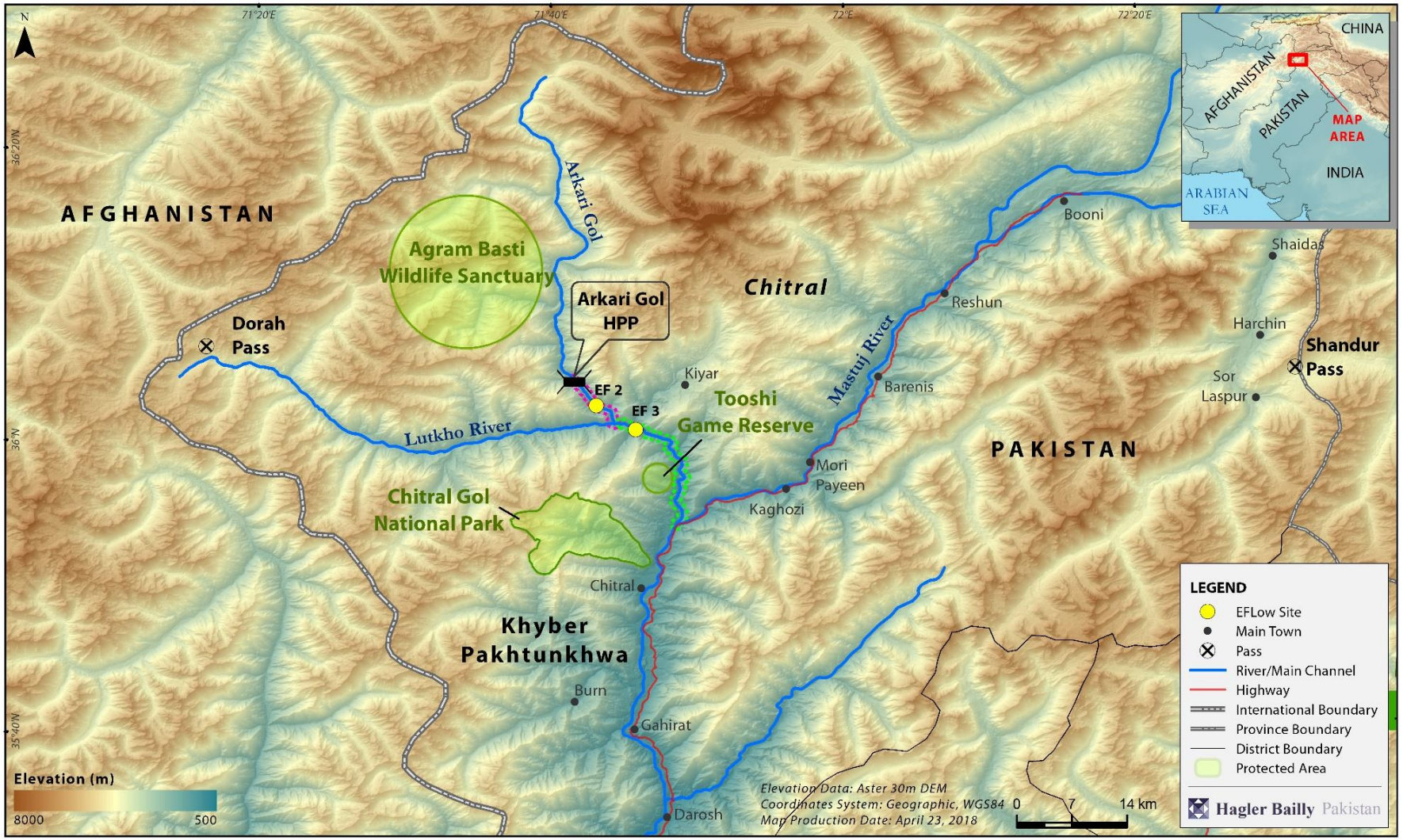


Exhibit M.7: Selected Indicator Fish Species

No	*Scientific Name*	*Common Name*	*IUCN Status*	*Commercial Importance*	*Migratory*	*Restricted Range/ Endemism*
1.	*Schizothorax richardsonii*	Snow Trout	Vulnerable	High	✓	–
2.	*Triplophysa choprai*	Chitral Loach	Not Assessed	Low	–	–

Exhibit M.8: Photographs of Indicator Fish Species

a) Snow Trout *Schizothorax richardsonii*

b) Chitral Loach *Triplophysa choprai*

M.2.6 Operational Scenarios

M.2.6.1 Low Flow Section

The EFlow release scenario as presented in the Feasibility Report was modelled in the low flow section. However, for use in the Balakot HPP EFlow model this Eflow was scaled proportionately to compare with baseline flows and hydraulic parameters. The mean annual flow of the Kunhar River (at the low flow section) is 93 m^3/s, which is 6.2 times greater than the mean annual flow at the Arkari Gol low flow section. Therefore, the EFlows were scaled by a factor of 6.2 for used in the Balakot HPP EFlow model.

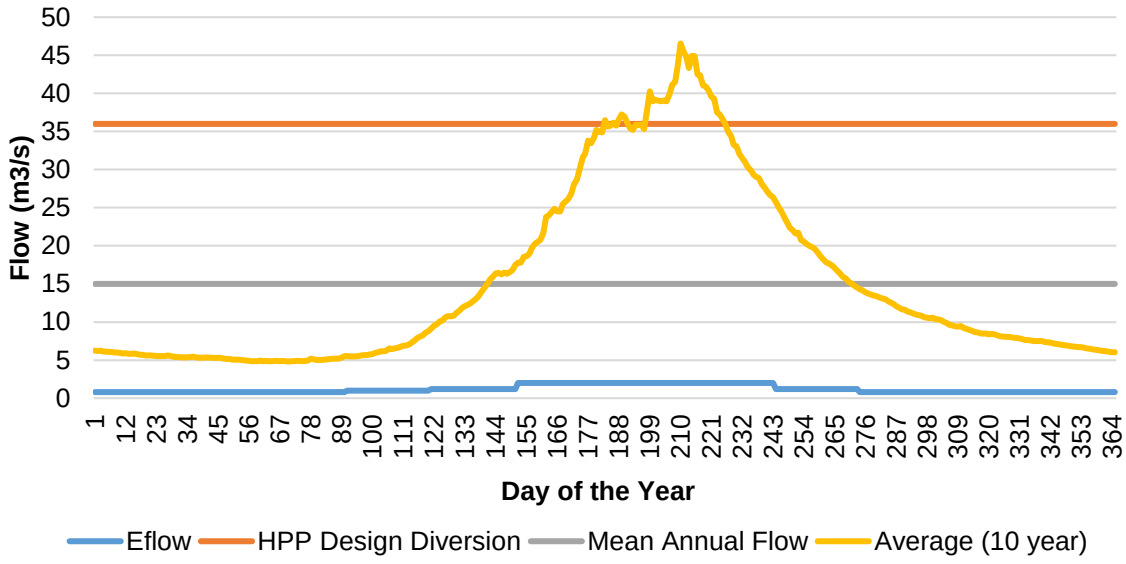
Furthermore, the Arkari Gol has a high design diversion capacity which will result in minimal spills from the dam in the wet season. Specifically, the design diversion of the Arkari Gol HPP is about 80% of the maximum average monthly flow, whereas the design diversion of the Balakot HPP is only 55% of the maximum average monthly flow. Therefore, the modelled design diversion in the Balakot HPP model was increased from 154 m^3/s to 225 m^3/s to represent a dam designed at 80% capacity.

The resultant scaled EFlows and design diversion are shown in **Exhibit M.9** and **Exhibit M.10**.

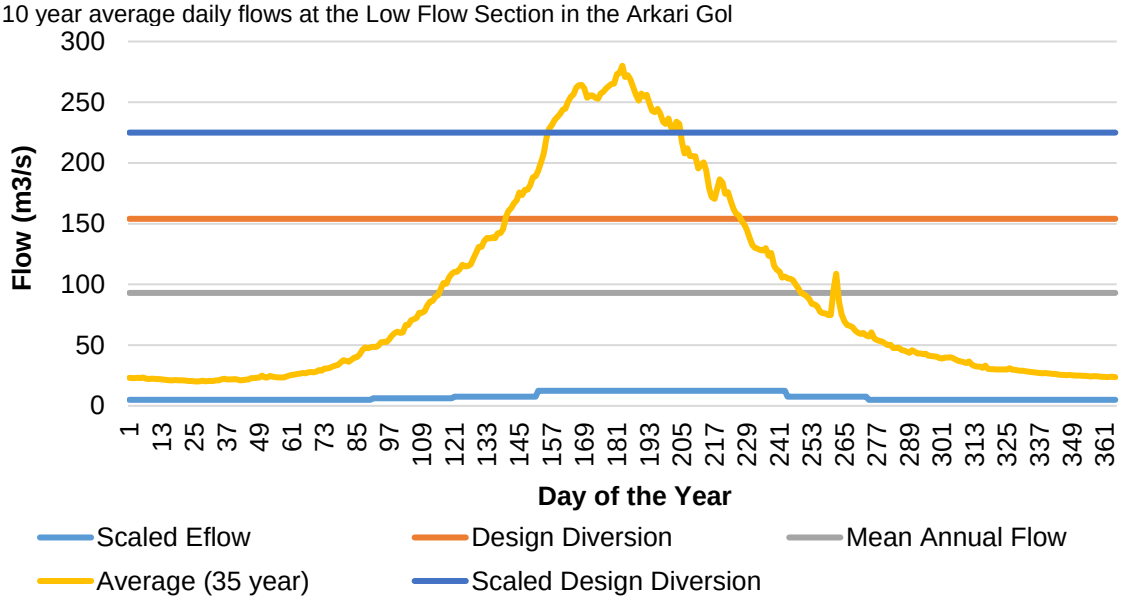
Exhibit M.9: Predicted Changes from Baseline Populations in the Low Flow Section

	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Feasibility Scenario	0.8	0.8	0.8	1	1.2	2	2	2	1.2	0.8	0.8	0.8
As used in this study	4.96	4.96	4.96	6.20	7.44	12.4	12.4	12.4	7.44	4.96	4.96	4.96

Exhibit M.10: Flow Regime and Dam Operation at Arkari and Balakot Hydropower Projects



10 year average daily flows at the Low Flow Section in the Arkari Gol



35 year average daily flows at the Low Flow Section in the Kunhar River, and the proposed level of diversion and EFlows to model the impacts of the Arkari HPP.

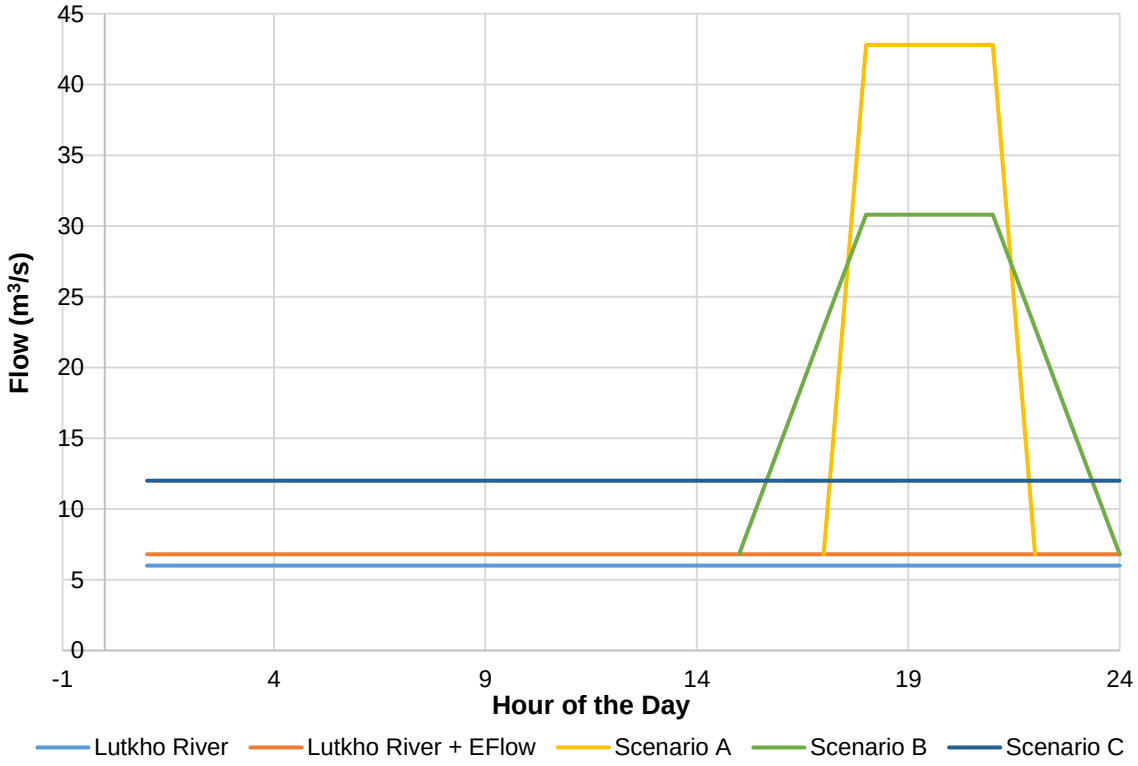
M.2.6.2 Peaking Section

Three peaking scenarios were considered for this study as described below:

- Scenario A: Four hours of peaking at 36 m^3/s corresponding to design capacity of powerhouse,
- Scenario B: Four hours of peaking at moderated peak of 24 m^3/s with two hours of ramp up and ramp down to peak discharge, and
- Scenario C: Baseload or true Run of River operation.

These scenarios are illustrated in **Exhibit M.11**.

Exhibit M.11: Peaking Operational Scenarios



Note: This exhibit is for illustrative purposes only and does not represent any specific day of the hydrological record. Figures are based on an average of January flows from the 10 year hydrological record.

M.2.6.3 Sediment and Nutrient Loading

As sediment is configured in the DRIFT model, a drop in river flow results in a corresponding drop in the suspended sediment load. However, this holds true when the river water is at or near its sediment carrying capacity. The Arkari Gol has low baseline levels of sediment as compared to the other rivers in the region. On an annual basis, the Chitral River at the Chitral gauging station carries 25 times the suspended sediment load

(kg/m^3), whereas the Jhelum River at the proposed Kohala HPP dam site carries approximately 3000 times the suspended sediment load of the Arkari Gol.

The nutrient loads in the Arkari catchment are similarly low, given the low population density in the catchment. The DRIFT EFlow models developed for projects in the Jhelum Basin were located in areas where there was large sewage discharge from households and commercial establishments into the river. A drop in river flow in the low flow section receiving urban and household sewage resulted in a corresponding increase in nutrient loads, as dilution capacity of the river water was decreased. However, field surveys showed that sewage discharge in the Arkari Gol is minimal to nonexistent and the river water is clear, clean and used for drinking. Therefore, the Response Curves in DRIFT model for sediment and nutrients were turned off during the modelling process.

M.3 Biophysical Results

Impacts on selected indicators are summarized in this section.

M.3.1 Impacts in the Low Flow Section

Main impacts in the Low Flow Section are to macroinvertebrates, the Snow Trout, and the Chitral Loach. These are presented in **Exhibit M.12**.

Exhibit M.12: Low Flow Section: Predicted Populations in 31 Years as Percentage of 2018 Baseline Population

Indicator	*Feasibility EFlow Scenario*
EPT Abundance	56%
Snow Trout	58%
Chitral Loach	20%

M.3.1.1 EPT Abundance

Ephemeroptera Plecoptera and Tricoptera (EPT) are a commonly used grouping of invertebrates. EPT abundance is predicted to drop to 56% of baseline population. The main impacts are due to the reduction in dry/winter season flow (which reduces the wetted area and hence habitat) and an increased duration of the dry season (aquatic invertebrates have life-histories that are adapted to wide variations in seasonal flows, however populations are likely to drop if the low-flow period is too long over consecutive years). The reduction in the wet season duration and the delay in the onset of wet season will not provide sufficient time for eggs to mature and hatch. Macroinvertebrates benefit from clearer waters from reduced sediment, however this factor was not considered in this assessment, and therefore this reduction in population presents a conservative estimate.

M.3.1.2 Snow Trout

The Snow Trout is a long distance migratory fish therefore cues and suitable habitat during migration and breeding are key factors for its survival. The Snow Trout breeds

during summer season from May to August (see **Section 4.1.4**). By this time of the year, the fish eggs reach final stage of maturity provided the aquatic system provides sufficient food for proper development of eggs. Once the eggs reach their final stage of maturity, the fish is ready to spawn under various triggers like the snowmelt, rise in water temperature, higher turbidity level, swelling of rivers, creation of side channels etc. mainly linked with snow melt in the upper reaches (Rafique and Qureshi 1997). The delay in the onset of the wet season, (and a lack of wet season in years where there are little to no spills) will effect migration and breeding.

Furthermore, a reduction in the maximum flood season flows, inflow to pools will be less and water levels lower. Flood peaks also scour pools and with a reduction in flood peak, the pools will become shallower. Therefore, smaller flood peaks will lead to a degradation in overall yearlong habitat for the fish over time.

Snow Trout are omnivorous and feed on benthic plants and aquatic invertebrates (mainly EPT; Raina and Petr 1999). They are opportunist feeders and their dependence on invertebrates varies depending on the season and stage of maturity. Therefore, reduced EPT productivity does not impact the fish significantly.

M.3.1.3 Chitral Loach

An 80% decline over present day populations for the Chitral Loach is predicted. This fish is more sensitive than the Snow Trout in terms of food sources, summer and winter habitat and breeding cues.

Chitral Loach are strictly carnivorous and feed on aquatic invertebrates mainly EPT (Hora 1936). The fish eat only invertebrates irrespective of the season and stage of maturity. In years with low productivity of EPT, the fish would have less food and the population of fish would be compromised (Jhingran 1991).

A reduced wet season duration may not be long enough for breeding and for fry to grow. In very long or short flood seasons, maturity of eggs in both early and late spawning fish would not coincide with spawning cues (Amanov 1985).

Similarly, as with the Snow Trout, large flood peaks in the flood season rejuvenate the river habitat. Higher flows in flood season flush the habitat by removing debris, silt and sediments in the river bed. Flood peaks scour pools, which are overwintering and feeding habitat for the fish (Reiser et al. 1987). In years when there are lower peak flows in the flood season, there is likely to be a reduction in suitable breeding habitat, which would negatively impact breeding success (McKinney et al. 1999). Reduced flood season would also affect the spawning triggers negatively affecting the breeding process. The loach breeds in shallow side pools and channels with cobble beds. It avoids floods and strong flow and moves to slow side-channels and spaces between boulders closer to the banks in the flood season. Smaller flood flows will also reduce the area of secondary channels and backwaters.

Lastly, the fish survives in the dry season in crevices and under the boulders protected from the main current. Low dry season hydraulic habitat will mean reduced wintering area and restricted fish movement. Some fish will survive in deeper waters with some flow, but they will be under stress.

M.3.2 Impacts in the Peaking Section

Impacts on fish downstream of the tailrace are discussed in this section. These impacts do not take into consideration the 400 meter segment between the tailrace of the Arkari Gol HPP and the confluence of the Arkari Gol with the Luthko River.

Exhibit M.13: Downstream of Tailrace Subjected to Peeking Flows: Predicted Populations in 31 Years as Percentage of 2018 Baseline Population

As a percentage of 2018 baseline population

Indicator	*Scenario A*	*Scenario B*	*Scenario C*
Snow Trout	40%	70%	100%
Chitral Loach	50%	Negligible change, less than 5% decline	100%

Scenario B in which the level of peak is reduced to 24 m^3/s and flow is gradually ramped up to peak level and is then ramped down towards the end of the peaking period buffers the impact of a peaking operation as assumed in Scenario A significantly. The impacts of peaking can be eliminated entirely if the power house is operated in a true Run of River mode. This mode of operation, however, will not provide peaking power which carries economic value and helps in balancing the operation of the power grid. Scenario B is therefore recommended as approach to power generation, as it provides a balance between economic value of power and impacts of the Project in river ecology.

M.4 Conclusions

The environmental flow release proposed in the Project Feasibility Study can be justified as the diversity and abundance of fish in the section of the Arkari Gol subjected to low flow is low. The Vulnerable and long distance migratory Snow Trout is either not present in this section, or is abundance is relatively low compared to that in the Lutkho River in the sub-basin.

A fish ladder is not required as fish were not observed upstream of the natural fall in the river located about 2.5 km downstream of the dam.

Downstream of the tailrace the impacts on aquatic ecology depend on the operational scenario selected. Under true run of river conditions (Scenario C) where no peaking is carried out populations of the Snow Trout and Chitral Loach will not decline due to the Project. However, under peaking conditions (Scenario A) their populations will decline to 40% and 50% of present day baseline levels, respectively, over a period of 31 years. A modified peaking scenario (Scenario B) is an option in which the operational peak is reduced to 24 m^3/s and flow is gradually ramped up to peak level and is then be ramped down towards the end of the peaking period. This will buffer the impact of a peaking operation. Under this operational scenario the Snow Trout will decline to 70% of baseline while the Chitral Loach will not be significantly impacted. An approach to power generation that provides a balance between economic value of peaking power and impacts of the Project on river ecology and can be justified as "No Net Loss Where Feasible" in a Natural Habitat as defined in PS6 should be selected in consultation with the power purchaser.

Annexure A: Overview of DRIFT Model for Environmental Flow Assessment

DRIFT Decision Support System

The DRIFT Decision Support System (DSS) is programmed using Delphi XE and uses a NexusDB v3 database. The software is designed for use in all computers running Windows XP and upwards, and the DSS supports both single-user and multi-user modes.

The DSS makes use of Google Earth (standard version) and Google kml files.

The DRIFT DSS is divided into three sections, each dealing with a different stage in the EF determination process. These are (Brown *et al*. 2013):

1. Set-up,
2. Knowledge Capture, and
3. Analysis.

The first two sections deal with the population of the DSS and the calibration of the relationships that will be used to predict the ecosystem response to changes in flows. The third section is used to generate results once the first two sections have been populated, and to produce the reports and graphics detailing the predictions for the scenarios under consideration.

All hydrological modelling is done outside of the DSS. The DSS is dependent on the outputs of two external models, namely:

- an Hydrological Model used to provide baseline basin hydrology; and
- a Water Resource Model used to predict the changes in the flow regime associated with the existing and proposed water-resource developments under the various scenarios.

Additional detail on the DSS, including a User Manual, is available in Brown *et al.* (2013).

Summary of DRIFT Process

DRIFT (Downstream Response to Imposed Flow Transformations; King *et al.* 2003) was used to evaluate different water management scenarios for the Jhelum River for, *inter alia*, the following reasons:

1. It is a holistic interactive method, which provides the biophysical consequences for the downstream river for various scenarios of flow change. These scenarios can then be used to determine the impact of proposed operating rules for the dam, and possible mitigation thereof.
2. It is a published method (King *et al*. 2003), with a detailed User Manual (Brown *et al.*, 2008), and as such is has been peer reviewed.

3. It has been widely applied in the Southern African Development Community, such as Lesotho (King *et al*. 2003), Mozambique (Beilfuss and Brown, 2010; Southern Waters 2011), Namibia (Southern Waters 2010), Peru (Norconsult and Southern Waters 2011), South Africa (e.g. Brown *et al*., 2006), Tanzania (PBWO/IUCN 2008), Zimbabwe (Brown 2007) and Sudan (Southern Waters 2009). It was used as the basis of a basin-wide EF assessment in the Okavango River Basin (Angola, Namibia and Botswana; King and Brown 2009), and has been used in Pakistan on the Neelum-Jhelum River (Southern Waters and Hagler-Bailly Pakistan 2013).
4. It is based on Response Curves constructed from any relevant knowledge including expert opinion and local wisdom and as such is suitable for use in regions where there are few biophysical data available for the flow-related aspects of the rivers, as was the case for the Jhelum River
5. It aims to provide an objective and transparent assessment of the effects of changes in flow on the downstream environment based solely on structured consideration of the biophysical aspects thereof.

DRIFT is a data-management tool, allowing data and knowledge to be used to their best advantage in a structured way. Within DRIFT, each specialist, to derive the links between river flow and river condition, uses discipline-specific methods. The central rationale of DRIFT is that different aspects of the flow regime of a river elicit different responses from the riverine ecosystem. Thus, removal of part or all of a particular element of the flow regime will affect the riverine ecosystem differently than will removal of some other element.

In DRIFT, the long-term daily-flow time-series is partitioned into parts of the flow regime that are thought to play different roles in sculpting and maintaining the river ecosystem, such as the onset of important flow seasons, which may affect breeding cycles, or the magnitude of the annual flood, which may inundate a floodplain. This makes it easier for ecologists to predict how changes in the flow regime could affect the ecosystem. The ‘parts’ of the flow regime used in DRIFT are called flow indicators.

- Seasonal/daily variations
  - Mean annual runoff
  - Dry season onset
  - Dry season minimum 5-day discharge
  - Dry season duration
  - Dry season average daily volume
  - Wet season onset
  - Wet season minimum 5-day discharge
  - Wet season duration
  - Wet season flood volume
  - Transition 1 average daily volume

- Transition 2 average daily volume
- Transition 2 recession shape

- Hourly variations (required for sites downstream of the tailrace, which releases flows resulting from peak power generation):
  - Dry season within day range in discharge
  - Dry season maximum instantaneous discharge
  - Dry season minimum instantaneous discharge
  - Wet season within day range in discharge
  - Wet season maximum instantaneous discharge
  - Wet season minimum instantaneous discharge
  - Transition 1 within day range in discharge
  - Transition 1 maximum instantaneous discharge
  - Transition 1 minimum instantaneous discharge
  - Transition 2 within day range in discharge
  - Transition 2 maximum instantaneous discharge
  - Transition 2 minimum instantaneous discharge.

The variability of the flow regime in timing and magnitude, both in its natural state and in any future scenario, was captured automatically through instructions within the hydrological module of the DSS that identify the flow indicators year-by-year. Thus, for the Jhelum River, the time-series are made up of annual time-series of each flow indicator for the 31 years of flow record. This means the specialists can consider a response to a condition for a particular time-step rather than thinking of an averaged response over several years. They can also use data from a particular year or season to calibrate time-series responses.

The study process was structured as follows:

1. The study focused on EF sites on the Jhelum Rivers. The flow changes that were evaluated encompass a mixture of:
   i. Changes in magnitude.
   ii. Changes in duration.
   iii. Changes in timing (e.g., delayed onset of wet season or range of hourly discharge fluctuations).
2. Specialists provided opinion on the consequences of these changes in the form of Response Curves. The disciplines represented were:
   i. Water quality
   ii. Hydraulics
   iii. Geomorphology

iv. Algae

v. Riparian vegetation

vi. Invertebrates

vii. Fish

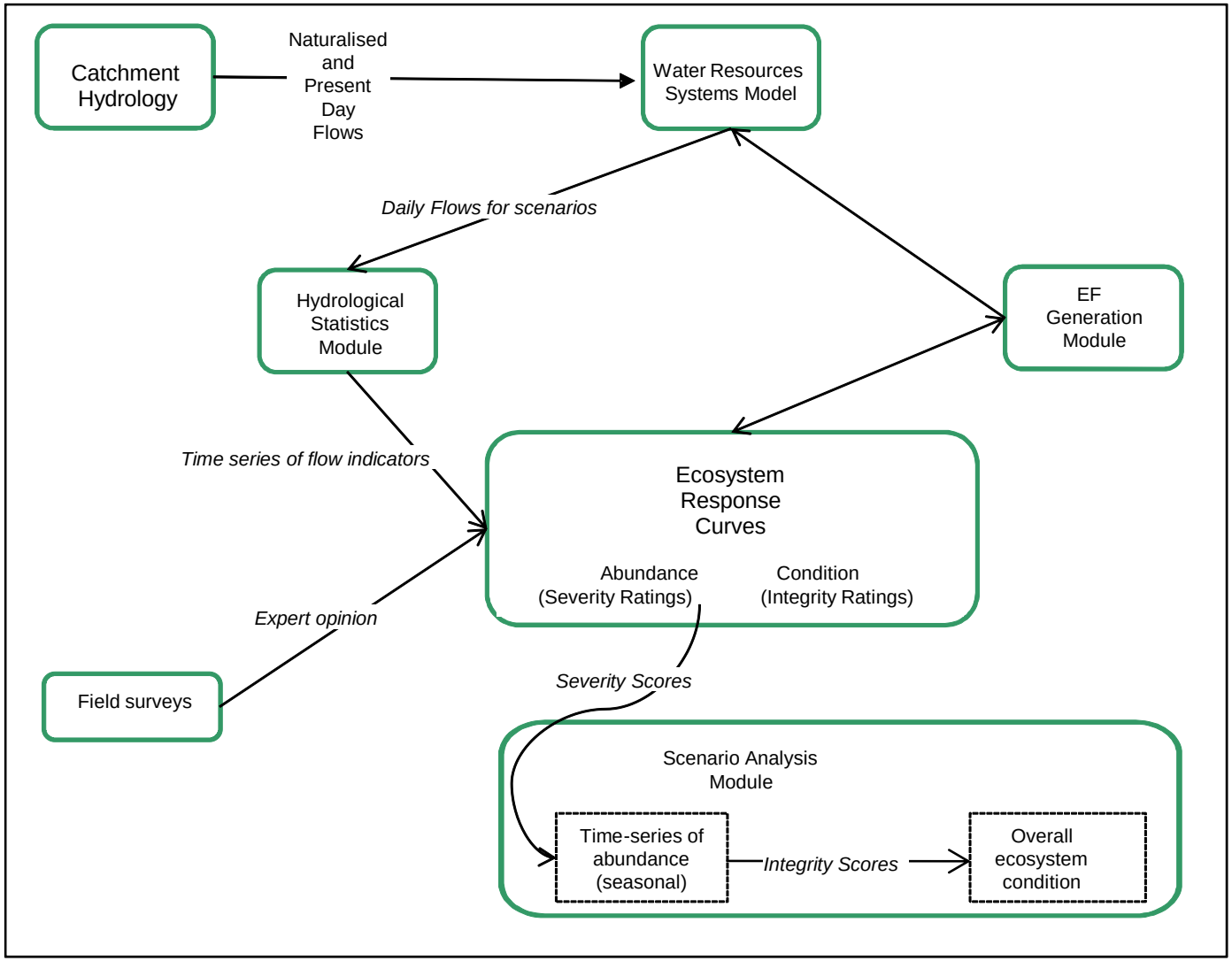
viii. Socioeconomics.

3. The database was used to evaluate
    i. changes in individual aspects of the ecosystem (e.g. fish, vegetation), for each site and scenario;
    ii. changes in the overall condition of the river, for each site and scenario.

The basic sequence of activities in the DRIFT DSS can be summarized as follows **Exhibit 1**):

1. Collect data for the study at the river.
2. Augment with expert knowledge for similar river systems and a global understanding of river functioning.
3. Construct relationships for the expected response of individual ecosystem indicators to changes in aspects of the flow regime (Response Curves).
4. Use Response Curves to predict time-series of abundance changes.
5. Adjust the severity ratings to integrity ratings by assigning a negative sign for a move away from the natural ecosystem condition and a positive for a move towards natural.
6. Model future changes in catchment hydrology.
7. Calculate annual flow indicator time-series.
8. Use Response curves to calculate severity scores and develop time-series of change in abundance for ecosystem indicators.
9. Calculate average severity score for each indicator for entire hydrological time-series.
10. Convert severity scores to Integrity Scores to predict overall ecological condition.

Exhibit 1: Flow chart of DRIFT process



Response Curves[4]

Response Curves depict the relationship between a biophysical or socio-economic indicator and a driving variable (e.g., flow). In this EF assessment, Response Curves linked an indicator to any other indicator deemed to be driving change. The aim is not to ensure that every conceivable link is captured but rather to restrict the linkages to those that are most meaningful and can be used to predict the bulk of the likely responses to a change in the flow or sediment regimes of the river.

The number of Response Curves constructed for an EF assessment depends on the level of detail at which a flow assessment is done. These were used to evaluate scenarios by taking the value of the flow indicator for any one scenario and reading off the resultant value for the biophysical indicators from their respective Response Curves. Once this had been done the database combined these values to predict the overall change in each biophysical indicator and in the overall ecosystem under each scenario.

Construction of the Response Curves

The Response Curves used in this project were constructed as follows:

- Draft curves constructed at a workshop in Islamabad attended by Southern Waters and Hagler-Bailly Pakistan team members.
- Draft curves re-evaluated by Southern Waters once the scenarios has been run, and adjusted where deemed necessary.
- Draft curves re-evaluated by Hagler-Bailly Pakistan using these scenarios as reference, and adjusted where deemed necessary.
- Final curves agreed on by Hagler-Bailly Pakistan and Southern Waters.

Response Curves and cumulative change

The time-series approach means that the Response Curves are used to predict the likely seasonal change in an ecosystem indicator in response to the flow/sediment conditions experienced in that, or possibly preceding, seasons. For instance, the kind of question typically asked to facilitate setting the dry season discharge Response Curve for Kashmir catfish are:

- "If the dry season discharge declines from baseline values, what will be the consequences for the abundance of Kashmir catfish?":
  - Do Kashmir catfish use the main river in the dry season?
  - Do Kashmir catfish abundances change noticeably over the climatic range covered in the baseline, i.e., are they noticeably more abundant in wet years than in dry years, or vice versa?
  - What kinds of habitat do adult Kashmir catfish use in the main river?
  - Do Kashmir catfish breed in the dry season?
  - Do they breed in the main river or in the tributaries?

[4] The bulk of this section is taken from Joubert *et al*., 2009.

- Where do Kashmir catfish lay their eggs?
- What sorts of habitat do fry, fingerlings and juvenile trout use in the main river?
- At what discharge(s) does the favoured habitat(s) disappear?
- What is the consequence of these habitats not being available for one season?
- If discharge reaches zero for one season, are there pools that the trout will be able to survive in?
- Can the Kashmir catfish survive for a dry season in pools?
- Is water temperature a concern, i.e., would winter temperature be an issue for Kashmir catfish if discharge dropped?
- What do Kashmir catfish adults/juveniles/fingerlings/fry eat?
- How will the food base be affected by changes in dry season low flows?
- Etc.

Often, a species (such as Kashmir catfish will be expected to survive even an extremely-dry dry season, with possibly only minor changes (5-10%) in overall abundance if dry season flows drop to zero. If, however, the flows drop to this level in the dry season year after year, then the cumulative effect on catfish populations is likely to be far greater. The time-series enable the DSS to capture this cumulative effect.

Scoring System Used

Into the foreseeable future, predictions of river change will be based on limited knowledge. Most river scientists, particularly when using sparse data, are thus reluctant to quantify predictions: it is relatively easy to predict the nature and direction of ecosystem change, but more difficult to predict its timing and intensity. To calculate the implications of loss of resources to subsistence and other users in order to facilitate discussion and tradeoffs, it is nevertheless necessary to quantify these predictions as accurately as possible.

Two types of information are generated for each biophysical indicator, *viz*.:

- Severity ratings, which describe increase/decreases for an indicator in response to changes in the flow indicators, and;
- Integrity ratings, which indicate whether the predicted change is a move towards or away from natural, i.e., how the change influences overall ecosystem condition.

The severity ratings are used to construct the Response Curves. The Integrity ratings are used to describe overall ecosystem condition/health.

Severity Ratings

The severity ratings comprise 11-point scale of -5 (large reduction) to +5 (very large change; Brown *et al*., 2008; **Exhibit 2**), where the + or – denotes a increase or decrease in abundance or extent. These ratings are converted to percentages using the relationships provided in **Exhibit 2**. The scale accommodates uncertainty, as each rating encompasses

a range of percentages; however, greater uncertainty can also be expressed through providing a range of severity ratings (i.e. a range of ranges) for any one predicted change (after King *et al.*, 2003).

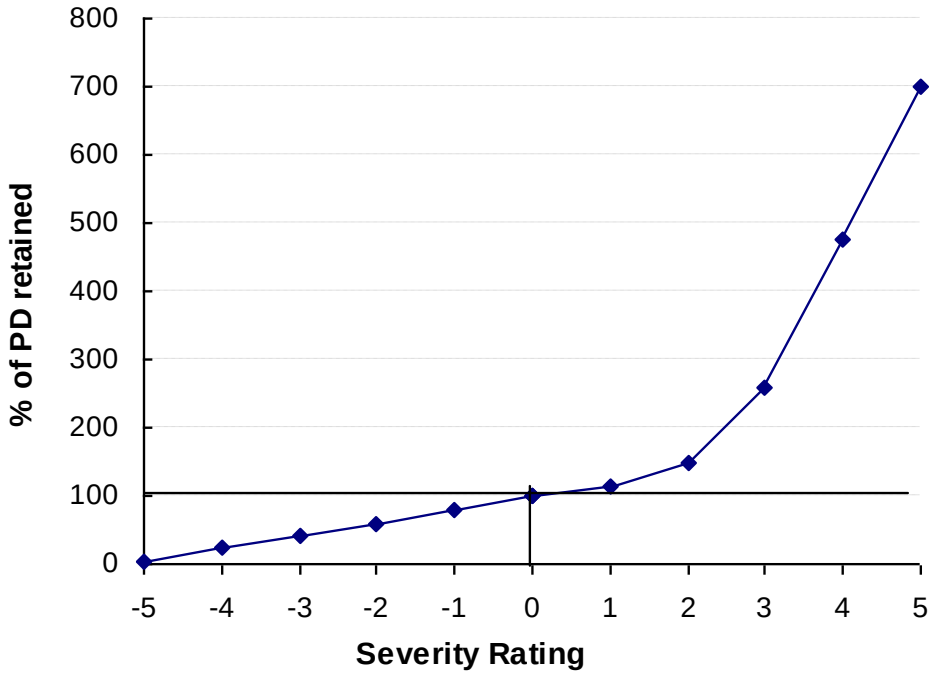
Exhibit 2: DRIFT severity ratings and their associated abundances and losses – a negative score means a loss in abundance relative to baseline, a positive means a gain.

Severity rating	*Severity*	*% abundance change*
5	Critically severe	501% gain to ∞ up to pest proportions
4	Severe	251-500% gain
3	Moderate	68-250% gain
2	Low	26-67% gain
1	Negligible	1-25% gain
0	None	no change
-1	Negligible	80-100% retained
-2	Low	60-79% retained
-3	Moderate	40-59% retained
-4	Severe	20-39% retained
-5	Critically severe	0-19% retained includes local extinction

Note that the percentages applied to severity ratings associated with gains in abundance are strongly non-linear[5] and that negative and positive percentage changes are not symmetrical (**Exhibit 3**; King *et al*. 2003).

[5] The non-linearity is necessary because the scores have to be able to show that a critically-severe loss equates to local extinction whilst a critically severe gain equates to proliferation to pest proportions.

Exhibit 3: The relationship between severity ratings (and severity scores) and percentage abundance lost or retained as used in DRIFT and adopted for the DSS. (PD=present day AND = 100%)



For each year of hydrological record, and for each ecosystem indicator, the severity rating corresponding to the value of a flow indicator is read off its Response Curve. The severity ratings for each flow indicator are then combined to produce a severity score, which provides an indication of how abundance, area or concentration of an indicator is expected to change under the given flow conditions in each year, relative to the changes that would have been expected under baseline conditions in the catchment.

Identification of Ecologically-relevant Elements of the Flow Regime

One of the main assumptions underlying the DRIFT EFs process is that it is possible to identify ecologically-relevant elements of the flow regime and isolate them within the historical hydrological record. Thus, one of the first steps in the DRIFT process is to identify the ecologically-important flow indicators, which are calculated per season for each year.

Major Limitations of DRIFT

Predicting the effect of flow changes on rivers is difficult because the actual trajectory and magnitude of the change is additionally dependent on so many other variables, such as climate, sediment supply and human use of the system. Thus, several assumptions underlie the predictions. Should any of these assumptions prove to be invalid, the actual changes may not match the predicted changes. This does not necessarily make the predictions themselves incorrect or invalid, but simply means that the surrounding set of circumstances that support the predictions has changed.

The main limitation is the paucity of data. This is a universal problem, as ecosystems are complex and we will probably never have complete certainty of their present and possible future characteristics. Instead it is essential to push ahead cautiously and aid decision-making, using best available information. The alternative is that water resource development decisions are made without consideration of the consequences for the supporting ecosystems, eventually probably making management of sustainability impossible. Data paucity is addressed in the DRIFT process by accessing every kind of knowledge available - general scientific understanding, international scientific literature, local wisdom and specific data from the river under consideration or from similar ones – and capturing these in a structured process that is transparent, with the DSS inputs and outputs checked and approved at every step. The Response Curves used (and the reasoning used to construct them) are available for scrutiny within the DSS and they, as well as the DRIFT DSS, can be updated as new information becomes available.

A second aspect of the paucity of data is that it is neither known what the river was like in its pristine condition nor exactly how abundant each ecosystem aspect (sand bars, fish, etc.) was then or is now. To address this, all DRIFT predictions are made relative to the baseline situation (there will be a little more, or a lot less, than today, and so on), as explained further below.

These inherent uncertainties also mean that the trends and relative position of the scenarios are more reliable predictors of the impacts of the scenarios than are their absolute values. Also, DRIFT is designed to predict overall condition, and focusing on one indicator to the exclusion of others is not recommended.

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Appendix N: Generic Construction Site Environmental Management Plan

In addition to Project proponent's E&S documentation the Construction Management Plan will incorporate the measures discussed in this section. Specific management plans will be developed to summarize the mitigation measures and facilitate their implementation.

N.1 Minimizing Erosion

Objective

To minimize the quantity of soil lost during construction due to land-clearing.

Suggested measures

- Develop and follow an Erosion Control Plan
- Schedule measures to avoid and reduce erosion by phasing the work program to minimize land disturbance in the planning and design stage.
- Keep the areas of land cleared to a minimum, and the period of time areas remain cleared to a minimum
- Base control measures to manage erosion on the vulnerability of cleared land to soil loss, paying particular attention to protecting slopes.
- Mulch, roughen and seed cleared slopes and stockpiles where no works are planned for more than 28 days, with sterile grasses.
- Keep vehicles to well-defined haul roads.
- Keep public roads clear of mud and soil by preventing muddy trucks from entering public highways, by scheduling work wherever possible to avoid truck traffic on unpaved site roads, by washing mud off tires and truck bodies before they leave the site, and by clearing the public roads before soil and mud become a problem.
- Rehabilitate cleared areas promptly.

N.2 Storm Water Management

Objective

To minimize the generation of contaminated storm water.

Suggested Measures

- Minimize the quantity of uncontaminated storm water entering cleared areas.

- Establish cut-off or intercept drains to redirect storm water away from cleared areas and slopes to stable (vegetated) areas or effective treatment installations.
- Reduce water velocities.

N.1 Sediment Controls

Objective

To minimize the impact of contaminated storm water on receiving waters.

Suggested Measures

- Install erosion and sediment control measures, if possible before construction commences.
- Identify drainage lines and install control measures to handle predicted storm water and sediment loads generated in the mini-catchment.
- Design and install appropriate erosion and sediment run-off control measures appropriate to site conditions to handle a one-in-two-year storm event (two-year ARI with intensity of six hours), for temporary structures, and a one-in-fifty year storm event, for permanent structures.
- Establish an adequate inspection, maintenance and cleaning program for sediment run-off control structures.
- Ensure that contingency plans are in place for unusual storm events.
- Continually assess the effectiveness of sediment control measures and make necessary improvements.

N.2 De-watering Work Sites

Objective

To ensure that de-watering operations do not result in turbid water entering natural waterways.

Suggested Measures

- Treat contaminated water pumped into the storm water system or a natural waterway to remove sediment if the turbidity exceeds 30 NTU.
- Ensure that the level of suspended solids in waters pumped into natural waterways never exceeds the regulatory water quality standard.
- De-water by pumping water, wherever practical, on to vegetated area of sufficient width to remove suspended soil, or to sediment control devices.
- Supervise all pumping and implement precautions to ensure that turbidity of pumped water is minimized.
- Monitor every hour during a pumping operation the turbidity of water pumped directly to a natural waterway or a drainage system discharging to a natural waterway.

N.3 Dust Control

Objective

To ensure there is no health risk or loss of amenity due to emission of dust to the environment.

Suggested Measures

- Implement a dust prevention strategy, developed at the Project planning stage.
- Take dust suppression measures, such as promptly watering exposed areas when visible dust is observed.
- Install wind fences wherever appropriate.
- Absolute prohibition on soil or mud accumulation on public roads. Public and Project access roads should be frequently cleaned and visually inspected daily to prevent any soil or mud accumulation.

N.4 Management of Stockpiles and Batters

Objective

To manage soil stockpiles so that dust and sediment in run-off are minimized.

Suggested Measures

- Minimize the number of stockpiles, and the area and the time stockpiles are exposed.
- Keep topsoil and under burden stockpiles separate.
- Locate stockpiles away from drainage lines, at least 10 m away from natural waterways and where they will be least susceptible to wind erosion.
- Ensure that stockpiles and batters are designed with slopes no greater than 2:1 (horizontal/vertical).
- Stabilize stockpiles and batters that will remain bare for more than 28 days by covering with mulch or anchored fabrics or seeding with sterile grass.
- Establish sediment controls around unstabilized stockpiles and batters.
- Suppress dust on stockpiles and batters, as circumstances demand.

N.5 Noise and Vibration

Objective

To ensure nuisance from noise and vibration does not occur.

Suggested Measures

- Develop and follow Noise and Vibration Control Plan
- Fit and maintain appropriate mufflers on earth-moving and other vehicles on the site.

- Enclose noisy equipment.
- Provide noise attenuation screens, where appropriate.
- Where an activity is likely to cause a noise nuisance to nearby residents, restrict operating hours to between 7 am and 6 pm weekdays and 7 am to 1 pm Saturday, except where, for practical reasons, the activity is unavoidable.
- Noise should not be above background levels inside any adjacent residence between 10 pm and 7 am.
- Advise local residents when unavoidable out-of-hours work will occur.
- Schedule deliveries to the site so that disruption to local amenity and traffic are minimized.
- Conduct a study on the impact of ground vibration from construction activities, where these operations occur within 50 m of a building and take appropriate action.
- Minimize air vibrations.

N.6 Waste Minimization

Objective

To minimize the waste load discharged to the environment.

Suggested Measures

- Develop and follow a Waste Management Plan
- Carry out a waste minimization assessment which examines opportunities for waste avoidance reduction, reuse and recycling.
- Reduce wastes by selecting, in order of preference, avoidance, reduction, reuse and recycling.
- Incorporate waste minimization targets and measures into the environmental management plan.

N.7 Contaminated Material and Wastes

Objective

To ensure that all contaminated material uncovered on a construction site are excavated and disposed of in an environmentally responsible manner.

Suggested Measures

- Develop and follow Hazardous Materials Management Plant
- Assay material uncovered on-site prior to disposal. If the wastes include putrescible wastes, then also analyze leachate and landfill gases.
- Excavate material in a manner which avoids off-site environmental problems.

- Seal remaining contaminated material or wastes, where only part of the tip has been excavated, to ensure that there is no off-site effect now or in the future.
- Transport odorous wastes in covered vehicles.
- Dispose of contaminated material in a landfill licensed to take the type of contaminated material or wastes uncovered.

N.8 Air Quality

Objective

To ensure there is no health risk or loss of amenity due to emission of exhaust gases to the environment.

Suggested Measures

- Ensure that all vehicles and machinery are fitted with appropriate emission control equipment, maintained frequently and serviced to the manufacturers' specifications.
- Smoke from internal combustion engines should not be visible for more than ten seconds.
- All permanent facilities, such as generators, batching plants and aggregate production system will be located at least 250 m from any residential building.

N.9 Litter

Objective

To ensure that all litter is disposed of in a responsible manner, and is not released into the environment.

Suggested Measures

- Develop and follow a Waste Management Plan
- Maintain a high quality of housekeeping and ensure that materials are not left where they can be washed or blown away to become litter.
- Provide bins for construction workers and staff at locations where they consume food.
- Conduct ongoing awareness with staff of the need to avoid littering.

N.10 Storing Fuels and Chemicals

Objective

To ensure that fuel and chemical storage is safe, and that any materials that escape do not cause environmental damage.

Suggested Measures

- Develop and Spill Prevention and Response Plan
- Minimize fuels and chemicals stored onsite.
- Install bunds and take other precautions to reduce the risk of spills.

N.11 Keeping Roads Clean

Objective

To ensure that roads are kept clean of soil.

Suggested Measures

- Install wheel washes and rumble grids at all main road crossings.
- Ensure that the roads are swept frequently (continuous if needed), with machinery and by hand, on uncontrolled road crossings when construction vehicles are travelling off the site.
- Absolute prohibition on soil or mud accumulation on public roads. Public and Project access roads should be frequently cleaned and visually inspected daily to prevent any soil or mud accumulation.
- Install litter traps lined with filter cloth in all side-entry pits.
- Cover all loads of soil being taken off site for disposal.

Hagler Bailly Pakistan

ESIA of Arkari Gol Hydropower Project

Resettlement Action Plan

Draft Report

HBP Ref.: D8RA3AGH

June 11, 2018

Master Hydro Pvt. Ltd.

Lahore

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Introduction

Master Hydro (Pvt.) Ltd. (MHL) intends to develop the 99 megawatt (MW) Arkari Gol Hydropower Project (the Arkari HPP or the Project) on the Arkari Gol, about 8 kilometer (km) upstream of the confluence of Arkari Gol with Lutkho River in the Chitral District of Khyber Pakhtunkhwa (KP). The dam is located 370 km from Peshawar. The dam and powerhouse are at a distance of 7.5 km. The Project is required to comply with the laws of KP.

The environmental and social safeguard documents that are prepared for the Project are as follows:

1. Environment and Social Impact Assessment (ESIA) including the Environmental Management Plan (EMP), Environmental Flow (EFlow) Assessment, and Cumulative Impact Assessment (CIA)
2. Resettlement Action Plan (RAP)

A Feasibility Study of the Project (FS) was released in March 2014. MHL has acquired the services of Hagler Bailly Pakistan (Pvt.) Ltd. (HBP) to prepare the environmental and social safeguard documents for the Project that meet the requirements of the Overseas Private Investment Corporation (OPIC) and conform to environmental legislation of KP and of Pakistan.

This document is the RAP of the proposed Project.

The Project is a run of the river hydropower project with daily peaking in winter, to be constructed on the Arakri Gol. The Project site is located 40.5 km upstream of the Chitral main town, near the Ucchatur village, Chitral District, KP. The geographical coordinates of the proposed dam site are 36° 4'3.49"N, 71°41'33.99"E and of the proposed powerhouse site are 36° 1'15.32"N, 71°44'13.07"E. The Project site is about 495 km by road from Islamabad.

The total installed capacity of the Project will be 99 MW. The average annual energy generation will be 378 Gigawatt-hour (GWh).

The main dam will be a concrete-faced, rock-filled structure with a height of 20 m from the foundation level and dam crest width of 6 m. The reservoir capacity at full supply level (FSL) of 2,190 m above mean sea level (amsl) will be 1.06 million cubic meters (MCM) of which live storage will be 0.489 MCM. The surface area of the reservoir will extend to approximately 0.121 km upstream of the dam.

The average annual discharge at the proposed dam site is 17 m^3/s. The design discharge is 36 m^3/s. There will be a headrace tunnel with a length of 5.9 km.

The powerhouse will be a surface-type powerhouse with an open 500 kilovolt (kV) switchyard.

There will also be permanent and temporary camp facilities, a workshop area and offices.

Legal Instruments and Policy Framework

The relevant legislation for land acquisition and compensation is included in the Land Acquisition Act of 1894 (amended). It sets out the procedure and rules for land acquisition and compensating the owners, as well as for compensating owners for damage caused to their properties, crops and trees affected by projects.

The national law governing land acquisition is the Land Acquisition Act 1894 (LAA 1894) and successive amendments to it. The LAA 1894 regulates the land acquisition process and enables the government to acquire private land for public purposes. It sets out the procedure and rules for land acquisition and compensating the owners, as well as for compensating owners for damage caused to their properties, crops and trees affected by projects.

The law comprises of 55 sections dealing with area notifications, surveys, acquisition, compensation, appointment awards, disputes resolution, penalties and exemptions. Under section 23 of LAA 1894 and its amendments, in addition to the market–value of the land, a sum of fifteen percent of the market value as compulsory acquisition surcharge is to be paid to the AP, if the acquisition is for a public purpose and a sum of twenty–five percent on such market–value if the acquisition is made for a Company. The APs, if not satisfied, can go to the Court of Law under section 18 to contest the compensation award of the Land Acquisition Collector (LAC). As requirements of lender and best international practices OPIC Environmental and Social Policy Statement ("Policy Statement") and Performance Standard 5 of IFC was also considered during development of the policy Framework. The main objectives of OPIC and IFC guidelines are to avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs and to improve, or restore, the livelihoods and standards of living of displaced persons.

RAP Preparation Methodology

The RAP of the Arkari Gol HPP has been prepared following the specific requirements of the law and best international practices like IFC guidelines where possible. This section outlines the process that has been followed for the preparation of the RAP.

The land required for the Project and therefore selected for the resettlement survey was identified by the Executing Agency (EA) following global standards for hydropower projects.

Based on the detailed study undertaken on international best practices the optimal land scope line up to which the land will be procured and would be prudent in the best interest of the project and adjoining communities for safe operations of the project was determined. The affected structures and agricultural lands were identified using ***Google Earth™*** satellite imagery dated May 24, 2016 and September 19, 2017. Each identified structure and plot of land was given a unique identification number.

Based on this methodology a Resettlement Field Survey (RFS) was conducted from March 29 to April 15, 2018. In this period 48 affected households were surveyed from three affected settlements.

Stakeholder consultation was undertaken as part of the ESIA of the Arkari Gol HPP where general opinion about the Project including resettlement was sought. In these

consultations communities' opinions about preference regarding relocation was collected. Moreover, questions regarding land acquisition, entitlement matrix, and determination of fair replacement cost, resettlement planning and expectations from the Master Hydro (Private) Limited were asked.

Project Impacts

The Project will result in loss of; land, residential, commercial and public structures, livelihood, fruit, and non–fruit trees and crops. The Project will have further impacts on local communities through disturbance due to construction work, damages to the travel routes, issues related to health, safety and well–being, pressure on local markets (businesses) and pressure on basic infrastructure. These indirect impacts are covered in the ESIA of the Project, while RAP provides the direct Project impacts. **Exhibit I** shows the types of losses due to the Project.

Exhibit I: Type of Losses by the Project

Type of Loss	*Unit*	*Quantity*	*No. of AHs*
Loss of Houses			
Houses	Number	27	27
Loss of Land			
Cultivated Land	kanal[1]	212.00	41
Uncultivated Land	kanal	156.00	47
Land under Houses and other Structures	kanal	32.22	27
Uncultivated Communal Land	kanal	719.95	0
Total	**kanal**	**1,120.17**	
Loss of Structure and Other Assets			
Loss of Cropped Area	kanal	212	41
Loss of Fruit Trees	Number	1,838	35
Loss of Non-Fruit Trees	Number	5,331	37
Loss of Commercial Structures	Number	2	2
Loss of Public and Community Infrastructure Assets			
Jamat Khana	Number	2	
School	Number	1	
Mosque	Number	1	

Socioeconomic Conditions

Out of a total of 48 AHs, 13 HHs belong to Mumi settlement, 13 HHs belong to Andahti settlement and 22 HHs belong to Uchhtar settlement. Based on RFS total population of

[1] 1 Kanal = 505.86 square meter

surveyed HHs is 350 of which 52.3% are male and 47.7% are female and on average, each HH comprises 7.29 members. The female to male ratio of the AHs is 1:0.91.

The major castes of the AHs are Khauja Alanjas (27%), Katur (27%), Khujakhel (21%), Zondray (8%), Raees (6%), Shagoria (6%) and Dashmaner (4 %).

The Project area has a 100% Muslim population with a majority (91%) belonging to Ismaili sect of Islam while 9% of the population belongs to Sunni sect of Islam. Primary language of all the affected population is Khowar and secondary language of all the APs is Urdu.

The socioeconomic survey conducted in the Project area revealed that the literacy rate among the surveyed population above the age of fifteen years is 77%. Moreover, literacy rate for males is 84%, higher than that for females (70%). Less than 1% obtained their education from a Madrasa, 8% have studied less than primary, 16% have education up to primary level, 21% have education up to Matric level, 16 % have education up to intermediate level, 7% have education up to graduate level and 9% have higher education.

No minorities (cultural, religious, or ethnic) and indigenous HHs are being affected by the Project.

Minimum cultivated land of a HH is 0.5 kanal and maximum is 32 kanals with an average of 4.80 kanals per household. While the minimum uncultivated land of a household is 1 kanal and maximum is 30 kanal with an average of 5.66 kanals per household.

Majority of the working–age population surveyed were without any gainful employment. Of the people with gainful employment, about 34% were employed in private sector, 19% were employed in public sector, 13% percent were involved in agriculture, about 12% were working as skilled and unskilled labor and about 5% were doing trade or involved in their own business. Out of the total income earning population about 8% are female and 92% are male.

During analysis of HH income earned from different sources, income from agriculture was also included. Income from fruit trees and consumed crops by the HHs themselves (in terms of monetary value) was included in agricultural income.

The private and public sector (salaried jobs) sector is the main income-producing sector which accounts for 65% of the entire income followed by labor (15%) and business (10%). While the agriculture sector and livestock sector is producing 2% income.

Certain groups of the population, by virtue of their socioeconomic realities, are considered socially vulnerable and thus in need of special consideration so that they can benefit from the development activities of the Project. These groups include; (a) hardcore poor HHs (HHs under national poverty line); (b) female–headed HHs (FHH), and (c) HHs headed by disabled persons. The RFS revealed that out of a total of 48 AHs, one AH is female-headed HHs and 14 AHs are below the national poverty line. These will be considered as vulnerable AHs.

Poverty is usually measured as an index of income inequality. In Pakistan the poverty line is PKR 3,030 per person per month. Of the surveyed AHs, the proportion of HHs

living under the estimated national poverty line is 29% (14 HHs) while, HHs earning more than PKR 10,000 per person per month are 10% (5 HHs), which can be considered as higher income level

Regarding housing, 17 houses (35%) are having brick built construction with a tin roof (semi–*pucca*) while 16 houses (33%) are *katcha* (made of wood with mud walls) and houses having brick built construction with concrete roof (*Pucca*) are 15 (59%).

On average, one house has three rooms, one kitchen, and one bathroom. Out of total houses, 6% of the houses are small (less than 5 Marla), 29% of the houses are medium (5 Marla–10 Marla) and 65% of the houses are large (more than 10 Marla).

During the last two years (2016-2017) in the AHs 13 live births and 2 still births took place.

There was no serious illness reported in the AHs in last two years however, common illnesses reported by the surveyed HHs were cold and flu, stomach, Diarrhea, Blood Pressure, Malaria, Blood Pressure and joint aches.

Stakeholder Consultation

The purpose of consultation and participation has been to ensure meaningful and adequate consultation with all stakeholders in Project planning processes, particularly the primary stakeholders in the Project area. Thus, the resettlement planning processes have followed a participatory planning process with local inputs in decision–making, policy development and mitigation measures. Provisions for disclosures and mechanisms for information sharing among the stakeholders are also discussed.

This is also in compliance with the requirements of the OPIC and IFC policies and guidelines, which give high priority to public consultation and participation in designing and implementation of a socially and environmentally compliant Project.

During the consultation process concerns raised by the directly affected communities are summarized as follows:

- Majority of the APs expressed concern about receiving fair compensation rates and payments for lost assets such as houses, land, and trees. They proposed that any land that might be affected due to the Project must be compensated at market prices.
- Some of the APs suggested that Project authorities could provide communities with land in exchange for the acquired land.
- Incomes would not be restored to current levels and adequate employment opportunities in the Project would not be provided to the local community.
- Some people also expressed their concern that due to blasting in the area land sliding may increase.
- Some people expressed the need for basic amenities i.e. health, education, roads, safe drinking water.
- Most of the community women were not willing to give their land, especially the land on which their residence is located.

- Community women emphasized that they want rates higher than the market value as the value of land will increase after execution of the Project. Therefore, they will not be able to buy land at current market prices.
- Children's education will be affected due to the Project activities, heavy traffic, and labor in the area.
- Mobility of women will be affected due to construction activities in the area.
- Due to the cutting of trees and construction work the environment will be affected.

After feedback from consultations, the following steps will be taken by Master Hydro (Private) Limited.

- Market value of affected assets including transaction costs will be paid before taking physical possession of the affected assets and lands.
- Transitional period costs and livelihood restoration support in terms of resettlement allowances and trainings will be paid to the AHs. However, land for land compensation is not possible due to unavailability of lands in the nearby areas. Moreover as discussed with the affected communities most of the AHs have enough lands to reconstruct their houses in the same villages and others can purchase land in the same villages from their relatives.
- All the AHs will be served a prior notice by the district management on behalf of the Deputy Commissioner (DC) to evacuate their lands and assets after providing the compensation and all the allowances to them. If any HH rejects to do so they will be approached by the Project authorities to do so. Forced eviction will be the last resort.
- Priorty will be given to the locals in Project created jobs and labour works during the construction and execution phase.
- Basic amenities like health, education, roads, and safe drinking water will be provided to the affected communities as well adjacent communities through Corporate Social Responsibility (CSR).
- A clause will be added to the contractor's contract documents that they will be confined to the Project working boundary and will not breach the privacy of local communities.

Eligibility and Entitlements

The eligibility and entitlement will follow the approved entitlement matrix which covers a wide range of losses. **Exhibit II** summarizes various entitlements against losses.

Exhibit II: Entitlements against Losses

No	*Type of Loss*	*Entitled Persons (Beneficiaries)*	*Entitlement (Compensation Package)*	*Implementation Issues/Guidelines*	*Responsible Organization*
1	Loss of agricultural land, pond, ditches, and orchards etc.	Legal owner(s) of land	▶ Market value of land including 25% compulsory land acquisition surcharge.	▶ Market price of the land will be computed by the District price assessment committee keeping in view the recent transactions in the area, quality of land and demand of the land owners. ▶ The Project through Land Acquisition Collector will pay cash compensation prior to acquisition of the land.	▶ All the funds will be provided by the Project, however, land acquisition and disbursement of payments is the responsibility of Revenue Department
2	Loss of access to cultivable land by owner-cultivator/ tenant/ sharecropper	Tenants/sharecropper /Legal owner/grower/socially recognized owner/lessee/ unauthorized occupant of land	▶ Based on current market value of land including 25% compulsory land acquisition surcharge.	▶ Market price of the land will be computed by the District price assessment committee keeping in view the recent transactions in the area, quality of land and demand of the land owners. ▶ The Project through Land Acquisition Collector will pay cash compensation through cross cheque prior to acquisition of the land.	▶ All the funds will be provided by the Project, however, land acquisition and disbursement of payments is the responsibility of Revenue Department

No	*Type of Loss*	*Entitled Persons (Beneficiaries)*	*Entitlement (Compensation Package)*	*Implementation Issues/Guidelines*	*Responsible Organization*
3	Loss of homestead/residential/commercial/ plots by owners/authorities	Legal owner(s) of the land	Option A:[2] ▶ Market value of land including 25% compulsory land acquisition surcharge **Option B:** ▶ Provision of residential/ commercial Plot at relocation site ▶ Provision of basic infrastructures at new resettlement area such as access road, drinking water supply, sanitation, schools, electricity, mosque, health facility and commercial area free of cost.	Option A: ▶ Market price of the land will be computed by the District price assessment committee keeping in view the recent transactions in the area, quality of land and demand of the land owners. ▶ Project through Land Acquisition Collector will pay for the land. Option B: ▶ Project will develop the resettlement sites with provision of basic amenities as electricity, potable water, roads ▶ The plots at resettlement sites will be provided at a subsidized rate to be finalized by the district land valuation committee.	Option A: ▶ Project through Land Acquisition Collector will pay for the land. Option B: ▶ Relocation site development will be the responsibility of the Project if required.
4	Loss of trees	Person with legal ownership of the land Socially recognized owner/unauthorized occupant of the trees/fishes	▶ Market value of the lost item	▶ Values of lost items computed based on RFS and rates taken from local market	▶ Compensation of trees and other land-based assets will be included in the land award and will be paid by the Revenue Department

[2] Both the options were discussed with the AHs and option A was finalized for the project because of unavailability of land in the area for land based compensation.

No	*Type of Loss*	*Entitled Persons (Beneficiaries)*	*Entitlement (Compensation Package)*	*Implementation Issues/Guidelines*	*Responsible Organization*
5	Loss of residential/commercial structure by owner(s)	Legal titleholder Owner(s) of structures	▶ Replacement value of residential structure. ▶ One time shifting allowance of PKR 25,000 per affected HH. ▶ Owner will be allowed to take away all salvageable materials free of cost.	▶ Applicable to all structures located within the acquisition areas. ▶ District Collector with expertise from Works and Services Department will determine the replacement value	▶ Replacement value, Relocation grant and special assistance will be paid directly by the Project, if not included in the award
6	Loss of residential/commercial structure by squatters and unauthorized occupants	Informal settlers/squatters/on–tilted APs occupying public land without title/or squatting on Govt. land	▶ Replacement value of residential structure. ▶ One time shifting allowance of PKR 25,000 per affected HH. ▶ Owner will be allowed to take away all salvageable materials free of cost.	▶ Applicable to all structures located within the acquisition areas. ▶ District Collector with expertise from Works and Services Department will determine the replacement value	▶ Replacement value, relocation grant and special assistance will be paid directly by the Project, if not included in the award
7	Loss of standing crops	Cultivators identified by District Collector through land acquisition survey	▶ Market value of standing crops. ▶ Owners will be allowed to harvest of standing crops prior to be affected.	▶ Applicable for all crops standing on land within the acquisition area at the time of dispossession. ▶ Project will pay through District Collector for crops. ▶ District Collector with assistance from Department of Agriculture will recommend resettlement value of crops at harvest.	▶ Compensation of crops will be included in the land award and will be paid by the Revenue Department

No	*Type of Loss*	*Entitled Persons (Beneficiaries)*	*Entitlement (Compensation Package)*	*Implementation Issues/Guidelines*	*Responsible Organization*
8	Loss of business due to dislocation	Owner/operator of the business as recorded by RFS	▶ Compensation equivalent to Three months (90 days) income from the business calculated during RFS	▶ Business owners will be paid the entitlements after award of compensation by District Collector to the owner of premises.	▶ Master Hydro (Private) Limited will directly pay the entitlement to the eligible APs, if not included in the award.
9	Loss of Income and work days due to displacement	HH head/employees identified by the RFS	▶ Grant to cover temporary loss of regular wage income @ PKR 500/– (Five hundred) X 90 days	▶ AP must have been an employee of landowner or business located in the acquired lands for at least twelve months, as identified by the RFS.	▶ Master Hydro (Private) Limited will directly pay the entitlement to the eligible APs, if not included in the award.
10	Poor and vulnerable HHs	Poor and vulnerable HHs including informal settler, squatters /women headed HH without elderly son/ non–titled APs identified by RFS	▶ Special assistance of PKR 50,000/ HH additional amount included in their compensation package.	▶ Vulnerable HH must be identified during RFS.	▶ Master Hydro (Private) Limited will directly pay the entitlement to the eligible APs, if not included in the award.
11	Displacement of community structure	Community structure representative as identified by the RFS	▶ The Project will construct the structures for common properties in the self–managed resettlement sites selected by the PAPs.	▶ Land for common structures will be purchased/ acquired by the Project.	▶ Project will directly pay the entitlement to the eligible APs.
12	Temporary impact during construction	Community/Individual	▶ Compensation equal to loss during construction	▶ Temporary impact during construction will be computed by the PMU on request of AP.	▶ Project will directly pay the entitlement to the eligible APs.

No	*Type of Loss*	*Entitled Persons (Beneficiaries)*	*Entitlement (Compensation Package)*	*Implementation Issues/Guidelines*	*Responsible Organization*
13	Unforeseen impact	Concerned impacted persons	▶ Entitlements will be determined as per the resettlement policy framework	▶ The unforeseen impacts will be identified through a special survey by the PMU. The entitlements will be approved by Master Hydro (Private) Limited	▶ Compensation of land-based assets will be included in the land award and will be paid by the Revenue Department ▶ Compensation of other assets will be paid directly by the Project, if not included in the award.
14	Public Structure	Concerned Department	▶ Replacement of affected structures	▶ Master Hydro (Private) Limited and concerned department with the help of DC will be responsible for the replacement of the affected public structures with the financial assistance of the project at the appropriate site.	▶ Project will be responsible for financial assistance
15	Severe impact	Persons losing more than 10% of their income from all sources	▶ One time severe impact allowance @ PKR 50,000/– (Fifty thousand) per HH. ▶ One person from the HH will be eligible for labor work or job according to its skills and education.	▶ The one-time severe impact allowance will be paid by Project.	▶ Project will be responsible to pay the severe impact allowance, if not included in the award.

Relocation and Livelihood Restoration Plan

During the HH consultations and group discussions, it was observed that majority of the affected communities prefer to relocate by themselves and none of the AHs opted for Project managed relocation (**Exhibit 7.4**). Out of 27 physically displaced households 16 (59%) HHs own land or can purchase land within the same villages or in Chitral District to construct their houses, 6 (22%) HHs like to migrate to other cities of the country while 5 (19%) HHs replied that they have not decided yet. Based on community preference, it is planned that AHs will be provided compensation amount and resettlement allowances and will be allowed to construct their houses on their own. All the AHs requiring relocation will be given sufficient time (4 months) after the payment of compensation and allowance to arrange their housing before evacuating their current houses.

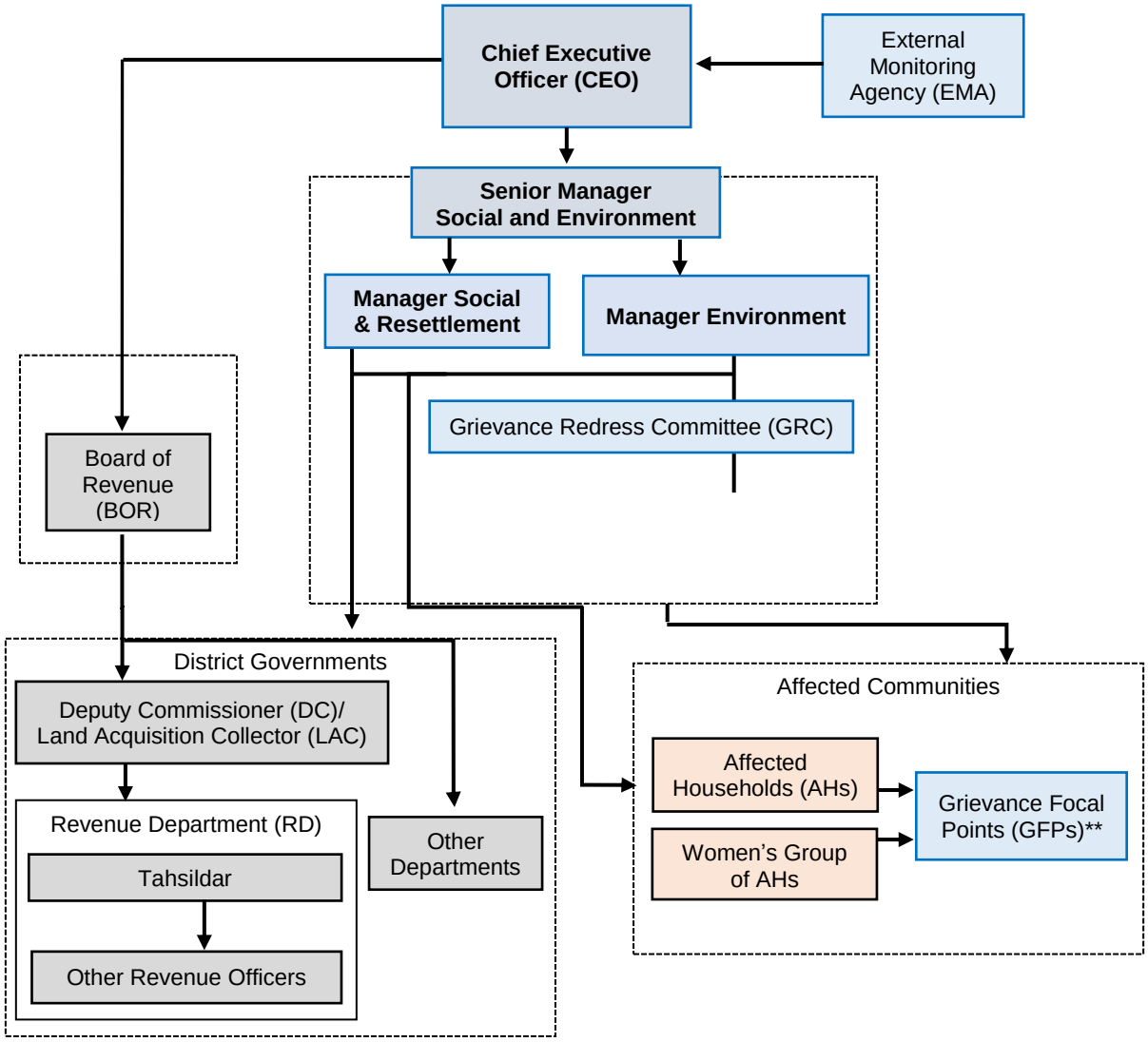
Out of the 48 AHs 27 AHs will be physically displaced and 26 will lose part of their livelihood in terms of cultivated land loss and loss of commercial structures. They will be compensated for their lands, crops, and structures in cash as in kind compensation is not possible due to unavailability of land in the affected villages or in nearby villages. Moreover, it will not affect their livelihood because agriculture is not the main source of income of the AHs as mentioned in Section 6.6 income from agriculture is 1.3% of the total income earning of the AHs. Out of these 26 AHs, 8 AHs will lose more than 10% of their monthly income earning as a result of land acquisition. Every HH losing his livelihood resources or places of income generation as a result of Project interventions will be supported with income and livelihood restoration assistance. Measures for immediate assistance include the following:

- Payments to compensate for land and other lost assets is settled in full before relocation;
- Provision of priority in employment in the Project or Project–related construction activities;
- Providing special allowance for vulnerable groups such as women and people under national poverty line;
- Providing severe impact allowance to AHs losing more than 10% of their regular income.
- Provision of vocational trainings to one person of every affected household.

Institutional Framework

Master Hydro (Private) Limited will establish a PMU for Arkari Gol HPP. For the efficient implementation and management of resettlement activities, a Social and Environment Unit and a Purchase of Land Unit will be established within the PMU. The Social and Environment Unit and Purchase of Land Unit will be accountable and responsible for the implementation of the RAP of the Project. The overall institutional arrangement for the Project is provided in **Exhibit III**.

Exhibit III: Institutional Arrangement for Implementation of Resettlement Action Plan



*CLO: Community Liaison Officer (male & female)

**GFPs: One literate male and one literate female from each community

Grievance Redress Mechanism and Monitoring

A two-tier village level and project level grievance redressal mechanism will be developed for redressal of the aggrieved affected persons.

The village–level GRC will be established to engage village–level community members/leaders to participate in the decision–making processes and to have "voices" of the aggrieved person/communities in the grievance redress procedures. This will also enhance local ownership of the Project. Having members based in the village, the village–level GRC will be helpful in resolving the grievances quickly often without going into lengthy documentation. The local participation will further build local capacity in

dispute resolution and decision–making and provide leadership support in the implementation of the Project. Cases which are not satisfactorily resolved or those in which APs remain aggrieved will then be forwarded to the Project–level GRC as the prime forum for resolution of the grievances.

The purpose of the GRM is to facilitate the resolving of disputes without going into litigation. In this regard, the decision of the Project level GRC will be final within the GRM. However, if any dispute remains unsatisfactorily resolved with the GRC outcome, the disputant can seek redress from a court of law. The composition of the two GRCs is shown in **Exhibit IV**.

Exhibit IV: Members of GRC

Organization	*Village GRC*	*Project GRC*
Master Hydro (Private) Limited	Representatives from PMU (1 Chairperson, 1 Secretary and 1 Member)	Representative from PMU (1 Chairperson, 1 Secretary and 1 Member)
Revenue Department	Concerned Patwari	LAC or LAC's Representative
Community	One or two elders nominated by the community	One or two elders nominated by the community

The GRC members will be selected by the Project management according to their responsibility and personal integrity. Community members of the GRCs will be selected after consultation with the communities. All GRC members will be approved and notified by the PMU. All the GRC members will be provided training and information regarding GRC members and their roles and responsibilities will be disseminated by the Project Management Unit (PMU).

For grievances related to social and environmental safeguards, the aggrieved person may file a grievance with the village–level GRC in one of the following ways:

1. Submit a written complaint to any member of the village GRC.
2. Given the local cultural context, any aggrieved women may submit complaints to GRCs directly or through the head of the HH.
3. Aggrieved person can also submit complaint to GRC through ordinary mail and email
4. Aggrieved person can also drop written complaint (anonymous, non-anonymous) in suggestion box fixed at the security gate and/ or any other accessible place.

On receipt of a complaint secretary of the GRC will register the complaint and convene a meeting of the GRC within 10 calendar days. On the appointed date the GRC may deliberate on the nature and circumstances of the complaint, investigate the complaint based on evidence provided by the complainant, meet with the complainant and other persons, visit the site and take a decision. In any case, all complaints shall be resolved within 30 calendar days of logging. Once the complaint is resolved the secretary will document the decision and prepare full documentation on the process including minutes of the meeting, photographs of visits, documents reviewed, and reasons for the decision.

The GRC will ensure that the complainant is fully informed of the decision and is also informed about his/her right to appeal to the Project GRC and to the court of law. If the complainant is not satisfied with the decision of the village GRC it may contact the Project GRC.

The PMU will ensure that it receives copies of all complaints, meeting notices, decisions, and documentation related to proceedings of the village and Project GRCs. The PMU will maintain complete records of the complaints in a database or tabular form. PMU will prepare a quarterly report on the GRM activities and these reports will be publically available on the Project's website and at the Project's field office.

Monitoring and Evaluation is a continuous process of collecting, collating and analyzing information about the progress of RAP implementation and a tool for identifying strengths and weaknesses of the process. Periodic evaluation of the process and the outcomes will enable Master Hydro (Private) Limited to identify deficiencies and implement corrective measures to achieve the desired goals and objectives of the RAP. The Project will be monitored internally as well as and externally. Objectives of monitoring and evaluation are;

- Assessment of implementation progress,
- Rescheduling key actions to meet the objective timelines,
- Early identification of issues,
- Resolving problems faced by the PAPs, and
- Developing solutions immediately to meet resettlement objectives.

The Project will be implemented during a period of 48 months. The implementation schedule has been formulated to accommodate different phases of the Project and therefore there will be different resettlement activities as necessitated by the civil works. Preparation for RAP implementation, particularly information dissemination and maintaining a constant dialogue with the PAPs, will continue throughout Project implementation.

Cost and Budget

The total estimated cost of this RAP including compensations for the affected lands, houses, crops, trees, cost of replacement of affected public structures, relocation allowances and technical assistance, administration charge 15% of compensations and 10% contingency has been estimated at PKR 620.59 million (US$ 5.33 million).

Conclusion and Action Plan

The RAP prepared for the Project provides relevant details including the legal framework, project impacts, socioeconomic conditions of AHs, resettlement planning, institutional framework, grievance redressal mechanism, monitoring, and evaluation plan, implementation schedule and budget for smooth execution of the land acquisition, relocation and resettlement of the AHs.

Due to limitations such as time constraints, unavailability of official prices of land and other structures and unavailability of final design there are some gaps left in the RAP.

These gaps will be addressed before financial closure and before implementation of the RAP. These gaps are as follows:

- As the official rates of affected assets have not yet been approved, after finalization of official rates budget for the RAP will be finalized;
- Due to lack of time and unavailability of final design it is possible that some of the affected areas and AHs, could not be surveyed. After the finalization of the design of the Project RFS will be conducted in remaining areas (if any);
- More consultations are required especially regarding relocation and livelihood restoration;
- The RAP will be improved as well as updated with the help of new data and official prices; and
- Prices of affected assets determined by district management will be reviewed and feedback from the AHs will be collected. If the prices are found to be less than replacement cost, additional amounts will be paid by the Master Hydro (Private) Limited.

For smooth implementation of the RAP Master Hydro (Private) Limited will establish a PMU at the Project site as a pre–construction activity to help build local capacity and confidence, and help the affected people and communities identify problems, constraints, and possible solutions. It will also provide the affected communities the confidence, motivation, and opportunity to address resettlement issues. The resettlement specialist will actively be engaged in activities related to (i) disclosure of Project impacts; (ii) consultation with AHs/communities; (iii) consultation with other stakeholders, including district administration, (iv) keep the community engaged with the Project to move Project implementation work forward.

The GRCs are to ensure accessibility, fairness, and independence of the procedures and communicating information and any other engagement regarding resettlement. Two Grievance Redressal Committees will be established at village level and at Project level to receive and resolve community issues during the land acquisition process and implementation of the RAP.

A databank on baseline/census data for the RAP implementation as well as monitoring and evaluation data on social and resettlement plans will be computerized for effective monitoring of the day–to–day progress in the field.

Internal monitoring of the RAP will be started as soon as the PMU is established and Master Hydro (Private) Limited will be responsible for preparation of the quarterly monitoring reports while at the same time Master Hydro (Private) Limited will also mobilize an external monitoring consultant.

Abbreviations

AH	Affected household
APs	Affected persons
CIA	Cumulative Impact Assessment
CSR	Corporate Social Responsibility
DPs	Displaced Persons
DRD	District Revenue Department
EA	Executing Agency
EFlow	Environmental Flow
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESIA	Environment and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GBHP	Ghazi–Barotha Hydropower Project
GIS	Geographic Information System
GRM	Grievance Redress Mechanism
HBP	Hagler Bailly Pakistan Pvt. Ltd
HH	Household
HPP	Hydropower Projects
IFC	International Finance Corporation
LAA	Land Acquisition Act
LAC	Land Acquisition Collector
LLOs	Low-level Outlets
LPG	Liquefied Petroleum Gas
MHL	Master Hydro (Pvt.) Ltd.
M&E	Monitoring and Evaluation
MDRP	Mangla Dam Raising Project
NRP	National Resettlement Policy
NTDC	National Transmission and Dispatch Company
OPIC	Overseas Private Investment Corporation
PAPs	Project Affected Persons

RAP	Resettlement Action Plan
RCC	Roller Compacted Concrete
RFS	Resettlement Field Survey

Units

amsl	Above Mean Sea Level
Kg	Kilogram
kg/m^3	Kilogram per Cubic Meter
km	Kilometer
km^2	Square Kilometer
kW	kilowatt
kWh	Kilowatt-hour
L/day	Liters per Day
M	Meters
m/s	Meter per Second
m^2	Square Meter
m^3	Cubic Meter
m^3/s	Cubic Meter per Second (cumec)
MW	Megawatt

Currency

PKR	Pakistani Rupees
USD	United States Dollar

Glossary of Terms

Affected Person	includes any person, affected households (AHs), firms or private institutions who, on account of changes that result from the project will have their (i) standard of living adversely affected; (ii) right, title, or interest in any house, land (including residential, commercial, agricultural, forest, and/or grazing land), water resources, or any other moveable or fixed assets acquired, possessed, restricted, or otherwise adversely affected, in full or in part, permanently or temporarily; and/or (iii) business, occupation, place of work or Residence, or habitat adversely affected, with or without displacement.
Affected Household	A Household affected by project-related changes in use of land, water, natural resources, or income losses.
Assistance	Means support, rehabilitation and restoration measures extended in cash and/or kind over and above the compensation for lost assets.
Awardees	Means the person with interests in land to be acquired by the project after their ownership of said land has been confirmed by the respective Deputy Commissioner's office as well as persons with interests in other assets to be acquired by the project. Compensation for acquired assets is provided to 'awardees' through notification under Section 7 of the Land Acquisition Ordinance.
Asset Inventory	A complete count and description of all property that will be acquired.
Compensation	Means payment in cash or kind for an asset to be acquired or affected by a Project at replacement cost at current market value.
Cut-off-date	This is the date on and beyond which any persons who encroach on the area are not entitled to compensation or any other form of settlement assistance. It is often established on the commencement date or last date of the census of APs.
Encroachers	Mean those people who move into the project area after the cut-off date and are therefore not eligible for compensation or other rehabilitation measures provided by the project. The term also refers to those extending private land into public land or constructing a structure on public for renting purposes.
Executing Agency	Executing agency means the agency, public or private, that is responsible for the execution of a development project.
Economic Displacement	Loss of land, assets, access to assets, income sources, or means of livelihoods as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas.

Entitlement	Means the range of measures comprising cash or kind compensation, relocation cost, income restoration assistance, transfer assistance, income substitution, and business restoration which are due to AHs, depending on the type and degree /nature of their losses, to restore their social and economic base.
Grievance Procedure	The processes established under law, local regulations, or administrative decision to enable property owners and other displaced persons to redress issues related to acquisition, compensation, or other aspects of resettlement.
Household	A household includes all persons living and eating together (sharing the same kitchen and cooking food together as a single-family unit).
Household Survey	A complete and accurate survey of the project-affected population. The survey focuses on income-earning activities and other socioeconomic indicators.
Inventory of losses	Means the pre-appraisal inventory of assets as a preliminary record of Affected or lost assets.
Involuntary Resettlement	Any resettlement, which does not involve willingness of the persons being adversely affected, but is forced through an instrument of law.
Income Restoration	Income restoration means re-establishing income sources and Livelihoods of APs.
Katcha	A house is considered katcha, if both the walls and roof of the house are made of a material that includes grass, leaves, mud, un-burnt brick or wood.
Land	Land includes benefits arising out of land and things attached to earth or permanently fastened to anything attached to the earth and land under water, well, footpath, road, tunnel, culvert, nala, bridge and street
Land Acquisition	Land acquisition means the process whereby a person is compelled by a public agency to alienate all or part of the land she/he owns or possesses, to the ownership and possession of that agency, for public purposes in return for fair compensation.
Mouza	A demarcated territorial unit for which separate revenue record including a cadastral map is maintained by the Revenue Department.
Non-titled	Means those who have no recognizable rights or claims to the land that they are occupying and includes people using private or public land without permission, permit or grant i.e. those people without legal title to land and/or structures occupied or used by them. JICA's policy explicitly states that such people cannot be denied resettlement assistance.
Physical Displacement	Relocation, loss of residential land, or loss of shelter as a result of (i) involuntary acquisition of land.
Pucca	A house/Structure is considered pucca if both the walls and roof of the house are made of a material that includes tiles, cement sheets, slates, corrugated iron, zinc or other metal sheets, bricks, lime, and stone or RBC/RCC concrete.

Project affected person	Any person (household) that loses their home, land, or business interests because of land acquisition.
Population Census	A complete and accurate count of the population that will be affected by land acquisition and related impacts. When properly conducted, the population census provides the basic information necessary for determining eligibility for compensation.
Public property	A building, land, place or premises vesting, in or under the management or control of Government, local council, autonomous body or registered cooperative society or such other authority;
Relocation	Means displacement or physical moving of the APs from the affected area to a new area/site and rebuilding homes, infrastructure, provision of assets, including productive land/employment and re-establishing income, livelihoods, living and social systems.
Rehabilitation	Assistance provided to affected persons to supplement their income losses in order to improve, or at least achieve full restoration of, their pre-project living standards and quality of life.
Replacement cost	Means the value of assets to replace the loss at current market price, or Its nearest equivalent, and is the amount of cash or kind needed to replace an asset in its existing condition, without deduction of transaction costs or for any material salvaged.
Replacement land	means the land affected by the project that is compensated through the provision of alternative land, rather than cash, of the same size and/or productive capacity as the land lost and is acceptable to the AP.
Resettlement	Means mitigation of all the impacts associated with land acquisition including restriction of access to, or use of land, acquisition of assets, or impacts on income generation as a result of land acquisition.
Resettlement Action Plan (RAP)	A resettlement action plan is the planning document that describes what will be done to address the direct social and economic impacts associated with the involuntary taking of land.
Resettlement Entitlements	Resettlement entitlements with respect to a particular eligibility category are the sum total of compensation and other forms of assistance provided to displaced persons in the respective eligibility category.
Semi Pucca	A house/Structure is considered semi Pucca if both the walls and roof of the house are made of a material that includes wood, planks, grass, leaves, and wall are made of bricks walls with mud masonry or un-burnt brick.
Squatters	Means the same as non-titled and includes households, business and common establishments on land owned by the State. Under the project, this includes land on part of the crest and slopes of canal dykes, flood control embankments, and similar areas of the drainage channels.
Structures	Means all buildings including primary and secondary structures including houses and ancillary buildings, commercial enterprises, living quarters, community facilities and infrastructures, shops, businesses, fences, and walls.

Socioeconomic Survey	The population census, asset inventory, and household survey together constitute the socioeconomic survey of the affected population.
Vulnerable Households	Means households that are (i) headed by single woman or woman with dependents and low incomes; (ii) headed by elderly/ disabled people without means of support; (iii) households that fall on or below the poverty line (iv) losing the last parcel of land (v) households of indigenous population or ethnic minority; and (vi) households of low social group or caste.
Vulnerable APs	Distinct groups of people who might suffer disproportionately from resettlement effects. They are the households below the poverty line or will become below the poverty line as a result of loss to assets and/or livelihoods, female headed households, or disabled persons.

1. Introduction

Master Hydro (Pvt.) Ltd. (MHL), a subsidiary of Master Industries, is developing the 99 megawatt (MW) Arkari Gol Hydropower Project (the "Project" or "AGHPP") in Khyber Pakhtunkhwa (KP). The proposed Project is a run-of-river (RoR) project located on Arkari Gol, which is a tributary of the Lutkho River in the Chitral District of KP.

The valley of Arkari Gol descends from an elevation of 6,952 meters above mean sea level (masl) and at Uchhatur up to 2,169.8 masl at the proposed dam site. On the basis of the 100 m Digital Elevation Model (DEM), the elevation in the watershed varies from 2,172 masl to 6,732 masl.

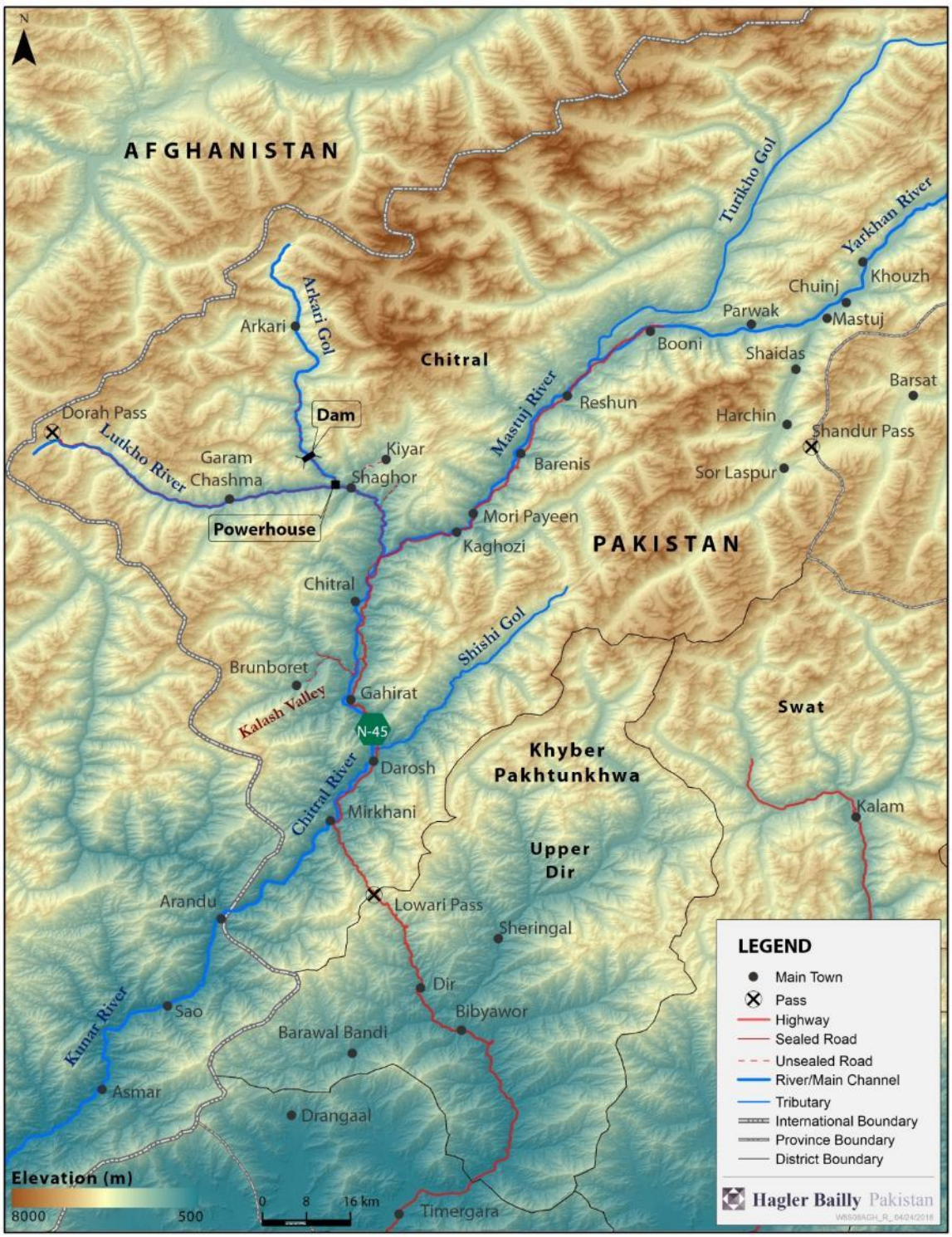
The Project area is accessible via road, at a distance of 460 km from Islamabad and 370 km from Peshawar, the capital of KP province. The location of the Project is shown in **Exhibit 1.1**. The Project is required to comply with the laws and regulations of Pakistan as well as guidelines of the Overseas Private Investment Corporation (OPIC).

A Feasibility Study of the Project (FS) was released in March 2014, based on which the optimized capacity was determined to be 99 MW. The optimized project will produce 378 GWh/year.

MHL has contracted the services of Hagler Bailly Pakistan (Pvt.) Ltd. to carry out an Environmental and Social Impact Assessment of the Project and prepare a Resettlement Action Plan (RAP).

This document is the RAP of the proposed Project.

Exhibit 1.1: Arkari Gol Hydropower Project Location



1.1 Objectives and Scope of the RAP

The RAP complies with the requirements of the Land Acquisition Act of 1894—the legal instrument governing land acquisition in Pakistan—and the requirements of OPIC.

The main objective of the RAP is to identify impacts and to plan measures to mitigate adverse social impacts resulting from loss of assets due to the construction of the several Project facilities such as the reservoir, powerhouse, construction camp, staff colony, access roads etc. The RAP is based on the findings of the census survey, field visits, meetings and consultations with various Project–affected persons (APs) in the Project area (area where land is required and to be acquired for the Project). The RAP presents (a) type and extent of loss of assets, including land and structures; (b) principles and legal framework applicable for mitigation of these losses; (c) the entitlement matrix, (d) relocation strategies and plan, including provisions for livelihoods, (e) resettlement budget; and (v) institutional framework for the implementation of the plan, including monitoring and evaluation.

To evacuate power from the proposed Project, the transmission line will be constructed by the National Transmission and Dispatch Company (NTDC) which falls into the category of associated project. The scope of the present RAP does not include the design, construction, and operation of the transmission line for evacuation of the power produced by the Arkari Gol HPP.

1.2 Study Team

The RAP has been developed by a team of professionals working with HBP or are associated with HBP, who are the leading experts in their respective fields in the country. The names of the study team members and their roles are shown in **Exhibit 1.2**.

Exhibit 1.2: Study Team

Name	*Education and Experience*	*Role*
HBP		
Anwar Fazal Ahmed	▶ MSc (Hons) Rural Development ▶ MA Economics 16 years of experience in resettlement planning and implementation	▶ Social Safeguards Expert (Land Acquisition and Resettlement) ▶ Household socioeconomic data collection, analysis, and reporting.
Muhammad Yasar Asad	▶ MS Sociology ▶ 8 years of experience in social development	▶ Social Safeguards Expert (Land Acquisition and Resettlement) ▶ Household socioeconomic data collection
Jan Muhammad	▶ MS Economics 8 years of experience in social development	▶ Socioeconomic field data collection ▶ Community Consultations
Muhammad Usman Berches Niazi	▶ M.Sc. Geography ▶ B.A. Geography and Economics 5 years of experience in Geographic Information Systems (GIS)	▶ Socioeconomic, physical and ecological report maps

Name	*Education and Experience*	*Role*
Ghulam Murtaza	▶ MSc Sociology (in progress) ▶ BA Sociology ▶ FSc Pre–Engineering 8 years of experience in geographic information systems (GIS) and 9 years of experience in ecology field surveys	▶ Socioeconomic, physical and ecological report maps
Imran Khalid	▶ Certification in MS Office and Hardware ▶ Graduation 12 years of experience in formatting and designing of technical documents	▶ Editorial Services
Umer Jahangir	▶ Graduation 7 years of experience in formatting and designing of technical documents	▶ Editorial Services
Kamran Minai	▶ MSc Environmental Science and Management ▶ BSc Biology 4 years of experience in environmental assessments	▶ Reviews and Quality Control

1.3 Organization of the Report

The RAP is organized into 14 sections including this section, **Section 1** (*Introduction*). The contents of the sections are as follows:

- **Section 1:** Introduction

Context and terminology

- **Section 2**: Legal, Policy and Institutional Framework
  - Discussion of Land Acquisition Act 1894 and the process that is followed to implement it in Pakistan.
  - Description of OPIC Guidelines.
- **Section 3:** Project Description
  - Brief description of the Project, focusing on aspects that require land.
  - Land acquisition options.
  - Considerations for maximizing public safety and minimizing resettlement and its impacts.
- **Section 4:** RAP Preparation Methodology
  - A detailed description of the methodology followed to prepare the RAP.
  - The limitations in the survey and its impact on the information contained in the RAP.

- **Section 5:** Project Impacts
  - A description of Project impacts including APs, affected households (AHs) and affected assets (private, communal and state land, trees, structures, crops).
  - A summary is provided in the section with more details in the appendices.
- **Section 6:** Socioeconomic Conditions

  Results of the socioeconomic survey of the AH. The survey covers the following:
  - Demography (population, male–female ratio, population pyramid, marital status, household size)
  - Education (literacy rate, educational achievement, children in school)
  - Livelihood (sources of livelihood, number of persons working, dependency ratio)
  - Housing information (construction type, ownership status, number of rooms, age of construction)
  - Available facilities (telephone, electricity, sewerage system, water supply, fuel)
  - Social profile (marriage pattern, decision making, migration pattern)
  - Family health (births and deaths, common illnesses, instances of serious illnesses, serious accidents)
  - Family assets (appliances, vehicles, livestock, land holding, farming implements)
  - Farming (crops, fruit trees, timber trees)
  - Family economics (income, loans, expenses)
- **Section 7:** Stakeholder Consultation
  - Description of the different modes of consultation and summary of the results.
  - The detailed consultation logs are included in the appendices.
  - The need and proposed mechanism for conducting future consultations.
- **Section 8:** Resettlement Planning
  - Entitlement matrix
  - Valuation mechanism
- **Section 9**: Relocation and Livelihood Restoration Plan
  - Relocation process
  - Livelihood restoration needs
- **Section 10:** Institutional Framework
  - Description of the institutions, their institutional capacities, their roles and their responsibilities in the implementation of the RAP.

- Coordination mechanism between institutions (District Revenue Department, Master Hydro (Private) Limited, monitoring and evaluation team, and others, if any).

- **Section 11:** Grievance Redress Mechanism
  - The process to register, track, review and address grievances of the APs during implementation.
- **Section 12:** Monitoring and Evaluation
  - The internal monitoring process of MHL
  - Key performance indicators
  - External monitoring and audit of RAP implementation
  - Reporting frequency and mechanism of monitoring and audit reports
- **Section 13:** Implementation Schedule
  - Steps in the implementation of RAP and the corresponding schedule. A brief description of the activities including linkages with Project activities.
- **Section 14:** Cost and Budget

  Details of financial resources required for implementation of RAP including, but not limited to:
  - Compensation for private land
  - Compensation for communal (Shamilat) land
  - Compensation for structures
  - Compensation for trees
  - Compensation for other assets
  - Compensation for crops
  - Relocation allowances
  - Compensation for loss of income during relocation
  - Operational cost
  - Compensation for government land and assets
  - Compensation for community assets
  - External monitoring and audit
  - Community development
  - Livelihood restoration
- **Section 15:** Conclusion and Action Plan
  - The need to update the census, inventory of assets, and costing at the time of implementation.

- The action plan for revising and updating the RAP.

- Appendices

Copies of the census and survey forms, consultation logs, detailed inventory of land and assets, maps, terms of reference for external monitoring.

2. Legal Instruments and Policy Framework

The legal framework of Pakistan which applies to land acquisition and compensation is discussed in this section together with the relevant OPIC guidelines as best international practices. This section also provides lessons learned from the experience of developing resettlement action plans in similar projects. The Resettlement Policy Framework for the Project is also established.

2.1 Legal Framework

The relevant legislation for land acquisition and compensation is included in the Land Acquisition Act of 1894 (amended). It sets out the procedure and rules for land acquisition and compensating the owners, as well as for compensating owners for damage caused to their properties, crops, and trees affected by projects. In 2001 and 2002, the government of Pakistan proposed "Draft Project Implementation and Resettlement of Affected Persons Ordinance 2001" and "Draft National Resettlement Policy (NRP), 2002". However, both the drafts have not been approved by the cabinet and Parliament and are no more under consideration, therefore, they are not applicable at present.

2.1.1 Land Acquisition Act 1894

The national law governing land acquisition is the Land Acquisition Act 1894 (LAA 1894) and successive amendments to it. The LAA 1894 regulates the land acquisition process and enables the government to acquire private land for public purposes. It sets out the procedure and rules for land acquisition and compensating the owners, as well as for compensating owners for damage caused to their properties, crops, and trees affected by projects.

The law comprises of 55 sections dealing with area notifications, surveys, acquisition, compensation, appointment awards, disputes resolution, penalties, and exemptions. Under section 23 of LAA 1894 and its amendments, in addition to the market–value of the land, a sum of fifteen percent of the market value as compulsory acquisition surcharge is to be paid to the AP, if the acquisition is for a public purpose and a sum of twenty–five percent on such market–value if the acquisition is made for a Company. The APs, if not satisfied, can go to the Court of Law to contest the compensation award of the Land Acquisition Collector (LAC).

Furthermore, from an operational point of view, the LAA is a provincial law and each province has its own version and interpretation of this law, mostly procedural in nature. Also, the LAA is unclear about the issue of customary rights over lands. These differences lead to different dispensations in compensation and resettlement packages for the APs. Furthermore, the LAA provisions are inadequate on many grounds – for example, (i) lack of attention to displacement and resettlement, (ii) low and delayed compensation, (iii) no assistance to non–titled persons; and (iv) no provision for post–resettlement support and assistance – and thus incomplete to deal comprehensively with project impacts.

The various sections relating to land acquisition are summarized in **Exhibit 2.1**.

Exhibit 2.1: Key Feature of the LAA 1894

Section	*Actions [Person Responsible]*	*Purpose and Effect*	*Citizens' Rights*	*Comments*
4	▶ Publication in the official gazette of a notification that a "land in any locality is needed or is likely to be needed for any public purpose or for a Company" [Collector] ▶ Public notice of the substance of such notification at convenient places in the said locality [Collector]	Allows preliminary investigation. In effect, it demonstrates the interest of the government that the "land in any locality is needed or is likely to be needed for any public purpose or for a Company" Allows the Collector to authorize persons to enter, and where necessary, clear the land to: survey the land; undertake soil and other studies for determining the suitability of the land; measure land and demarcate boundaries by placing markers.	▶ Before entering any building or other enclosed structure a 7–day notice shall be given to the occupier ▶ Any damage done to assets during the investigation shall be compensated	Publication of Section 4 notice only allows initiating of the preliminary investigation. It *may* result in the identification of specific land but is not necessary.
5 and 5A	▶ Publication in the official gazette by the government a) the intention of the government that any particular land included in section 4 notification is needed for public purposes or for a Company, b) the administrative location of the land, c) the purpose of land acquisition, d) its approximate area and e) location where the development plan for the land, if required, is available for public inspection, if required, [DC, if land required for public purposes or the provincial government if land required for a Company] ▶ Public notice of the substance of such notification at convenient	Notifies the intention of the government to acquire land for the particular purpose in order to give the opportunity to the interested persons (persons who would be entitled to claim an interest in compensation if the land were acquired) to file an objection to the land acquisition. The objection can be filed within 30 days.	▶ The right to review the plan ▶ The right to object to the plan ▶ The right to be heard in person or through pleader	▶ The objection raised by the interested persons are heard by the Collectors and the final decisions are taken by the Deputy Commissioner ▶ The declaration under section 5 is for seeking comments from the public. However, it still does not declare a firm intention on the part of the government.

Section	*Actions [Person Responsible]*	*Purpose and Effect*	*Citizens' Rights*	*Comments*
	places in the said locality's Collector			
6	► The Collector, if satisfied after reviewing the report made under Section 5–A, subsection (2), will make a declaration in the official Gazette with conclusive evidence, stating that particular land is required for public/private purpose. The declaration will include the location of the land, the purpose and its approximate area. ► The declaration shall be made only after ensuring that the compensation is to be paid by the Company.	Provides the declaration from the collector for the purchase of required land. The declaration is published and communicated to the public at large to notify the acquisition of land including its location, area, and purpose.	The right to know about the purchase of land for certain purpose.	The declaration can only be made after the compensation assessment and ensuring the purpose of the land acquisition.
7	After declaration under Section 6, the LAC issues the order for the acquisition of the land.	Official orders are given by the Executive District Officer, Revenue, directing the Collector, to initiate the formal land acquisition process.		
8	If the required land is not demarcated under Section 4, the Collector, will give orders to mark, measure and plan out the required land.	Demarcation of required land as per the exact requirement of the project.	Please see citizen rights of Section 4 of this document.	Publication of Section 4 notice only allows initiating of the preliminary investigation. However, the demarcation of land is necessary under Section 8.
9	► The Collector to issue public notice at convenient places on or near the land and in leading local and national newspapers to show intentions for acquiring required land and inviting to file claims for	To inform the landowners and the public at large, well ahead the time, about the acquisition of the demarcated land to ensure that interested persons are given sufficient time to object or claim.	► The right to know about the purpose behind the purchase of the demarcated land. ► The right to know well ahead of time so they can	The public notice shall only be issued after the demarcation of required land.

Section	*Actions [Person Responsible]*	*Purpose and Effect*	*Citizens' Rights*	*Comments*
	compensation, objections to measurements etc., indicating date, time and place for all the landowners, indicating such date not earlier than 15 days. ► The Collector also to serve notice, by post, to the occupier or to the known landowners (if any), residing within the revenue district or elsewhere. ► The Collector shall also serve notice, not less than 15 days prior to the date fixed under sub–section (2) of Section 9, to the landowners about the inquiry to be held under Section 11 for determination of claims and objections.		register their objections/claims in time.	
10	► The Collector will also require and send a notice to any other interested person (co–proprietor, sub–proprietor, mortgagee, tenant or otherwise) with interest/claim pertaining to the required land. ► Any person claiming any interest under this Section or Section 9 will be bound to do so within the meaning of Section 175 and 176 of Pakistan Penal Code.	To ensure that there are no financial discrepancies left unaddressed during the process of land acquisition and every person associated with the land is duly informed and their objection/claims are appropriately addressed.	The right of every interested person, associated with the land to be acquired, to know that the land is required by the government for some company so that they can claim their interests in time.	
11	On the fixed date, the Collector to enquire into the claims and objections of interested persons with regard to measurements made under Section 8, value of the land (at the date of the	To determine the actual landowners and precise measurements of the required land. This Section also ensures that the compensation paid is	The right to object on land ownership, measurement of land, price valuation of land and distribution of	The inquiries shall be conducted on the fixed date. Any change in date due to unforeseen and unavoidable circumstances should be

Section	*Actions [Person Responsible]*	*Purpose and Effect*	*Citizens' Rights*	*Comments*
	publication of the notification under Section 4, sub–section (1) and respective claims. The Collector can make an award (under his jurisdictions) of true area of the land, compensation which in his opinion should be allowed for the land and the distribution of the compensation among all the known or believed to be interested in the land, whether they have appeared before him or not.	a true representation of the value of land. To ensure that the compensation is fairly distributed among all the owners of the land.	compensation among the legal owners of the required land.	communicated to the interested persons well ahead the scheduled date and time and rescheduled in compliance with the time period of 15 days as mentioned in Section 9 of this act.
12	► The award filed in the Collector's office shall be deemed conclusive, whether the interested persons have appeared before the Collector or not. ► The Collector shall issue an immediate notice of the award to the landowners whether they have appeared personally or by their representatives when the award is made.	To avoid potential future conflicts between the government and the owners of the land. This ensures that the decision made by the Collector is final. To convey complete information in a timely manner to the landowners. This Section ensures that the landowners have complete information on the award irrespective of their presence in Collector's office.	They are communicated the award details whether they appear in Collector's office or not.	
12 –A	The Collector can rectify any mistake (typographical, arithmetical errors) in the award by his own motion or on the application of any of the parties.	To ensure that there are no errors or mistakes in the award or the assessment of the land. This ensures that the measurement and valuation of the land is done justly.	If a mistake takes place in the valuation of measurement of land, the citizens have a right to appeal to the Collector for the rectification of the error.	
13	The Collector may conduct or discontinue and reschedule the inquiry for any reason, any day/time fixed by him.	To implement check and balance on the system. This ensures a sense of responsibility for the government officers.	The citizens have a right to appeal to the Collector if they feel they have been treated unfairly by the government officers or the system.	

Section	*Actions [Person Responsible]*	*Purpose and Effect*	*Citizens' Rights*	*Comments*
14	The Collector is empowered by this Section to call and enforce the attendance of witnesses, including the interested parties or any of them to produce the documents by the same means, and in the same manner, as provided in the case of a Civil Court under the Code of Civil Procedures.	To avoid future conflicts and increase transparency in the land acquisition process. To ensure that only the rightful legal owners who have proper documents are paid the award and no illegal claims are entertained.	This Section ensures that no citizens are treated unfairly during the acquisition process.	
15	The Collector shall be guided by Section 23 and 24 in determining compensation.		The right to know about the matters which are included and excluded during the process undertaken to determine compensations.	Section 23 covers the matters to be considered in determining compensations while Section 24 covers those matters which are to be neglected during the determination of compensation.
16	Under this section, the Collector may take possession of the land, after the compensation paid to the owner of the land or deposited in the Civil Court in his name by the acquisition authority and the required land shall then be granted to the government without any further claim.	To ensure a smooth transfer of land rights from the owner to the acquisition authority. This gives security to the acquiring authority that once the award is paid in full, the Collector will take the possession of the land.	The right to receive compensation from the [Collector] against the claimed land.	The required land, under this act, is finally transferred to the government. The acquisition process, limited only to the transfer of land, completes at this Section. The government can then hand over the land to the company which wishes to develop it for public purposes.

2.1.2 Policy and Legal Framework for Grievance Procedure in Pakistan

The LAA 1894 allows for "objections" or "reference" to Court under Section 18 against any "award" of compensation by the LAC, requiring further review of the award. However, in case of grievance arising from "non–land" impacts and issues, there are no statutory mechanisms provided in the LAA 1894. The West Pakistan Requisitioning of Immovable Property (Temporary Powers) Act, 1956 provides for dispute resolution for buildings through arbitrator and court. Neither of the two Acts, however, has provisions on relocation and resettlement of project–APs or grievances related to resettlement entitlements and other extra–legal benefits.

2.2 Lessons from other Hydropower Projects and Good Practices

The construction of Mangla and Tarbela Dams in the 1960s and 1970s respectively led to the displacement of a large population due to land acquisition. The compensation was paid in accordance with the LAA 1894 and resettlement did not receive due attention as no planning was done on livelihood restoration and lands as compensation for lands were allotted in faraway areas of the country where APs were not willing to relocate. Later in the 1990s and early 2000s, the Ghazi–Barotha Hydropower Project (GBHP) and Mangla Dam Raising Project (MDRP) were implemented with comparatively well–developed resettlement plans, which were in compliance with guidelines of International Financial Institutions.

A review of resettlement experience in hydropower projects in Pakistan reveals adoption of many good practices that influenced better project management and outcomes. The good practices derived from the analysis have been incorporated in designing RAPs. Similarly, lessons learned from international best practices have also been considered. Based on these lessons along with market prices of the affected assets transaction costs and transitional costs have been considered in this RAP. Moreover for livelihood restoration trainings and livelihood restoration allowances are proposed in this RAP and to address grievances of the APs a grievance redressal plan is proposed.

2.2.1 World Commission on Dams 2000

The World Commission on Dams (WCD) established the most comprehensive guidelines for dam building. It describes an innovative framework for planning water and energy projects that is intended to protect dam-affected people and the environment, and ensure that the benefits from dams are more equitably distributed. The WCD framework covers key areas for improved planning of dams, including the need to fully assess all available options for meeting water and energy needs; addressing outstanding social issues from existing dams before building new ones, gaining public acceptance for key decisions, and the importance of protecting healthy rivers.[3] The Project is being constructed in an area with natural resources of value both in terms of ecology and socioeconomics. It is being financed by an international funding body, the OPIC, therefore, international standards, guidelines and best practices need to be considered.

[3] International Rivers, The World Commission on Dams, Available at <https://www.internationalrivers.org/campaigns/the-world-commission-on-dams>, accessed April 18, 2017

2.3 OPIC Environmental and Social Policy Statement

2.3.1 Statement of Purpose and Scope

OPIC's Environmental and Social Policy Statement ("Policy Statement") addresses OPIC's commitments regarding the environmental and social dimensions of sustainable development and provides applicants notice of the general environmental and social requirements that OPIC applies in evaluating prospective projects and monitoring on-going OPIC supported projects.

2.3.2 OPIC Commitment

As a development assistance agency of the United States Government, OPIC policies reflect the five principal goals of the United States development cooperation policy:

1. The alleviation of the worst physical manifestation of poverty among the world's poor majority.
2. The promotion of conditions enabling developing countries to achieve self-sustaining economic growth with equitable distribution of benefits.
3. The encouragement of development processes in which individual civil and economic rights are respected and enhanced.
4. The integration of developing countries into an open and equitable international economic system.
5. The promotion of good governance through combating corruption and improving transparency and accountability.

OPIC's Environmental and Social Policy Statement outlines how OPIC will put into practice its commitment to the development goals through its environmental and social review and monitoring processes. Specifically OPIC will ensure through its processes that projects receiving OPIC support:

- Are environmentally and socially sustainable.
- Are compatible with low and no-carbon economic development.
- Avoid prejudice and discrimination and respect Human Rights including the rights of Workers and the rights of Project Affected People.
- Avoid adverse impacts and, if such impacts are unavoidable, properly mitigate or compensate for the impacts.
- Undertake Meaningful Consultation with Project Affected People regarding project activities.
- Are undertaken in countries that are taking steps to adopt and implement laws that extend Internationally Recognized Worker Rights.

2.3.3 Source of Policy

This Policy Statement implements applicable environmental and social requirements and procedures contained in U.S. law. Additionally, this Policy Statement reflects specific policy commitments that have been made by OPIC with respect to environmental and

social policies and procedures. Finally, this Policy Statement adopts, as a standard for the environmental and social review process, the International Finance Corporation's (IFC) Performance Standards (PS) on Social and Environmental Sustainability, and Industry Sector Guidelines and any subsequent revisions to those standards.

2.4 IFC Performance Standards on Involuntary Resettlement

The main features of IFC PSs relevant to involuntary resettlement are summarized below.

1. The client will consider feasible alternative project designs to avoid or minimize physical and/or economic displacement, while balancing environmental, social, and financial costs and benefits, paying particular attention to impacts on the poor and vulnerable.
2. When displacement cannot be avoided, the client will offer displaced communities and person's compensation for loss of assets at full replacement cost and other assistance to help them improve or restore their standards of living or livelihoods.
3. The client will engage with affected communities, including host communities in decision–making processes related to resettlement and livelihood restoration.
4. The client will establish a grievance mechanism as early as possible in the project development phase. This will allow the client to receive and address specific concerns about compensation and relocation raised by displaced persons or members of host communities in a timely fashion, including a recourse mechanism designed to resolve disputes in an impartial manner.
5. Where involuntary resettlement is unavoidable, either as a result of a negotiated settlement or expropriation, a census will be carried out to collect appropriate socio–economic baseline data to identify the persons who will be displaced by the project, determine who will be eligible for compensation and assistance and discourage ineligible persons, such as opportunistic settlers, from claiming benefits.
6. In cases where APs reject compensation offers that meet the requirements of this Performance Standard and, as a result, expropriation or other legal procedures are initiated, the client will explore opportunities to collaborate with the responsible government agency, and, if permitted by the agency, play an active role in resettlement planning, implementation, and monitoring.
7. The client will establish procedures to monitor and evaluate the implementation of a RAP.
8. Implementation of a Resettlement Action Plan or Livelihood Restoration Plan will be considered completed when the adverse impacts of resettlement have been addressed in a manner that is consistent with the relevant plan as well as the objectives of this Performance Standard.
9. Where the exact nature or magnitude of the land acquisition or restrictions on land use related to a project with the potential to cause physical and/or economic displacement is unknown due to the stage of project development, the client will

develop a Resettlement and/or Livelihood Restoration Framework outlining general principles compatible with this Performance Standard.

10. Displaced persons may be classified as persons (i) who have formal legal rights to the land or assets they occupy or use; (ii) who do not have formal legal rights to land or assets, but have a claim to land that is recognized or recognizable under national law or (iii) who have no recognizable legal right or claim to the land or assets they occupy or use. The census will establish the status of the displaced persons.
11. Project–related land acquisition and/or restrictions on land use may result in the physical displacement of people as well as their economic displacement. Consequently, requirements of this Performance Standard in respect of physical displacement and economic displacement may apply simultaneously.
12. In the case of physical displacement, the client will develop a Resettlement Action Plan that covers, at a minimum, the applicable requirements of this Performance Standard regardless of the number of people affected. This will include compensation at full replacement cost for land and other assets lost. The Plan will be designed to mitigate the negative impacts of displacement; identify development opportunities; develop a resettlement budget and schedule; and establish the entitlements of all categories of APs (including host communities). Particular attention will be paid to the needs of the poor and the vulnerable. The client will document all transactions to acquire land rights, as well as compensation measures and relocation activities.
13. If people living in the project area are required to move to another location, the client will (i) offer displaced persons choices among feasible resettlement options, including adequate replacement housing or cash compensation where appropriate; and (ii) provide relocation assistance suited to the needs of each group of displaced persons.
14. In the case of physically displaced persons the client will offer the choice of replacement property of equal or higher value, security of tenure, equivalent or better characteristics, and advantages of location or cash compensation where appropriate.
15. In the case of physically displaced persons under paragraph 14, the client will offer them a choice of options for adequate housing with security of tenure so that they can resettle legally without having to face the risk of forced eviction. Where these displaced persons own and occupy structures, the client will compensate them for the loss of assets other than land, such as dwellings and other improvements to the land, at full replacement cost, provided that these persons have been occupying the project area prior to the cut–off date for eligibility.
16. The client is not required to compensate or assist those who encroach on the project area after the cut–off date for eligibility, provided the cut–off date has been clearly established and made public.
17. Forced evictions will not be carried out except in accordance with law and the requirements of this Performance Standard.

18. In case of projects involving economic displacement only, the client will develop a Livelihood Restoration Plan to compensate APs and/or communities and offer other assistance that meets the objectives of this PS.
19. Economically displaced persons who face the loss of assets or access to assets will be compensated for such loss at full replacement cost. In cases where land acquisition or restrictions on land use affect commercial structures, affected business owners will be compensated for the cost of re-establishing commercial activities elsewhere, for lost net income during the transition period, and for the costs of the transfer and reinstallation of the plant, machinery, or other equipment.
20. In addition to compensation for lost assets, if any, economically displaced persons whose livelihoods or income levels are adversely affected will also be provided opportunities to improve, or at least restore, their means of income–earning capacity, production levels, and standards of living.
21. Transitional support should be provided as necessary to all economically displaced persons, based on a reasonable estimate of the time required to restore their income–earning capacity, production levels, and standards of living.

2.5 Actions to Bridge the Gaps between IFC Policy and Legal Framework

There are gaps between LAA 1894 and IFC PS5. To establish an equal and appropriate land acquisition and resettlement system the Pakistan government proposed the "Draft National Resettlement Policy (NRP), 2002" and "Draft Project Implementation and Resettlement of Affected Persons Ordinance 2001." However, they have not been approved by the cabinet and Parliament, therefore, are not applicable at present. As described above, there are legal frameworks for public consultation for ESIA implementation but there are none for land acquisition and resettlement.

The differences between the Pakistani legal frameworks and IFC PS5 on land acquisition and resettlement are analyzed in the RAP and presented in **Exhibit 2.2**. It also provides measures to fill the gap. MHL is committed to addressing the gaps to achieve full compliance with both Pakistani and IFC requirements.

Exhibit 2.2: Pakistani Legal Frameworks and IFC Performance Standards

No.	*IFC Performance Standards*	*Laws of Pakistan (LAA 1894)*	*Gaps between IFC Performance Standards and Laws of Pakistan*	*Policy of measurement to fill the gap*
1	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.	None	There is policy or legal requirement for this.	The following criteria will be applied: ▶ Select alignments of drawn–in line and transmission line that can avoid involuntary resettlement and minimize the extent of land acquisition. ▶ Select uncultivated or grazing lands, or unencumbered government land as much as possible. ▶ Develop appropriate measures for protection of lives and livelihoods. ▶ Avoid any adverse impact on vulnerable people.
2	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken.	None	There is policy or legal requirement for this.	As a good practice the Project will follow the IFC guidelines.

No.	*IFC Performance Standards*	*Laws of Pakistan (LAA 1894)*	*Gaps between IFC Performance Standards and Laws of Pakistan*	*Policy of measurement to fill the gap*
3–1	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre–project levels.	▶ Land Acquisition Act (LAA), 1894: ▶ Land and crops are compensated in cash at the current market rate to titled landowners. In past practice land acquisition was usually based on the last 3 to 5 years average registered land–sale rates. However, in several recent cases, the median rate over the past 1 year, or even the current rates have been applied. In addition to the market–value of the land plus a sum of 15 percent amount as compulsory acquisition surcharge is also paid to the AP, if the acquisition has been made on a public purposes and a sum of 25 percent on such market–value if the acquisition has been made for a company ▶ Grant of lands in instead of awarding cash compensation can be arranged under Section 31 (3) of LAA 1894.	Compensation for land, crops, structures are required under LAA. However, there is no requirement of income and livelihood restoration or provision of opportunities for benefit sharing.	▶ This Project will follow the IFC guideline and provide restoration of livelihood and provision of benefit sharing. ▶ To determine the land price including communal lands, the followings may be considered: (i) the latest price paid for land recently acquired in the vicinity; (ii) the price paid in private transactions as discoverable from the register of mutations, and records of the land revenue office; (iii) all other information available, (iv) the committee may consult other people who are disinterested with regard to value of the land. ▶ Transaction costs and transitional costs will be paid to the APs like shifting allowance, severe impact allowance, vulnerability allowance. ▶ Livelihood restoration support and trainings will be provided to the AHs to restore livelihoods of AHs.

No.	*IFC Performance Standards*	*Laws of Pakistan (LAA 1894)*	*Gaps between IFC Performance Standards and Laws of Pakistan*	*Policy of measurement to fill the gap*
3–2	For houses and other structures, it is the market cost of the materials to build a replacement structure with an area and quality similar to or better than those of the affected structure, or repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors fees, plus the cost of any registration and transfer taxes.	▶ The valuation of structures is based on official rates, with depreciation deducted from gross value of the structure. ▶ Only registered landowners, sharecroppers and lease holders are eligible for compensation of crop losses. ▶ Tree losses are mostly compensated based on outdated officially fixed rates by the relevant forest and agriculture department.	▶ In Pakistan, the compensation for structures is the value based on official rates with depreciation deducted from gross value of the structure. ▶ A common practice is that the APs are given the option to use salvaged material to reconstruct their houses after payment of 15% of its market value to the Government.	▶ APs losing their productive assets (farmland, house or business), or in case of partial loss when the remaining assets are not viable for continued use, will be entitled for full compensation for the entire affected assets at replacement cost. ▶ The remaining of partial impact on their assets are viable for continued use, and where the livelihood is not land–based, the compensation for affected assets would be paid in cash. ▶ In determining the replacement cost, depreciation of the asset and the value of salvage materials are not taken into account, nor is the value of benefits to be derived from the Project deducted from the valuation of affected assets. The replacement cost also includes provisions to support any labor, construction costs or equipment.

No.	*IFC Performance Standards*	*Laws of Pakistan (LAA 1894)*	*Gaps between IFC Performance Standards and Laws of Pakistan*	*Policy of measurement to fill the gap*
4	Compensation must be based on the full replacement cost as much as possible.	None	There is no legal framework requiring provision of replacement cost.	▶ This Project will follow IFC guidelines. ▶ After finalization of the official rates revenue department will make an agreement with the affected communities. ▶ Compensation of communal lands will be paid to all the community members.
5	Compensation and other kinds of assistance must be provided prior to displacement.	In case of urgent acquisition, land possession shall be taken prior to payment of compensation.	There is no mechanism to ensure the payment of compensation before displacement.	This Project will make sure to prepare compensation and other forms of assistance in advance to displacement. The detail will be considered based on the results of socioeconomic surveys and public consultations.
6	For projects that entail involuntary resettlement, RAP must be prepared and made available to the public.	Land Acquisition shall be implemented based on negotiated purchase. Procedures available through signed instructions and agreement.	There is no law or policy that requires preparation of RAP	In this Project, RAP will be prepared referring to the IFC Performance Standard 5.
7	In preparing a RAP, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance.	The decisions regarding land acquisition and the amounts of compensation to be paid are published in the official Gazette and notified in accessible places so that the people affected are well informed.	No requirements for public consultations about RAP.	▶ The relevant information about land acquisition and resettlement will be published in the official Gazette in Urdu and English and notification will be made at places in the affected communities. ▶ In addition, public consultations will be held and all relevant information will be explained to the public.

No.	*IFC Performance Standards*	*Laws of Pakistan (LAA 1894)*	*Gaps between IFC Performance Standards and Laws of Pakistan*	*Policy of measurement to fill the gap*
8	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.	None	There is no legal framework specifying the language in consultations.	The consultations will use materials that can be easily understood by the people with no technical knowledge. The consultations will be held in Urdu language.
9	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.	None	▶ No requirements for public participation. ▶ No requirements to prepare and disclose monitoring reports.	▶ Public will be involved in preparation process of RAP. ▶ A monitoring plan will be enclosed in RAP.
10–1	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.	▶ APs are provided right for review, enquiry and complain of quantities and compensations. Any objection shall be made to the Collector in writing. ▶ Any person can object to the acquisition of the land for a public purpose within thirty days (30) after the issue of the preliminary notification. ▶ The Collector gives notice to all affected/displaced persons (APs/DPs) that the government intends to take possession of the land based on the land survey. If APs/DPs have any claims for compensation then those claims are to be made to the Collector at an appointed time.	▶ Grievance can be filed through the land acquisition process as ruled in LAA. However, there is no requirement to establish a grievance mechanism. ▶ Moreover, the Collector holds the powers to change even the negotiated land prices in Section 11 of LAA.	Grievance mechanism will be established and included in the RAP. The basic rules such as timing will be based on the LAA. Other structures will be referred to IFC PS 5 and practices followed in other similar projects.

No.	*IFC Performance Standards*	*Laws of Pakistan (LAA 1894)*	*Gaps between IFC Performance Standards and Laws of Pakistan*	*Policy of measurement to fill the gap*
10–2	Affordable and accessible grievance procedures for third–party settlement of disputes arising from resettlement should take into account the availability of judicial recourse and community and traditional dispute settlement mechanisms.	In case of dissatisfaction with "the award", displaced persons (DPs) may request the Collector to refer the case onward to the court for a decision within six (6) weeks from the date of Collector's award.	No gaps	Grievance mechanism will be established in appropriate manner.
11	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut–off date, asset inventory, and socioeconomic survey), preferably at the Project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.	The Collector is responsible for issuing notification of cut–off date in the Official Gazette, not the Project proponent.	The LAA rules the power and role of the Collector. However, the LAA does not include a mechanism of identifying affected people and land.	In this Project, IFC Performance Standards will be referred to identify the affected people, decide the eligibility criteria and entitlement matrix. The identification of affected people will be limited to a cut of date. For this Project The district LAC will be responsible to notify the cut–off date/Section 4 of LAA 1894 in the official gazette.after finalization of the cut–off date, official prices, and land records RAP will be updated accordingly. However to prevent the influx of ineligible non–residents who might take advantage of Project entitlements a cut–off date of start of RFS was fixed as cut off date.

No.	*IFC Performance Standards*	*Laws of Pakistan (LAA 1894)*	*Gaps between IFC Performance Standards and Laws of Pakistan*	*Policy of measurement to fill the gap*
12	Eligibility of benefits include, (1) the APs who have formal legal rights to land (including customary and traditional land rights recognized under law), (2) the APs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and (3) the APs who have no recognizable legal right to the land they are occupying.	▶ Only titled landowners or customary rights holders are recognized for compensation and any other support. ▶ Only registered landowners, sharecroppers and lease holders are eligible for compensation of crop losses. ▶ Tree losses are compensated based on outdated officially fixed rated by the relevant forest and agriculture department.	In Pakistan, untitled displaced persons are not entitled to rehabilitation support.	▶ The group of people who have no recognizable legal right or claim to the land they are occupying, will be provided "resettlement assistance" in lieu of compensation for the land they occupy, and other assistance to replace their shelter and income source such as productive land and structures for business. ▶ The cut–off date will be set to prevent any influx of encroachers and announced in the Official Gazette in Urdu and English.
13	Wherever possible preference should be given to land–based resettlement strategies for displaced persons whose livelihoods are land–based.	▶ Negotiated purchase of land shall be taken. ▶ Procedures available through instructions and agreement signed.	No gaps	There is provision for in kind compensation in LAA. However due to limited agricultural lands in the area and low dependency on agriculture (Section 6.6, only 1.3 % income is coming from agriculture) cash compensations are proposed in the RAP.
14	Provide support for the transition period (between displacement and livelihood restoration).	None	There are also no special allowances of support for transition period.	In this Project, IFC Performance Standards will be referred. Provision of support for transition period will be considered and enclosed in RAP.
15	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.	None	There are also no special allowances of support for vulnerable and tribal (indigenous/minorities) groups.	In this Project, IFC Performance Standards will be referred and attention will be paid to vulnerable people. Concerns and opinions of vulnerable people will be collected through focus group discussion and interviews.

3. Project Description

This section provides a brief description of the Project. The description is based on the FS carried out for the Project, released in March 2014.[4]

The Arkari Gol HPP is a run-of-river hydropower project with daily peaking throughout the year, to be constructed on the Arkari Gol. The Arkari Gol is a left tributary of Lutkho River. It joins Lutkho River about 1 km upstream Shoghore Village. The Arkari Gol is called Arkari Gol ('Gol' being tributary in local language). The drainage area of Arkari Gol up to the proposed dam site is about 1,036 km^2.

The dam and intake structure will be located 8 km upstream of the confluence of Arkari Gol and Lutkho River, near the village of Ucchatur in Chitral District, KP. The powerhouse will be located 7.5 km downstream of the dam on the right bank of Arkari Gol, near the village of Andakht.

The Project area is accessible via road, at a distance of 460 km from Islamabad and 370 km from Peshawar, the capital of KP province.

A map showing the Project setting is provided in **Exhibit 3.1**. The general layout of the Project facilities is shown in **Exhibit 3.2**.

3.1 Main Components

The main permanent structures to be designed are as follows:

- Concrete-faced rock-filled dam.
- Roller-compacted concrete (RCC) spillway.
- Bottom outlets for sediment flushing.
- Intake structure.
- Headrace tunnel.
- Pressure shaft and pressure tunnel.
- Surface-type powerhouse.
- Tailrace channel.

Temporary works comprise the diversion structures including the cofferdams and a diversion tunnel. The main structures are described below.

[4] Pakhtunkhwa Hydel Development Organization (PHYDO), Government of Khyber Pakhtunkhwa, March 2014, Feasibility Study for the Arkari Gol Hydropower Project, District Chitral, (Lower), Khyber Pakhtunkhwa, Volume 1, Main Report

Exhibit 3.1: Project Location

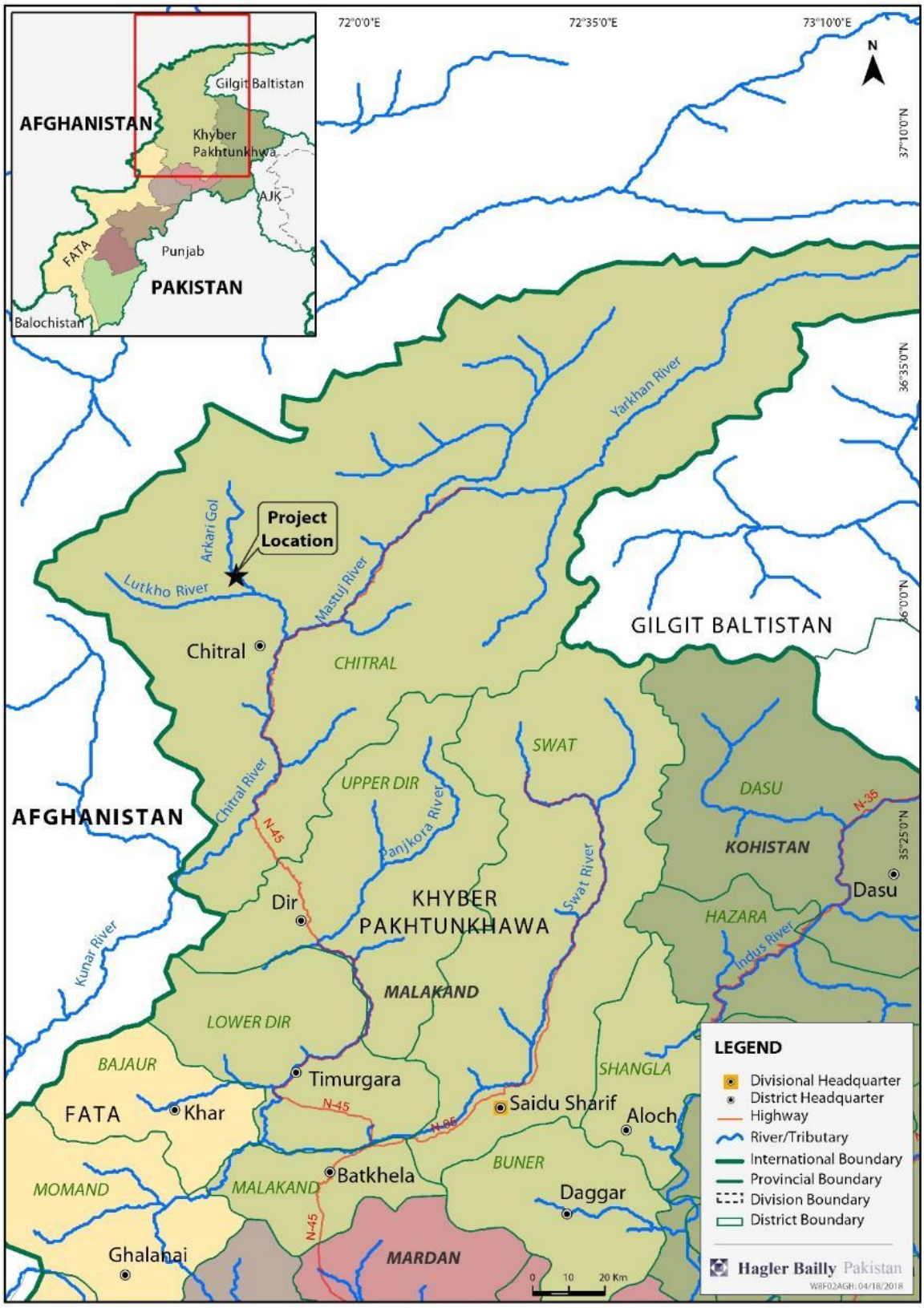
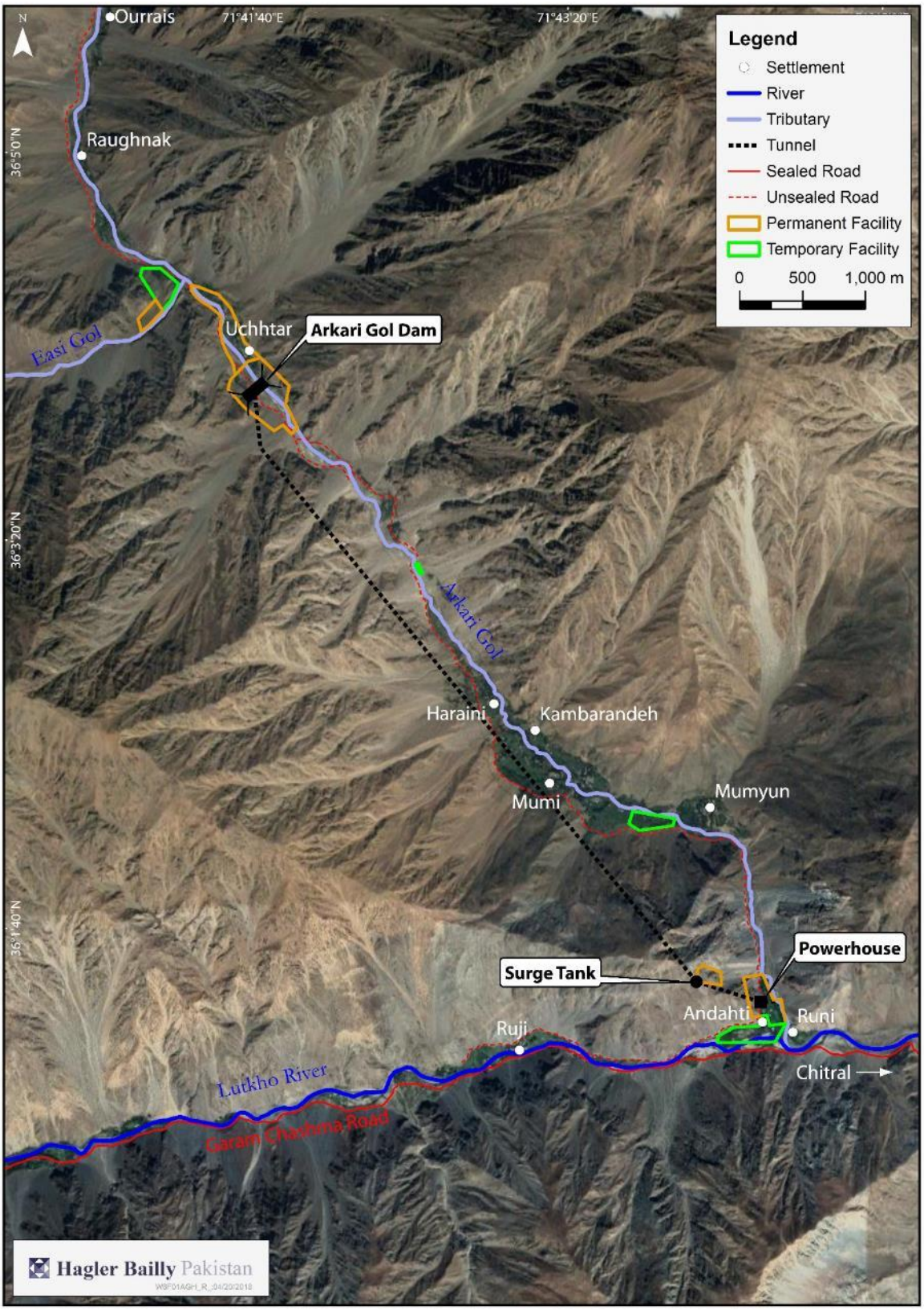


Exhibit 3.2: Project Layout



3.1.1 The Main Dam

The main dam will be a concrete-faced, rock-filled structure, with a height of 20 m above the riverbed. The soil investigations of the dam site show that the rock is about 100 m deep. Therefore a rock-fill type dam was recommended. Axis of the weir and diversion embankment has been selected on the basis of prevailing hydrological, topographical, geological and environmental conditions.

There spillway will comprise four units having four vertical roller gates with stoplog arrangements.

3.1.2 Powerhouse

Studies have shown a clear superiority of an external type powerhouse, located on the right bank of Arkari Gol near Andahti Village at the confluence of Arkari Gol and Lutkho River. The power station comprises following main structures:

- Turbine shaft for installation of three Pelton wheel turbines.
- Surface machine hall and operation building.
- Tailrace channel.

Three vertical shaft Pelton turbines are proposed. Each unit will be designed for a rated flow of 12 m^3/s producing a discharge of 36 m^3/s. This will result in a net head of 318 m and a rated mechanical turbine power of 33 MW. Therefore, total capacity will be 99 MW.

The gross head will be 335.33 m and net head 318 m. Maximum reservoir level will be 2,190 masl and tail water level will be 1,854.7 masl.

3.1.3 Intake Structure

The intake structure will comprise two bays fitted with vertical gates to regulate inflow from the reservoir. On each bay a trash rack will be provided upstream of the gates to check the entry of floating debris into the power waterway. The intake structure is proposed along the right bank of the river as close to the embankment of the dam as possible. This will facilitate flushing of sediment and maintenance of maximum submergence. A lateral structure is proposed to minimize head losses and accelerate flow uniformly for the trash rack to the gate downstream. The intake structure is designed to be capable of discharging the total design discharge for the turbines plus 20% of the design discharge for flushing of the sediments settled in the de-sanding chambers. Total design discharge of the intakes will be about 36 m^3/s.

3.1.4 Headrace Tunnel from Intake to Surge Tank

The headrace tunnel will run from the intake to the surge structure. The optimal internal tunnel diameter will be 4.4 m to give a rated discharge of 36 m^3/s for the Pelton turbines. The resulting flow will be approximately 3 m/s which is within the range allowed for concrete-lined tunnels.

3.1.5 Surge Tank

The surge structure branches at an elevation of 2,165.96 masl & 2,209.6 masl. The surge shaft is of an internal diameter of 4.5 m and is of 71.18 m high. A three-chamber surge tank has been selected.

- The Lower Chamber-A has a horseshoe section and a length of 96 m.
- The Lower Chamber-B has a horse shoe section and a length of 96 m.
- The end of the lower chambers will be connected again over a horizontal/vertical connection tunnel with the headrace tunnel.
- The upper chamber will be excavated from the working platform at an elevation of 74.5 m. The chamber has to be closed by a concrete wall with sufficient freeboard to the maximum surge level.
- Ventilation for the surge tank is proposed by an opening at the portal top.

The final dimensioning of the surge structures will need detail of basic requirements of the manufacturers for the hydro-mechanical equipment.

3.1.6 Pressure Shaft, Pressure Tunnel and Tailrace

The powerhouse and the pressure shaft will be connected by a pressure tunnel with a vertical length of 296 m. The total length of the tailrace channel to the outlet structure will be 100 m.

3.1.7 Reservoir

The Project is designed for a full supply level (FSL) at 2,190 masl creating a reservoir of volume of approximately 1.06 million m^3. The live operating storage is 0.489 million m^3. The reservoir will have a length of 1.3 km.

3.1.8 Sediment Flushing

Mean annual suspended sediment load at the weir site is about 0.259 million m^3. Mean annual bed load at the weir site is about 0.039 million m^3. Mean annual total sediment inflow to the Arkari reservoir is about 0.297 million m^3.

Based on information from the developers the reservoir will reach equilibrium seven years after construction. Flushing will be carried out annually over a period of 3-7 days during July (high flow season) depending on the sediment inflow.

3.1.9 Associated Facilities

To evacuate power from the proposed Project, the transmission line to be constructed by NTDC falls in the category of an associated project.[5] NTDC will be responsible for the design and construction, as well as the EIA, of these facilities.[6] To achieve environmental or social outcomes consistent with the IFC guidelines, which are being followed by

[5] The associated facility is defined as “facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable”

[6] Specific details on the transmission lines are not yet available.

OPIC, it is essential that NTDC undertake the environmental assessment of the transmission line and develop a sound ESMS consistent with the national and provincial legal environmental requirements as well as that of the IFC PSs. ESMS of transmission line will be developed as part of the design of the transmission line once Arkari Gol HPP project is finalized. The scope of Consultant's assignment does not include the evaluation of the design, construction, and operation of the transmission line for evacuation of the power produced by the Project.

3.1.10 Camps and Offices

Camps and offices will be required during the construction phase for the contractors' staff and engineers as well as for the clients engineering staff. As is the case with other hydropower projects, it is anticipated that low density housing and amenities will be provided. In addition, there will likely be a large labor workforce which will require accommodation. This may be a combination of married and single quarters.

3.2 Project Preparation and Construction

This section describes the following aspects related to Project construction:

- River Diversion
- Construction Timeline and Materials
- Spoil Disposal
- Quarry Areas

3.2.1 Main Construction Activities

River Diversion

River diversion facilities have been designed for up to 10-years return period of 284 m^3/s. The diversion facilities will be in service for approximately three years during construction. In case of floods with higher frequency the cofferdams would be over spilled and flushed downstream. The safety of completed concrete blocks in such an event depends on the stage of actual construction progress (bottom outlets). Design floods of higher frequency results in increasing cost for the temporary river diversion.

Construction Timeline

Based on the FS the Project will take 4 years (48 months) to construct. The construction will follow the following sequence:

- Mobilization
- Pre-construction works
- Diversion tunnel
- Dam
- Spillway
- Power canal from Intake structure
- Headrace tunnel

- Surge chambers
- Pressure shaft and pressure tunnel
- Tailrace canal

In parallel construction will be carried out on the powerhouse, switchyard and erection of equipment. Following this testing and commission will be done.

3.2.2 Construction Material

Materials required to carry out the construction of civil works include concrete aggregates, cement, pozolons, various types of fill materials and steel products.

3.2.3 Spoil Disposal

Excavation of tunnels, desanders, and forebay will result in the production of huge quantities of muck comprising various rock types. In the weir area the rocks expected from the excavation of desanders and the portion of headrace tunnel comprise of granitic gneisses and amphibolites.

3.2.4 Quarry Areas

Two huge deposits of crushed aggregate exist in the vicinity of Aawi village and are about 2 km from Shoghore. Coarse aggregates of this area are being extensively used in construction of road building and concrete production.

3.3 Transport Corridor

The Arkari Gol HPP will entail procurement, transportation and installation of heavy and large sized construction and powerhouse equipment such as cranes, turbines, generators, transformers etc. Most of the equipment will be imported from foreign countries and will land at Karachi Port before being transported to the Project site.

The road infrastructure beyond Chakdara will need rehabilitation/upgradation at certain sections. This will entail upgradation/maintenance of roads, bridges, culverts, tunnels etc. and improvements in their existing design parameters such as widths, clear heights, profiles, cross-sections, curves, slopes, loading class etc.

A final decision with regard to the route and mode of transport will however be taken after sufficient data is available for making a comparative analysis of the competing options.

4. RAP Preparation Methodology

The RAP of the Arkari Gol HPP has been prepared following the specific requirements of the law and best international practices such as IFC PS5. This section outlines the process that has been followed for the preparation of the RAP.

4.1 Preparatory Work

4.1.1 Affected Land Identification

The land required for the Project and therefore selected for the resettlement survey was identified by the Project Proponent following global standards for hydropower projects. The land will be acquired by the Government of KP following the applicable laws.

The required land is divided into two categories; permanent and temporary land acquisition. The land required for the life of the Project falls in the former category whereas the land required only for the duration of construction falls in the latter category. The LAA 1894, the law that governs the involuntary land acquisition by the government, has provision for permanent as well as temporary land acquisition. However, the duration of temporary acquisition is limited to three years and to only certain type of land. Also, a large portion of the land acquired temporarily will undergo geomorphological and topographical changes due to disposal of construction waste where it is not possible to restore to original condition before returning to the owners. For this reason all the land will be acquired permanently and all the AHs will be treated equally.

4.1.2 Affected Structure Identification

Based on the detailed study undertaken on international best practices to ascertain the optimal land scope line up to which the land will be procured and would be prudent in the best interest of the Project and adjoining communities for safe operations of the Project affected structures were identified using ***Google Earth™*** satellite imagery. Each identified structure was given a unique identification number. Maps showing the structures are provided in **Appendix A**. A database of the structures was also created for survey use.

4.1.3 Affected Agricultural Land Identification

Based on the land requirement specified in the FS, agricultural lands within the affected land were identified using ***Google Earth™*** satellite imagery dated May 24, 2016 and September 19, 2017. To the extent possible, each plot of land was separately marked and its area was determined. It is recognized that each plot thus identified does not necessarily mark the boundary between individual landowners. Due to hilly terrain, the agricultural fields are separated into terraces and a single owner's field may be located on several terraces. In some areas, the terraces are very small and it was not possible to mark them separately. All other plots were separately marked and given a unique identification number. Maps showing the agricultural fields are provided in **Appendix A**. A database of the fields was also created for later use.

There is always a chance of error using satellite imagery for identification of cultivated and uncultivated lands. Therefore, a detailed field survey was carried out by the HBP RFS team to collect more detailed and accurate data of cultivated and uncultivated lands. The data provided in the RAP is based on land survey by the resettlement team of HBP.

4.2 Field Surveys

Field surveys for the RAP consisted of five different but interrelated surveys. **Exhibit 4.1** provides the description and scope of the surveys. The forms used for each survey are given in **Appendix B**. For accuracy and efficiency data was collected digitally on tablets.

HBP started the fieldwork in the Project area based on geo–referenced maps of the affected lands. The starting point of the survey was the structures. The flowchart that was followed to ensure that all APs are identified is shown in **Exhibit 4.2**. In this manner it is anticipated that all APs falling in any of the following categories will be identified:

- Persons losing their residences, whether they are the owner or rent the property
- Persons not living on affected land but are co–owner of land with persons living on the affected land
- Persons who are not land owning but are land dependent i.e. share cropper, permanent laborer and informal land users.
- Persons not living on affected land but are owners of or are employees in, businesses located on the affected land
- Persons not living on affected land but are working in government or private institutions located on the affected land

4.3 Affected Person Consultation

Stakeholder consultation was undertaken as part of the ESIA of the Arkari Gol HPP where general opinion about the Project including resettlement was sought. In these consultations, communities' opinions about preference regarding relocation was collected moreover, questions regarding land acquisition, entitlement matrix, determination of fair replacement cost, resettlement planning and expectations from the MHL were asked.

Exhibit 4.1: Description of Field Surveys

Survey	*Objective*	*Scope*	*Form*
Census of APs and Project Impacts	▶ Identify all persons and households that are likely to be affected by the land acquisition ▶ Identify the type of impacts	▶ All owners of land, structures, businesses on the affected land ▶ All person otherwise associated with the land and businesses such as tenants and employees in the businesses	Census of APs and Project Impacts
Affected Structure	▶ Measure the dimension of the structure ▶ Ascertain its use ▶ Identify persons associated with the structure	▶ All structures on the affected land	Structure Survey Form
Affected Land	▶ Identify the owners of the agricultural land ▶ Identify non–resident owners of the land	▶ All agricultural land within the affected land	Census of APs and Project Impacts
Household Profile	▶ Collect information on the socioeconomic conditions of the AH	▶ All owners of land, structures, businesses on the affected land ▶ All person otherwise associated with the land and businesses such as tenants and employees in the businesses	Household Profile
Affected Business	▶ Collect information on the nature and volume of the business ▶ Identify persons whose livelihood is associated with the business	▶ All business within the Project footprint.	Business Survey Form

Exhibit 4.2: Flowchart to Identify All Affected Persons

Step 1	*Step 2*	*Subsequent Steps*	
Conduct Structure Survey	**If the structure is residential** Conduct: Census of APs and Project Impacts Household Profile Survey	**If the AH owns land** Conduct: Land Survey for agricultural and non-agricultural land Identification of other land owners, share cropper, permanent laborer and informal land users[7] and Census of APs and Project Impacts Household Profile Survey	**If the ownership of land is shared by other persons living outside affected land** For the other owners, conduct: Census of APs and Project Impacts Household Profile Survey
	If the structure is business Conduct: Business Survey	**If the business owner does not reside in the affected land** For the business owner, conduct: Census of APs and Project Impacts Household Profile Survey	**If there are persons working in the business who are not living in the affected land** For each such employee, conduct: Census of APs and Project Impacts Household Profile Survey
	If the structure is owned by the government or private institution or is a communal asset Conduct: Enter into Institutional Structure Register	**If there are persons working in the institution who are not living in the affected land** For each such person, conduct: Census of APs and Project Impacts Household Profile Survey	

[7] Users of the river (including mining, hunting, and fishing) that may be affected by the Project are covered in ESIA of the Project.

5. Project Impacts

This section presents the socioeconomic impacts of the Project based on land acquisition drawings provided by Project proponent, census of AHs and inventory of affected assets. The Resettlement Field Survey (RFS) was conducted from March 29 to April 15, 2018. Record of number of APs, their names, and photographs as evidence were taken during the RFS (see **Appendix C** and **D**). The population census provides the basic information to identify the magnitude of direct impacts and to determine eligibility for compensation.

5.1 Cut–off date

The cut–off date of eligibility refers to the date prior to which the occupation or use of the project area makes residents/users of the area eligible to be categorized as PAPs and therefore, eligible to Project entitlements.

The establishment of the eligibility cut–off date is intended to prevent any changes on the land to be acquired and to prevent the influx of ineligible non–residents who might take advantage of Project entitlements.

The district LAC will be responsible to notify the cut–off date/Section 4 of LAA 1894 in the official gazette. After finalization of the cut–off date, official prices, and land records RAP will be updated accordingly. However to prevent the influx of encroachers a date of start of RFS March 29, 2018 was fixed as cut–off–date. which was communicated to all AHs during consultation.

5.2 Affected Households

As shown in **Exhibit 5.1** by the execution of the Project a total of 48 households (HHs) will be affected. Out of total 48 HHs, 27 HHs' residences will be affected, 41 HHs' cultivated lands will be affected, 29 HHs' uncultivated lands will be affected 35 HHs will lose their fruit trees, 37 HHs will lose their non–fruit trees, 2 HHs will lose commercial structures and will lose their businesses.

Exhibit 5.1: Affected Households

Impacts	*Affected HH*
Loss of Residence	27
Loss of Cultivated lands	41
Loss of Uncultivated lands	29
Loss of Fruit trees	35
Loss Non–Fruit Trees	37
Loss of Commercial Structures	2
Loss of Livelihood	2

5.3 Type of Losses

The major impacts on the community are identified as loss of residence, loss of cultivated and uncultivated land, loss of structure and assets and loss of public infrastructure (see **Exhibit 5.2** for details). As claimed by the affected communities all the AHs are legal owners of the land.

Exhibit 5.2: Type of Losses by the Project

Type of Loss	*Unit*	*Quantity*	*No. of AHs*
Loss of Houses			
Houses	Number	27	27
Loss of Land			
Cultivated Land	kanal[8]	212	41
Uncultivated Land	kanal	156	47
Land under Houses and other Structures	kanal	32.22	27
Uncultivated Communal Land	kanal	719.95	0
Total	**kanal**	**1,120.17**	
Loss of Structure and Other Assets			
Loss of Cropped Area	kanal	212	41
Loss of Fruit Trees	Number	1,838	35
Loss of Non-Fruit Trees	Number	5,331	37
Loss of Commercial Structures	Number	2	2
Loss of Public and Community Infrastructure Assets			
Jamat Khana	Number	2	
School	Number	1	
Mosque	Number	1	

Source: Resettlement Field Surveys August 2017, Land records provided by the EA

5.3.1 Covered Area of Affected Structures

As provided in **Exhibit 5.3**, all the affected structures cover an area of 8,148 square meters (m^2). **Appendix C** provides photographs of affected structures and **Appendix D** provides census and inventory of affected HHs and assets.

[8] 1 Kanal = 505.86 square meter

Exhibit 5.3: Covered Area of Affected Structures

Affected Structures	*Construction Type and Covered Area (sq.meter).*			
	Pakka/ RCC	*Semi Pucka*	*Katcha*	*Total*
Houses	1,225	2,482	2,596	6,303
School (Public Structures)	1,500			1,500
Mosques (Communal Structure)	113	-	-	113
Jamat Khana (Communal Structure)	113	-	48	161
Shops	-	-	71	71
Total	**2,951**	**2,482**	**2,715**	**8,148**

5.3.2 Loss of Houses

As provided in **Exhibit 5.4**, 27 houses will be affected by the Project. The total area of these houses is 8,978 m^2. These HHs will receive replacement cost as well as relocation allowances.

Exhibit 5.4: Covered area of Affected Houses

Settlements	*No. of Houses*	*Estimated % of AHs to total HHs of the Settlement*	*Construction Type and Covered area of Houses (sq.meter)*				
			Puckka	*Semi Puckka*	*Katcha*	*Total*	*Percentage*
Mumi	1	1%	201.50	-	54.00	255.50	4.1%
Andahti	11	85%	638.50	1,323.30	618.50	2,580.30	40.9%
Uchhtar	15	68%	385.23	1,158.50	1,923.93	3,467.66	55.0%
Total	**27**		**1,225.23**	**2,481.80**	**2,596.43**	**6,303.46**	**100.0%**
Percentage			**19.4%**	**39.4%**	**41.2%**	**100.0%**	

5.3.3 Loss of Cultivated Land and Crops

Exhibit 5.5 provides details of estimated agricultural lands based on the statements of the AHs during RFS. A total of 212 kanals of cultivated land will be affected by the Project; moreover these HHs will lose their standing crops. These HHs will be compensated at market prices of the lands, crops and transitional costs as resettlement allowances provides in **Section 8** and **Section 9**.

Exhibit 5.5: Loss of Cultivated Land

Villages	*Number of HH*	*Estimated % of AHs to total HHs of the Village*	*Area (kanals)*	*Percentage*	*Estimated % of Affected land of total Land of the Village*
Mumi	12	17%	43.00	20.3%	5%
Andahti	13	100%	63.00	29.7%	63%
Uchhtar	16	73%	106.00	50.0%	88%
Total	**41**		**212**	**100.0%**	

5.3.4 Loss of Uncultivated Land

Exhibit 5.6 provides details of estimated uncultivated lands based on the statements of the AHs during RFS. A total of 156 kanals of uncultivated land (uncultivated year-round, barren lands) will be affected by the Project. AHs will be compensated at market prices of the land. Due to lack of time and unavailability of land owners in the area some of the owners (3-4 owners) of the uncultivated lands could not be traced. However as payments will be made on land records of Revenue Department and these are unproductive lands this limitation will not affect payments of AHs.

Exhibit 5.6: Loss of Uncultivated Land

Villages	*Number of HH*	*Estimated % of AHs to total HHs of the Village*	*Area (kanals)*	*Percentage*	*Estimated % of Affected land of total Land of the Village*
Mumi	4	7.5%	15.00	9.6%	1.0%
Andahti	11	84.6%	97.00	62.2%	6.5%
Uchhtar	14	0.0%	44.00	28.2%	5.2%
Total	**29**		**156**	**100.0%**	

5.3.5 Loss of Communal Land

Other than loss of private cultivated and uncultivated lands affected communities will also lose 720 kanals of uncultivated/barren land owned by all the members of the community. These lands are partially used for grazing and fuel wood collection. All the community members will be compensated for these communal lands according to the law. However as acquired communal lands are an insignificant part (less than 5%) of the entire communal land, it will not affect livelihood of the communities.

5.3.6 Loss of Fruit Trees

Exhibit 5.7 provides details of estimated number of fruit trees based on the information provided by the AHs during RFS. By the implementation of the Project 804 private fruit trees will be affected by the Project and will be compensated for.

Exhibit 5.7: Loss of Fruit Trees

Tree	*Young*	*Fruit bearing*	*Old*	*Total*
Apple	94	254	41	**389**
Apricot	93	306	70	**469**
Banana	-	-	-	**-**
Mulberry	21	49	10	**80**
Peach	27	100	14	**141**
Plum	12	9	1	**22**
Peer	2	5	-	**7**
Walnut	37	111	13	**161**
Orange	-	-	-	**-**
Guava	-	2	-	**2**
Pomegranate	18	58	4	**80**
Persimmon	7	7	2	**16**
Figs (Anjeer)	20	50	3	**73**
Other	83	283	32	**398**
Total	**414**	**1,234**	**190**	**1,838**

5.3.7 Loss of Non–Fruit Trees

Exhibit 5.8 provides details of estimated number of non-fruit trees based on the information provided by the AHs during RFS. By the implementation of the Project 5,331 private non-fruit trees will also be affected by the Project and will be compensated for.

Exhibit 5.8: Loss of Non–Fruit Trees

Tree	*Small*	*Medium*	*Large*	*Total*
Deodar	110	35	13	158
Kikar	233	475	245	953
Wild Olive (Kao)	-	15	-	15
Eucalyptus	291	891	251	1,433
Shishum	161	367	11	539
Other	573	1,032	628	2,233
Total	**1,368**	**2,815**	**1,148**	**5,331**

5.3.8 Loss of Commercial Structure

Other than residential structures two commercial structures (shops) will be affected by the Project. These affected structures are owned by two HHs, each HH owning one structure. Both the HHs will be eligible for compensation of lost assets and resettlement allowances.

5.3.9 Loss of Public and Community Infrastructures

By the execution of the Project, one Government school, one Mosque (Communal ownership) and one Jamat Khana[9] (Communal ownership) will also be affected. Project will be responsible to reconstruct these structures. Moreover Project will not affect any graveyard or culturally significant sites.

5.3.10 Loss of Livelihood

During the RFS, information regarding the source of livelihood, income earning and loss of income due to loss of land, loss of commercial structures and loss of other income-earning assets was collected. In addition, crops used by the HHs themselves were quantified and considered as part of HH income as well as loss of income due to loss of cultivated land.

As provided in **Exhibit 5.9**, out of 48 AHs, 26 AHs will lose part of their livelihood in terms of cultivated land loss and loss of commercial structures and will be compensated for their lands, crops, and structures. Out of these 26 AHs, 8 AHs will lose more than 10 percent of their monthly income earning as a result of land acquisition. AHs losing more than 10 percent of their livelihood will also be eligible for severe impact allowance. Moreover, one person from these severely AHs will be eligible for labor work or a job in the Project according to their skills and education. While 2 HHs losing their business will also be eligible for business loss allowance equal to 90 days net income.

Exhibit 5.9: Livelihood Impacts

Villages	*Number of Households*				
	Losing <10% Monthly Income	*Losing >10% Monthly Income*	*Total Households affected for livelihood*	*No loss of livelihood*	*Total Household*
Mumi	4	1	5	8	13
Andahti	5	6	11	2	13
Uchhtar	9	1	10	12	22
Total	**18**	**8**	**26**	**22**	**48**
Percentage	38%	17%		46%	

5.4 Impacts on Water Channels

There are four water channels, two on each side of Arkari Gol and more than 150 acres of land is irrigated through these water channels. Moreover, four water flour mills and one micro hydro power plant at settlement Mumi are also operating on these water channels. During the consultations local communities raised their concern that water channels may be damaged by the Project and this irrigation system may be affected. For the rehabilitation of water channels a lump sum amount has been allocated in the budget of this RAP.

[9] Worship place of Ismaili Muslims

6. Socioeconomic Conditions

This section presents an overview of regional socioeconomic conditions and a profile of APs based on a HH level socioeconomic survey. Survey was conducted at household level and information was gathered in a meetings with 2-3 members of the family including men and youth. Due to local norms women participated rarely in these meetings. It is important to document the socioeconomic conditions of the Project area as this will serve as a baseline for assessing the Project's success in restoring the livelihoods of the AHs.

The Project falls within the Chitral district in KP province. Affected settlements are poor in terms of HH incomes and available infrastructures in the affected settlements as compared to other areas of the district.

6.1 Infrastructure in the Affected Villages

The affected settlements are connected to main towns and cities through Arkari Road which links settlements to Chitral Garam Chashma road on one side and to Arkari town to other side. Arkari Road is an unsealed road in poor condition moreover, it is a landslide area and occasionally land sliding also damages the road. All the settlements are reported to have 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. Most human waste is disposed of in septic tanks.

Police presence in the entire area is quite low, police check post is available in Shaghor. There are no banks or markets within the affected structures. For major purchases the surveyed settlements depend on nearby town Shaghor, Garam Chashma and Chitral city. There are one or two small shops selling basic groceries found in all settlements.

6.2 Distribution and Demography of Affected Households

As shown in **Exhibit 6.1**, of the total 48 surveyed AHs, 13 HHs belong to Mumi settlement, 13 HHs belong to Andahti settlement and 22 HHs belong to Uchhtar settlement.

Exhibit 6.1: Village–wise Distribution of Affected Households

Location	*Affected Households*	*Parentage*
Mumi	13	27.1%
Andahti	13	27.1%
Uchhtar	22	45.8%
Total	**48**	**100.0%**

Source: Field Survey March, April 2018

The total population of surveyed HHs is 350 of which 52.3% are male and 47.7% are female and on average, each HH comprises 7.29 members (**Exhibit 6.2**). The female to male ratio of the AHs is 1:0.91.

Exhibit 6.2: Settlement–wise Distribution of Surveyed Households and Sex Ratio

Location	*AHs*	*Estimated % of AHs to total HHs of the Village*	*Sex*				*Population*	
			Male	*%*	*Female*	*%*	*Total*	*Average*
Mumi	13	18.6%	51	51.5%	48	48.5%	99	7.62
Andahti	13	100.0%	43	44.3%	54	55.7%	97	7.46
Uchhtar	22	100.0%	89	57.8%	65	42.2%	154	7.00
Total	**48**		**183**	**52.3%**	**167**	**47.7%**	**350**	**7.29**

Source: Field Survey March, April 2018

6.3 Social Profile of the Affected Households

The major castes of the AHs are Khauja Alanjas (27 %), Katur (27 %), Khujakhel (21 %), Zondray (8 %), Raees (6%), Shagoria (6%) and Dashmaner (4 %) as presented in **Exhibit 6.3**.

Exhibit 6.3: Castes of Affected Households

Social Groups/Caste	*No. of HH*	*Percentage*
Khuja Alanjas	13	27%
Katur	13	27%
Khujakhel	10	21%
Zondray	4	8%
Raees	3	6%
Shagoria	3	6%
Dashmaner	2	4%
Total	**48**	**100.0%**

Source: Field Survey March, April 2018

6.3.1 Religion and Languages

The Project area has a 100% Muslim population with a majority (91%) belonging to Ismaili sect of Islam while 9% of the population belongs to Sunni sect of Islam. Primary language of all the affected population is Khowar and secondary language of all the APs is Urdu.

6.3.2 Matrimonial Practices

It was observed that 48% of HHs have no hesitation to marry their children out of their clan (**Exhibit 6.4**). However, in the past, the matrimonial trend was to marry children

within the clan mostly to cousins. As shown in **Exhibit 6.5**, out of total 80 married couples, 18% are married to their first cousins.

Exhibit 6.4: Out of Clan Marriages

Settlement	*Total No of HH*	*HH who marry out of clan*	*Percentage*
Mumi	13	12	92.3%
Andahti	13	12	92.3%
Uchhtar	22	21	95.5%
Total	**48**	**45**	**93.8%**
Percentage	52%	48%	

Source: Field Survey August, 2017

Exhibit 6.5: First Cousin Marriages

Village	*Married couples to first cousins*	*Total Married couples*	*Percentage*
Mumi	1	22	4.5%
Andahti	4	25	16.0%
Uchhtar	9	33	27.3%
Total	14	80	17.5%

Source: Field Survey March, April 2018

6.3.3 Decision Making

As provided in **Exhibit 6.6** below, 85% HHs take consultative decisions regarding HH budget management, 96% HHs take consultative decisions regarding family conflicts, 96% HHs take consultative decisions regarding matrimonial decisions and 88% HHs take consultative decisions regarding property and asset management and inheritance. Moreover, when the AHs were asked, “are the daughters consulted in their marriages” 94% HHs replied “yes”.

Exhibit 6.6: Decision Making

Issue	*Unilateral*		*Consultative*	
	Number	*Percentage*	*Number*	*Percentage*
Household budget management	7	14.6%	41	85.4%
Family conflicts	2	4.2%	46	95.8%
Matrimonial decisions	2	4.2%	46	95.8%
Property and asset management and inheritance	6	12.5%	42	87.5%

Source: Field Survey March, April 2018

6.3.4 Educational Level and Literacy Rate

The socioeconomic survey conducted in the Project area revealed that the literacy rate among the surveyed population above the age of fifteen years is 77%. **Exhibit 6.7** further shows that the literacy rate for males is 84%, higher than that for females (70%).

Exhibit 6.7: Literacy Rate of Affected Population

Literacy level	*Total Number of Persons*		
	Male	*Female*	***Total***
Illiterate	18	33	**51**
Literate	97	78	**175**
Total	**115**	**111**	**226**
Literacy Ratio %	84.3%	70.3%	77.4%

Source: Field Survey March, April 2018

As provided in **Exhibit 6.8**, among literate people less than 1% obtained their education from a Madrasa, 8% have studied less than primary, 16% have education up to primary level, 21% have education up to Matric level, 16 % have education up to intermediate level, 7% have education up to graduate level and 9% have higher education.

Exhibit 6.8: Education Level of Affected Population

Education Level	*Total Number of Persons*			
	Male	*Female*	***Total***	***Percentage***
Illiterate	18	33	51	21.9%
Madrassah	2	-	2	0.9%
No or Less than Primary	12	7	19	8.2%
Primary (Class 5 to Class 9)	21	16	37	15.9%
Matric (Class 10)	25	24	49	21.0%
Intermediate (FA/FSc)	16	22	38	16.3%
Graduate (BA/BSc)	10	7	17	7.3%
Above Graduate	18	2	20	8.6%
Total	**122**	**111**	**233**	**100.0%**

Source: Field Survey March, April 2018

6.3.5 Culture, Religion, Ethnic Minority and Indigenous Structures

The IFC's Performance Standard 7 recognizes that "Indigenous Peoples (IP) are social groups with identities that are distinct from dominant groups in national societies and that they are often the most marginalized and vulnerable segments of the society. Their economic, social, and legal status limits their capacity to defend their rights to, and

interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also come under threat. As a consequence, Indigenous Peoples may be more vulnerable to the adverse impacts associated with project development than non-indigenous communities."

In IFC Performance Standard 7, the term "Indigenous Peoples" is usually used in a generic sense to refer to a distinct social and cultural group possessing the following characteristics in varying degrees:

- Self-identification as members of a distinct indigenous cultural groups and recognition of this identity by others;
- Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;
- Customary cultural, economic social or political institutions that are separate from those of the dominant society or culture; or
- An indigenous language, often different from official language of the country or region.

Keeping in view the above mentioned characteristics no Indigenous Peoples are residing in the Socioeconomic Study Area. More than 90% of the entire population of the Socioeconomic Study Area belongs to Ismaili sect of Islam and others belong to Ahle Sunat sect. Ismaili sect is in minority in entire Pakistan however, based on the above mentioned characteristics it cannot be categorized as Indigenous Peoples.

6.3.6 Gender

Generally in affected settlements activities of the women are confined to their houses and nearby areas. Examples of these activities are management of houses, livestock rearing and assisting their men in agricultural activities. Their social contacts are mostly limited to the settlement level. Women in the area are vulnerable, not only economically but also due to their poor educational level and lack of contacts outside their homes. They are also susceptible to risks due to the impacts of Project in terms of resettlement and relocation. This will further increase due to the large influx of in-migrants and construction workers to the area which will affect their privacy. Therefore it may be concluded that resettlement will have more effects on women as compared to the men. Starting economic and social activities at new places will be difficult for women. In this context if there is a women headed household being affected by the project it needs special assistance.

As detected through RFS one female-headed HH is being affected by the Project. Taking into account the socioeconomic vulnerabilities of the AHs, vulnerable allowance as discussed in Entitlement Matrix will be provided to AHs to ensure that they are not marginalized in the process of land acquisition and Project implementation.

6.4 Land Ownership and Land Holding Size

As provided in **Exhibit 6.9**, minimum cultivated land of a HH is 0.5 kanal and maximum is 32 kanals with an average of 4.80 kanals per household. While the minimum uncultivated land of a household is 1 kanal and maximum is 30 kanal with an average of 5.66 kanals per household. As stated by the land owners all the affected land owners have legal ownership of the land. In the affected settlements lands are owned by male as well as female members of the family because lands are inherited to both male and female children from their parents. However, lands are managed by the head of HH and mostly head of household is a male member of the family. Other than private land ownership lands are also communally owned. Communal lands are usually uncultivated and barren lands used for fuel collection and grazing of animals by the entire community.

Exhibit 6.9: Land Holding Size of Affected Households

Nature of Land	*Minimum (Kanal)*	*Maximum (Kanal)*	*Average (Kanal)*
Cultivated Land	0.5	32	4.80
Uncultivated Land	1.0	30	5.66

Source: Field Survey March, April 2018

6.5 Occupation and Production System

A majority of the working–age population surveyed were without any gainful employment. As shown in **Exhibit 6.10** of the people with gainful employment, about 34% were employed in private sector, 19% were employed in public sector, 13% percent were involved in agriculture, about 12% were working as skilled and unskilled labor and about 5% were doing trade or involved in their own business. Out of the total income earning population about 8% are female and 92% are male. In can also be concluded that out of total population of the affected settlements 22% people are involved in income earning activities and remaining 78% population comprises of small children, students old population and un-employed population

Exhibit 6.10: Occupational Profiles of Affected Population

Livelihood Sector	*No. of Persons*				
	Male	*Female*	*Total*	*% of Total Population*	*Population of Working age*
Employed in government Sector	15	-	15	4.3%	19.48%
Employed in private Sector	26	-	26	7.4%	33.77%
Pension	8	-	8	2.3%	10.39%
Self-employed, livestock rearing	1	3	4	1.1%	5.19%
Self–employed, working as artisans	1	-	1	0.3%	1.30%
Working as skilled or unskilled laborer	9	-	9	2.6%	11.69%
Self–Owned trade and business	4	-	4	1.1%	5.19%

Livelihood Sector	*No. of Persons*				
	Male	*Female*	*Total*	*% of Total Population*	*Population of Working age*
Income generating farming	7	3	10	2.9%	12.99%
Total	**71**	**6**	**77**		**100.00%**
Gender % of Total Population	**38.8%**	**3.6%**	**22.0%**		
Gender % of Working Population	**92.2%**	**7.8%**	**100.0%**		

Source: Field Survey March, April 2018

6.6 Source of Household Income

During analysis of HH income earned from different sources, income from agriculture was also included. Income from fruit trees and consumed crops by the HHs themselves (in terms of monetary value) was included in agricultural income.

The private and public sector (salaried jobs) sector is the main income-producing sector which accounts for 65% of the entire income followed by labor (15%) and business (10%). While the agriculture sector and livestock sector is producing 2% income. The annual income of AHs is presented in **Exhibit 6.11.**

Exhibit 6.11: Annual Income of Affected Households

Livelihood Sector	*Annual Income*	*Percentage*
Employed in government Sector	5,172,000	25.2%
Employed in private Sector	8,220,000	40.0%
Pension	1,080,000	5.3%
Self-employed, livestock rearing	145,000	0.7%
Self–employed, working as artisans	420,000	2.0%
Working as skilled or unskilled laborer	3,180,000	15.5%
Self–Owned trade and business	2,049,600	10.0%
Income generating farming	265,000	1.3%
Total	**20,531,600**	**100.0%**

Source: Field Survey March, April 2018

6.7 Average Income and Expenditure

As provided in **Exhibit 6.12** the average income of one HH is Pakistani Rupee (PKR) 484,033 per annum and average expenditures of one HH are PKR 225,592 per annum. While on average one HH is saving PKR 258,442 per annum.

Exhibit 6.12: Income and Expenditures of Affected Households

Income and Expenditures	*Income and Expenditures in PKR/Annum*		
	Minimum	*Maximum*	*Average*
Income	66,000	1,980,000	484,033
Expenditures	60,000	488,200	225,592
Savings	2,200	1,497,400	258,442

Source: Field Survey March, April 2018

6.8 Vulnerability

Certain groups of the population, by virtue of their socioeconomic realities, are considered socially vulnerable and thus in need of special consideration so that they can benefit from the development activities of the Project. These groups include; (a) hard core poor HHs (HHs under national poverty line); (b) female–headed HHs (FHH), (c) HHs headed by disabled persons, (d) HHs headed by elderly persons and (e) HHs headed by landless persons. The RFS revealed that out of total 48 AHs, 1 AH is female–headed HH and 14 AHs are below national poverty line. These will be considered as vulnerable AHs.

Poverty is usually measured as an index of income inequality. In Pakistan the poverty line is PKR 3,030[10] per person per month. Of the surveyed AHs, the proportion of HHs living under the estimated national poverty line is 29% (14 HHs) while, HHs earning more than PKR 10,000 per person per month are 10% (5 HHs), which can be considered as higher income level as given in **Exhibit 6.13**.

Exhibit 6.13: Income Level and Percentage of Affected Households Above and Below Poverty Line

Income Level PKR/Person/Month	*Number of HH**	*Percentage*
Up to 3,030 (national poverty line)	14	29.2%
3,030 to 5,000	11	22.9%
5,001 to 10,000	18	37.5%
10,001 and above	5	10.4%
Total	**48**	**100.0%**

Source: Field Survey March, April 2018

6.9 Housing

Exhibit 6.14 shows that 17 houses (35%) are having brick built construction with a tin roof (semi–*pucca*) while 16 houses (33%) are *katcha* (made of wood with mud walls) and houses having brick built construction with concrete roof (*Pucca*) are 15 (59%).

[10] Dawn <http://www.dawn.com/news/1250694> accessed on April 27,2018.

Exhibit 6.14: Construction Type of Houses

Village	*Construction Type (No. of Houses)*				
	Pucca	*Semi Pucca*	*Katcha*	*Other*	***Total***
Mumi	1	5	7	-	**13**
Andahti	4	8	1	-	**13**
Uchhtar	10	4	8	-	**22**
Total	**15**	**17**	**16**	**0**	**48**
Percentage	**31.3%**	**35.4%**	**33.3%**	**0.0%**	**100.0%**

Source: Field Survey March–April 2016

On average, one house has three rooms, one kitchen, and one bathroom. As given in **Exhibit 6.15**, 6% of the houses are small (less than 5 Marla), 29% of the houses are medium (5 Marla–10 Marla) and 65% of the houses are large (more than 10 Marla).

Exhibit 6.15: Covered Area of Houses

Village	*Covered Area (No. of Houses)*			
	Small	*Medium*	*Large*	***Total***
Mumi	1	6	6	13
Andahti	0	2	11	13
Uchhtar	2	6	14	22
Total	**3**	**14**	**31**	**48**
Percentage	6%	29%	65%	100%

Source: Field Survey March, April 2018

6.10 Household Assets

6.10.1 Appliances

Exhibit 6.16 shows the number of HHs having different home appliances.

Exhibit 6.16: Appliances Owned by Affected Households

Appliances	*No. of Appliances*	*No. of HH*
Television	42	42
Refrigerator/Freezer	9	9
Washing Machine	34	33
Electric Iron	47	45
Electric Fan	57	34
Electric Room Heater	37	23

Appliances	*No. of Appliances*	*No. of HH*
Electric Water Heater/Geyser	26	23
Sewing Machine	40	39
Computer	12	10
Generator	0	0

6.10.2 Livestock

As provided in the **Exhibit 6.17** type of livestock found in the Project area includes buffaloes, cows, calves, goats, sheep, oxen and chicken. During the field survey, it was observed that most of the HHs keep livestock. Of the HHs who keep livestock 100% keep livestock for self–consumption.

Exhibit 6.17: Livestock Owned by Affected Households

Livestock	*No. of Livestock and Use*				
	Self	*Commercial*	*Both*	*Total*	*Percentage*
Buffalo	2	–	–	**2**	0.5%
Cow	96	–	–	**96**	24.1%
Oxen	6	–	–	**6**	1.5%
Calf	46	–	–	**46**	11.5%
Goat/Sheep	35	–	–	**35**	8.8%
Lamb	–	–	–	**–**	0.0%
Horse	–	–	–	**–**	0.0%
Donkey	–	–	–	**–**	0.0%
Chicken	209	–	–	**209**	52.4%
Other	5	–	–	**5**	1.3%
Total	**399**	**–**	**–**	**399**	
Percentage	**100.0%**	**–**	**–**	**100.0%**	

Source: Field Survey March, April 2018

6.10.3 Vehicles

As provided in **Exhibit 6.18** type of vehicles owned by AHs include motorcycles and cars which are used for personal as well as commercial purposes.

Exhibit 6.18: Vehicles Owned by Affected Households

Type	*Number of Vehicles*			
	Personal	*Commercial*	*Both*	***Total***
Car	3	4	–	**7**
Motorcycle	13	–	–	**13**
Total	**16**	**4**	**–**	**20**

Source: Field Survey March, April 2018

6.11 Water and Sanitation

The main source of drinking water for AHs is the natural spring's water. Most of the HHs have installed pipelines from water springs to bring water to their houses. People irrigate their agricultural fields with river water through water channels.

There is no proper sanitation system in the Project area. Some people discharge their sewerage on the land to the agricultural fields or to the stream. All the affected 48 surveyed HHs have a Septic tank.

6.12 Fuel Sources

The fuel sources commonly used by AHs are electricity, fuelwood, liquefied petroleum gas (LPG) as given in **Exhibit 6.19**.

Exhibit 6.19: Fuel Sources used by Affected Households

Fuel Sources	*No. of HHs*			
	Lighting	*Space heating*	*Water heating*	*Cooking*
Electricity	33	-	-	-
Fuel Wood (Gathered)	-	36	36	36
Fuel Wood (Market)	-	11	11	11
LPG	-	-	-	10
Kerosene	-	-	-	-

Source: Field Survey March, April 2018

6.13 Family Health

6.13.1 Births and Deaths

During the last two years in the AHs 13 live births and 2 still births took place. There was no serious illness reported in the AHs in last two years as shown in the (**Exhibit 6.20**).

Exhibit 6.20: Serious Illness and Outcome

Illness	*No. of Persons and Outcome*					
	Treated	*Persisting*	*Disability*	*Lost job or occupation*	*Death*	*Total*
Tuberculosis	–	–	–	–	–	–
Hepatitis	–	–	–	–	–	–
Asthma	–	–	–	–	–	–
Jaundice	–	–	–	–	–	–
Tetanus	–	–	–	–	–	–
Paralysis	–	–	–	–	–	–
Diabetes	–	–	–	–	–	–

Illness	*No. of Persons and Outcome*					
	Treated	*Persisting*	*Disability*	*Lost job or occupation*	*Death*	*Total*
Cancer	–	–	–	–	–	–
Heart disease	–	–	–	–	–	–
Other	1	–	–	–	–	1
Total	**1**	–	–	**–**	**–**	**1**
Percentage	**100.0%**	–	–	–	–	**100.0%**

Source: Field Survey March, April 2018

6.13.2 Common Illnesses

As provided in the **Exhibit 6.21** common illnesses reported by the surveyed HHs were cold and flu, stomach, Diarrhea, Blood Pressure, Malaria, Blood Pressure and joint aches.

Exhibit 6.21: Common Illness

Common Illness	*Age Group*				*Total*	*% of Common Illness*
	Adult men	*Adult Women*	*Children*	*Infants*		
	(15 to 65)	*(15 to 65)*	*(6 to 14)*	*(0 to 5)*		
Flu/Fever	46	48	41	31	166	72%
Diarrhea/Dysentery	5	5	3	1	14	6%
Skin diseases	–	1	–	–	1	–
Breathing problems	1	1	–	–	2	1%
Diabetes	–	1	–	–	1	–
Typhoid	–	–	–	–	–	–
Malaria	5	5	2	1	13	6%
Joint aches	6	5	–	–	11	5%
Jaundice	–	–	–	–	–	–
Chicken Pox	–	–	–	–	–	–
Tetanus	–	–	–	–	–	–
Goiter/Thyroid	–	–	–	–	–	–
Allergy	–	–	–	–	–	–
Blood Pressure	7	7	–	–	14	6%
Other	3	3	1	–	7	3%
Total	**73**	**76**	**47**	**33**	**229**	
% of Common Illness in different age groups	**20.9%**	**21.7%**	**13.4%**	**9.4%**	**65.4%**	

Source: Field Survey March, April 2018

7. Stakeholder Consultation

Stakeholders are groups and individuals that are affected by or can affect the outcome of a project. This section describes the process of consultation with stakeholders, summarizes their concerns and discusses the mechanism of addressing the raised concerns.

7.1 Identification of Stakeholders

The Project will have direct and indirect impacts on local communities. The person who will lose his land, assets, and livelihood due to the Project is classified as "directly AP" whereas the person who will be affected by the noise, dust and traffic generated as a result of Project activities will be classified as "indirectly AP".

Project stakeholders are all Project affected persons (PAPs) and Project beneficiaries. **Exhibit 7.1** describes the primary and secondary stakeholders of the Project.

Exhibit 7.1: Primary and Secondary Stakeholders

Type of Stakeholder	*Stakeholder Profile*
Primary	All Project APs, HHs, communities, clans, and sub–clans; Project owner, Project beneficiaries – for instance, residents of the Project area, including the resettled communities and users of electricity.
Secondary	Government departments/agencies of KP, District administration, Project contractors, construction workers, in–migrants and followers, supply and service providers, mass media/civil society members, consultants and Project advisors

7.2 Information Disclosure

The main objective of the consultation and participation is information disclosure. Information regarding the Project was disseminated to the Project affected people in particular and local communities in general from ESIA scoping sessions in April 2018. For information disclosure, a Background Information Document in Urdu (**Appendix E)** and maps showing affected structures (**Appendix A**) was shared with the communities. Consultation process included two methodologies; one was door to door individual HH consultation and other was group discussions.

At these consultative meetings the following points were discussed:

- Project details;
- Construction related impacts;
- Reduction in power outage and revival of the affected economies;
- Land acquisition;
- Relocation of houses and different relocation options; and
- Resettlement issues.

7.3 Purpose of Consultation and Participation

The purpose of consultation and participation has been to ensure meaningful and adequate consultation with all stakeholders in Project planning processes, particularly the primary stakeholders in the Project area. Thus, the resettlement planning processes have followed a participatory planning process with local inputs in decision–making, policy development and mitigation measures. Provisions for disclosures and mechanisms for information sharing among the stakeholders are also discussed.

This is also in compliance with the requirements of the international financing agencies such as IFC, which give high priority to public consultation and participation in designing and implementation of a socially and environmentally compliant Project.

7.4 Consultation Process

The consultations involved multiple methods including, HH level interviews, community meetings, and focus group discussions. The consultative process undertaken for the preparation of the RAP has included not only AHs, but also the local communities of the area. Special attention was paid to identify the needs of vulnerable groups (such as the poor, women, and elderly), to ensure that their views have been considered in the formulation of the RAP. This section summarizes consultations undertaken with the directly affected communities and consultations with the communities in the entire land acquisition area (the area is shown in **Appendix A**) while consultations with other stakeholders are provided in **Section 6** of the main **ESIA** Report.

Consultation with stakeholders at different stages of the Project is a requirement of the EPAs. The communities' and especially the AHs' responses to the proposed Project were found to be positive.

The consultation team consisted of one male consultation expert and one female consultation expert as well as a Gender Specialist. The field work and consultation process in the land acquisition area was carried out from March 29 to April 15, 2018, to understand the concerns and grievances of the directly and indirectly AHs. For this purpose, the consultation team held meetings with groups of men and women from settlements in the land acquisition area. A total of 13 group discussions and consultation sessions were held with seven groups of men and six groups of women, wherein a total number of 114 persons (53 men and 61 women) participated. During these consultations effort was made that at least one person from each AH should participate in the meetings.

During the same consultation sessions, the cut–off date for compensation eligibility, was communicated to all the participants. They were clearly told that no subsequent changes in the land use would be entertained by the Project for any compensation or financial assistance. **Exhibit 7.2** provides the number of participants in different consultations in different villages and **Exhibit 7.3** provides photographic documentation of the consultations.

Exhibit 7.2: Participants in Consultations

No	*Settlements*	*Number of Participants*		
		Men	*Women*	*Total*
1.	Raughnak	4	0	**4**
2.	Mumyun	8	9	**17**
3.	kambarandeh	9	10	**19**
4.	Haraini	6	11	**17**
5.	Andahti / Runi	10	13	**23**
6.	Uchhtar	8	11	**19**
7.	Mumi	8	7	**15**
	Total	**53**	**61**	**114**

Source: Field Survey, August 2017

Exhibit 7.3: Photographic Documentation of Consultations

Consultation with men at Andahti

Consultation with men at Mumi

Consultation with men at Uchhtar

Male Consultation with men at Mumyun

Consultation with women at Mumi

Consultation with women at Haraini

Consultation with women at Uchhtar

Consultation with women at Mumyun

7.5 Concerns Raised by the Affected Communities

The overall attitude of the communities towards the Project was positive. They support the Project and provided substantial assistance to the Resettlement Field Survey team for carrying out surveys. Locals are of the opinion that the Project is necessary for the current situation of power supply and demand. They are willing to give their lands at a fair price and to work in the Project construction activities and benefit from the Project.

The concerns raised in the consultation meetings with the directly affected communities are summarized as follows:

- Majority of the APs expressed concern about receiving fair compensation rates and payments for lost assets such as houses, land, and trees. They proposed that any land that might be affected due to the Project must be compensated at market prices.
- Some of the APs suggested that Project authorities could provide communities with land in exchange for the acquired land.
- Incomes would not be restored to current levels and adequate employment opportunities in the Project would not be provided to the local community.
- Some people also expressed their concern that due to blasting in the area land sliding may increase.
- Some people expressed the need for basic amenities i.e. health, education, roads, safe drinking water.

- Most of the community women were not willing to give their land, especially the land on which their residence is located.
- Community women emphasized that they want rates higher than the market value as the value of land will increase after execution of the Project. Therefore, they will not be able to buy land at current market prices.
- Children's education will be affected due to the Project activities, heavy traffic, and labor in the area.
- Mobility of women will be affected due to construction activities in the area.
- Due to the cutting of trees and construction work the environment will be affected.

7.5.1 Relocation Options Discussed

During the RFS relocation options were also discussed with the head of HH and other members of the HHs[11]. As provided in **Exhibit 7.4** during the HH consultations and group discussions it was observed that out of 27 physically displaced HHs the majority of the AHs prefer to relocate by themselves and none of them opted for Project managed relocation however, few 19% said that they have not decided yet.

Exhibit 7.4: Relocation Options

Relocation Options	*Number*	*Percentage*
On your own land	–	–
Project developed site	–	–
Within the same village	–	–
Within the district	16	59.3%
Not decided yet	5	18.5%
Others	6	22.2%
Total	**27**	**100%**

7.5.2 Feedback from the Stakeholder Consultations

Feedback from the stakeholder consultations is as under:

- Locals should be given due share in the employment opportunities created by the Project;
- Fair and timely compensation of land and assets should be made;
- Vocational training should be given to young men and needy people;
- Basic amenities like health, education, roads, safe drinking water should be provided to the affected communities;

[11] Women rarely participated in these meetings due to local norms.

- Community/public assets like schools and health facilities should be provided in the post–Project period where relocated; and
- Workers from inside and outside the Project area should respect the local norms.

7.5.3 Mechanism of Addressing the Views Emerging from Consultation

All feedbacks and concerns from various consultation meetings and surveys have been considered in the design of the RAP. Internal and external monitoring will ensure the implementation of the RAP. Although few people also asked for in kind compensation, cash compensation option was selected as a prevailing option because of unavailability of lands in the nearby areas and most of the AHs have available lands for relocation and others can purchase land in the same villages. Moreover as mentioned in **Section 6.6** people have insignificant dependence of agriculture. After feedback from consultations, the following steps will be taken by MHL.

- Market value of affected assets including transaction costs and transitional period costs in term of resettlement allowances will be paid before taking physical possession of the affected assets and lands.
- All the AHs will be served a prior notice by the district management on behalf of the DC to evacuate their lands and assets after providing the compensation and all the allowances to them. If any HH rejects to do so they will be approached by the Project authorities to do so. Forced evacuation will be the last resort.
- Priorty will be given to the locals in Project created jobs and labour works during the construction and execution phase.
- Basic amenities like health, education, roads, and safe drinking water will be provided to the affected communities as well adjacent communities through Corporate Social Responsibility (CSR).
- A clause will be added to the contractor's contract documents that they will be confined to the Project working boundary and will not breach the privacy of local communities.

8. Resettlement Planning

This section discusses the principles of the Project Policy and the entitlements of the PAPs based on the type and degree of their losses.

8.1 Principles of the Resettlement Policy for the Project

8.1.1 Avoid Land Acquisition and Involuntary Resettlement

Land Acquisition and Involuntary Resettlement will be avoided where feasible, or minimized, by identifying possible alternative Project designs that have the least adverse impact on the communities in the Project area.

Where displacement of HHs is unavoidable, all PAPs losing assets, livelihoods or resources will be fully compensated and assisted so that they can improve, or at least restore their former economic and social conditions.

Compensation and rehabilitation support will be provided to any PAPs, that is, any person or HH or business which on account of Project implementation would have their:

- Standard of living adversely affected;
- Right, title or interest in any house, interest in, or right to use, any land (including premises, agricultural and grazing land, commercial properties, tenancy, or right in annual or perennial crops and trees or any other fixed or movable assets, acquired or possessed, temporarily or permanently;
- Income earning opportunities, business, occupation, work or place of residence or habitat adversely affected temporarily or permanently; or
- Social and cultural activities and relationships affected or any other losses that shall be identified during the process of resettlement planning.

8.1.2 Eligibility for Compensation

All affected people will be eligible for compensation and rehabilitation assistance, irrespective of tenure status, social or economic standing and any such factors that may discriminate against achievement of the objectives outlined above.

8.1.3 Entitlements without Legal Claims to Land[12]

Lack of legal rights to the assets lost or adversely affected tenure status and social or economic status will not bar the PAPs from entitlements to such compensation and rehabilitation measures or resettlement objectives. All PAPs residing, working, doing business and/or cultivating land within the Project impacted areas as of the date of the latest census and inventory of lost assets, are entitled to compensation for their lost assets (land and/or non–land assets), at replacement cost, if available and restoration of incomes and businesses, and will be provided with rehabilitation measures sufficient to assist them

[12] This principle of entitlements without legal claims is provided in resettlement planning as a provision to avoid any complications at any stage however, no such AP was found during RFS.

to improve or at least maintain their pre–Project living standards, income–earning capacity and production levels. Encroachers will not be eligible for compensation of land however they will be entitled to the compensation of structures.

PAPs that lose only part of their physical assets will not be left with a portion that will be inadequate to sustain their current standard of living. The minimum size of remaining land and structures will be agreed during the resettlement planning process.

People temporarily affected are to be considered as PAPs and resettlement plans address the issue of temporary acquisition.

Where a host community is affected by the development of a resettlement site in that community, the host community shall be involved in any resettlement planning and decision–making. All attempts shall be made to minimize the adverse impacts of resettlement upon host communities.

8.1.4 Compensation and Rehabilitation

Payment for land and/or non–land assets will be based on the principle of replacement cost. Solely cash compensation will be avoided as an option if possible, as this may not address losses that are not easily quantified, such as access to services and traditional rights, and may eventually lead to those populations being worse off than without the Project.

Compensation for PAPs dependent on agricultural activities will be land–based wherever possible. Land–based strategies may include the provision of replacement land, ensuring greater security of tenure, and upgrading livelihoods of people without legal land titles. If replacement land is not available, other strategies may be built around opportunities for re–training, skill development, wage employment, or self–employment, including access to credit.

Replacement lands, if the preferred option of PAPs, should be within the immediate vicinity of the affected lands wherever possible and be of comparable productive capacity and potential.[13] As a second option, sites should be identified that minimize the social disruption of those affected; such lands should also have access to services and facilities similar to those available in the lands affected[14]. Compensations will be paid to the owner of the affected asset (male or female) lump-sum in cash before taking physical position of the asset. After finalization of the official rates an agreement will be made by the Revenue Department and AHs and all the payments will be documented.

8.1.5 Livelihood Restoration

Losses of livelihoods due to land acquisition will be assessed during field surveys. In case land acquisition affects commercial structures, in addition to the compensation of

[13] Agricultural land for land of equal productive capacity means that the land provided as compensation should be able to produce the same or better yield the AP was producing on his/her land prior to the project. The production should be in the planting season immediately following the land acquisition. It can be for a future period if transitional allowance equal to the household's previous yield is provided to the AP household while waiting for the land to get back to the same productivity as the previous land.

[14] There is provision for land based compensation but due to unavailability of land, community preference and insignificant dependence on agriculture cash compensation strategy is adopted for the Project

affected assets, PAPs will be compensated for lost net income during the transition period, and for the costs of the transfer and reinstallation of the plant, machinery, or other equipment. As provided in **Section 6.6** there is insignificant dependence on agriculture in affected communities for livelihood restoration one person from every AH will be eligible for vocational training rather providing agriculture related support to the AHs. Moreover, PAPs will get priority in Project–related jobs and labor according to their education and skills.

8.1.6 Resettlement Assistance

Resettlement assistance will be provided not only for immediate loss but also for a transition period needed to restore livelihood and standards of living of PAPs. Such support could take the form of short–term jobs, subsistence support, salary maintenance, or similar arrangements.

8.1.7 Vulnerable Group

The resettlement plan must consider the needs of those most vulnerable to the adverse impacts of resettlement including the poor, those without legal title to land, ethnic minorities, women, children, elderly and disabled and ensure they are considered in resettlement planning and mitigation measures identified. Assistance should be provided to help them improve their socioeconomic status PAPs will be involved in the process of developing and implementing resettlement plans.

8.1.8 Consultation

The main objective of the consultation is information disclosure. Information regarding Project details, construction related impacts, land acquisition, relocation of houses, different relocation options and resettlement issues will be disseminated to the affected communities during planning and construction stage of the Project. Affected communities will be consulted about the Project, the rights and options available to them, and proposed mitigation measures for adverse effects, and to the extent possible be involved in the decisions that are made concerning their resettlement. Information disclosure will be done through direct contact, printed material and website of the Project.

8.1.9 Measures to Avoid Adverse Impacts

Adequate budgetary support will be fully committed and made available to cover the costs of land acquisition (including compensation and income restoration measures) within the agreed implementation period. The funds for all resettlement activities will come from the Government.

8.1.10 Timing of Relocation

Displacement does not occur before provision of compensation and of other assistance required for relocation. Sufficient civic infrastructure must be provided in resettlement site prior to relocation. Acquisition of assets, payment of compensation, and the resettlement and start of the livelihood rehabilitation activities of PAPs will be completed prior to any construction activities, except when a court of law orders so in expropriation

cases. Livelihood restoration measures must also be in place but not necessarily completed prior to construction activities, as these may be ongoing activities.

8.1.11 Organization and Administrative Arrangements

Organization and administrative arrangements will be identified and in place prior to the commencement of the process; this will include the provision of adequate human resources for supervision, consultation, and monitoring of land acquisition and rehabilitation activities.

8.1.12 Monitoring and Reporting

Appropriate reporting (including auditing and redress functions), monitoring and evaluation mechanisms, will be identified and set in place as part of the resettlement management system. The RAP implementation will be monitored internally as well as externally. The Project Management Unit's (PMU) Environment and Social Development Cell will internally monitor and evaluate the resettlement process during the pre–construction and construction stages of the Project. An external monitoring agency (EMA) will also be hired by the Project and will evaluate the resettlement process and final outcome.

8.2 Measures to Avoid Encroachment

The cut–off date of eligibility refers to the date prior to which the users of the land to be acquired are considered eligible to be categorized as PAPs and will be eligible for Project entitlements. Moreover the establishment of the eligibility cut–off date is intended to prevent the influx of ineligible non–residents who might take advantage of Project entitlements.

Legally the cut-off date is the date of announcement of section 4 of LAA 1894. In the Project area section 4 of LAA 1894 has not announced yet therefore, date of start of survey of March 29, 2018 has been fixed as cut–off–date. The illegal encroachers that settle in the affected area and/or establish any asset after this date will not be eligible for compensation. They will, however, be given sufficient advance notice requesting them to vacate premises/corridor and dismantle affected structures and/or other establishments (if any) prior to Project implementation. However, the Project cannot force the owners of the land not to make any transactions unless section 4 of LAA 1894 is announced. After the announcement of the section 4 of LAA, a new RFS will be conducted and the RAP will be updated.

8.3 Linking Resettlement Activities to Civil Work

All resettlement-related activities, particularly payments of compensation and relocation site development, will be completed prior to Project civil works. The acquired land and other assets, for example, housing/commercial structures will not be demolished without compensation being paid and/or alternative housing/resettlement sites being provided.

For Project activities requiring relocation or resulting in loss of shelter, the APs will be informed of the Project activities and schedule such as (a) target dates for start and completion of civil works; (b) timetables for transfers and possession of land from the

AHs; and (c) a full schedule of Project work, including specific Project activity involving land acquisition, relocation, and resettlement. Thus, the framework will ensure proper timing and coordination of the civil works so that no AP will be displaced (economically or physically) due to civil works activity, before compensation is paid and before any Project construction works can begin.

8.4 Eligibility and Entitlements

The eligibility and entitlement will follow the approved entitlement matrix which covers a wide range of losses. **Exhibit 8.1** summarizes various entitlements against losses. As provided in **Section 8.1** both in kind compensation and in cash compensation approaches were considered for the Project and due to unavailability of lands, community choice and insignificant dependence on agriculture by affected communities in cash compensation approach was preferred for the Project.

Exhibit 8.1: Entitlements against Losses

No	*Type of Loss*	*Entitled Persons (Beneficiaries)*	*Entitlement (Compensation Package)*	*Implementation issues/Guidelines*	*Responsible Organization*
1	Loss of agricultural land, pond, ditches, and orchards etc.	Legal owner(s) of land	▶ Market value of land including 25% compulsory land acquisition surcharge.	▶ Market price of the land will be computed by the District price assessment committee keeping in view the recent transactions in the area, quality of land and demand of the land owners. ▶ The Project through Land Acquisition Collector will pay cash compensation	▶ All the funds will be provided by the Project, however, land acquisition and disbursement of payments is the responsibility of Revenue Department
2	Loss of access to cultivable land by owner-cultivator/ tenant/ sharecropper	Tenants/sharecropper /Legal owner/grower/socially recognized owner/lessee/ unauthorized occupant of land	▶ Based on current market value of land including 25% compulsory land acquisition surcharge.	▶ Market price of the land will be computed by the District price assessment committee keeping in view the recent transactions in the area, quality of land and demand of the land owners. ▶ The Project through Land Acquisition Collector will pay cash compensation through cross cheque.	▶ All the funds will be provided by the Project, however, land acquisition and disbursement of payments is the responsibility of Revenue Department

No	*Type of Loss*	*Entitled Persons (Beneficiaries)*	*Entitlement (Compensation Package)*	*Implementation issues/Guidelines*	*Responsible Organization*
3	Loss of homestead/residential/commercial/ plots by owners/authorities	Legal owner(s) of the land	Option A:[15] ▶ Market value of land including 25% compulsory land acquisition surcharge Option B: ▶ Provision of residential/ commercial Plot at relocation site ▶ Provision of basic infrastructures at new resettlement area such as access road, drinking water supply, sanitation, schools, electricity, mosque, health facility and commercial area free of cost.	Option A: ▶ Market price of the land will be computed by the District price assessment committee keeping in view the recent transactions in the area, quality of land and demand of the land owners. ▶ Project through Land Acquisition Collector will pay for the land. Option B: ▶ Project will develop the resettlement sites with provision of basic amenities as electricity, potable water, roads ▶ The plots at resettlement sites will be provided at a subsidized rate to be finalized by the district land valuation committee.	Option A: ▶ Project through Land Acquisition Collector will pay for the land. Option B: ▶ Relocation site development will be the responsibility of the Project if required.
4	Loss of trees	Person with legal ownership of the land Socially recognized owner/unauthorized occupant of the trees/fishes	▶ Market value of the lost item	▶ Values of lost items computed based on RFS and rates taken from local market	▶ Compensation of trees and other land based assets will be included in the land award and will be paid by the Revenue Department

[15] Both the options were discussed with the AHs and option A was finalized for the project.

No	*Type of Loss*	*Entitled Persons (Beneficiaries)*	*Entitlement (Compensation Package)*	*Implementation issues/Guidelines*	*Responsible Organization*
5	Loss of residential/commercial structure by owner(s)	Legal titleholder Owner(s) of structures	▶ Replacement value of residential structure. ▶ One time shifting allowance of PKR 25,000 per affected HH. ▶ Owner will be allowed to take away all salvageable materials free of cost.	▶ Applicable to all structures located within the acquisition areas. ▶ District Collector with expertise from Works and Services Department will determine the replacement value	▶ Replacement value, Relocation grant and special assistance will be paid directly by the Project, if not included in the award
6	Loss of residential/commercial structure by squatters and unauthorized occupants	Informal settlers/squatters/on–tilted APs occupying public land without title/or squatting on Govt. land	▶ Replacement value of residential structure. ▶ One time shifting allowance of PKR 25,000 per affected HH. ▶ Owner will be allowed to take away all salvageable materials free of cost.	▶ Applicable to all structures located within the acquisition areas. ▶ District Collector with expertise from Works and Services Department will determine the replacement value	▶ Replacement value, relocation grant and special assistance will be paid directly by the Project, if not included in the award
7	Loss of standing crops	Cultivators identified by District Collector through land acquisition survey	▶ Market value of standing crops. ▶ Owners will be allowed to harvest of standing crops prior to being affected.	▶ Applicable for all crops standing on land within the acquisition area at the time of dispossession. ▶ Project will pay through District Collector for crops. ▶ District Collector with assistance from Department of Agriculture will recommend resettlement value of crops at harvest.	▶ Compensation of crops will be included in the land award and will be paid by the Revenue Department

No	*Type of Loss*	*Entitled Persons (Beneficiaries)*	*Entitlement (Compensation Package)*	*Implementation issues/Guidelines*	*Responsible Organization*
8	Loss of business due to dislocation	Owner/operator of the business as recorded by RFS	▶ Compensation equivalent to Three months (90 days) income from the business calculated during RFS	▶ Business owners will be paid the entitlements after award of compensation by District Collector to the owner of premises.	▶ Master Hydro (Private) Limited will directly pay the entitlement to the eligible APs, if not included in the award.
9	Loss of Income and work days due to displacement	HH head/employees identified by the RFS	▶ Grant to cover temporary loss of regular wage income @ PKR 500/– (Five Hundred) X 90 days	▶ AP must have been an employee of landowner or business located in the acquired lands for at least twelve months, as identified by the RFS.	▶ Master Hydro (Private) Limited will directly pay the entitlement to the eligible APs, if not included in the award.
10	Poor and vulnerable HHs	Poor and vulnerable HHs including informal settler, squatters /women headed HH without elderly son/ non–titled APs identified by RFS	▶ Special assistance of PKR 50,000/ HH additional amount included in their compensation package.	▶ Vulnerable HH must be identified during RFS.	▶ Master Hydro (Private) Limited will directly pay the entitlement to the eligible APs, if not included in the award.
11	Displacement of community structure	Community structure representative as identified by the RFS	▶ The Project will construct the structures for common properties in the self–managed resettlement sites selected by the PAPs.	▶ Land for common structures will be purchased/ acquired by the Project.	▶ Project will directly pay the entitlement to the eligible APs.
12	Temporary impact during construction	Community/Individual	▶ Compensation equal to loss during construction	▶ Temporary impact during construction will be computed by the PMU on request of AP.	▶ Project will directly pay the entitlement to the eligible APs.

No	*Type of Loss*	*Entitled Persons (Beneficiaries)*	*Entitlement (Compensation Package)*	*Implementation issues/Guidelines*	*Responsible Organization*
13	Unforeseen impact	Concerned impacted persons	▶ Entitlements will be determined as per the resettlement policy framework	▶ The unforeseen impacts will be identified through a special survey by the PMU. The entitlements will be approved by Master Hydro (Private) Limited	▶ Compensation of land-based assets will be included in the land award and will be paid by the Revenue Department ▶ Compensation of other assets will be paid directly by the Project, if not included in the award.
14	Public Structure	Concerned Department	▶ Replacement of affected structures	▶ MHL and concerned department with the help of DC will be responsible for the replacement of the affected public structures with the financial assistance of the project at the appropriate site.	▶ Project will be responsible for financial assistance
15	Severe impact	Persons losing more than 10% of their income from all sources	▶ One time severe impact allowance @ PKR 50,000/– (fifty thousand) per HH. ▶ One person from the HH will be eligible for labor work or job according to its skills and education.	▶ The one time severe impact allowance will be paid by Project.	▶ Project will be responsible to pay the severe impact allowance, if not included in the award.

9. Relocation and Livelihood Restoration Plan

9.1 Relocation of Households

During the HH consultations and group discussions, it was observed that majority of the affected communities prefer to relocate by themselves and none of the AHs opted for Project managed relocation (**Exhibit 7.4**). Out of total 27 physically displaced HHs 16 (59%) HHs can purchase land within the district to construct their houses while 5 (19%) HHs replied that they have not decided yet. Based on community preference, it is planned that AHs will be provided compensation amount and resettlement allowances and will be allowed to construct their houses on their own. All the AHs requiring relocation will be given sufficient time (4 months) after the payment of compensation and allowance to arrange their housing before evacuating their current houses. If someone cannot construct their house within provided time they may be given extra time, if possible.

9.2 Livelihood Restoration

As provided in **Section 5.3.9** *(Loss of Livelihood)*, out of 48 AHs, 26 will lose part of their livelihood in terms of cultivated land loss and loss of commercial structures. They will be compensated for their lands, crops, and structures. As stated in **Section 8.1.4** there is provision for land based compensation but due to unavailability of land, preference of affected communities and insignificant dependence on agriculture, cash compensation strategy is adopted for the Project.

Out of these 26 AHs, 8 AHs will lose more than 10% of their monthly income earning as a result of land acquisition. Every HH losing his livelihood resources or places of income generation as a result of Project interventions will be supported with income and livelihood restoration assistance. Measures for immediate assistance include the following:

- Payments to compensate for land and other lost assets is settled in full before relocation;
- Provision of priority in employment in the Project or Project–related construction activities;
- Providing special allowance for vulnerable groups such as women and people under national poverty line;
- Providing severe impact allowance to AHs losing more than 10 percent of their regular income.
- One Person from every AH will be provided vocational training.

As mentioned in **Section 6.6** agriculture is not a significant source of income of the affected communities, agriculture related measures are not included in the measures listed above. Moreover, measures such as provision of credit, area development and provision of social safety nets will be part of Corporate Social Responsibility (CSR) which will be

planned before start of construction work. MHL will also provide the following assistance for income and livelihood restoration to the HHs losing their livelihood.

9.2.1 Assistance to Support Lost Income

PAPs, including those experiencing indirect impacts, will be eligible for assistance for loss of employment/workdays (wage earners) owing to relocation. A one–time cash grant for an estimated number of days will be paid to all such eligible PAPs. The number of days for which payment is made is estimated on the assumption that the PAPs would be able to recover their losses and/or find alternative employment within this period.

9.2.2 Assistance to Re–Establish Business/Enterprises

Owners of affected businesses will receive cash compensation and cash grant for loss of business premises plus shifting or moving allowance. This assistance is intended to help them re–establish their enterprises in new locations. All PAPs are likely to continue their previous occupations and commercial activities in nearby areas. Project assistance to re–establish business/enterprises in the short–term are the following:

i. Replacement value of structure at the market rate prevailing at the time of dispossession and also the salvaged structure materials; and
ii. A one–time shifting allowance.
iii. Trainings
iv. Priority in Project related jobs and labor
v. Preference in procurement contracts for construction materials, food, etc.

9.2.3 Employment in Construction Work

The Project construction activities will require many unskilled laborers and skilled staff. In this respect, the Project will arrange training of local people to facilitate employment during Project implementation. One person from every interested affected HH will be eligible for training. The PMU will arrange training of the APs from any reputed vocational training institutions within Pakistan. Further, the PMU will include necessary clauses in construction contracts to facilitate the employment of PAPs and their dependents when workers for construction activities are recruited. Employment in Project construction will act as an added source of income to the income and livelihood restoration processes of PAPs. MHL will monitor the implementation of this contract condition through monthly statements submitted by the contractor.

10. Institutional Framework

10.1 Master Hydro (Private) Limited

MHL, being the Project owner will have the overall responsibility for resettlement and land acquisition. Responsibilities of MHL will be to:

- Ensure availability of budget for all activities;
- Form PMU and other necessary committees;
- Monitor the effectiveness of programs; and
- Cross–agency coordination

10.2 Project Management Unit (PMU)

MHL will establish a PMU for Arkari Gol HPP. For the efficient implementation and management of resettlement activities, a Social and Environment Unit will be established within the PMU. The Social and Environment Unit will be accountable and responsible for the implementation of the RAP of the Project. The PMU will supervise the implementation of RAP in order to facilitate the following tasks:

1. Synchronization of resettlement activities with the Project construction schedule;
2. Ensure that all eligible APs are identified, provided with their respective entitlements according to the resettlement policy and are relocated/compensated as per the implementation schedule;
3. Work closely with the concerned district government's office to collect data for assessment of eligible persons and their entitlements as per RAP policy;
4. Liaison with the Revenue Department offices regarding timely acquisition of lands required for the Project and payment of compensation in a transparent way and ensure that these activities are completed as per schedule;
5. Negotiate with Contractors for arranging employment for APs in construction works;
6. Ensure to comply the safeguard management of resettlement, gender, and grievance redress;
7. Disclose information and involve APs in the RAP process; and
8. Monitoring and reporting of social/Land acquisition and resettlement/environment issues compliance during implementation.

10.3 Grievance Redress Committee (GRC)

Two tear GRCs, one at village level and one at Project level will be established for addressing conflicts and appeal procedures regarding eligibility and entitlements as well as the implementation of the resettlement activities. The GRCs will receive and facilitate the resolution of concerns and grievances from PAPs.

10.4 External Monitoring Agency

The PMU of MHL may hire an independent EMA who will conduct independent monitoring and evaluation during RAP implementation if required. The EMA will:

- Review the implementation progress;
- Evaluate the level of achievement of objectives; and
- Identify the gaps (if any) and propose remedial measures to be taken.

10.5 Board of Revenue

The Board of Revenue (BoR) has function of land acquisition and power to approve the allocating/granting land for projects of public interest with conditions.

10.6 District Administration

Land acquisition functions rest with BOR but the land rights in the rural areas are administered by the District Administration on behalf of the BOR. The DC has the power and responsibility as LAC to acquire land and to assess compensation of property.

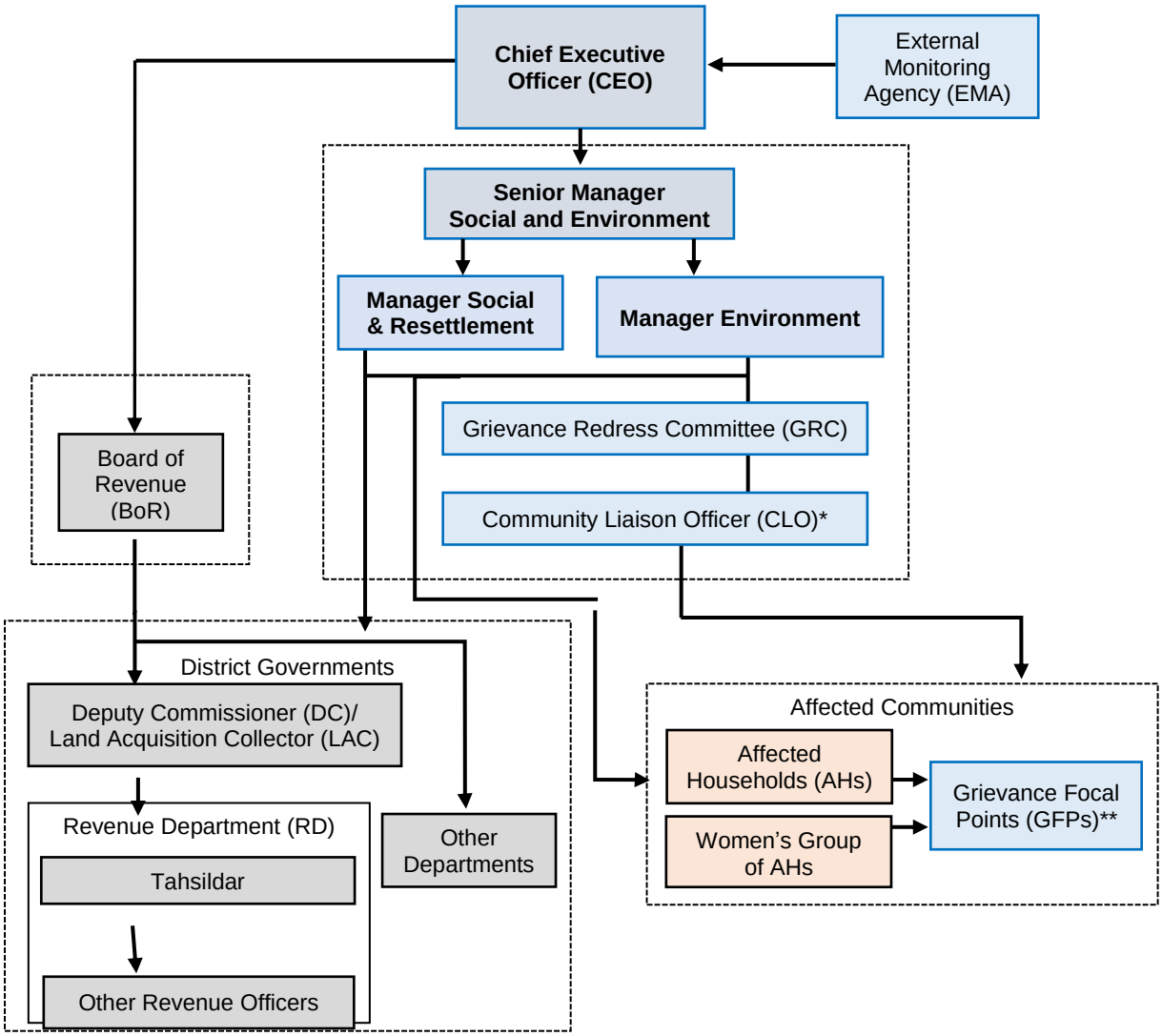
The DC of district Chitral who also act as LAC, will assign the Tehsildars of the concerned departments to manage the entire land acquisition. Other staff members of the District Revenue Department (DRD), called Qanoongo (clerical staff of DRD) and Patwari (field staff of DRD) will carry out titles identification and verification of the ownership.

Compensation of non–land assets pertains to relevant agencies of the government and their district level offices as follows:

- Compensation for buildings will be determined by the District Collector with advice on the rates from Department of Buildings and Works;
- Compensation for crops and productive trees will be determined by the Department of Agriculture; and
- Compensation for wood trees will be determined by the Forest Department.

An organogram of institutional arrangements is presented in **Exhibit 10.1**.

Exhibit 10.1: Institutional Arrangement for Implementation of Resettlement Action Plans



* CLO: Community Liaison Officer (male & female)

**GFPs: One literate male and one literate female from each community

11. Grievance Redress Mechanism

Timely and effective redress of stakeholder grievances will contribute to bringing sustainability in the operations of the Project. In particular, it will help advocate the process of forming and strengthening relationships between project management and the stakeholder community groups and bridge any gaps to create a common understanding, helping the project management to efficiently operate in the area.

To register and resolve the grievances of the community in this process, a Grievance Redress Mechanism (GRM) will be established. The proposed mechanism will be based on two–tear grievance redress committees—at village level (Depending on the project impacts) and at Project level. The proposed GRM will help achieve the objectives of sustainability by dealing with the environmental and social issues of the Project in a timely manner.

The village–level GRC will be established to engage village–level community members/leaders to participate in the decision–making processes and to have "voices" of the aggrieved person/communities in the grievance redress procedures. This will also enhance local ownership of the Project. Having members based in the village, the village–level GRC will be helpful in resolving the grievances quickly often without going into lengthy documentation. The local participation will further build local capacity in dispute resolution and decision–making and provide leadership support in the implementation of the Project. Cases which are not satisfactorily resolved or those in which APs remain aggrieved will then be forwarded to the Project–level GRC as the prime forum for resolution of the grievances.

The purpose of the GRM is to facilitate the resolving of disputes without going into litigation. In this regard, the decision of the Project level GRC will be final within the GRM. However, if any disputant remains unsatisfactorily resolved with the GRC outcome, the disputant can seek redress from a court of law.

MHL will be responsible for:

1. Establishing the GRM at each village level and at the Project level. The GRM will be established as soon as RAP is approved.
2. PMU must ensure that the community is informed of the mechanism to redress complaints.

11.1 Grievance Redress Committees

The Grievance Redress Committees (GRCs) are to ensure accessibility, fairness, and independence of the procedures. The GRCs will be established at two–levels:

1. Village GRC, with the scope limited within the village; and
2. Project GRC, covering all the project affected villages.

The composition of the two committees is shown in **Exhibit 11.1**.

Exhibit 11.1: Members of GRC

Organization	*Village GRC*	*Project GRC*
Master Hydro (Private) Limited	Representatives from PMU (1 Chairperson, 1 Secretary and 1 Member)	Representative from PMU (1 Chairperson, 1 Secretary and 1 Member)
Revenue Department	Concerned Patwari	LAC or LAC's Representative
Community	One or two elders nominated by the community	One or two elders nominated by the community

11.2 GRC's Scope of Work

The scope of work of the GRC is as follows:

1. The village GRC will ensure that all grievances related to social and environmental issues are registered, formally recorded, reviewed, resolved and the concerned person is informed in a timely manner.
2. The Project GRC will monitor the working of the village GRC and will work as a forum for appeal against the decision of the village GRC.
3. GRC will not consider complaints related to the procurements or with any matters pending in the court of law.
4. In resolving the disputes, the GRCs will take into consideration the following:

- Merit of the complaints/case received for consideration;
- Evidence to take a decision on the complaint;
- Witness statements;
- Plausibility of the case in the light of related project activity;
- Applicable laws, environmental guidelines of Pakistan, ESIA and RAP of the Project, and best international practices such as IFC environmental guidelines;
- Observations made on the field; and
- Available information on previous complaints of similar nature.

11.3 Approval and Orientation of GRC Members

The GRC members will be selected by the project management according to their responsibility and personal integrity. Community members of the village level GRCs will be selected after consultation with the communities. Community members of Project-level GRCs will be nominated by the affected community. All GRCs members will be approved and notified by the PMU.

All GRC members will attend a training and orientation meeting prior to the commencement of their work if required. The training will be provided by competent technical experts in social/resettlement and environmental management. The training will address the policy aspects, compliance requirements, expectations of the community, and need for rapport and communication with the affected communities, and finally need for

independence and transparent views in dealing with grievances. Members of the GRCs can be replaced after bi-annual evaluation of GRM by the project management.

11.4 Dissemination of GRCs

After notification of all the GRCs information regarding GRCs will be disseminated in all the concerned villages by the Environment and Social Unit of the PMU. Information dissemination will comprise the following;

- List of GRC members including address and contact numbers.
- GRC scope of work.
- Grievance redress procedure.

11.5 Grievance Redress Procedure

The following procedure will be adopted to resolve grievances received by the GRCs. The grievance redress mechanism will be made public through public consultations by the Environment and Social Unit of PMU and Consultant.

11.5.1 Filing of Grievances to Village GRC

For grievances related to social and environmental safeguards, the aggrieved person (or their authorized representatives) may file a grievance with the village–level GRC in one of the following ways:

5. Submit a written complaint to any member of the village GRC.
6. Given the local cultural context, any aggrieved women may submit complaints to GRCs directly or through the head of the HH.
7. Aggrieved person can also submit complaint to GRC through ordinary mail and email.
8. Aggrieved person can also drop written complaint (anonymous, non-anonymous) in suggestion box fixed at the security gate and/ or any other accessible place.

For complaints registration, Complaint Registration Forms will be available with the secretary of the village level GRCs and complaints will be registered on Grievance Log. Templates of Complaints Registration Forms, Grievance Log of village level GRC and Grievance Log of Project-level GRC are provided as **Appendix F**, **Appendix G**, and **Appendix H**.

11.5.2 Hearing and Resolution of the Cases by Village GRC

The procedure for hearing and resolution of the complaint will be as follows:

1. Upon receipt of a complaint:

- Secretary of village GRC will log the complaint in a register called Complaint Register.
- Contact other members of the GRC to conduct a meeting within 10 calendar days of the logging of the complaint.

- If needed, request the complainant or his representative to meet the Village GRC on the appointed date to discuss his complaint.
- Prepare all the relevant information and documents relevant to the complaint prior to the meeting and provide copies to all members.

2. The GRC will meet on the appointed date during which it may:

- Deliberate on the nature and circumstances of the complaint;
- Investigate the complaint based on evidence provided by the complainant;
- Meet with the complainant and other persons;
- Visit the site; and
- Take a decision.

3. If the GRC needs extra time to investigate or deliberate on the complaint, the secretary will inform the complainant of the time when a decision is expected. In any case, all complaints shall be resolved within 30 calendar days of logging.
4. Once the complaint is resolved the secretary will document the decision and prepare full documentation on the process including minutes of the meeting, photographs of visits, documents reviewed, and reasons for the decision.
5. The GRC will ensure that the complainant is fully informed of the decision and is also informed about his/her right to appeal to the Project GRC and to the court of law.
6. In case follow–up action is required, the chairperson of the village GRC will ensure that the actions are taken and are documented.

11.5.3 Hearing and Resolution of the Cases by Project GRC

The procedure for hearing and resolution of the complaint by the Project GRC will be as follows:

1. On receipt of a complaint:

- Secretary of Project GRC will request all the concerned documentation from the secretary of the concerned village GRC.
- Contact other members of the Project GRC to conduct a meeting within 15 calendar days of the logging of the complaint to the Project GRC.
- If needed, request the complainant or his representative to meet the Project GRC on the appointed date and place to discuss his complaint.
- If needed, request the members of the village GRC to meet the Project GRC on the appointed date and place.
- Prepare all the relevant information and document relevant to the complaint prior to the meeting and provide copies to all members.

2. The Project GRC will meet on the appointed date during which it may:

- Deliberate on the nature and circumstances of the complaint;

- Investigate the complaint;
- Meet with the complainant and other persons;
- Visit the site; and
- Take a decision.

3. If the GRC needs extra time to investigate or deliberate on the complaint, the secretary will inform the complainant of the time when a decision is expected. In any case, all complaints shall be resolved within 45 calendar days of logging with the Project GRC.
4. Once the complaint is resolved the secretary will document the decision and prepare full documentation on the process including minutes of the meeting, photographs of visits, documents reviewed, and reasons for the decision.
5. The GRC will ensure that the complainant is fully informed of the decision and is also informed about his/her right to appeal to the court of law.
6. In case follow–up action is required, the chairperson of the Project GRC will ensure that the actions are taken and are documented.

11.5.4 Maintenance and Evaluation of Data by PMU

The PMU will ensure that it receives copies of all complaints, meeting notices, decisions, and documentation related to proceedings of the village and Project GRCs

The PMU will maintain complete records of the complaints in a database or tabular form consisting of the following fields:

- Project name
- Village, union council, tehsil, and district
- Name of complainant
- Nature of complaint like environment (trees cutting, noise, dust, waste, air–water–soil pollution etc.), social (damage to infrastructure, land, privacy, favoritism/nepotism issues, etc.), gender (gender equality, empowerment, privacy etc.) and non–compliance to the government/donor provided guidelines.
- Date of logging of complaint with village GRC.
- Date of the first meeting of village GRC.
- Information on members attended, number of meetings, meeting with the complainant, and site visit.
- Date of decision of village GRC.
- Follow–up actions, responsibilities, and completion with dates.
- Date of logging of complaint with Project GRC.
- Date of the first meeting of Project GRC.

- Information on members attended, number of meetings, meeting with the complainant, and site visit.
- Date of decision of Project GRC.
- Follow–up actions, responsibilities, and completion with dates.

11.5.5 Reporting

The PMU will prepare a quarterly report on the GRM reporting, for example, on:

- Number and list of complaints received by village GRC, Project GRC and nature of complaints;
- Outcomes of the registered complaints.
- The average time of it took to resolve the complaint; and
- The fraction to complaints that were resolved at the village GRC level.

These reports will be publically available on the Project's website and at Project field office.

12. Monitoring and Evaluation

This section presents the monitoring and evaluation (M&E) system for RAP implementation. This is a continuous process of collecting, collating and analyzing information about the progress of RAP implementation and a tool for identifying strengths and weaknesses of the process. Periodic evaluation of the process and the outcomes will enable MHL to identify deficiencies and implement corrective measures to achieve the desired goals and objectives of the RAP.

12.1 Objectives of Monitoring and Evaluation

The objective of the M&E system presented herein is not only to assist in maximizing benefits of the resettlement packages to the PAPs but also to enhance the delivery capacity of MHL with regard to resettlement implementation. Further, the system will serve as a tool to ensure timely and fair delivery of PAP entitlements.

The M&E will obtain feedback from target populations and the field operatives to facilitate the formulation of remediation measures when required and as a result, ensure achievement of targets within schedule. The M&E will be carried out through collecting and analyzing information from the field and verifying the progress reporting on resettlement implementation progress and its effectiveness. It will ensure that inputs are provided, procedures are followed, and outputs are monitored and verified as per approved plan and schedule of action. A database with Geographic Information System (GIS) will be developed for the purpose of the ongoing monitoring and also for ex–post evaluation.

Monitoring and reporting mechanism of resettlement related operations involves a two–pronged approach. Monitoring will be done both internally and externally, to provide feedback to PMU and to assess the effectiveness of the RAP and its implementation. Monitoring will be carried at all three stages of RAP implementation: preparatory stage, relocation stage, and rehabilitation stage. Monitoring and reporting activities help in:

- Assessment of implementation progress,
- Rescheduling key actions to meet the objective timelines,
- Early identification of issues,
- Resolving problems faced by the PAPs, and
- Developing solutions immediately to meet resettlement objectives.

Land acquisition and resettlement activities will be monitored internally by PMU and externally by EMA as per mechanisms described in the following sections.

12.2 Internal Monitoring

Implementation of RAP activities will be internally monitored by PMU on a regular basis. The objectives of the internal monitoring will be to:

- Monitor the timely progress of key activities;

- Verify the compliance with safeguard measures;
- Document and disclose the monitoring results and identify necessary corrective and preventive actions in the periodic monitoring reports; and
- Follow up on the corrective and preventive actions to ensure progress toward the desired outcomes.

As soon as the RAP is updated as described in **Section 13**, a detailed internal monitoring plan will be developed by the PMU identifying key performance indicators and a framework for monitoring the effectiveness of corrective actions. Benchmarks of internal monitoring will be based on the approved RAP and cover the following:

- Information campaign and consultation with PAPs;
- Status of land acquisition and payments on land compensation;
- Status of payments on affected structures and other assets compensation;
- Status of payments for resettlement allowances;
- Relocation of AHs;
- Payments for loss of income and income restoration activities;
- Ensure the mitigation measures adopted for gender issues; and
- Ensure that resettlement activities are implemented following a planned time frame.

Information on the status and effectiveness of the key activities from the Project site will be collected by the PMU through following instruments:

- Review of census information of PAPs;
- Consultation and informal interviews with PAPs;
- Interviews with key informants; and
- Community public meetings.

12.3 External Monitoring

RAP activities will be externally monitored by the social experts of an EMA over the life of RAP initiation and implementation. The PMU will develop a detailed Terms of Reference for the EMA to be appointed by MHL after the finalization of the RAP. The basis of the TOR is provided in **Appendix I**. The objectives of external monitoring will be to:

- Verify compensation rates determined by DRD;
- Verify whether resettlement allowances are sufficient to assist local communities to resettle;
- Verify the RAP implementation progress towards intended outcomes;
- Identify issues and recommend corrective and preventive actions;

- to identify any induced impacts that may have been caused as a result of the resettlement process and how to mitigate/corrective actions
- Verify eligibility, consultation process, timing was fair and reasonable. and
- Verification of livelihood restoration of AHs.

Key tasks of the external monitor are:

- Review and verify internal monitoring reports prepared by PMU;
- Review of the socio–economic baseline, census, and inventory of losses of pre–displaced persons;
- Review of pre and post Project socioeconomic conditions of AHs to verify that they have not worsened;
- Identify and select impact indicators;
- Collect key information from the Project site through formal and informal consultations and interviews with APs and key informants such as local council officials and community leaders;
- Assessment of resettlement implementation progress, efficiency, effectiveness, and sustainability;
- Review of adherence to the community involvements and gender mitigation measures; and
- Document and disclose the results in the periodic monitoring reports.

The monitoring indicators will be:

- Timetables of activities
- Quality and frequency of consultation and disclosure
- Valuation of property and ability to replace lost assets
- Disbursement of compensation and other entitlements
- Communications and reactions from APs on entitlements
- Changes in socio–economic conditions of the APs in the post–resettlement period
- Rehabilitation of severely affected people and vulnerable groups
- Level of satisfaction of APs in the post–resettlement period
- Grievance procedures, including recording, reporting, processing, and redress of grievances

The issues identified by the EMA will be discussed internally by the PMU of MHL. Based on the recommendations made by EMA, the PMU will determine corrective actions.

Internal and external monitoring and reporting will primarily continue until completion of relocation. A second, and less intense, stage of monitoring will be undertaken during the livelihood restoration stage.

12.4 Reporting Requirements

The PMUs will prepare quarterly progress reports on resettlement implementation activities. The EMA will submit progress monitoring and final monitoring reports to MHL for onward submission to funding agencies to assist in ascertaining whether resettlement goals have been achieved, and more importantly, whether livelihoods and living standards have been restored or enhanced, as required. The reports will also include corrective action plans if required and recommendations for improvement. The internal and external monitoring reports will also be publicly available at Project site office for any interested person, including posting on the Project website.

13. Implementation Schedule

This section presents the implementation schedule of the RAP. The Project will be implemented during a period of 48 months. A time–bound implementation schedule is presented in **Exhibit 13.1**. The implementation schedule has been formulated to accommodate different phases of the Project and therefore there will be different resettlement activities as necessitated by the civil works. Preparation for RAP implementation, particularly information dissemination and maintaining a constant dialogue with the PAPs, will and continue throughout Project implementation.

Exhibit 13.1: Implementation Schedule

	RAP Activity/Task	*Responsibility*		*Pre-Construction*				*Year 1*				*Year 2*				*Year 3*				*Year 4*			
		Primary	*Secondary*	*I*	*II*	*III*	*IV*	*I*	*II*	*III*	*IV*	*I*	*II*	*III*	*IV*	*I*	*II*	*III*	*IV*	*I*	*II*	*III*	*IV*
Preparation (RAP)	Site Demarcation of Affected Lands	Master Hydro (Private) Limited	DRD																				
	Resettlement Field Survey	Consultant	Master Hydro (Private) Limited																				
	Finalization of prices of affected assets	DRD	Master Hydro (Private) Limited																				
	Draft Resettlement Action Plan	Consultant	Master Hydro (Private) Limited																				
	RAP Revision	Consultant	Master Hydro (Private) Limited																				
	Land Acquisition for the Project	DRD	–																				
	Physical Position of the Land	DRD	–																				
	Verification of census survey already completed	Master Hydro (Private) Limited	Consultant																				
	Consultations with affected communities	Master Hydro (Private) Limited	Consultant																				
	Updating and improvement of RAP	Master Hydro (Private) Limited	Consultant																				
	Preparation of internal Monitoring Plan	Master Hydro (Private) Limited	Consultant																				
	Disclosure of RAP Master Hydro (Private) Limited and funding agencies Website	Funding agencies	Master Hydro (Private) Limited																				
	RAP Disclosure – Brochure in Urdu	Master Hydro (Private) Limited	–																				

	RAP Activity/Task	*Responsibility*		*Pre-Construction*				*Year 1*				*Year 2*				*Year 3*				*Year 4*			
		Primary	*Secondary*	*I*	*II*	*III*	*IV*	*I*	*II*	*III*	*IV*	*I*	*II*	*III*	*IV*	*I*	*II*	*III*	*IV*	*I*	*II*	*III*	*IV*
Implementation (RAP)	Mobilize Project Implementation Consultant	Master Hydro (Private) Limited	–																				
	RAP Updating/Revision (if necessary)	Master Hydro (Private) Limited	–																				
	Submit revised RAP for approval to funding agencies	Master Hydro (Private) Limited	–																				
	Mobilize External Monitoring Consultant	Master Hydro (Private) Limited	–																				
	Payment of Compensations and Allowances	DRD	Master Hydro (Private) Limited																				
	Livelihood Restoration	Master Hydro (Private) Limited	–																				
	Grievance Redress Process	Master Hydro (Private) Limited	–																				
Construction	Internal Monitoring of RAP Implementation	Master Hydro (Private) Limited	–																				
	External Monitoring of RAP implementation	Master Hydro (Private) Limited	EMA																				
	Award of Contracts for Civil Works	Master Hydro (Private) Limited	–																				
	Contractor mobilized to start work	Master Hydro (Private) Limited	–																				
	Commencement of Civil Works	Contractor	Master Hydro (Private) Limited																				

Note: I, II, III and IV means first, second, third and fourth quarter of the year i.e. January to March, April to June, July to September and October to December

14. Cost and Budget

This section presents unit rates for compensation cost and budget for the implementation of the RAP. Rates used for different assets are based on the assessments during the RFS. Official rates may be different.

14.1 Unit Rates

Currently the unit rate for lands, houses, crops, fruit and non–fruit trees and public and community infrastructure have not been finalized and will be determined by the district LAC. The following sections will be updated once the rates are finalized by the competent authority. However, these rates will be subject to be confirmation by the EMA. Rates used in this section are from the assessments made by the RFS team based on the consultations with the communities.

14.1.1 Lands

Land in the area to be acquired has no established market price because no transactions for ownership change have taken place over the past several years. The land values, therefore, are based on the consultations with the local communities (affected and non-affected) and rates provided for land acquisition for similar projects including the Golen Gol HPP, keeping in view inflation rates. Once the official rates are finalized Revenue Department will make an agreement with local communities. The prices for cultivated, residential/commercial, un-cultivated barren/hilly lands were calculated separately following the above procedure. **Exhibit 14.1** below provides the prices of different categories of land according to the manner in which the land is valued in the area.

Exhibit 14.1: Rates Used in Valuation of Land by Type

Land Type	*Ownership*	*Unit Rate (PKR/ Kanal)*
Cultivated Land	Private owner	650,000
Uncultivated Land	Private owner	200,000
Land under Houses and other Structures	Private owner	650,000
Uncultivated Communal Land	Private owner	100,000
Total		

14.1.2 Houses and Other Structures

Rates for houses and other affected structures including community and public structures were calculated based on the construction cost in the area observed during RFS. Affected structures are categorized as; (i) pucca houses with concrete roof/corrugated sheet roofing, (ii) semi–pucca houses with blocks/stones/masonry, mud mortar and T–iron, Girder roof, (iii) kacha structures/house with stone walls/mud mortar, wood batten roof.

Exhibit 14.2 below provides rates of different affected structures. These rates need to be updated at the compensation payment stage.

Exhibit 14.2: Unit Price for Affected Structures

Structure	*Construction Type of Structures*	*Unit*	*Unit Price (PKR)*
Houses and other Structures	Pucca	Square meter	21,530
	Semi Pucca	Square meter	12,918
	Kacha	Square meter	4,909

14.1.3 Crops

Based on the RFS, average income per kanal in Rabi (winter cropping season, wheat) and in Kharif (summer cropping season, maize) is PKR 5,600.

14.1.4 Fruit Trees

The prices of trees are based on consultations with local communities. Details are provided in **Exhibit 14.3** below.

Exhibit 14.3: Unit Price for Fruit Trees (PKR)

Trees	*Unit Rate PKR/ Tree*		
	Small	*Medium*	*Large*
Apple	2,400	4,800	6000
Apricot	2,400	4,800	6,000
Mulberry	1000	1500	200
Peach	1,800	3,250	4,500
Plum	1800	3,250	4500
Peer	1800	3250	4500
Walnut	35,000	80,000	120,000
Guava	1,000	1,500	2,000
Pomegranate	1,000	1,500	2,000
Persimmon	2,000	5000	7,500
Figs (Anjeer)	1500	3200	3000
Other	1,500	2,200	3,650

14.1.5 Non–Fruit Trees

Exhibit 14.4 below provides details of compensation rates of non–fruit trees. The prices of trees are based on consultations with local communities.

Exhibit 14.4: Unit Price for Non–Fruit Trees (PKR)

Trees	*Rate PKR/ Tree*		
	Small	*Medium*	*Large*
Deodar	5,000	22,500	60,000
Kikar	2,500	7,000	15,000
Poplar	1,200	30,000	8,500
Wild Olive (Kao)	1,200	3,800	9,500
Eucalyptus	1,000	2,500	5,650
Shishum	1,500	3,500	16,500
Other	750	1,500	2,500

14.2 Estimated Budgets

14.2.1 Land

As detailed in **Section 5**, a total of 1,120.17 kanals of land will be required for the construction of different components of the Project. **Exhibit 14.5** below provides a break up of estimated prices of land and total cost to acquire 1,120.17 kanals of land including Compulsory Acquisition Surcharge (CAS).

Exhibit 14.5: Cost Estimate for Land Acquisition

Land Type	*Ownership*	*Cost Estimate of Land Acquisition*		
		Quantity (Kanal)	*Unit Rate (PKR/ Kanal)*	*Total Cost (PKR)*
Cultivated Land	Private owner	212.00	650,000	137,800,000
Uncultivated Land	Private owner	156.00	200,000	31,200,000
Land under Houses and other Structures	Private owner	32.22	650,000	20,940,316
Uncultivated Communal Land	Private owner	719.95	100,000	71,995,413
Compulsory Land Acquisition Surcharge			25%	**65,483,932**
Total		**1,120.17**		**327,419,661**

14.2.2 Houses and Other Structures

Cost estimates for affected houses, shops, communal structures (Mosques and Jamat Khana) and public structures (school) are provided in **Exhibit 14.6.**

Exhibit 14.6: Cost Estimate for Compensation of Affected Structures

Structure	*Construction Type of Structures*	*Quantity*	*Unit*	*Unit Price (PKR/Sqm)*	*Total Amount (PKR)*
Houses and other Structures	Pucca	2,951	Square meter	21,530	63,537,599
	Semi Pucca	2,482	Square meter	12,918	32,059,776
	Katcka	2,715	Square meter	4,909	13,329,563
Total					**108,926,938**

14.2.3 Crops

Based on average rates of crops, cost estimates of compensation of crops are provided in **Exhibit 14.7**.

Exhibit 14.7: Cost Estimate for Crops

Location	*Cropped Area (Kanal)*	*Unit Price (PKR/Kanal)*	*Compensation (PKR)*
Mumi	43.00	5,600	240,800
Andahti	63.00	5,600	352,800
Uchhtar	106.00	5,600	593,600
Total	**212.00**	**5,600**	**1,187,200**

14.2.4 Fruit Trees

Exhibit 14.8 provides details of compensation of fruit trees.

Exhibit 14.8: Cost Estimate for Fruit Trees (PKR)

Trees	*Number of Trees*			*Rate PKR/ Tree*			*Total*	
	Small	*Medium*	*Large*	*Small*	*Medium*	*Large*	*Trees*	*Cost*
Apple	94	254	41	2,400	4,800	6,000	389	1,690,800
Apricot	93	306	70	2,400	4,800	6,000	469	2,112,000
Mulberry	21	49	10	1,000	1,500	200	80	96,500
Peach	27	100	14	1,800	3,250	4,500	141	436,600
Plum	12	9	1	1,800	3,250	4,500	22	55,350
Peer	2	5	0	1,800	3,250	4,500	7	19,850
Walnut	37	111	13	35,000	80,000	120,000	161	11,735,000
Guava	0	2	0	1,000	1,500	2,000	2	3,000
Pomegranate	18	58	4	1,000	1,500	2,000	80	113,000
Persimmon	7	7	2	2,000	5,000	7,500	16	64,000
Figs (Anjeer)	20	50	3	1,500	3,200	3,000	73	199,000
Other	83	283	32	1,500	2,200	3,650	398	863,900
Total	**414**	**1,234**	**190**				**1,838**	**17,389,000**

14.2.5 Non–fruit Trees

Exhibit 14.9 below provides details of compensation of non–fruit trees.

Exhibit 14.9: Cost Estimate for Non– Fruit Trees

Trees	*Number of Trees*			*Rate PKR/ Tree*			*Total*	
	Small	*Medium*	*Large*	*Small*	*Medium*	*Large*	*Trees*	*Cost*
Deodar	110	35	13	5,000	22,500	60,000	158	2,117,500
Blue pine	–	–	–	–	–	–	–	–
Chirr	–	–	–	–	–	–	–	–
Kikar	233	475	245	2,500	7,000	15,000	953	7,582,500
Poplar	–	–	–	1,200	30,000	8,500	–	–
Wild Olive (Kao)	–	15	–	1,200	3,800	9,500	15	57,000
Eucalyptus	291	891	251	1,000	2,500	5,650	1,433	3,936,650
Shishum	161	367	11	1,500	3,500	16,500	–	–
Other	573	1,032	628	750	1,500	2,500	2,233	3,547,750
	1,368	**2,815**	**1,148**				**4,792**	**17,241,400**

14.2.6 Rehabilitation of Water Channels

A lump sum amount of PKR 2,000,000 has been allocated for the rehabilitation of water channels.

14.2.7 Cost of Compensation for Business loss

During the RFS it was observed that two HHs will lose their business in addition to loss of houses, lands and commercial structures. Total average income from their business is estimated to be PKR 50,000 per month. Therefore total compensation for three months will be PKR 150,000.

14.2.8 Resettlement Allowances

Exhibit 14.10 provides details of resettlement allowances. During the RFS one woman-headed HHs and 14 poor HHs (under national poverty line) were identified as Vulnerable. These Vulnerable AHs will be eligible for the vulnerability allowance. The HHs who are losing more than 10% of their monthly income earning as a result of land acquisition are eligible to the severe impact allowance and HHs needing relocation will require shifting allowance.

Exhibit 14.10: Cost Estimate for Resettlement Allowances

Category	*Eligible HH*	*Unit Price (PKR/HH)*	*Total Amount (PKR)*
Vulnerable Allowance	15	50,000	750,000
Shifting Allowance for Houses	27	25,000	675,000
Shifting Allowance for Commercial Structures	2	25,000	50,000
Severe Impact Allowance	8	50,000	400,000
Vocational Trainings	48	50,000	2,400,000
Total			**4,275,000**

14.2.9 Technical Assistance

A provision of PKR 7.2 million has been made for 24 months of time of a Resettlement Specialist who will assist the PMU in implementation of the RAP. An External Monitoring Expert will be engaged for independent review of implementation of the RAP and identification of gaps and shortcomings for which a provision of PKR 4.8 million has been made for an intermittent input of 12 months.

14.3 Overall Resettlement Budget

The total estimated cost of this RAP (**Exhibit 14.11**), including compensations for the affected lands, houses, crops, trees, cost of replacement of affected public structures, relocation allowances and technical assistance, administration charge 15% of compensations and 10% contingency has been estimated at PKR 620.59 million (US$ 5.33 million).

Exhibit 14.11: Estimated Resettlement Cost of Arkari Gol HPP

No.	*Resettlement Activity*	*No.*	*Unit*	*PKR./Unit*	*Total PKR.*
A.	**Asset Compensation:**				
A.1	**Affected Structures:**				
A.1.1.1	Pucca	2,951	Square meter	21,530	63,537,599
A.1.1.2	Semi Pucca	2,482	Square meter	12,918	32,059,776
A.1.1.3	Katcka	2,715	Square meter	4,909	13,329,563
A.1	**Total**	**8,148**			**108,926,938**
A.2	**Land:**				
A.2.1	Cultivated Land	212	Kanal	650,000	137,800,000
A.2.2	Uncultivated Land	156	Kanal	200,000	31,200,000
A.2.3	Land under Houses and other Structures	32	Kanal	650,000	20,940,316
A.2.4	Uncultivated Communal Land	720	Kanal	100,000	71,995,413

No.	*Resettlement Activity*	*No.*	*Unit*	*PKR./Unit*	*Total PKR.*
A.2.5	25% Compulsory Land Acquisition Surcharge	0.25		261,935,729	65,483,932
A.2	**Total**	**1120**			**327,419,661**
A.3	Fruit Trees (Private):	1,838	Number	–	17,389,000
A.4	Non-Fruit Trees (Private):	4,792	Number	–	17,241,400
A.5	Crops:	212	Kanal	5,600	1,187,200
A.6	Business:	2	3 Month	50,000	150,000
A.7	Rehabilitation of Watercourses	–	Lump sum		2,000,000
A.	**Total**	**–**	**–**	**–**	**474,314,199**
B	**Resettlement Allowances**				
B.1	Vulnerable Allowance	15	Number	50,000	750,000
B.2	Shifting Allowance for Houses	27	Number	25,000	675,000
B.3	Shifting Allowance for Commercial Structures	2	Number	25,000	50,000
B.4	Severe Impact Allowance	8	Number	50,000	400,000
B.5	Vocational Trainings	48	Number	50,000	2,400,000
B	**Total**				**4,275,000**
C	**Technical Assistance:**	**–**	**–**	**–**	**-**
C.1	Resettlement Specialist (implementation)	24	Person/month	300,000	7,200,000
C.2	External Monitoring	12	Person/month	400,000	4,800,000
C	**Total**	**–**	**–**	**–**	**12,000,000**
D.	**Administration Costs (15% of A+B+C)**	**0.15**	**Lump sum**	490,589,199	**73,588,380**
E.	**Subtotal (A+B+C)**	**–**	**–**	**–**	**564,177,579**
F.	**Contingency (10% of F)**	**0.1**	**Lump sum**	564,177,579	**56,417,758**
Total Amount (Pak. Rupees):		**–**	**–**	**–**	**620,595,337**
Total Amount (US Dollars*):		**–**	**–**	**–**	**5,327,456**

*Exchange Rate US $ 1 = 116.49 PKR[16]

[16] https://www.google.com.pk/search?q=exchange+rates+in+pakistan&rlz=1C1DVCO_en-GBPK688PK688&oq=Exchange+Rates&aqs=chrome.1.69i57j0l5.6765j0j8&sourceid=chrome&ie=UTF-8 cited on April 27, 2018.

15. Conclusion and Action Plan

The RSP prepared for the Project provides relevant details including the legal framework, project impacts, socioeconomic conditions of AHs, resettlement planning, institutional framework, grievance redressal mechanism, monitoring, and evaluation plan, implementation schedule and budget for smooth execution of the land acquisition, relocation and resettlement of the AHs.

15.1 Gaps Analysis of the Survey

Due to limitations such as time constraints, unavailability of official prices of land and other structures and unavailability of final design there are some gaps left in the RAP. These need updating before implementation of the RAP. These gaps are as follows:

- As the official rates of affected assets have not yet been approved, after finalization of official rates budget for the RAP will be finalized;
- Due to lack of time and unavailability of final design it is possible that some of the affected areas and AHs, could not be surveyed. After the finalization of the design of the Project RFS will be conducted in remaining areas (if any);
- The impacts assessed in the RAP are based on Google maps only in light of missing topographical information and a satellite image in adequate scale and with recent date of observation. These figures will be updated once a georeferenced satellite image is available.
- More consultations are required especially regarding relocation and livelihood restoration;
- The RAP will be improved as well as updated with the help of new data and official prices; and
- Prices of affected assets determined by district management will be reviewed and feedback from the AHs will be collected. If the prices are found to be less than replacement cost, additional amounts will be paid by the Master Hydro (Private) Limited.

Once prices of affected assets are finalized, the RAP will be updated. This will follow the entitlement matrix of the RAP. The time frame for updating the RAP is provided in **Exhibit 13.1**. The following steps will be taken to improve and update it before taking physical possession of the required lands for the Project.

- More consultations with affected communities will be conducted.
- The RAP will be improved as well as updated with the help of new data and official prices and
- Prices of affected assets determined by district management will be reviewed and feedback from the AHs will be collected. If the prices are found to be less than replacement cost, additional amounts will be paid by the MHL.

In addition to improving and updating of RAP, MHL needs to start preparatory works in the pre–construction period.

At the Project–level, the Project Director MHL, Social and Environment Unit and land acquisition staff of PMU will be required to address and manage various tasks related to updating of the RAP, stakeholder consultations, communications, resettlement, livelihood, gender, monitoring and management before and during the implementation phase. In the following section, a set of tasks are listed to briefly to illustrate the extent of work necessary for the implementation of the RAP.

15.2 Establishment of PMU

For smooth implementation of the RAP MHL will establish a PMU at the Project site as a pre–construction activity to help build local capacity and confidence, and help the affected people and communities identify problems, constraints, and possible solutions. It will also provide the affected communities the confidence, motivation, and opportunity to address resettlement issues. The resettlement specialist will actively be engaged in activities related to (i) disclosure of Project impacts; (ii) consultation with AHs/communities; (iii) consultation with other stakeholders, including district administration, (iv) keep the community engaged with the Project to move Project implementation work forward.

15.3 Grievance Redressal Mechanism

The GRCs are to ensure accessibility, fairness, and independence of the procedures. Two Grievance Redressal Committees will be established at village level and at Project level to receive and resolve community issues during the land acquisition process and implementation of the RAP.

15.4 Management Information System (MIS)

Databank on baseline/census data on the APs/HHs and their basic livelihood information, resettlement impacts, income rehabilitation, as well as monitoring and evaluation data on social and resettlement plans will be computerized for effective monitoring of the day–to–day progress in the field.

15.5 Monitoring and Evaluation

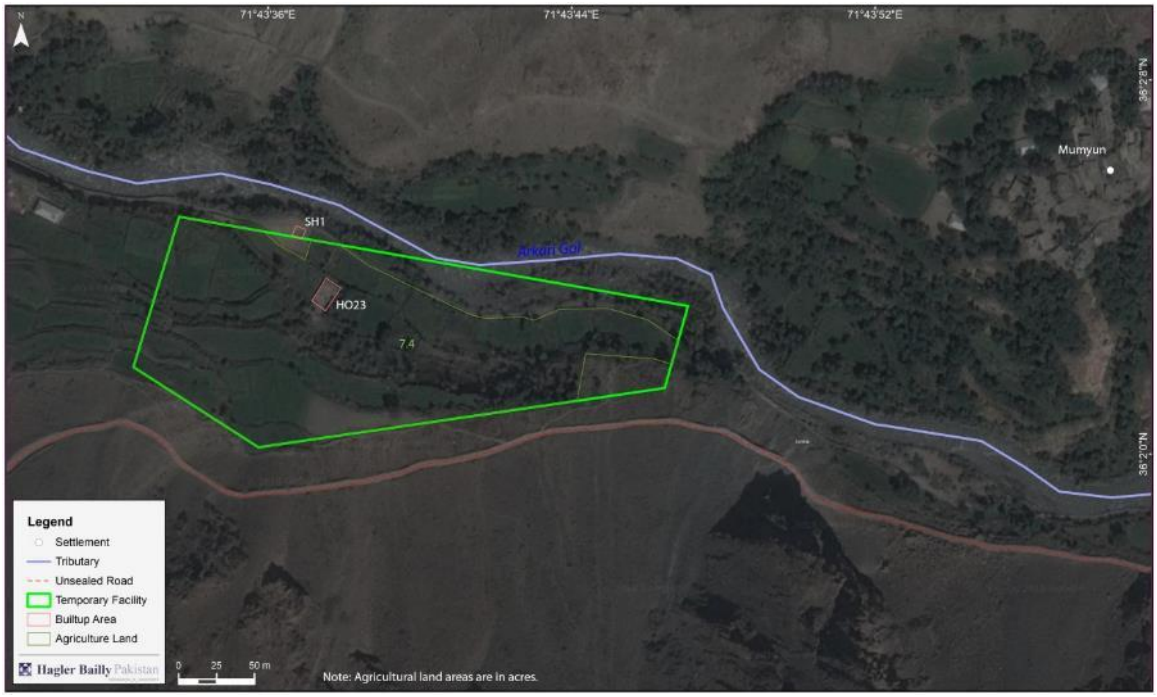
The objective of the M&E system presented herein is not only to assist in maximizing benefits of the RAP to the PAPs but also to enhance the delivery capacity of Master Hydro (Private) Limited with regard to RAP implementation. Further, the system will serve as a tool to ensure timely and fair delivery of PAP entitlements.

The M&E will obtain feedback from target populations and the field operatives to facilitate the formulation of remediation measures when required and as a result, ensure achievement of targets within schedule. M&E will be carried out through collecting and analyzing information from the field and verifying the progress reporting on RAP implementation progress and its effectiveness. It will ensure that inputs are provided, procedures are followed, and outputs are monitored and verified as per the approved plan and schedule of action. A database with Geographic Information System (GIS) will be

developed for the purpose of the ongoing monitoring and evaluation and also for ex–post evaluation.

Internal monitoring of the RAP will be started as soon as the PMU is established and MHL will be responsible for preparation of the monthly monitoring reports while at the same time MHL will also mobilize an external monitoring consultant.

Appendix A: Maps Showing Affected structures




Surge Tank
Powerhouse
Arkari Gol
Andahti
Runi
Lutkho River
HO25
HO24
HO26
HO27
HO29
SH2
HO31
MO1
HO28
HO30
HO32
HO33
HO34
Legend
Settlement
Tunnel
River
Tributary
Sealed Road
Unsealed Road
Permanent Facility
Temporary Facility
Builtup Area
Agriculture Land
Hagler Bailly Pakistan
Note: Agricultural land areas are in acres.

Appendix B: Questionnaires used for Field Survey

See following pages.

BASELINE SOCIOECONOMIC CONDITIONS

Questionnaire for Household Profile

A. Investigator Information

Name of Investigator(s): _____

Date: _____ Start Time: _____ End Time: _____

Note any pause in interview shall be noted in the Comments section on Page 10

B. Location Information

Primary Structure ID: _____ Settlement: _____ Mauza: _____

Other Structures (with explanation): _____

UC: _____ Tehsil: _____ District: _____

GPS Coordinate: _____º _____' _____" N, ____º _____ ' _____" E

1. Structure ID should be the same as that on the area map. If the family has more than one structures, list the remaining IDs in the second row with explanation in brackets.
2. GPS coordinate to be provided only where GPS is available
3. Settlement is the name by which the village is identified by the residents
4. Mauza is the revenue village

C. Respondent and Head of Household (HHH) Information

	Respondent	*Head of Household*
Name		
Father/Husband Name		
NIC Number		
Mobile Number		
Gender	☐ Male ☐ Female	☐ Male ☐ Female
Age (Response)		
Year of Birth (as in NIC)		
Relation to HHH	☐ Self ☐ Father ☐ Brother ☐ Son ☐ Other _____	
Education	☐ Illiterate ☐ Madrassah ☐ No or less than Primary ☐ Primary (Class 5 to Class 9) ☐ Matric (Class 10) ☐ Intermediate (FA/ FSc) ☐ Graduate (BA/BSc) ☐ Other _____	☐ Illiterate ☐ Madrassah ☐ No or less than Primary ☐ Primary (Class 5 to Class 9) ☐ Matric (Class 10) ☐ Intermediate (FA/ FSc) ☐ Graduate (BA/BSc) ☐ Other _____

If respondent is the head of household, the third column should be left blank

D. Demographic Profile

Total Number of Persons in the Family (including HHH) _____

No.	*Name (Including HHH)*	*Relation-ship with HHH*	*Name of Father /Husband*	*Age (Yrs)*	*Gender (M/F)*	*Marital Status*	*Education Level*	*Class (School going child)*	*Primary Occupation*	*Secondary Occupation*	*Special Person (Give Detail)*
1.		Self									
2.											
3.											
4.											
5.											
6.											
7.											

Note: Go to Next Page if HH members are more than 8.

Occupational Codes (See Additional Notes for further explanation**):**

Income Generating	**E-GOV** = Employed in government Sector **E-PVT** = Employed in private Sector **S-ART** = Self-employed, working as artisans **S-LAB** = Working as skilled or unskilled laborer **S-STB** = Self owned trade and business **I-FAR** = Income generating farming
Non-income generating	**N-FAR** = non income generating subsistence farming **N-LIV** = non income generating livestock rearing
For those not working	**UNE** = Unemployed and seeking jobs **NEM** = Not employed willingly **STU** = Student against those still studying and not working
Education Codes	**Ill** = Illiterate **Mdr** = Madrassah **No** = No or less than Primary **Prim** = Primary (Class 5 to Class 9) **10** = Matric (Class 10) **Int** = Intermediate (FA/FSc) **Grad** = Graduate (BA/BSc) Other _____

Relationship	Self-Father Mother Husband Wife Brother Sister Son Daughter Grandson Granddaughter Daughter-in-law Other
Marital Status	Married Unmarried Widowed Divorced
Age	Enter whole number only. Round off, where needed; Enter Zero “0” for infants less than 6 months and “1” for infants between 6 months and a year.

No.	*Name (Including HHH)*	*Relation-ship with HHH*	*Name of Father /Husband*	*Age (Yrs)*	*Gender (M/F)*	*Marital Status*	*Education Level*	*Class (School going child)*	*Primary Occupation*	*Secondary Occupation*	*Special Person (Give Detail)*
8.											
9.											
10.											
11.											
12.											
13.											
14.											
15.											

Do you have servants, tenants, or other workers living with you? If yes please provide the details

No.	*Name*	*Job*	*Age (Yrs)*	*Gender (M/F)*	*Marital Status*	*Education Level*	*Is he/she paid in cash or in kind or both?*
1.							
2.							
3.							

If the respondent is not part of the household (as listed in Demographic Profile Table) what is his place of residence?
Settlement: ___ Mauza: _____

E. Housing

Ownership Status? ☐ Owned ☐ Rented ☐ Free ☐ Others _____

Construction ☐ Pucca (Bricks/blocks/stones) ☐ Semi Pucca ☐ Katcha ☐ Others _____

Storeys _____ Number of rooms in the house (including bedrooms) _____

Number of bedrooms _____ Number of bathrooms/toilets _____

Number of kitchens _____ Number of rooms/sheds for animals? _____

Approximate plot size of the house (State units) _____

Approximate covered area (State units) _____

When was the house constructed? _____

Covered area is the area of all floors in the house. Plot size is the size of land on which the house is built and includes the court yard, out houses, driveway etc.

F. Available Facilities in the House

Do you have Telephone Connection (landline)? ☐ Yes ☐ No If "Yes", when connected (Year)? _____

Do you have electricity connection? ☐ Yes ☐ No If "Yes", when connected (Year)? _____

Do you have Sewerage System? ☐ Yes ☐ No

Sewerage system includes constructed septic tanks and soak pit

Drinking Water Source

☐ Spring ☐ Groundwater ☐ River/Stream ☐ Open Pond

Water Supply System from the source

☐ Pipe ☐ Electric Pump ☐ Hand pump ☐ Carried on Animals
☐ Carried by Family ☐ Tankers ☐ Open channel ☐ Other _____

G. Fuel Sources and Consumption

Type	*Y/N*	*Average Bill/expense (per month)*		*Units Consumed per Month (mention units)*		*Source (For LPG, Purchased wood, and Kerosene, the **Location** of Market; For Gathered Wood, **Area** where gathered)*	*Uses*			
		Winter	Summer	Winter	Summer		*L*	*SH*	*WH*	*C*
Electricity										
Fuel wood (Gathered)										
Fuel wood (Market)										
LPG										
Kerosene										
Other										

L: Lighting SH: Space Heating WH: Water Heating C: Cooking

H. Social Profile

Religion _____ Caste _____ Mother Tongue _____

Do you marry children outside your tribe/clan? ☐ Yes ☐ No

How many of the married members of the HH are married to their first cousins? _____

I. Decision Making

Who takes decision in the family on the following issues, and how?

Issue	How the decision is taken	If unilateral who takes the decision? (Indicate member no) If consultative, list the members consulted
Household budget management	☐ Unilateral ☐ Consultative	
Family conflicts	☐ Unilateral ☐ Consultative	
Matrimonial decisions	☐ Unilateral ☐ Consultative	Are daughters consulted in their marriage? ☐ Yes ☐ No
Property and asset management and inheritance	☐ Unilateral ☐ Consultative	

J. Migration Patterns

Years since settled in settlement: _____

If less than 10 years, then previous location: _____

Purpose of relocation from previous place: _____

K. Family Health

Births and Deaths

Number of births in the family in last 2 years Live_____ Stillbirth_____

Deaths in the family in the last 2 years

No	*Age*	*Cause*
1		
2		
3		
4		

Serious illnesses

Did any of your family members suffered from any serious illnesses during the past 2 years?

Person	*Illness*	*Outcome*	*Treatment Type*	*Treatment Location*	*Estimated Cost of Treatment*	*Who paid for Treatment?*

Illness:	Tuberculosis, Hepatitis, Asthma, Jaundice, Tetanus, Paralysis, Diabetes, Cancer, Heart disease, Others (specify)
Outcome:	Treated, Persisting, Disability, Lost job or occupation, Death
Treatment type:	Hospitalization, OPD/Clinic, Herbal/Hakeem, Faith healer, Homeopath, Other (specify)

Accidents

Did any of your family members suffered met an accident during the past 2 years?

Person	*Accident*	*Outcome*	*Treatment Type*	*Treatment Location*	*Estimated Cost of Treatment*	*Who paid for Treatment?*

Accidents:	Fall from height, Snake bite, Road accident, Burns, Electrocution, Accident at work, Other (specify)
Outcome:	Treated, Persisting, Disability, Lost job or occupation, Death
Treatment type:	Hospitalization, OPD/Clinic, Herbal/Hakeem, Faith healer, Homeopath, Other (specify)

Common illnesses

Are the following illnesses common in your family in the specified category (Yes/ No)

Common Diseases (عام بیماریاں)		*Men* (مرد)	*Women* (خواتین)	*Adult-Children (6 to 14)* (بالغ بچے)	*Children (0 to 5)* (بچے)
Tuberculosis	تپ دق				
Diarrhea	اسہال				
Breathing Problems	دمہ				
Jaundice	پیلیا				
Skin Diseases	جلد کے امراض				
Cold and Flu	بخار اور فلو				
Stomach Diseases	پیٹ کے امراض				
Joint Aches	جوڑوں کا درد				
Tetanus	تشنج				
Paralysis	فالج				
Diabetes	ذیابیطس				
Cancer	کینسر				
Heart Problems	دل کے مسائل				
Other (specify)	دیگر				

L. Family Assets

Appliances

If you own any of the following in your house, Please give the quantity.
(Write quantity in figures in front of each item)

Television _____ Radio _____ Elec Room Heater ___ Elec water heater___

Refrigerator _____ Freezer _____ Washing Machine ___ Elec Iron _____

Electric Fan _____ Sewing Machine ___ Generator _____ Computer _____

Vehicles

If you own any vehicles, please provide the details:

Type	*Make (Year)*	*Model*	*Year Purchased*	*Current Value*	*Use (Commercial/ Personal)*

Include cars, motorcycles, trucks, pick-up, etc.

Livestock

Number of Livestock heads of each type owned by you.

Type	*Buffalo*	*Cow*	Calf	*Goat/ Sheep*	*Lamb*	*Oxen*	*Donkey*	*Horse*	*Chicken*	*Others (specify)*
Number										
Use										
Purpose										
Value Rs./Unit										
Income (State monthly or annual)										

Number:	If the family does not own any animal, enter "Nil". Do not leave blank.
Use:	**S**: Self **C**: Commercial **B**: Both
Purpose:	**Egg** Production, **Milk** Production, Rearing for **Meat**, Carrying **Load**, **Riding**, etc.
Note:	Annual Income should be zero if the livestock is only for self-use.

Are the animals sent for grazing? ☐ Yes ☐ No. If yes, where _____

Are the animals given fodder? ☐ Yes ☐ No. If yes, what is the monthly cost? _____

Estimated monthly expenses on grazing, feed, fodder and medicine _____

Land holding

Serial	*Land Use*	*In this village (mention units)*	*Overall Land (mention units)*
1	Cultivated area		
2	Uncultivated area		
3	Banjar Jadeed (بنجر جدید)		
4	Banjar Qadeem (بنجر قدیم)		
5	Ghair Mumkin (غیر ممکن)		
6	Fruit orchard area		
7	Other _____		
8	Other _____		
	Total		

Farming implements

Do you own any farming implements? ☐ Yes ☐ No. If yes,

☐ Plough for oxen ☐ Plough for tractor ☐ Spray machine

☐ Tractor ☐ Thresher ☐ Other _____

M. Farming

Agriculture

No.	*Crop*	*Season*	*Area under Cultivation (Specify units)*	*Yield / Units*	*Percent Sold in Market*	*Percent Self Consumed*
1	Wheat					
2	Maize					
4	Vegetables					
5	Fodder					
6	Other _____					
7	Other _____					

What is the annual expenditures to grow crops in your land? Rabi _____ Kharif _____

What is your average seasonal earning (PKR/Season)? Rabi _____ Kharif _____

Fruit Trees

No.	*Tree*	*Number of trees*	*Annual Production (Specify units)*	*Percent Sold in market*	*Percent Self consumed*
1	Banana (کیلا)				
2	Mulberry (شہتوت)				
3	Apple (سیب)				
4	Persimmon (املوک)				
5	Loquat (لوکاٹ)				
6	Walnut (اخروٹ)				
7	Apricot (خوبانی)				
8	Peach (آڑو)				
9	Orange (مالٹا)				
10	Plum (آلوچہ الوبخارا)				
11	Other _____				
12	Other _____				

What is annual expenditures to grow fruits? _____

What is your average annual earnings from fruits?_____

N. Comments and Notes

Additional Notes	
Table D. Demographic Profile	
Colum 9 — Class (In case of School going): For all children (15 years or less) either enter the class in which the child is studying or "Nil" in case the child is not going to school.	
Special persons	Persons with physical or mental disabilities
Occupational Codes:	**For income generating occupations**
	E-GOV = Employed in **government** Sector—Person employed for a salary by the government. Includes, for example, armed forces, school teachers, forest guards, and service in the municipal and tehsil administration E-PVT = Employed in **private** Sector— Person employed for a salary by a non-governmental organization on any kind of job. Includes, for example, working for NGOs, private schools, and private clinics S-ART = Self-employed, working as **artisans**. Earning depends on output of work. Includes, for example, carpet weaving, handicraft making, S-LAB = Working as skilled or unskilled **laborer**. Includes, for example, farm labors, off-farm labors, electricians, plumbers, mechanics, mason, and bricklayers, well-diggers S-STB = Self owned **trade and business**. Includes, for example, doctors, all shop owners, barbers, livestock traders, tailors, …
	For non-income generating activities
	N-FAR = non income generating subsistence farming
	N-LIV = non income generating livestock rearing
	For those not working
	UNE = Unemployed and seeking jobs
	NEM = Not employed willingly i.e., of their own choice (can include elderly)
	STU = Student against those still studying and not working

This section should be filled separately for every family (defined as persons who maintain separate accounts)

Family Economics

Indebtedness

Do you owe any money to others or institutions? ☐ Yes ☐ No

If "Yes", provide details as below:

Source	*Year Borrowed*	*Amount Borrowed (PKR)*	*Purpose*	*Amount Yet to Return (PKR.)*
NGO/Bank (specify)				
Friends/relatives				
Moneylender				
Shopkeeper				
Others _____				

Household Income (Average over last year)

Source	*Average (Rs.)*	*Monthly/Annual*
Salaried Jobs including remittances and pensions		
1.		
2.		
3.		
Family Sources		
Farming		
Livestock		
Business		
Rent		
Arts and craft making		
Other (please specify)		

Expenditures (Average over last year)

Heads of Expenditure	*Average (Rs.)*	*Monthly/Annual*
Food		
Clothing		
Combustion fuel (gas, kerosene, firewood, etc.)		
Rent or expenditure on dwelling		
Veterinary fees and medicines		
Electricity charges		
Medical		
Education		
Communication		
Transportation		
Social obligations (alms, charity, gifts, burials, weapons, litigations etc.)		
Farm-related expenditures		
Other expenditures (Please specify heads below)		

Interviewer

Signature: _____

Name: _____

Census of Affected Persons and Project Impacts

Investigator Information

Name of Investigator(s): _____

Location Information

Settlement: _____ Mauza: _____

UC: _____ Tehsil: _____ District: _____

GPS Coordinate: _____º _____' _____" N, ____º _____ ' _____" E

Respondent and Head of Household (HHH) Information

	Respondent	*Head of Household*
Name		
Father/Husband Name		
NIC Number		
Mobile Number		
Gender	☐ Male ☐ Female	☐ Male ☐ Female
Age (Response)		
Year of Birth (as in NIC)		
Relation to HHH	☐ Self ☐ Father ☐ Brother ☐ Son ☐ Other _____	

If respondent is the head of household, the third column should be left blank

Project Impacts Checklist

☐ I. Loss of Residence

☐ II. Loss of Other Infrastructure

☐ III. Loss of Cultivated land

☐ IV. Loss of Uncultivated land

☐ V. Loss of Fruit Trees

☐ VI. Loss of Other Trees

☐ VII. Loss of Livelihood

☐ VIII. Others

Inventory of Affected Structure

No.	*Structure ID*	*Structure Type*	*Use*
1			
2			
3			
4			
5			
6			

Inventory of Other Infrastructure (Water mill, retaining wall, access road, etc.)

Description	*Approximate Size*	*Approximate value*

Inventory of Cultivated Land

No.	*Land Unit*	*Land Category*	*Crops Grown*	*Area as Stated by AP*
1				
2				
3				
4				
5				
6				
7				

Note: Write the unit as stated by AP. Don't convert it into any unit.

Inventory of Uncultivated Land

No.	*Land Unit*	*Land Category*	*Use*	*Area as Stated by AP*
1				
2				
3				
4				
5				
6				
7				

Inventory of Fruit Trees

No	*Name/Species*	*Number*		
		Young	*Fruit Bearing*	*Old*
1	Banana (کیلا)			
2	Mulberry (شہتوت)			
3	Apple (سیب)			
4	Persimmon (املوک)			
5	Loquat (لوکاٹ)			
6	Walnut (اخروٹ)			
7	Apricot (خوبانی)			
8	Peach (آڑو)			
9	Orange (مالٹا)			
10	Plum (آلوچہ الوبخارا)			
11	Other _____			
12	Other _____			

Inventory of Other Trees

No	*Name/Species*		*Number*		
			Small	*Medium*	*Large*
1	Deodar				
2	Blue pine				
3	Chirr				
4	Kikar				
5	Poplar				
6	Wild Olive (Kao)				
7	Eucalyptus				
8	Shishum				
9	Other _____				
10	Other _____				

Inventory of Livelihood Impacts

Nature of Livelihood	*Total Income (PKR/Month)*	*Loss of Income (PKR/Month)*
Agriculture		
Livestock		
Business		
Job		
Labor		
Other (1) _____		
Other (2) _____		

Inventory of Other Impacts, Observations and Suggestions

If your agricultural land /commercial asset are to be acquired for Arkari Gol Hydropower Plant. Do you have any other sources of income? ☐ Yes ☐ No

If "Yes" specify the source _____

In case of relocation, where will you prefer to resettle?

☐ On your own land ☐ Project developed site ☐ Within the Same village

☐ Within the District ☐ Don't know ☐ Other _____

What mode of compensation for land will be your choice?

☐ Cash ☐ Alternate Land ☐ Other _____

If cash payments are made, then expected utilization of the money**:**

☐ Business ☐ Property ☐ Agricultural Land ☐ Other _____

Respondent	Interviewer
Signature: _____	Signature: _____
Name: _____	Name: _____

Business Survey Form

Investigator Information

Name of Investigator(s): _____

Location Information

Structure No _____ Settlement: _____ Mauza: _____

UC: _____ Tehsil: _____ District: _____

GPS Coordinate: _____º _____' _____" N, ____º _____ ' _____" E

Respondent and Business Owner

	Respondent	*Business Owner*
Name		
Father's/Husband's Name		
NIC Number		
Mobile Number		
Gender	☐ Male ☐ Female	☐ Male ☐ Female
Relation to Owner	☐ Self ☐ Son ☐ Brother ☐ Employee ☐ Other _____	

Detail of Business

Nature of business	☐ Service	☐ Goods	☐ Other_____

Brief description of business

Which year was the business established at this location?	
What is the estimated value of present stock in the shop?	PKR
What is the estimated value of movable assets in the shop?	PKR
What is the estimated average sale of goods/services?	☐ PKR/day ☐ PKR/month
What is the average profit?	☐ PKR/day ☐ PKR/month
Is the space rented or owned?	
If rented, rent of the shop	

Detail of Employs and daily workers

No.	Name	Father's / Husband's Name	Position	Job Status	Monthly earning (*PKR)*	Place of Stay	Is the residence effected? (Yes/No)	HH Survey Form No.
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Position	Property Owner Business Owner Joint Owner (In case of Family Business) Partner Manager Salesman Other (Specify)
Job Status	Permanent Daily wage Contractor

Inventory of Affected Public and Community Assets

Investigator Information

Name of Investigator(s): _____

Location Information

Settlement: _____ Mauza: _____

UC: _____ Tehsil: _____ District: _____

Respondent Information

	Respondent 1	*Respondent 2*	*Respondent 3*	*Respondent 4*
Name				
Father/Husband Name				
NIC Number				
Mobile Number				
Gender	☐ M ☐ F	☐ M ☐ F	☐ M ☐ F	☐ M ☐ F
Age (Response)				
Year of Birth (as in NIC)				
Occupation				

Area and Population of the Settlement

- Total area of the settlement _____ Acre. Affected area of the settlement _____ Acre
- Total houses of the settlement _____ Affected Houses of the settlement _____
- Total households of the settlement _____ Affected households of the settlement _____
- Total Population of the settlement _____ Affected Population of the settlement _____

Affected Public infrastructure in the Village

No	*Assets*	*Structure ID*	*Unit*	*Quantity*	*Construction Type*
1	Schools				
2	Roads and tracks				
3	Dispensary				
4	Offices				
5	Electric Line (Length)				
6	Electric poles				
7	Telecommunication Line (Length)				
8	Telecommunication poles				
9	Access road				
10	Water Supply				
11	Any other (specify)				

Affected Community Infrastructure in the Village

No	*Assets*	*Unit*	*Quantity*	*Construction Type*
1	Mosques			
2	Rest houses			
3	Electric poles			
4	Water Course			
5	Access road			
6	Hand Pump			
7	Water Supply			
8	Any other (specify)			
9	Any other (specify)			

Other Affected Communal Assets

No	*Assets*	*Unit*	*Quantity*
1	Forest		
2	Play Grounds		
3	Communal Lands		
3	Grazing Lands		
4	Any other (specify)		
5	Any other (specify)		

Affected Graveyards

Graveyard No.	*Quadrants*	*Estimated Area (Kanal)*	*No. of Graves*	*Estimated Year of establishment of the Graveyard*
1.				
2.				
3.				
4.				
5.				

Comments:

Affected Structures Survey

Investigator_____ Village_____ Latitude*_____ Longitude*_____ *Mandatory if no structure number **Respondent** Name_____ Father's Name_____ NIC_____ Cell No_____ **Head of Household** Name_____ Father's Name_____ Form No_____ CNIC_____ Cell No_____ **Structure** Use_____ Type_____ (Residential, Commercial, ……..) Ownership_____ (Private, Government) Construction Type_____ (Pukka, Semi-Pukka, Katcha) When Constructed?_____	Any Other Information

Under construction; New (<3yr), **R**ecent (After 2005), **O**ld (11-20 yrs), **V**ery Old (>20 yrs)

Appendix C: Photographic Documentation of Affected Structures

1009

2005

2003

1003

2009

3002

1017

1002

3001

1014

2001

1016

1015

2004

2010

1005

2007

1008

2002

1007

1004

Appendix D: Census of Affected Households and Inventory of Affected Assets

See following pages.

No.	*ID*	*Head of HH*	*Gender*	*Settlement*	*Stricture ID*	*Loss of Cultivated Land (kanal)*	*Loss of Un-Cultivated Land (kanal)*	*Covered area of affected House (m^2)*	*Covered area of affected Commercial structure (m^2)*	*Fruit Trees*	*Non fruit Trees*	*Per Capita Income*	*Loss of Livelihood (%)*
1	1017	Rehmat Din	Male	Andahti	HO27	3	5	128	0	138	255	8,333	8%
2	1020	Faisal Ibrahim	Male	Andahti	HO29	4	8	209	0	115	140	7,250	9%
3	1025	Israrundin	Male	Andahti	-	5	8	0	0	19	100	2,714	13%
4	2009	Shuja U Din	Male	Andahti	HO30	6	0	199	0	89	40	758	0%
5	1022	Habib Ur Rehman	Male	Andahti	HO32	5	8	362	0	93	180	8,750	5%
6	1018	Ameerundin	Male	Andahti	HO34	3	5	169	0	112	155	4,333	38%
7	1014	Muhammad Faraz Khan	Male	Andahti	HO33	8	20	346	0	75	185	4,615	8%
8	1023	Sanaullah	Male	Andahti	HO28, SH2	3	5	166	6	95	220	2,500	14%
9	1016	Sarijundin	Male	Andahti	HO25	3	10	236	0	46	200	5,725	5%
10	1015	Shahzada Anwar	Male	Andahti	HO24	8	10	220	0	42	196	4,167	20%
11	2010	Manzoor Ahmed	Male	Andahti	-	3	0	0	0	33	0	2,857	0%
12	1024	Iqbalundin	Male	Andahti	HO26	5	8	230.5	0	73	200	1,714	21%
13	1021	Muhammad Sharif Khan	Male	Andahti	HO31	7	10	314.8	0	98	190	3,625	17%
14	4007	Pinin Khan	Male	Mumi	-	1	0	0	0	0	0	3,000	0%
15	1039	Shashen Shah	Male	Mumi	-	4	1	0	0	3	0	5,000	3%
16	1036	Pinin Khan	Male	Mumi	-	4	0	0	0	4	0	12,500	5%
17	4008	Sikander Khan	Male	Mumi	-	3	0	0	0	0	0	7,143	0%
18	4009	Jam Mosh	Male	Mumi	HO23, SH1	5	6	255.5	65	33	37	5,000	70%

No.	*ID*	*Head of HH*	*Gender*	*Settlement*	*Stricture ID*	*Loss of Cultivated Land (kanal)*	*Loss of Un-Cultivated Land (kanal)*	*Covered area of affected House (m^2)*	*Covered area of affected Commercial structure (m^2)*	*Fruit Trees*	*Non fruit Trees*	*Per Capita Income*	*Loss of Livelihood (%)*
19	1037	Mustakhim Shah	Male	Mumi	-	1	0	0	0	6	9	3,333	2%
20	4008	Sikander Khan	Male	Mumi	-	2	0	0	0	0	0	1,100	0%
21	4004	Sulaiman Shah	Male	Mumi	-	10	0	0	0	0	25	3,278	0%
22	1038	Nadir Khan	Male	Mumi	-	3	0	0	0	0	0	5,000	4%
23	4006	Mirza Mosh	Male	Mumi	-	2	2	0	0	0	0	1,667	0%
24	1013	Bakhtar Khan	Male	Mumi	-	0	6	0	0	0	380	2,857	0%
25	4003	Adina Khan	Male	Mumi	-	5	0	0	0	0	0	2,000	0%
26	4005	Mirxa Khan	Male	Mumi	-	3	0	0	0	0	0	2,500	0%
27	3003	Shar Azam	Male	Uchhtar	-	32	6	0	0	3	200	5,833	0%
28	2003	Mast Ali Khan	Male	Uchhtar	HO2	5	0	186.7	0	51	300	8,333	0%
29	1002	Murad Ali	Male	Uchhtar	HO7	2	3	467	0	76	138	4,889	2%
30	1003	Addna Khan	Male	Uchhtar	HO6	1	0	167	0	86	0	14,286	4%
31	1011	Iqbal Zareen	Male	Uchhtar	-	3	2	0	0	0	90	2,500	0%
32	1009	Noor Ali	Male	Uchhtar	HO9	5	4	183	0	45	73	7,727	3%
33	2005	Fatela Beg	Male	Uchhtar	HO10	5	0	420.3	0	43	170	7,000	0%
34	3002	Charag Hunnain	Male	Uchhtar	HO4	11	0	203.43	0	51	320	7,222	3%
35	3001	Firdost Khan	Male	Uchhtar	HO12	2	0	170	0	23	15	3,631	7%
36	3004	Shuja U Din	Male	Uchhtar	-	0	2	0	0	0	166	6,683	0%

No.	*ID*	*Head of HH*	*Gender*	*Settlement*	*Stricture ID*	*Loss of Cultivated Land (kanal)*	*Loss of Un-Cultivated Land (kanal)*	*Covered area of affected House (m^2)*	*Covered area of affected Commercial structure (m^2)*	*Fruit Trees*	*Non fruit Trees*	*Per Capita Income*	*Loss of Livelihood (%)*
37	2001	Haji Sher Gul	Male	Uchhtar	HO3	5	0	349	0	42	282	5,083	1%
38	2004	Farman Ali	Male	Uchhtar	HO5	0	0	160.1	0	37	0	7,000	0%
39	3005	Adena Khan	Male	Uchhtar	-	0	2	0	0	0	21	7,958	0%
40	1012	Haji Begum	Female	Uchhtar	HO13	0	1	74.75	0	16	65	2,100	0%
41	1005	Hawala Khan	Male	Uchhtar	HO11	6	2	178	0	32	197	8,333	6%
42	2007	Dost Ali	Male	Uchhtar	-	0	5	0	0	44	20	6,667	0%
43	1010	Nazor Shah	Male	Uchhtar	-	4	5	0	0	4	73	1,818	13%
44	1008	Rehmat Baig	Male	Uchhtar	HO15	4	2	156.7	0	65	96	13,750	1%
45	2002	Murad Gul	Male	Uchhtar	HO1	15	0	193.68	0	50	213	13,889	0%
46	1007	Wazir Ali	Male	Uchhtar	HO14	0	2	152	0	20	60	10,833	0%
47	1004	Zar Tali	Male	Uchhtar	HO8	6	2	406	0	76	70	6,667	5%
48	3006	Saif Ullah Jan	Male	Uchhtar	-	0	6	0	0	0	250	8,083	0%

Affected Public and Community Structure

No.	*ID*	*Affected Structure*	*Settlement*	*Structure ID*	*Covered area of affected Structure (m^2)*
1	1006	School	Uchhtar	*SC1*	*1500*
2	1019	Mosque	Andahti	MO1	113
3	2006	Jamat Khana	Uchhtar	JA1	113
4	2008	Jamat Khana	Uchhtar	JA2	48

Appendix E: Background Information Document

See following pages.

March, 2018

Background Information Document for Environmental and Social Assessment of Arkari Gol Hydropower Project

Introduction

Master Hydro (Pvt.) Ltd. (MHL) is carrying out an Environmental and Social Impact Assessment (ESIA) and to develop Resettlement Action Plan (RAP) for developing the 99 megawatt (MW) Arkari Gol Hydropower Project (the "Project" or "AGHPP") on the Arkari Gol in Chitral District, Khyber Pakhtunkhwa (KP). The Project includes a weir, diversion tunnel and powerhouse on the Arkari Gol before its confluence.

The Project is currently the subject of a feasibility study, which will evaluate the technical, environmental and socioeconomic factors influencing and arising from the Project. MHL has acquired the services of Hagler Bailly Pakistan to carry out Environmental and Social Impact Assessment (ESIA) and to develop Resettlement Action Plan (RAP) for the AGHPP that meets with the applicable laws in Pakistan and Khyber Pakhtunkhwa, as well as the Performance Standards of the International Finance Corporation (IFC) and the Safeguards of the Asian Development Bank (ADB).

As part of the ESIA process, consultations will be carried out with communities and institutions that may have an interest in the Project or may be affected by the Project (the "Stakeholders"). This stakeholder consultation exercise is being conducted to provide stakeholders with information on the Project and to record their concerns, so that any issues can be addressed during the Project design phase.

During the consultations, background information on the Project will be made available to the stakeholders in the form of the Background Information Document (BID).

Project Setting

The proposed Project is planned to be built on the Arkari Gol in Chitral District, Khyber Pakhtunkhwa (KP). The proposed project location is given in **Exhibit E.1** and a layout, along with key features of the Project, are reproduced in **Exhibit E.2**.

Project Outline

The Project is estimated to involve acquisition of about **112.9** acres of land which includes, **43.71** acres of cultivated land and **69.2** barren land including river bed.

Out of total required land 103.3 acers of land will be required permanently and **9.2** acre for temporary purpose (Contractor's camps, crushing plant etc.) for 05 years.

Exhibit E.1: Project Location

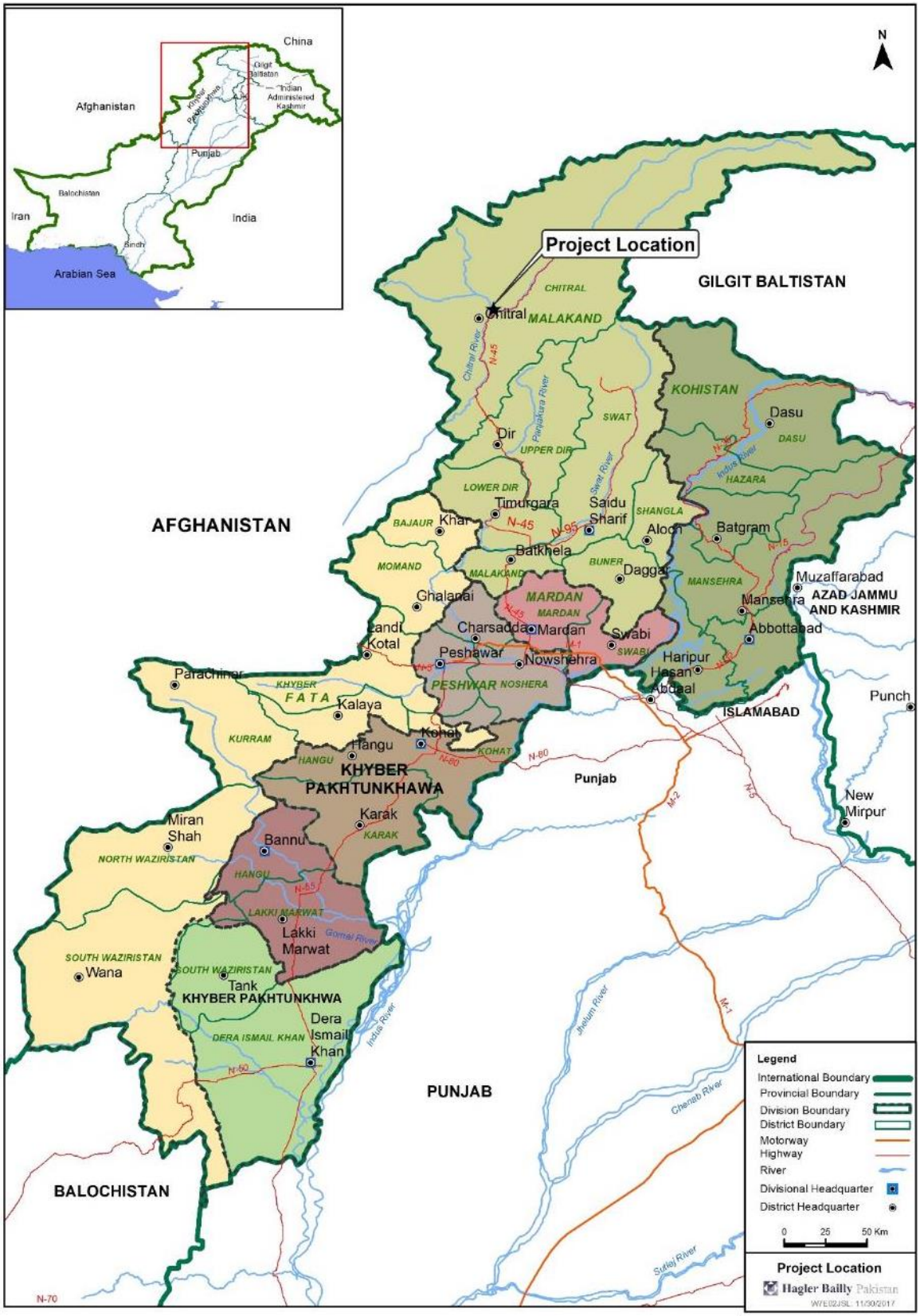
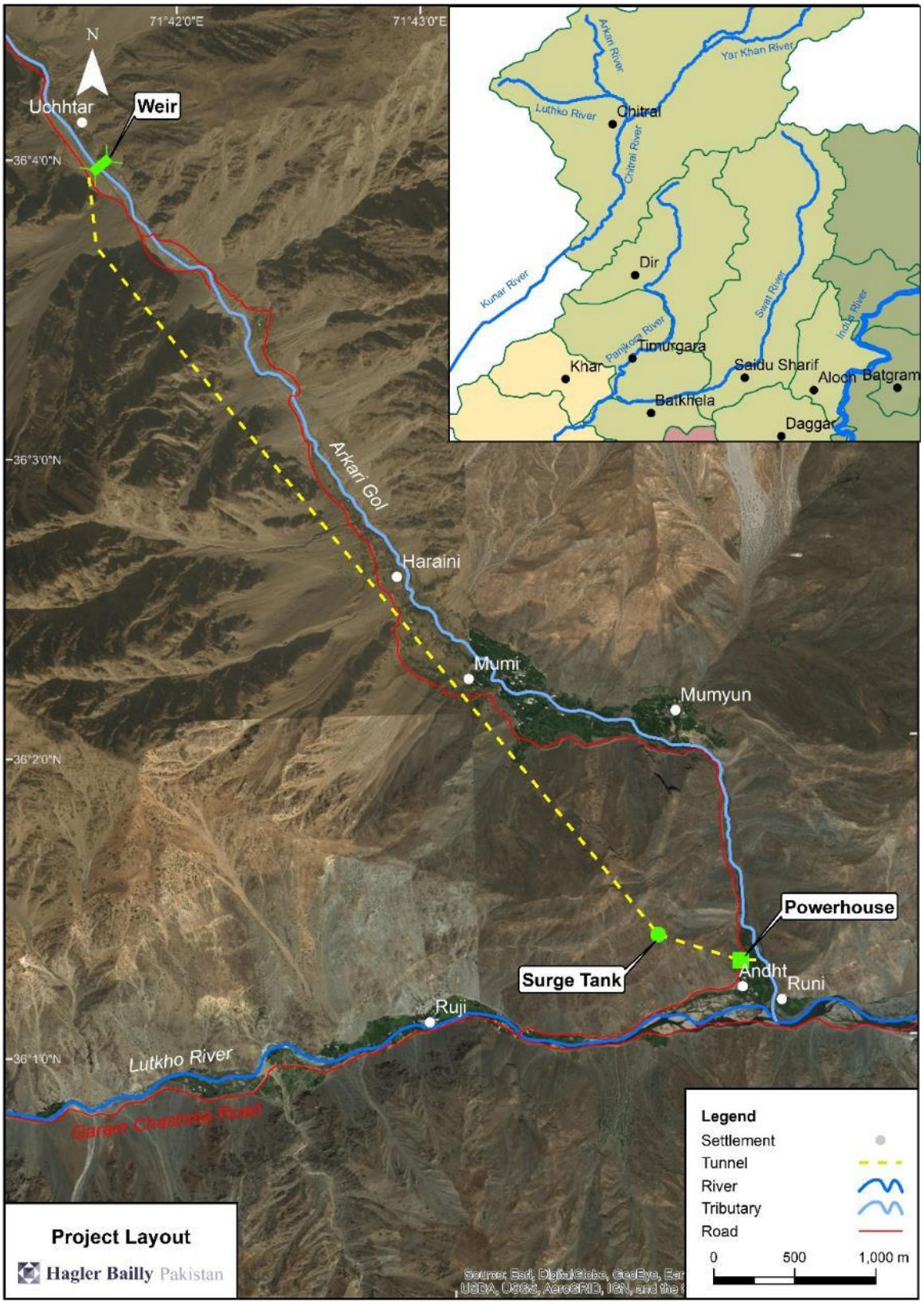


Exhibit E.2: Project Layout



Approach to ESIA

The ESIA will be undertaken in compliance with relevant national legislation and keeping in view the World Bank guidelines. The major components of the study include:

- baseline studies to characterize the existing physical, socioeconomic and ecological environment in the project area;
- a public consultation process to ensure that project stakeholders are informed of the project development plan and have an opportunity to influence it;
- an analysis of the physical, ecological and socioeconomic impacts of the project, both negative and positive and their evaluation against significance criteria (applicable national and international standards, guidelines, performance standards, and good industry practices); and,
- Suggested mitigation measures to address the identified adverse impacts.

Separate to the ESIA settlement level consultations and surveys, household level consultations and surveys, of land owners and households, will be carried out in the areas identified for land acquisition to develop the RAP for the Project.

A brief overview of the conceptual components of an ESIA process is given in **Exhibit E.3.**

Exhibit E.3: Conceptual Framework of ESIA Figure.

Component	*Main purpose*	*Activities related to Stakeholder Consultations*
Scoping	▶ Identify the issues on which the ESIA should focus. ▶ Identify project alternatives that should be evaluated during the course of the ESIA.	▶ Identify institutional and community stakeholders ▶ Engage stakeholders and record issues raised ▶ Provide feedback to the ESIA team to incorporate stakeholders' concern in baseline investigations and impact assessment
Baseline investigations	▶ Collect background information on the environmental and social setting of the project.	▶ Incorporate additional issues raised during the baseline survey

Component	*Main purpose*	*Activities related to Stakeholder Consultations*
Impact assessment, studies	▶ Define the potential impacts of the project ▶ Undertake specialist investigations to predict changes to environment due to the project ▶ Determine the significance of the potential impacts ▶ Identify measures for the management of the impacts ▶ Determine the residual impacts of the project after incorporation of the management measures. ▶ Evaluate the overall acceptability of the project (from environmental and social perspectives).	▶ Assess issues raised by stakeholders
Mitigation Measures and management plan	▶ Environmental mitigation and monitoring plan will describe the measures proposed to ensure implementation of the mitigation measures identified during the impact assessment. It will include, for example, specific designs and plans, training requirements, resource requirements, monitoring details (sampling locations, methodology, and frequency), review and reporting requirements and budget.	▶ Assess the acceptability and practicability of the proposed mitigation measures
ESIA Report Preparation	▶ After the studies, the ESIA team will pull together the detailed assessment of impacts and mitigation measures. This may involve liaison with various specialists to ensure correct interpretation of information and compile ESIA report.	▶ Provide stakeholders with a feedback on the ESIA specifically communicate how the project proponent proposes to address the issues raised by the stakeholders.
ESIA submittal to regulatory authorities and decision making	▶ Submittal and review of the ESIA report by regulatory authorities and other interested stakeholders. The reviewers will inform about their decision on the acceptability of the Project from environmental and social perspectives and the conditions of approval for the development.	▶ Attend the public hearings and respond to the issues raised during the public hearings.

Preliminary list of potential environmental and social impacts of the Project that will be investigated during the ESIA are as follows:

- Provision of employment to people
- Creation of service-sector jobs, procurement of consumables and the outsourcing to local service providers.
- Construction related impacts such as noise and dust
- Reduction in power outages and revival of the affected economies

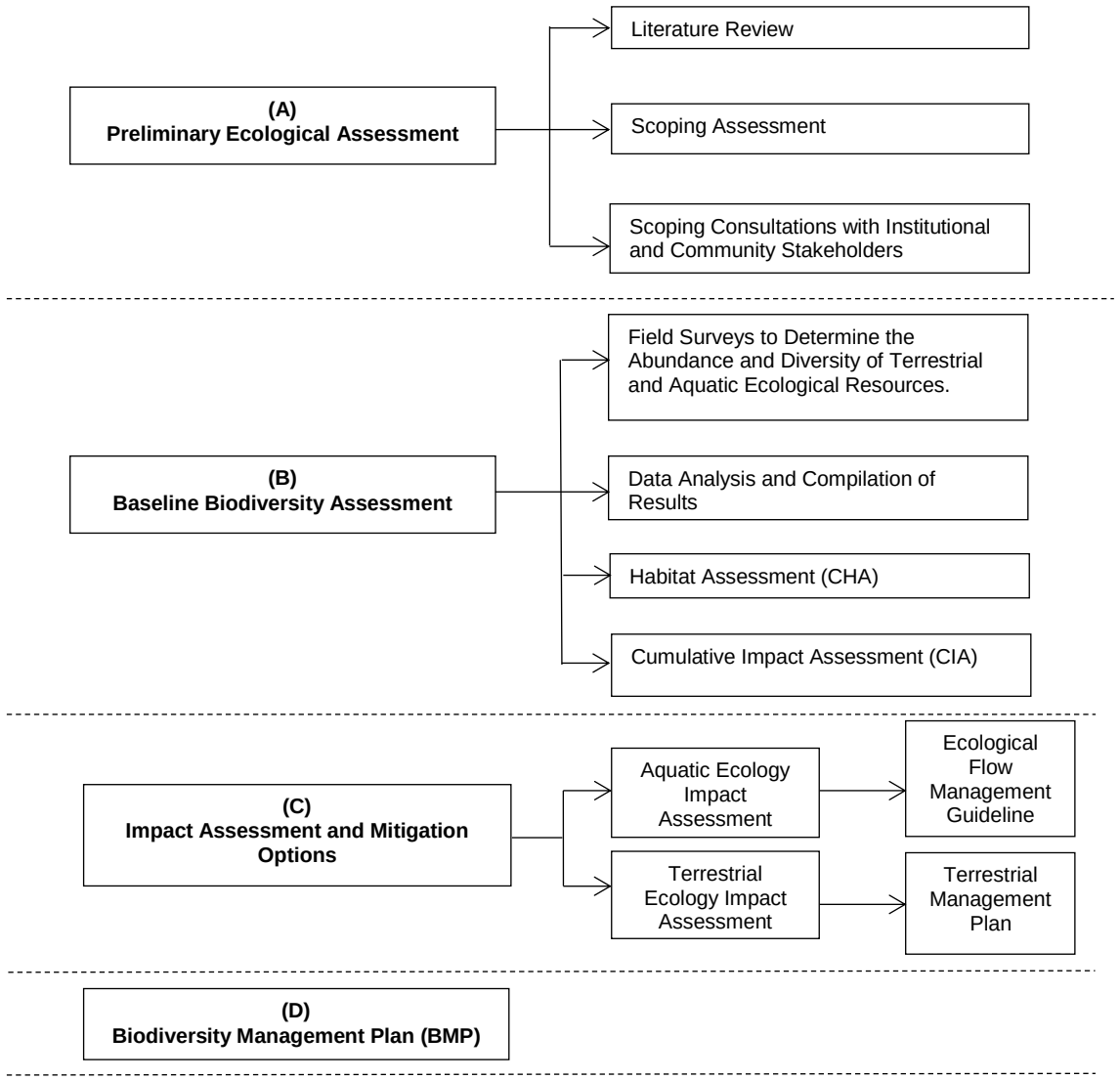
- Increase in traffic due to Project related transportation
- Disturbance due to blasting, dust, noise, vibration, road congestion, and safety hazard from heavy traffic
- Damage to infrastructure due to blasting and noise nuisance due to blasting, drilling and batching plant
- Changes to existing social and cultural norms
- Pressure on existing infrastructure as a result of influx of job seekers
- Impact on sand mining and gravel extraction
- Contamination of soil
- Transformation of landscape
- Physical displacement of some households resulting in disruption of existing socioeconomic setup

As impacts on the aquatic ecology due to the Project are of importance, HBP will draw on the results of a holistic environmental flow assessment conducted for a similar project downstream using Downstream Implications of Flow Transformation("**DRIFT**") Decision Support System ("**DSS"**) approach to assess the changes in flow regime of the river on fish and other river dependent wildlife. The list of potential biodiversity issues that will be investigated are as follows:

- Reduction in water quality and quantity
- Changes in sediment load of river
- Changes in the geomorphology of the river
- Fragmentation of fish habitat
- Damage to natural flora and fauna and river ecosystem
- Impact on endangered and migratory species

The detailed process to be followed for the study of ecological impacts of the Project is provided in **Exhibit E.4**.

Exhibit E.4: Biodiversity Assessment and Management Process



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آرکاری گول ہائیڈرو پاور پراجیکٹ
ماحول پر اثرات کا جائزہ، بنیادی معلومات

تعارف:

ماسٹر ہائیڈرو (پرائیویٹ) لمیٹڈ (کمپنی) دریائے آرکیاری پر 99 میگاواٹ کا آرکیاری گول ہائیڈرو پاور پراجیکٹ بنانا چاہتی ہے، جو کہ خیبر پختونخواہ، کے ضلع چترال میں دریائے آرکیاری اور لشکو کی سنگم پر بنے گا۔ پراجیکٹ کا محلِ وقوع **شکل نمبر 1** میں دکھایا گیا ہے، اس پراجیکٹ میں پاور ہاوس، بند اور سرنگ شامل ہے، پروجیکٹ فی الحال ایک ممکنہ مطالعہ کا موضوع ہے، جس سے پروجیکٹ سے متاثر اور پیدا ہونے والی تکنیکی، ماحولیاتی اور سماجی اقتصادی عوامل کا اندازہ کیا جائے گا،

کمپنی نے منصوبہ کی ماحولیاتی اور سماجی اثرات کا جائزہ اور دوبارہ دوبارہ منتقلی کا پلان ملکی اور بین الاقوامی قوانین کے تحت کرنے کے لئے ہیگلر بیلی پاکستان کی خدمات حاصل کیں ہیں۔

ماحول پر اثرات کے جائزے کے عمل کا ایک بنیادی جزو منصوبے سے ممکنہ طور پر متاثر ہونے والے اور منصوبے میں دلچسپی رکھنے والے افراد (یعنی سٹیک ہولڈرز) سے مشاورت کرنا، ان کے خدشات کو قلمبند کرنا اور ان کو حل کرنا ہے۔ یہ دستاویز مشاورت کے لئے سٹیک ہولڈرز کو منصوبے سے متعلقہ بنیادی معلومات فراہم کرنے کے لئے تیار کی گئی ہے۔ موجودہ سٹڈی کے لئے اسٹیک ہولڈرز سے مشاورت کی جارہی ہے۔ اس لیئے اسٹیک ہولڈرز کے ساتھ مشاورت کے لئے, یہ بنیادی معلومات کی دستاویز (Basic Information Document) تیار کی گئی ہے۔

منصوبے کا محل وقوع

منصوبہ کا مقام خیبر پختونخواہ، کے ضلع چترال میں دریائے آرکیاری پر بنے گا ڈیم آرکیاری وادی پر اور پاور ہاؤس شاگور گاؤں سے مغرب کی طرف (تقریباً 2.45 کلو میٹر) دریائے آرکیاری اور لوٹخو کی سنگم پر بنے گا جس میں تقریباً 5.8 (کلو میٹر) طویل سرنگ بنے گی، پراجیکٹ کا محلِ وقوع **شکل نمبر 1** میں دکھایا گیا ہے، مجوزہ منصوبہ کے کوآرڈینیٹس

ڈیم (N"57'03 ° 36، E"37'41 ° 71)

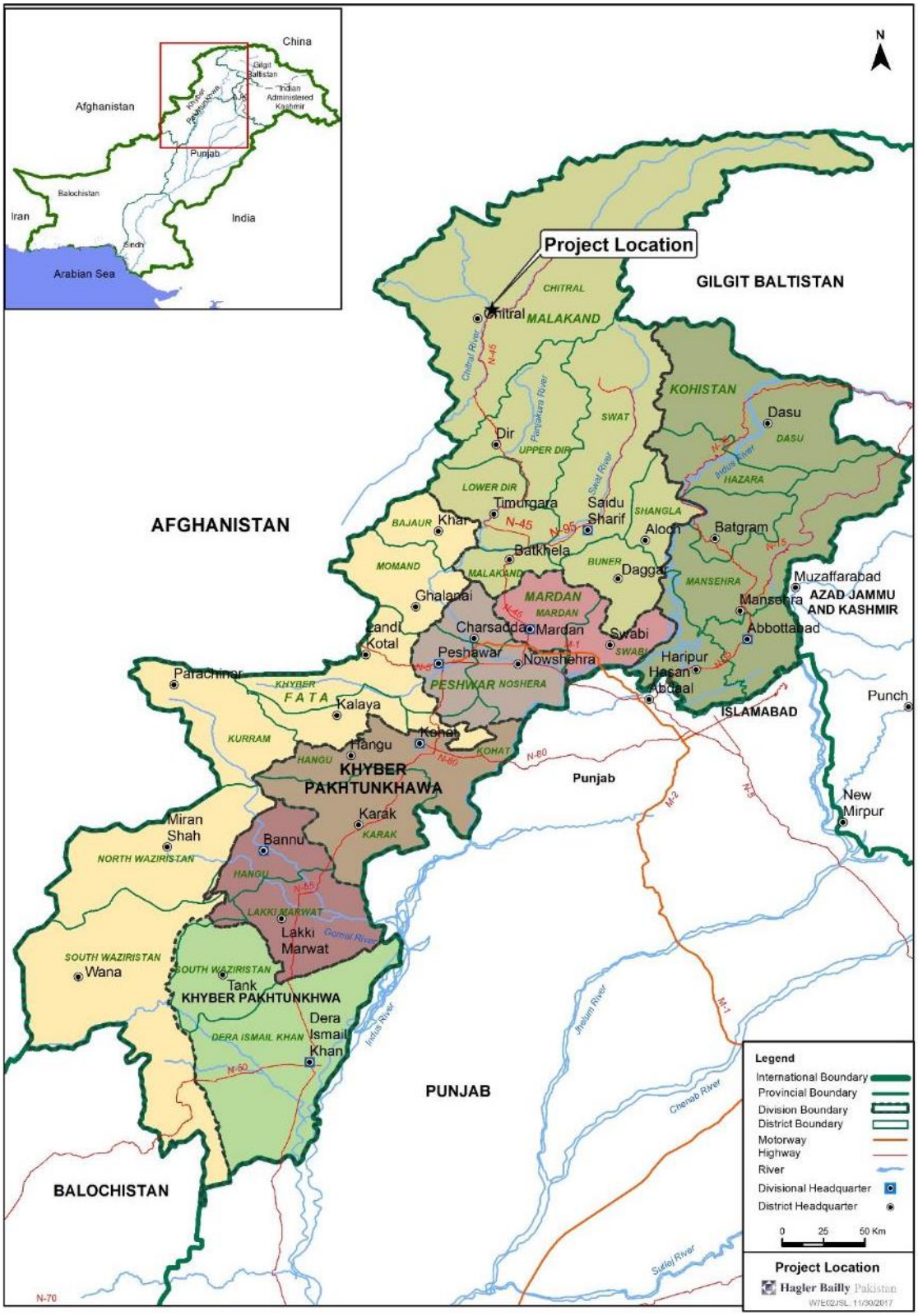
پاور ہاؤس (N"10'01 ° 36، E"11'44 ° 71) ہیں۔ منصوبے کی اہم خصوصیات اور ترتیب **شکل نمبر 2** میں دکھایا گیا ہے

منصوبہ کا خاکہ

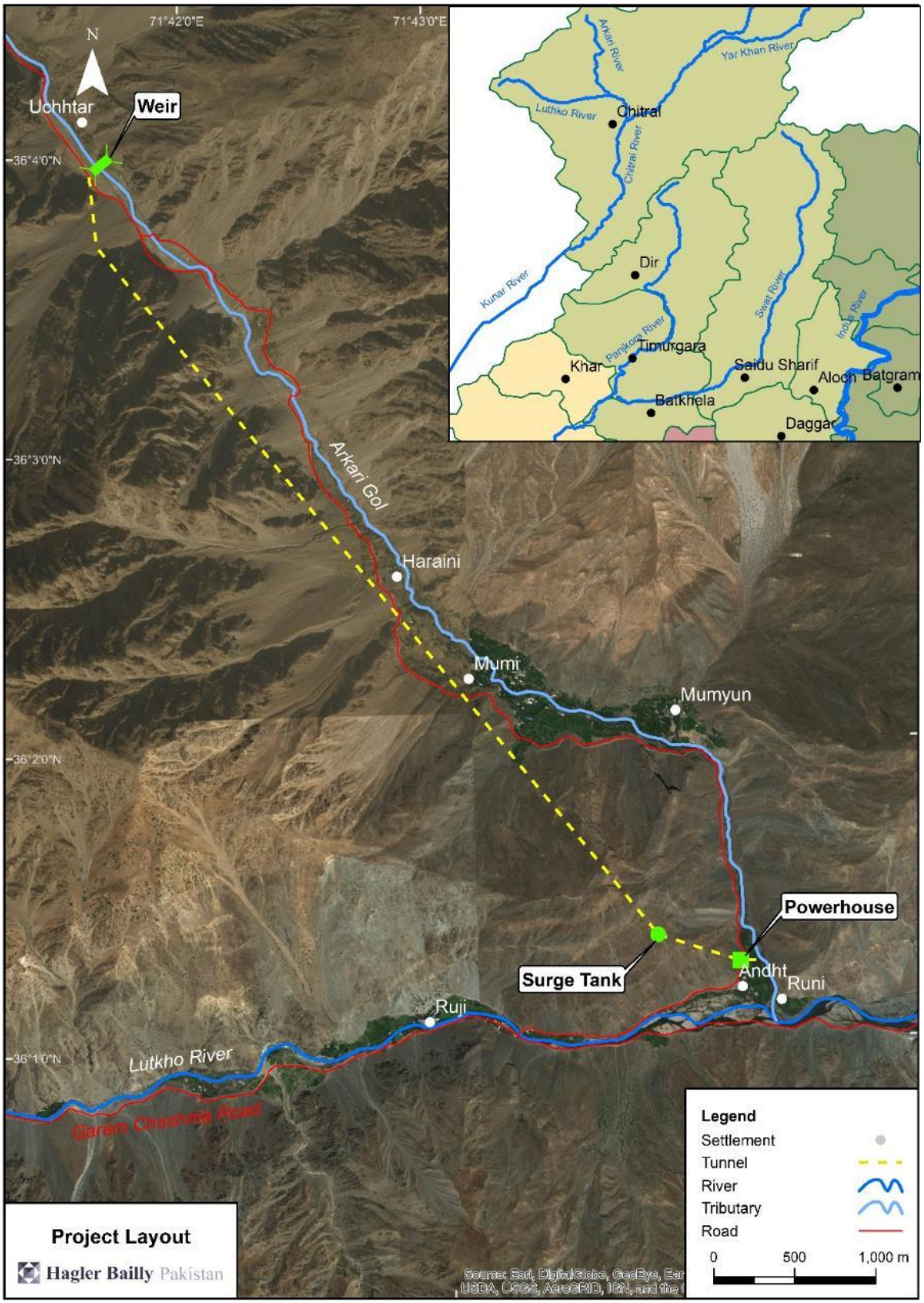
منصوبے کے اہم اجزاء مندرجہ ذیل ہیں:

- زمین کی حصول
- ہائیڈرو پاور پلانٹ کی تعمیر؛
- ہائیڈرو پاور پلانٹ کا آپریشن
- ایسوسی ایٹ سرگرمیاں

شکل نمبر 1: منصوبے کا محل وقوع



شکل نمبر2: منصوبے کا خاکہ



ماحولیاتی تجزیئے کا طریقہ کار

یہ منصوبہ متعلقہ ملکی ماحولیاتی قوانین اور ورلڈ بینک کے معیار کے مطابق تیار کیا جائے گا۔ اس منصوبے کے اہم جزو مندرجہ ذیل ہیں۔

- منصوبے کے ارد گرد موجودہ ماحول کا ایک جامع مطالعہ
- سماجی اقتصادی اور ماحولیاتی ماحول کا ایک جامع مطالعہ ؛
- مشاورت کا عمل تاکہ لوگوں اور اداروں کو منصوبے کے بارے میں آگاہ کیا جاسکے اور ان کو اپنے تاثرات بیان کرنے کا موقعہ دیا جاسکے
- منصوبے کے منفی اور مثبت ماحولیاتی، سماجی اقتصادیات کے اثرات کا تجزیہ
- شناخت شدہ مضر اثرات سے نمٹنے کے لئے تجویز کردہ اقدامات

ماحولیاتی تجزیہ کے علاوہ زمین کے مالکان اور گھرانوں کے مالکان کے ساتھ مشاورت کر کے سروے کیا جائے گا۔ گھروں اور زمین کے مالکان کے لئے زمین کی نشاندہی کی جائے گی منتقلی کا منصوبہ بنایا جائے گا۔

ESIA کے تصوراتی اجزا کا مختصر جائزہ **شکل نمبر** 3 میں دیا گیا ہے۔

شکل نمبر 3 ESIA کے عمل کا طریقہ کار

جزو	بنیادی مقصد	اسٹیک ہولڈرز سے مشاورت کی سرگرمیاں
	◄ ان مسائل کا تعین کرنا جن پر EIA میں خصوصی توجہ مرکوز کرنے کی ضرورت ہے ◄ پراجیکٹ کے متبادلات کا تعین جن کا جائزہ EIA کے عمل کے دوران لیا جائے گا۔	◄ پراجیکٹ سے متاثر ہونے والے افراد اور اداروں (سٹیک ہولڈرز) کا تعین ◄ سٹیک ہولڈرز سے رابطہ کرنا اور ان کی طرف سے اٹھائے گئے مسائل کا اندراج کرنا ◄ ESIA ٹیم کو اس ردِ عمل سے آگاہ کرنا تاکہ بنیادی تحقیقی سرگرمیوں اور اثرات کے جائزے میں ان آراء کو شامل کیا جاسکے
سرگرمیاں	◄ پراجیکٹ کے ماحولیاتی اور معاشرتی محلِ وقوع سے متعلق پس منظری معلومات کی جمع آوری	◄ بنیادی سروے کے دوران سامنے آنے والے مسائل کو شامل کیا جائے
مطالعات	◄ پراجیکٹ کے ممکنہ اثرات کا تعین جو کہ سٹیک ہولڈرز نے مشاورت کے دوران اٹھائے ◄ ممکنہ اثرات کی اہمیت کا تعین اور اثرات سے حل کے لیے اقدامات کی شناخت ◄ انتظامیہ کے ساتھ یا انتظامیہ کے بغیر ممکنہ اثرات کی اہمیت کا تعین کرنا ◄ پراجیکٹ کے (ماحولیاتی اور معاشرتی لحاظ سے) مجموعی طور پر قابل قبول ہونے کا جائزہ لینا	◄ سٹیک ہولڈرز کی طرف سے سامنے لائے گئے مسائل کا جائزہ
اثرات کو کم کرنے کے اقدامات اور ان کی منصوبہ بندی	◄ اثرات کے جائزے کے دوران ان کو کم کرنے کے اقدامات کا تعین اور ان پر عمل درآمد کو یقینی بنانے کے لیے مجوزہ اقدامات کی تفصیل ماحولیاتی اثرات سے نمٹنے اور ان کی نگرانی کے منصوبے میں دی جائے گی اور پلانٹ کو ایشیائی ترقیاتی بینک کے 2009 SPS اور قومی قوانین وضوابط کے مطابق لانا۔ مثال کے طور پر اس میں مخصوص	◄ مخصوص طریقہ کار یا تخفیف کے اقدامات پر بحث جو اثرات کے جائزے کے دوران ظاہر ہوتے ہیں

جزو	بنیادی مقصد	اسٹیک ہولڈرز سے مشاورت کی سرگرمیاں
	ڈیزائنز اور منصوبے، تربیتی تقاضے، ذرائع کی فراہمی کے تقاضے، نگرانی کی تفصیلات (محلِ وقوع کی نمونہ بندی، طریقہ کار اور تعدّد وغیرہ)، جائزے اور رپورٹس کے تقاضے اور بجٹ	
تیاری	◄ جائزے کے عمل کی تکمیل کے بعد EIA ٹیم اثرات اور تخفیف کے اقدامات کی تفصیلی تشخیص کرے گی۔ اس میں معلومات کی درست تشریح کو یقینی بنانے کے لیے مختلف ماہرین کے ساتھ رابطہ اور EIA کی رپورٹ مرتب کرنا ہے	◄ سٹیک ہولڈرز کو EIA کی طرف سے جوابًا بتایا جائے کہ منصوبے کے تجویزکار کس طرح ان کی طرف سے سامنے لائے گئے مسائل کا حل تلاش کریں گے۔
اداروں کو پیش کیا جانا اور فیصلہ سازی	◄ EIA رپورٹ کا انتظامی اداروں، اور دیگر دلچسپی رکھنے والے افراد یا اداروں کو پیش کیا جانا۔ جائزہ لینے والے افراد اور ادارے بتائیں گے کہ ماحولیاتی اور معاشرتی لحاظ سے پراجیکٹ کے قابلِ قبول ہونے سے متعلق ان کا فیصلہ کیا ہے اور منظوری کن شرائط پر دی جارہی ہے۔	◄ ادارہ ماحولیات تحفظ ایک عوامی اجتماع منعقد کرے گا جس میں دیکھا جائے گا کہ سٹیک ہولڈرز کے کوئی ایسے خدشات تو باقی نہیں رہ گئے جن کو فیصلہ لینے سے پہلے نہ پرکھا گیا ہو

ممکنہ سماجی، ماحولیاتی اور حیاتیاتی اثرات جن کی چھان بین ESIA کے دوران کی جائے گی، درج ذیل ہیں۔

- ◄ لوگوں کو ملازمت کی فراہمی
- ◄ سروس کے شعبے کی ملازمتوں، استعمال ہونے والی اشیاء کی پروکیورمنٹ اور مقامی سروس فراہم کرنے والوں کیلئے نوکریوں کی تخلیق
- ◄ تعمیراتی کام کے اثرات مثلاً شور اور دھول
- ◄ لوڈشیڈنگ میں کمی اور ملک کی متاثرہ معیشت کی بحالی
- ◄ پراجیکٹ سے متعلقہ نقل وحمل کی وجہ سے ٹریفک میں اضافہ
- ◄ بلاسٹنگ سے پیدا ہونے والا خلل، شور، دھول، vibration، سڑکوں پر بھیڑ اور زیادہ ٹریفک کی وجہ سے حادثات کا خطرہ
- ◄ بلاسٹنگ سے عمارات کو نقصان اور دھماکے، ڈرلنگ اور batching plant کی وجہ سے شور
- ◄ موجودہ ثقافتی اور سماجی طور طریقوں میں ردوبدل
- ◄ موجودہ سہولیات پر کام کرنے کے لئے علاقے میں آنے والوں کا بوجھ
- ◄ دریا سے ریت اور پتھر حاصل کرنے میں ممکنہ مشکلات
- ◄ گرد سے آلودگی
- ◄ قدرتی نظارے میں تبدیلی
- ◄ گھروں کی منتقلی سے معاشی اور سماجی نظام پر اثرات

جیسا کہ آبی حیات پر منصوبے کے اثرات کی اہمیت ہے، ہیگلر بیلی پاکستان اسی طرح کے منصوبے کے لئے مجموعی ماحولیاتی بہاؤ کے جائزے کے نتائج استعمال کرے گا جو کہ اس منصوبے سے نیچے ہے۔ یہ جائزہ **DRIFT** اور **DSS** کا طریقہ استعمال کرتے ہوئے پانی کے بہاؤ میں تبدیلی کے مچھلیوں اور دوسرے دریا پر انحصار کرنے والے دوسرے جانوروں پر اثرات کا تجزیہ کرتا ہے۔ ممکنہ حیاتیاتی اثرات جن کی جانچ پڑتال کی جانی ہے، درج ذیل ہیں۔

- ڈیم کے بعد دریا میں پانی کے معیار اور مقدار میں کمی
- پانی میں موجود ریت میں کمی
- دریا کی شکل اور راستے میں ممکنہ تبدیلی
- دریا میں مچھلیوں پر منفی اثرات
- پانی کے قدرتی ماحول اور آبی حیات کو نقصان
- خطرے سے دوچار (Endangered) حیات اور دور سے آنے والے آبی پرندوں پر اثرات

مزید معلومات کے لئے رابطہ :

عزیز کریم، ہیگلر بیلی پاکستان	شکیل احمد ہیگلر بیلی پاکستان
بلاک 1، کمرشل ایریا، گلی نمبر 21، F-8/2 ، اسلام آباد،	بلاک 1، کمرشل ایریا، گلی نمبر 21، F-8/2 ، اسلام آباد،
فون: 07-7200 285 (51) 92+	فون: 07-7200 285 (51) 92+
فیکس: 09-7208 285 (51) 92+	فیکس: 09-7208 285 (51) 92+
موبائل: 9000 502 (345) 92+	موبائل: 9813640 (343) 92+
ای میل: AKarim@haglerbailly.com.pk	ای میل: SAhmad@haglerbailly.com.pk

Appendix F: Template of Complaints Registration Form in English and Urdu

Complaints Registration Form

Name of Complainant _____

Father/ Husband Name _____

NIC Number: _____

Contact Address: _____

_____

Contact Number: _____

Nature of Grievance or Complaint:

Environmental: ☐ Social: ☐ Gender: ☐

Details:

_____

_____

_____

_____

_____

Complainant		Recipient Village GRC		Recipient District GRC	
Signature:		Signature:		Signature:	
Name:		Name:		Name:	
Dated:		Dated:		Dated:	

شکایت اندراج کا فارم

شکایت کنندہ کا نام

والد یا خاوند کا نام

شناختی کارڈ نمبر

پتہ:

فون نمبر:

شکایت کی نوعیت:

ماحولیاتی ☐ سماجی ☐ خواتین کے مسائل ☐

تفصیل:

شکایت کنندہ	گاؤں کی جی آر سی کا وصول کنندہ	ضلع کی جی آر سی کا وصول کنندہ
دستخط یا نشانِ انگوٹھا	دستخط	دستخط
نام	نام	نام
تاریخ	تاریخ	تاریخ

Appendix G: Template of Grievance Log of Village Level GRC

Complaint No.	*Registration Date*	*Name of The Complainant*	*Summary of Complaint*	*Summary of supporting Documents**	*Summary of 1st Hearing*	*Summary of Field visit*	*Summary of 2nd Hearing*	*Decision*

* Supporting documents include Land Records, witness statements, Photographic documentation etc.

Appendix H: Template of Grievance Log of Project Level GRC

*Complaint No.**	*Registration Date*	*Name of The Complainant*	*Summary of Complaint*	*Decision of Village level GRC*	*Summary of 1st Hearing*	*Summary of Field visit*	*Summary of 2nd Hearing*	*Decision*

*Complaint Number will be the same registered at Grievance Log of Village Level GRC

Appendix I: Terms of Reference for EMA

Terms of Reference for EMA

The External Monitor/s will independently monitor Master Hydro (Private) Limited's performance in implementing the RAP and the compliance of Master Hydro (Private) Limited.

Objectives

The main objectives of the EMA are as under;

- Prepare a Monitoring and Evaluation Plan, for review and approval by the Master Hydro (Private) Limited. The plan should clearly define the activities and deliverables per reporting, schedule and highlight the scope and strategy of monitoring system, key indicators and methodology in the collection and analysis of data.
- Validate the internal monitoring and reporting procedure of Master Hydro (Private) Limited. The External Monitor is expected to review the adequacy of Master Hydro (Private) Limited's internal monitoring and reporting procedure, determine adequacy and integrity of the process.
- Recommend corrective action plan.

Specific Tasks

The specific tasks expected to be undertaken by the External Monitor are;

- Validation of list of the affected households and inventory of affected households.
- Validation of replacement costs assessed for the affected lands and assets are the replacement costs of the assets.
- Validate the resettlement allowances are sufficient for resettlement of affected households.
- Assess the extent to which the procedure are followed during implementation of RAP including timeliness of payment.
- The External Monitor must closely look into the documents of payments of compensation such as receipt or any other document stating acceptance of compensation by the affected person or his/her representative.
- Assess the adequacy of income restoration strategy and evaluate the matching of specific livelihood development activities against the needs of the intended recipients/beneficiaries.
- Assess the adequacy of institutional arrangements, specifically the capacity of Master Hydro (Private) Limited, the local authorities involved in the land

acquisition and resettlement process and other organizations expected to implement the RAP to ensure that the objectives of the RAP are achieved, and suggest necessary enhancement measures, if necessary;

- When unanticipated involuntary resettlement impacts are found during RAP implementation, the External Monitor should assess and advise Master Hydro (Private) Limited the need to conduct additional social impact assessment and/or updating of RAP, and ensure all existing applicable requirements, entitlements and provisions are followed.
- Validate the adequacy of public consultation and disclosure of information as designed and described in the RAP. Where necessary, the External Monitor should advise Master Hydro (Private) Limited if additional public consultation and disclosure of information need to be undertaken.
- Document and highlight major problems/issues encountered and lessons learned; and
- Where necessary, participate in discussion with Master Hydro (Private) Limited and its consultants and financing agencies.
- The External Monitor will conduct semi–annual site visits, interview affected people and conduct consultations.