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Environmental Impact Assessment

PATRIND HYDROPOWER PROJECT

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EXECUTIVE SUMMARY

1. INTRODUCTION

Patrind Hydropower Project (the Project) is sponsored by STAR Hydropower Limited (the Company). The Report on Environmental Impact Assessment (EIA) has been prepared on behalf of the Sponsor by Pakistan Engineering Services (Pvt.) Lahore. The Project consists of a weir on Kunhar river, located on the boundary of District Abbottabad of Khyber Pakhtunkhwa and District Muzaffarabad of Azad Jammu and Kashmir (AJK). The powerhouse is located on right bank of Jhelum river in lower Chatter area of District Muzaffarabad, (AJK).

EIA Study was conducted by a multidisciplinary team initially during the period between June – September 2006 as the part of feasibility study. The proposed EPC Contractors for the Project have intimated slightly modified design which includes relocation of Weir and Powerhouse from the proposed sites in the feasibility study. As a result of this change additional environmental surveys were conducted in March 2010 and the EIA study has been updated accordingly.

2. THE PROJECT

Patrind is a small village on the left bank of Kunhar river, 12 ½ km downstream from Garhi Habibullah bridge. The project components will consist of a weir near Patrind village, a head pond behind the weir at conservation level of 765 m above mean sea level, Intake Structure followed by sand trap, headrace tunnel, pressure shaft, surge chamber, penstocks, powerhouse, and tailrace. Two coffer dams and a diversion tunnel will be built to keep the Kunhar river bed in dry condition during construction of the weir.

3. PROJECT LAYOUT ALTERNATIVES

During feasibility study four alternatives for the project layout were identified and assessed. Each of the alternatives is the result of varying the location of the powerhouse keeping the location of the weir and headrace tunnel the same. The EPC Contractor while keeping the main concept of the feasibility study intact proposed a slight design modification by relocating the Weir and Powerhouse. EPC Contractor also proposed to construct a diversion channel on Jhelum river to divert the flow temporarily during the low flow season for the construction of permanent bridge across Jhelum river to access the Powerhouse site.

4. LEGAL FRAMEWORK

The EIA Report of the Project has been prepared in accordance with the national requirements for environment assessment and resettlement. The provisions laid down in Pakistan Environmental Protection Act 1997, National Environmental Quality Standards (NEQS), AJK Environmental Protection Act 2000, Land Acquisition Act 1894, Draft National Resettlement Policy 2002, NWFP Forest Ordinance 2002 and Sarhad National Conservation Strategy 1992 have been followed. Similarly requirements laid down by the World Bank/ International Finance Corporation, Asian Development Bank. In particular provisions of ADB *Safeguard Policy Statement* 2009 on resettlement have been used.

5. ENVIRONMENTAL BASELINE

Physiography

Catchment area of Kunhar river is mountainous and rugged with high relief amplitude and steep slopes. Starting from the upper areas, the landforms include valley slopes and terraces containing shale, slate, phyllite and scree. Only level areas in the catchment, consisting of small terraces, support human settlements. Patrind village about 484 acres in extent, downstream of the weir at about 780 m elevation is one such human resettlement. The geology of the project area mostly consists of slate. A value of 0.52 g has been adopted as maximum credible earthquake (MCE) for structural design purposes.

Climate

The data of the meteorological stations at Balakot and Muzaffarabad has been used for the project area. The climate is pleasant with mild summers and cold winters. The average annual rainfall at Balakot is 1538.5 mm and at Muzaffarabad is 1351.9 mm.

Water Resources

Besides numerous small streams (nullahs) and springs, Kunhar and Jhelum are the major rivers in the project area. Daily flows of Kunhar river at weir site vary from an average maximum of 10,000 cusecs (285 cumecs) to average minimum of 850 cusecs (24 cumecs) with annual average of 3,671 cusecs (104 cumecs). Beyond the weir site, the reach of Kunhar river is joined by six nullahs, two of them being major one contributing high in flows of water through the year. To maintain ecological balance of Kunhar river valley, below the weir it is

recommended to maintain a minimum of 2 cumecs below the weir during operation phase of the project.

Water Quality

Besides bottom load of pebbles and boulders, the suspended load of Kunhar river contains sand, silt and clay, their proportion varying in low and high flow seasons. The overall sediment load at weir site has been estimated at 4.94 million tons on the mean annual basis.

Flora and Fauna

The project region has flora in abundance. A variety of flora starting from Dhaman grass to spruce trees including herbs, weeds, grasses, plants, flowers and trees is found. The region has subtropical pine forests supporting broad leaved species as snatha and temperate forests supporting coniferous species like fir. Forest wealth of the region is shrinking due to illegal deforestation.

The valley slopes high above the project area are characterised by animal biodiversity promoted by variations in altitude, topography and climate providing wildlife habitats for mammals, reptiles, amphibians, insects and birds. As an example, mammals include Rhesus monkey, wild bear and avifauna include sparrow hawk and wood cock. Growth of human population has put pressure on the natural resources of the region, particularly the forests and wildlife. The population of avifauna will increase due to the creation of head pond at Patrind. Besides offering resting place for migratory birds, the avifauna population will also increase due to the improvement in the vegetal cover around the head pond.

6. SOCIO - ECONOMIC ENVIRONMENT

The 8 villages in the vicinity of the weir site and 5 villages around powerhouse site have a population of 7,397 according to 1998 census report. The household size ranges from 5 to 9 persons per household. There is a Panchayat/ Jirga system (informal village council) for conflict resolution mechanism at village level. The members of the Panchayat include Nazim of the Union Council, Numbardar (Revenue Collector) and representatives of the village households.

The per capita income in the project area is below the national level. Farming and livestock rearing are the major occupations of the local population followed by forest and construction labour. Some people own shops located around villages while others work in transport business. Socio−economic indicators point to poor standard of living, poor health, inadequate status of community water

supply, sanitation and education. Women face problems due to restricted mobility, lack of decision making, limited productive employment opportunities and lack of awareness about health and hygiene.

7. ENVIRONMENTAL IMPACTS

Both construction and operation phases of Patrind Hydropower Project will have some impact on physical, biological and socio-economic environment of the project area. The nature and effect of construction related impacts will be limited to a 4 years construction period compared to the operation phase impacts which will last over the life of the project. As far as possible the magnitude and probability of occurrence of impacts have been quantified and described below.

Water Resources

During high flow period (May − August) when there will be water in excess of the requirements for the power generation, the variations in flow downstream of the weir will not be significant. But in the low flow period the flow variations will become significant, becoming even more so within months when the plant may be operated only during peak hours. The Kunhar river reach below the weir would then receive compensation flow of 2 cumecs from the headpond. This compensation flow, of course, will be substantially supplemented by six streams which join Kunhar river downstream of the weir, thus mitigating the stress on aquatic flora and fauna.

Land Resources

The land resources of the project area would be affected in terms of permanent acquisition (63.8 Ha) and in terms of temporary land acquisition (31.59 Ha). The permanent acquisition consists of reservoir impounding, structures on the weir side, powerhouse, maintenance and access roads. The temporary land acquisition involves temporary diversion channel on Jhelum river side, construction camps, storage area and dumping sites on both weir and Powerhouse side. The temporary land acquisition would be required for duration of the project construction phase estimated to be 4 years.

Excavated Material

Excavation work for diversion tunnel, weir, sand trap, headrace tunnel, pressure tunnel, surge chamber and pressure shaft would result in excavated material, some of which would be used as fill material for construction of project components. The coffer dam would result in excavation of 11,014 m^3 of spoil

but would require 21, 767 m^3 as fill material obviating any need for disposal of surplus material. The surplus material at the weir side requiring disposal is about 604,287 m^3 and surplus material requiring disposal on powerhouse side is about 317,117 m^3. Keeping in view the accessibility and haul distance for disposal of the excavated material, sites for deposition of surplus material have been identified in the vicinity of powerhouse and weir locations. The diversion channel on Jhelum river side would result in excavation of 100,100 m^3, and about 16,000 m^3 of total excavation would be used for the embankments of the upper and lower coffer dams. The spoil of the coffer dam on Jhelum river after the construction of bridge will be disposed off safely to the identified sites of disposal.

River Ecology

During project operation, compensation flow will be discharged year round downstream of the weir. As a result, river ecology particularly the flora and fauna would not be adversely affected.

Socio – Economics

During construction phase opportunities will be available to the locals for employment in the project activities. Once the project is completed, it is expected to invigorate the level of economic activity in the project area. Development of infrastructure facilities due to project construction and operation will lead to increase in tourist traffic promoting beneficial socio-economic changes for the local population.

8. MITIGATION MEASURES

With reference to physical, biological and socio-economic environment of the project area mitigation strategies aim at managing the environmental effects in a manner that minimize adverse impacts and maximize secondary benefits.

Excavated Material

As a result of excavation work for powerhouse, headrace tunnel, sand trap, diversion tunnel, surge chamber, pressure shaft and temporary diversion channel etc. spoil material will be generated. Maximum use of this excavated material would be made for the construction of various civil works e.g. bulk fill, coarse aggregate, stone rip rap, construction of roads and embankments. The surplus excavated material will be disposed off in an environmentally sound manner. In order to facilitate as well as economise the transportation costs, the surplus material will be disposed off not far from where it is produced. The

proposed land areas for disposal of excavated material have been estimated 21 acres for weir side and 35 acres for powerhouse side.

Erosion Control

Considering the site conditions in the context of erosion control methods, it is recommended that vegetation/ aforestation being the most effective and economical way, may be adopted as preferred options. Both sides of the affected areas should be planted with grass cover, tiny bushes and trees.

River Ecology

In order to take care of the stress on aquatic flora and fauna during low flow conditions in Kunhar river reach downstream of the weir site, it is recommended that a minimum flow of 2 cumecs should be allowed from the headpond during project operation phase. This of course would be in addition to the contribution of flows made by the six nullahs joining the Kunhar river downstream of the weir site.

Tree Cutting

It is recommended that smallest number of trees should be cut for project implementation.

Environmental Pollution Control

Environmental pollution control addresses water/ air pollution, and noise as well as safety measures. Excavated material will not be dumped in the rivers. Lubricants, waste oil and other chemical wastes will be collected and disposed off safely. Sprinkling of water to settle dust shall be practised in areas where equipment like compressors, blowers, dumper and excavators would be used. For safety measures the contractor shall provide Personnel Protective Equipment (PPE) to his personnel. The areas where noise cannot be kept within NEQS/ WB Guidelines, like blasting, will be posted as zones of high noise levels.

Wildlife

Workers including supervisory staff associated with the project may be educated to protect wildlife. Any stray animals found may be handed over to the Wild Life Departments of Khyber Pakhtunkhwa and AJK.

Land Acquisition

The land acquired on temporary basis will be leased for 4 years to be compensated at rates decided in consultation with land owners.

Resettlement

The project implementation will directly affect 14 houses displacing 146 persons. During field surveys, persons/ communities affected by Patrind Hydropower Project were individually as well as collectively interviewed to gather their opinion for resettlement and relocation. All owners of land and houses directly affected by the project preferred the option to receive cash compensation instead of, land for land compensation or land for construction of new houses. As a result no resettlement sites have been identified or investigated.

9. RESETTLEMENT BUDGET AND FINANCING

The resettlement and environmental cost of Patrind Hydropower Project is estimated as Rs. 194.27 million (US$ 2.3 million). The cost of land subject to submergence by the Headpond is Rs. 110.04 million and is the largest component of the environmental cost of the total environmental budget.

10. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

Environmental management aims at providing safeguards for and enhancement of social, environmental and economic quality parameters which would be subject to project impacts whereas monitoring involves measurement and recording of such parameters to identify adverse trends for timely mitigation. These parameters have been enumerated in Environmental & Social Management Plan. The key players in the implementation of the plan are STAR Hydropower Limited (SHPL), Supervisory Consultant (SC), EPA Khyber Pakhtunkhwa and EPA AJK.

11. CONCLUSIONS AND RECOMMENDATIONS

The overall findings of the environmental impact assessment and resettlement plan shows that the project is environmentally and socially viable provided that the proposed activities are carried out as mentioned in this report, and the mitigation measures are completely and effectively implemented.

It is recommended that the Company should follow the RP for addressing the involuntary resettlement issues pertaining to land acquisition and compensation for houses and other economic assets by adhering to the environmental legislation and regulations.

CHAPTER – 1

PROJECT DESCRIPTION

1.1 INTRODUCTION

The Report on Environmental Impact Assessment and Resettlement Plan of Patrind Hydropower Project (the Project) has been prepared on behalf of STAR Hydropower Limited (the Company) by Pakistan Engineering Services (Pvt.) Ltd. Lahore. This EIA Report is an integral part of project feasibility study which was completed in May 2007 and also approved by Panel of Experts (POE) appointed by PPIB. Subsequent review of the Feasibility Study in February 2010 by EPC Contractor resulted in some changes in the layout and design aspects of the project. These changes consist of moving the weir by 150 m upstream from its proposed position in feasibility study, sand trap changed from underground to open, moving the powerhouse 460 m downstream from its previously proposed location in the feasibility study and constructing a temporary diversion channel of about 445 m along Jhelum river for construction of a permanent bridge across the river.

The physical layout of the hydropower project extends from location of its weir on Kunhar river near Patrind village which acts as a boundary between Khyber Pakhtunkhwa and AJK to location of its powerhouse on Jhelum river at Lower Chattar in Muzaffarabad district, (AJK).

1.2 PROJECT BACKGROUND

In 1984, Montreal Engineering Company Monenco conducted an Inventory and Ranking Study for exploration of major hydroelectric schemes in Pakistan. Besides other regions Monenco identified three hydroelectric schemes at Naran, Suki Kinari and Patrind on Kunhar River. Stream gauging stations were installed at three locations (Naran, Khanian and Garhi Habibullah) on Kunhar River by WAPDA's Surface Water Hydrology Project (SWHP) in 1960. For Patrind project Monenco proposed a concrete gravity dam 130 m high with gated spillway in the central portion of the dam. Full supply level of the head pond was fixed at 838 m above mean sea level which extended the head pond about 3 km upstream beyond Gari Habibulllah. Low level outlets were provided for sediment control. River diversion was proposed through a 7.0 m diameter concrete lined tunnel in the left abutment. This tunnel would have subsequently served as a headrace

tunnel and would have been linked to the power intake by a 5.7 m diameter inclined concrete lined tunnel. The scheme promised an index capacity of 150 MW with 3 Francis turbine units.

The hydropower potential on Kunhar River at Patrind was further studied by Sarhad Hydel Development Organization (SHYDO) with the collaboration of German Agency for Technical Co-operation (GTZ), which proposed two more layout alternatives in addition to the Menenco's layout. In their proposal GTZ considered the powerhouse site at the downstream limb of Jhelum river bend near Muzaffarabad. The short distance of 1.6 km from dam site to the bend of Jhelum river would have provided an additional head of about 82 m. The head pond level was lowered by GTZ to reduce the large human displacement associated with the Menenco's proposal. The detailed description of GTZ's layout alternatives can be found in SHYDO – GTZ publication "Identification of Hydropower Development Potential in Kaghan Valley, Vol. II, NWFP Pakistan" Second edition January 1995.

1.3 CONSULTANCY SERVICES

Under provisions of the original Agreement for Consultancy Services ETA LLC appointed Pakistan Engineering Services PES (Pvt.) Ltd. Lahore as the lead consultants in association with Fichtner GmbH Consulting Engineers Germany to carry out feasibility study for the Project. The Consultancy Agreement in terms of environmental impact assessment and resettlement plan includes the following.

- Conduct studies on all relevant environmental aspects (social, economic, cultural, physical and ecological) of the project, including the watershed, the head pond, the sites of the structures, and the upstream and downstream reaches that may be affected during construction and operation phases of the project.
- Determine potential impacts and costs; delays due to land acquisition and relocation of residents and utilities and other infrastructure; and identify mitigating measures to minimize the risk.
- Determine the requirements of an environmental management plan specifying mitigation measures for dealing with significant effects.

"All studies to be conducted in accordance with the EIA Guidelines for Energy Sector Pakistan issued by the Environmental and Urban Affairs Division of the Government of Pakistan, the guidelines of the major

international development banks; and within the guidelines of the Land Acquisition Act, the Environmental Protection Act and the National and Provincial Conservation Strategy of Pakistan."

1.4 THE PROJECT

1.4.1 Project Location

The area of Patrind Hydropower Project is covered by G.T. Sheet No. 43-F/8 of Survey of Pakistan. The proposed weir site is accessed by Boi Road on right side of Kunhar river. It is at a distance of 12.3 km from Garhi Habibullah bridge. The centre line of Kunhar river at the project site marks the boundary between Pakistan and Azad Jammu & Kashmir. The left bank of Kunhar river thus lies in AJK which can be accessed by a 3.1 km track leaving main road between Muzaffarabad and Garhi Habibullah (Hazara Trunk Road). The proposed powerhouse site is located on the right bank and downstream limb of Jhelum river at Lower Chattar District Muzaffarabad in AJK. The left bank of Jhelum river at the proposed site of powerhouse is accessible from Lower Chattar in Muzaffarabad district. A new bridge needs to be constructed to access the right bank for transportation of labour and equipment to the construction area of the powerhouse. Figure 1.3 shows the location of project components.

1.5 PROJECT COMPONENTS

The physical components of the project as shown in Figure 1.3 consist of the weir, head pond, intake, headrace tunnel, sand trap, pressure shaft, surge chamber, penstock, powerhouse, and tail race. Diversion of Kunhar river flow will be required at the weir site to undertake construction of the weir in dry-bed condition. For this purpose two coffer dams on upstream and downstream of weir site will be constructed. For the construction of permanent bridge across Jhelum river, a temporary diversion channel of about 445 m would be needed. For this purpose two temporary coffer dams on upstream and downstream of the diversion channel will be constructed for an estimated period of 4 months.

Table 1.1: Components of Patrind Hydropower Project

Sr. #	Project Components	Details
1.	**River**	
	River Name	Kunhar River
	Catchment Area	2, 429.00 Km^2
2.	**Weir**	
	Type of Weir	Concrete Gravity Dam
	Height	42.00 m from river bed elevation 727 m amsl
	Crest Elevation	769.00 m amsl
	Width	8.20 m
	Length	130.00 m
3.	**Head Pond**	
	NHWL (Conservation Level)	765.00 m amsl
	Reservoir Submergence Area	57.2 Hectares
	Reservoir Capacity	5.81 million m^3
4.	**Spillway**	
	Design Discharge	2,626.6 m^3/sec
	Crest Level	757.00 m amsl
	Type	Flip Bucket Type
	No. of Radial Gates	4 Nos. each 12 X 10.33 m
5.	**Intake**	
	Design Discharge	153 m^3/sec
	No. of Chambers	2
6.	**Sand Trap**	
	Type	Open Type
	Design Discharge	153 m^3/sec
	No. of Chambers	2

Sr. #	Project Components	Details
	Size of Each Chamber	Width : 23 m Height : 26.7 m
7.	**Headrace Tunnel**	
	Shape	Modified Horse Shoe (Inner Circular Section)
	Type	Concrete Lined
	Size	Diameter : 7 m
8.	**Surge Tank**	
	Type	Simple Orifice, Circular
	Size	Diameter 16 m
	Max. Upsurge Level	788.70 m amsl
	Min. Downsurge Level	745.10 m amsl
9.	**Vertical Pressure Tunnel and Horizontal Pressure Tunnel**	
	Type	Concrete Lined
	Shape	Inner Circular Section
	Size	Diameter : 7 m
10.	**Penstock**	
	Type	Inner Circular Section, Steel Lined
	Size and Nos.	Diameter : 5.5 m, 1 No. Diameter : 3.0 m, 3 Nos.
11.	**Powerhouse**	
	Type	Surface Station
	Size	38.2m x 66.0m x 41.7 High
	Discharge	153 m^3/sec
	Capacity	150 MW
	Turbine Units	3 Nos.

Sr. #	Project Components	Details
	Type	Vertical Francis
12.	**Tailrace**	
	Type	Open Channel
	Length	55 m
13.	**U/S Coffer Dam on Kunhar River**	
	Type	Concrete Gravity Dam
	Crest Height	13.0 m
	Crest Elevation	750.0 m amsl
14.	**D/S Coffer Dam on Kunhar River**	
	Type	Earth Dam
	Crest Width/ Height	3.0 m/ 3.0 m
	Crest Elevation	739 m amsl
15.	**U/S Coffer Dam on Jhelum River**	
	Type	Earth Dam
	Length	140 m
	Height	6 m
	Width B/T	26 m/ 5 m
16.	**D/S Coffer Dam on Jhelum River**	
	Type	Earth Dam
	Length	60 m
	Height	4 m
	Width B/T	20 m / 4 m
17.	**Diversion Channel (Jhelum River)**	
	Type	Open Channel

Sr. #	Project Components	Details
	Length	445 m
	Height	5 m
	Width B/T	40 / 50 m

1.5.1 WEIR

The weir site is located 12 Km downstream of Garhi Habibullah concrete bridge on Kunhar river. The gorge at that site is relatively narrow and river bed level is 727 m above mean sea level. The sharp bend on Kunhar river near Patrind village ensures the shortest length of weir and a suitable diversion arrangement during construction phase. Weir site is accessible on the right bank of Kunhar river by Boi Road. The intake for the headrace tunnel will be on the left bank of Kunhar river.

1.5.2 WEIR HEIGHT

Possible human resettlement issues associated with high weir structure restrict the height of weir. Therefore, the crest of gated overflow weir has been fixed at a height 42 m from river bed after estimating the design flood and waves surcharge over the crest as well as the minimum elevation of human settlements. This weir height ensures that not even a single house will be subject to submergence by the head pond.

1.5.3 DESIGN DISCHARGE

The design discharge for power generation adopted for medium to high head projects is usually 25 to 40 % of the available flow of natural stream. The optimal design discharge is the one which results in a project size that will give maximum net present value (NPV). Flow in Kunhar river at Patrind varies from an average minimum of 24 m^3/sec in January to an average maximum of 285 m^3/sec in June. The average annual flow being 104 m^3/sec. The design discharge is 153 m^3/sec, which is available 27% of the time of the year.

The project costs and benefits were estimated by varying the design discharge for headrace tunnel from 100 to 180 m^3/sec for all project layout alternatives while releasing a minimum flow of 2 m^3/s in Kunhar River downstream of weir throughout the year. The number of turbine units is also optimized by analyzing

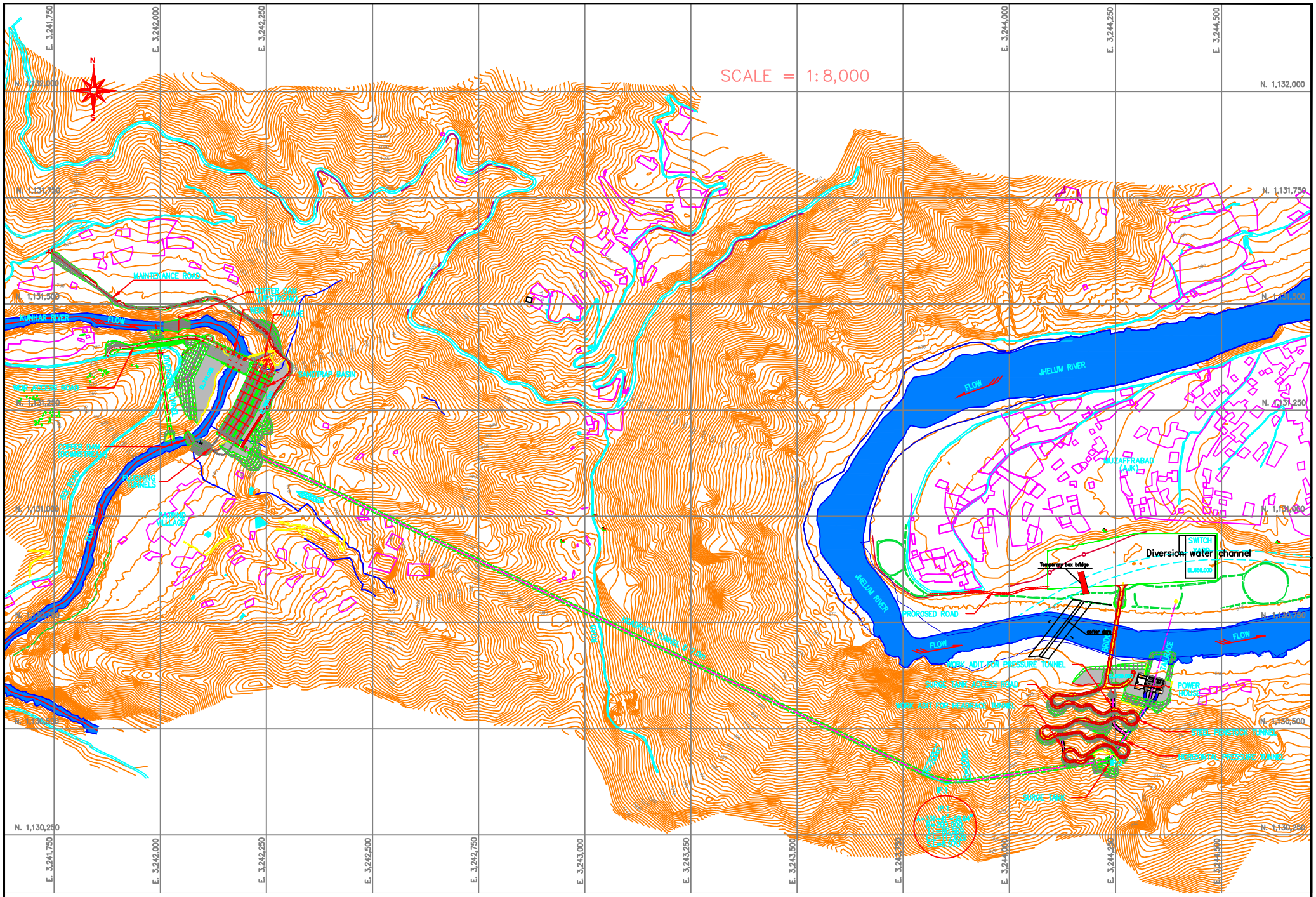


Figure 1.3 : Patrind Hydropower Components and their Locations

the units to ensure consistent working of machines during low flows as well as to avoid too heavy machines/parts considering the proposed access facilities.

1.5.4 HEAD POND

Figure 1.6 shows the area-elevation-capacity curves. Keeping environmental considerations the foremost, the weir height has been fixed as 42 m with conservation level at elevation 765 m above mean sea level. Figure 1.7 shows that the surface area of the head pond at this elevation would be 57.21 ha with a storage capacity of 5.90 million cu.m.

1.5.5 HEADRACE TUNNEL

To gain an additional head of over 80 m the Kunhar river water will be diverted into headrace tunnel inlet at the weir site. The headrace tunnel, 2.2 Km long, is an underground structure. Its construction will start simultaneously at its two ends, each from weir site as well as from powerhouse site. The maximum land cover over the tunnel for Alternatives 1, 2, 3, 4 and EPC modified design can be estimated with reference to Figure 1.4.

1.5.6 POWER HOUSE

The powerhouse site has been proposed at right bank of Jhelum river on downstream limb of horse shoe bend of Jhelum river. Powerhouse Alternatives 1 and 2 is open surface structure and for Alternatives 3 and 4 it is proposed to be underground.

1.6 PROJECT LAYOUT ALTERNATIVES

The project components detailed in the Table 1.1 have been considered based on available information, project area maps, Monenco study review and field surveys. Kunhar river flows in a very narrow gorge in the vicinity of the proposed weir site. The studies for project layout alternatives focused on hydropower development utilizing the flow in Kunhar river at weir site and the head available using low height weir and more by joining the head pond water level to horse-shoe bend of Jhelum river at Muzaffarabad through a shortest headrace tunnel. It must be emphasized that assessment of all the layout alternatives, was primarily guided by the socio-environmental imperatives, particularly population displacement/ resettlement issues. The selected alternative was then sized for optimal weir height and design discharge.

1.6.1 SOCIO-ENVIRONMENTAL CONSIDERATIONS IN PROJECT LAYOUT

For optimal design of the project, socio-economic factors have also been focused besides technical considerations. The population of Garhi Habibullah along the Kunhar river banks has increased significantly during the last two decades. There are a number of camps of 2005 earthquake refugees from Balakot and Muzaffarabad located along the banks of Kunhar River upto 12 Km upstream of the proposed weir site. Due to these reasons, the project layouts which involve high dam for water storage (Monenco and GTZ proposals) were discarded for further studies. Due to environmental issues relating to human resettlement, the Consultants have considered run-of-river project layouts with relatively low height overflow weir and a headrace tunnel located on the left side of Kunhar River. For powerhouse, both surface and underground development alternatives have been studied. Figure 1.4 shows these alternatives which are discussed in the following sections.

No Project Option

At present there is an increasing demand for power outstripping supply in Pakistan. This disproportion results in power failures and load shedding i.e. intentional alternating disconnecting of power supply of rural areas/ cities. For example parts of major cities in the country remain without electricity supply for some hours every day putting industrial, commercial as well as domestic activities in great disruption. Adequate electrical power which would fully meet the requirements of all sectors of economy is a key to achieve growth targets of Pakistan economy resulting in higher welfare of its population. Thus, the "No Project Option" is not realistic scenario as the country needs urgent enhancement of electrical power generation to meet the increasing demand.

Alternative - 1

The weir site is to be located 12 Km downstream of Garhi Habibullah Bridge on Kunhar River. The gorge at that site is relatively narrow and river bed level is 733 m amsl. The sharp bend on Kunhar River near Patrind Village shown at Figure 1.3 provides a suitable diversion arrangement during construction. Weir site is accessible by Boi Road along the right bank of Kunhar River. The intake for headrace tunnel will be on the left bank.

The headrace will be concrete lined pressure tunnel 7.5 m diameter. The steel

penstocks with valve chambers will discharge into powerhouse turbines and then through tailrace channel into Jhelum River.

The powerhouse site has suitable geological conditions for surface power station. For access to powerhouse site on the right bank of Jhelum River a new bridge on Jhelum River is required to be constructed. With a weir height of 26 m, the difference in water level between head pond conservation level to powerhouse site is 110 m to be gained in an approximate distance of 2.0 km. The proposed river diversion for construction of weir i will be done through a 235m long horse shoe shape tunnel on right bank of Kunhar River just upstream of the river bend near Patrind village.

Alternative - 2

The layout is same as for Alternative − I, with a steel lined pressure shaft instead of penstocks. The diameter of pressure shaft would be 4.5 m with a flow velocity of 9.5 m/sec. The project layout plan for Alternative − 2 indicating the proposed location for project structures is shown in Figure 1.4.

Alternative - 3

As the project area lies in high seismic risk zone, the Consultants also considered the option of underground powerhouse possibilities/alternatives because of better resistance to high ground accelerations. Alternatives 3 & 4 both have been formulated with underground powerhouse keeping in view the recent seismic activities in the project area.

The layout of weir and intake is the same as for the above mentioned alternatives 1 and 2. The pressure shaft arrangement is same as for Alternative − 2 but with reduced length due to an underground powerhouse. The minimum cover over powerhouse will be approx. 60 m. The reduced length of pressure shaft implies less hydraulic losses thus providing more head for power generation. A tailrace tunnel 400 m in length will be provided. Geological investigations have identified the rock type as slate which is suitable for cavern type powerhouse.

Alternative - 4

The layout on Kunhar River side consists of underground project components as in Figure 1.4. The headrace tunnel length has been reduced to approx. 450 m by shifting the cavern powerhouse closer to the Kunhar River side. The location of upstream surge chamber has been changed accordingly.

EPC Contractor Proposed Design Modification

By moving the powerhouse from original position 460 m downstream, the safety of the powerhouse has been ensured. The amount of excavation and slope protection has also been minimized since the new powerhouse site is located on a low and gentler slope. As such this modification has been finally adopted for construction. The layout profile of this design is given in Figure 1.8.

1.7 COMMUNICATION INFRASTRUCTURE

1.7.1 Existing Road Network

The project area extends from location of its weir site in Abbottabad district (Khyber Pakhtunkhwa) to powerhouse site in Muzaffarabad district (AJK). For accessibility in terms of transportation of manpower/plant equipment as well as availability of national power grid, the distances with reference to existing road network from Islamabad are given in Table 1.2.

Table 1.2: Road Distances up to Project Site

Section	Distances (Km)		Remarks
	Incremental	Cumulative	
Route – 1: Islamabad – Abbottabad – Garhi Habibullah – Muzaffarabad			
Islamabad – Abbottabad	120	120	Silk Route
Abbottabad – Bassian	50	170	Silk Route
Bassian – Garhi Habibullah	15.5	185.5	Single Lane, Metalled
Garhi Habibullah – Patrind	12.3	197.8	Boi Road (weir site)
Patrind – Muzaffarabad	37.3	235.1	Via Garhi Habibullah (Powerhouse Site)
Route – 2: Islamabad – Murree – Muzaffarabad			
Islamabad – Murree	53	53	Expressway
Murree – Muzaffarabad	76	129	Metalled Road
Muzaffarabad – Lower Chattar	2.5	131.5	Metalled Road (Powerhouse Site)
Lower Chattar – Patrind	37.3	168.8	Metalled Road (Weir Site)

1.7.2 Proposed Access Roads

The plan for access road is established considering relocation of weir, sand trap, powerhouse, surge tank and etc. Minimum 15.0 m radius of curve was applied

to improve traffic capacity, safety and workability. The road width was extended by 7.0m and emergency parking bay will be installed. The access road to powerhouse starts in lower Chattar reaching prior to proposed bridge site near left bank of Jhelum river cover a distance of 1.7 km. this portion of 1.7 km is all metalled requiring possible widening at 2 to 3 locations. The distance beyond metalled portion before reaching the proposed bridge is 200 m and a proper road of 7m width needs to be constructed there.

Table 1.3: Route Outline of the Proposed Access Roads

Type	Section	Length (m)	Width (m)	Remarks
Weir	Boi Road – Weir	240	7.0	Weir Access
Weir	Construction Camp – Weir – Storage Camp	906	4.0	Maintenance Road at Weir Site
Powerhouse	Lower Chattar – Bridge Bridge – Powerhouse	200 84	7.0 7.0	Powerhouse Access Powerhouse Access
Surge Tank	Powerhouse – Surge Tank	1,162	4.0	Surge Tank Access
Switchyard	Switchyard	96	7.0	Switchyard Access

For actual accessibility for transportation of equipment, material and manpower to the sites of the weir and powerhouse construction, some length of metalled road as well as one bridge across Jhelum river is required to be built.

Weir Site

The right hand side of weir site on Kunhar river is accessible by Boi Road requiring no additional bridge for construction of weir, diversion tunnel and coffer dam. Muzaffarabad road (Hazara Trunk Road) crosses Kuhnar river at Garhi Habibullah and passes by the left hand side of the weir site. A length of less than ½ km of metalled road is required to access left hand side of the weir site, proposed headrace tunnel, its intake and sand traps.

Powerhouse Site

The location of the proposed powerhouse is on the right hand side of Jhelum River about 9 km upstream of the confluence of Kunhar with Jhelum river in Muzaffarabad district. This location requires construction of both a major bridge and a length of metalled road.

1.8 MANPOWER

Manpower both for construction phase and operation phase of the project would need professionals specialising in construction management, engineering personnel for operation & maintenance, technicians, and labour force. It is to be noted that semi-skilled and unskilled labour which forms bulk of the project manpower would be readily available from surrounding villages and towns, Garhi Habibullah, Mansehra and Abbottabad in case of weir site and Lower Chattar (Muzaffarabad) in case of powerhouse site. These workers will commute daily to the construction sites, thus obviating any need for their housing. The manpower estimates for construction and operation phases are as follows.

1.8.1 Weir Site

i) Construction Phase

Professional Staff	20
Skilled Labour	70
Semi - and un-skilled Labour	100

ii) Operation Phase

Professional Staff	2
Others	7

1.8.2 Powerhouse Site

i) Construction Phase

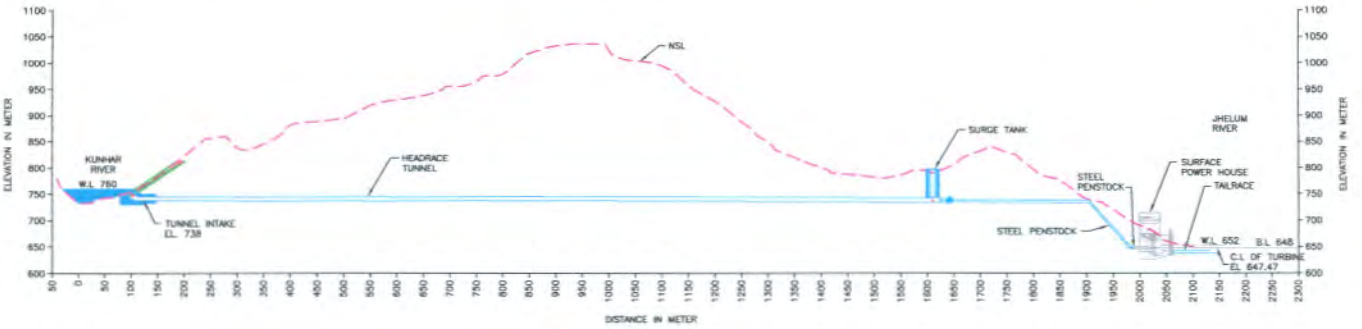
Professional Staff	25
Skilled Labour	75
Semi - and un-skilled Labour	95

ii) Operation Phase

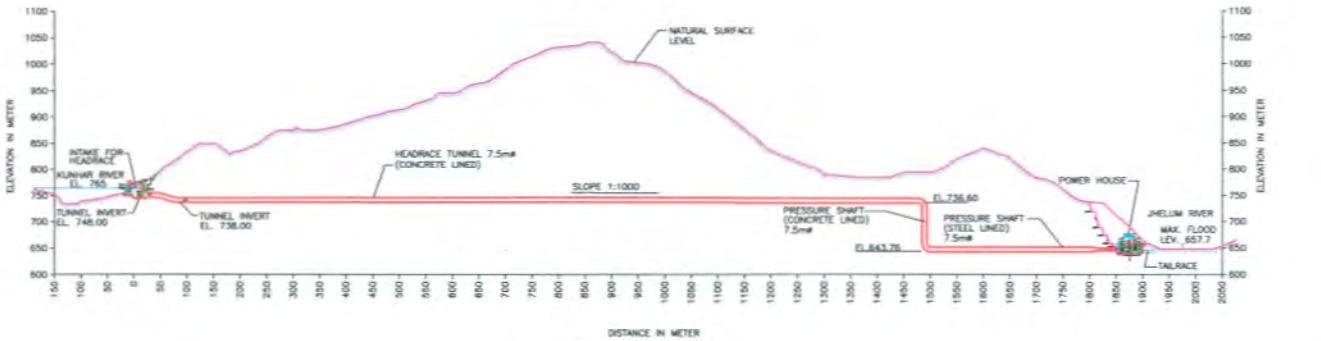
Professional Staff	4
Others	10

1.8.3 Construction Camps and Storage Areas

The manpower (skilled) needed for construction phase would require temporary housing including land for storage areas. Permanent residential facilities would be needed after completion of the project for operation and maintenance staff. The location of sites for such housing including storage areas at weir and powerhouse sites is marked on the location map at Figures 1.3 and 1.5 at an estimated land area requirement of ½ ha each.



ALTERNATIVE - 1
(INDICATIVE SKETCH)



ALTERNATIVE - 2
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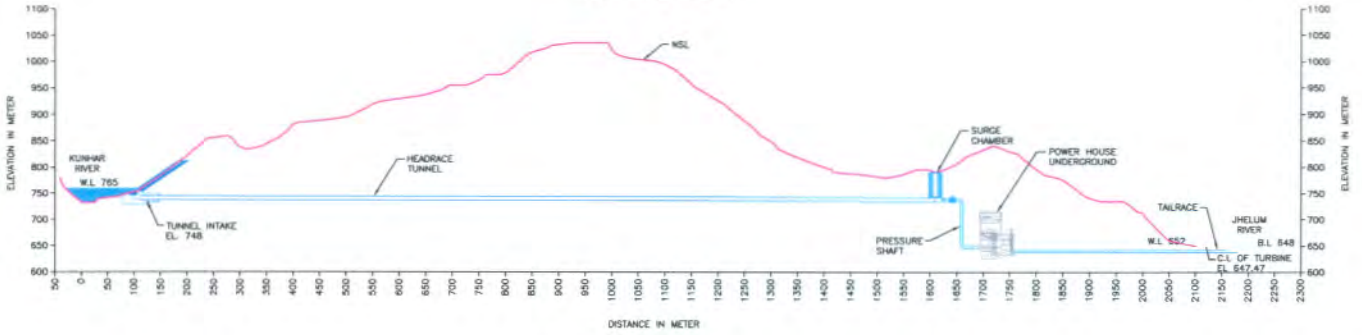
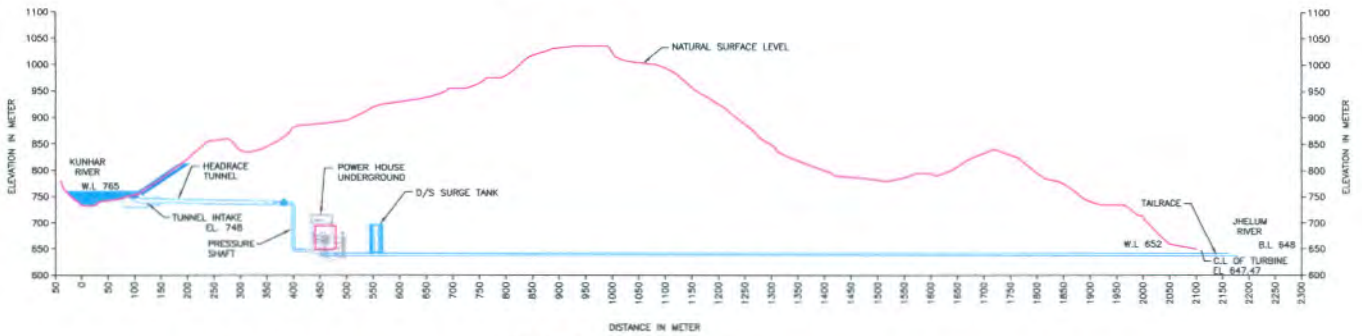
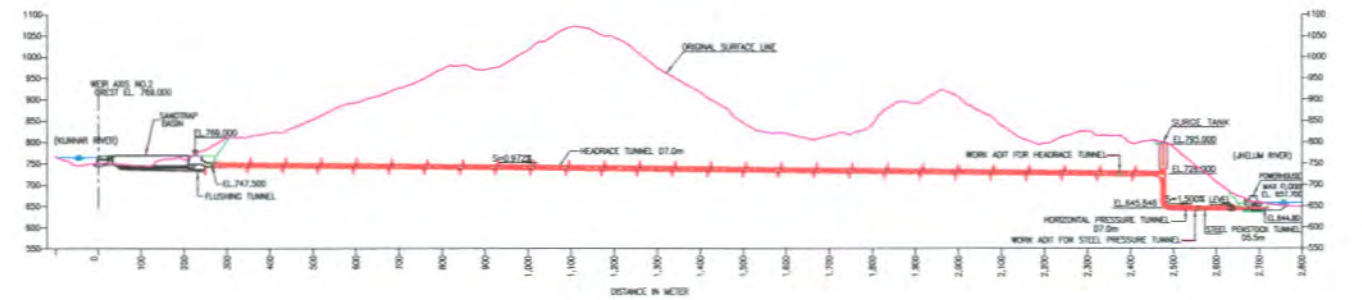


ALTERNATIVE - 3
(INDICATIVE SKETCH)



ALTERNATIVE - 4
(INDICATIVE SKETCH)



EPC Modified Layout

Figure 1.4 Project Layout Alternatives 1, 2, 3,4 and EPC Modified Layout

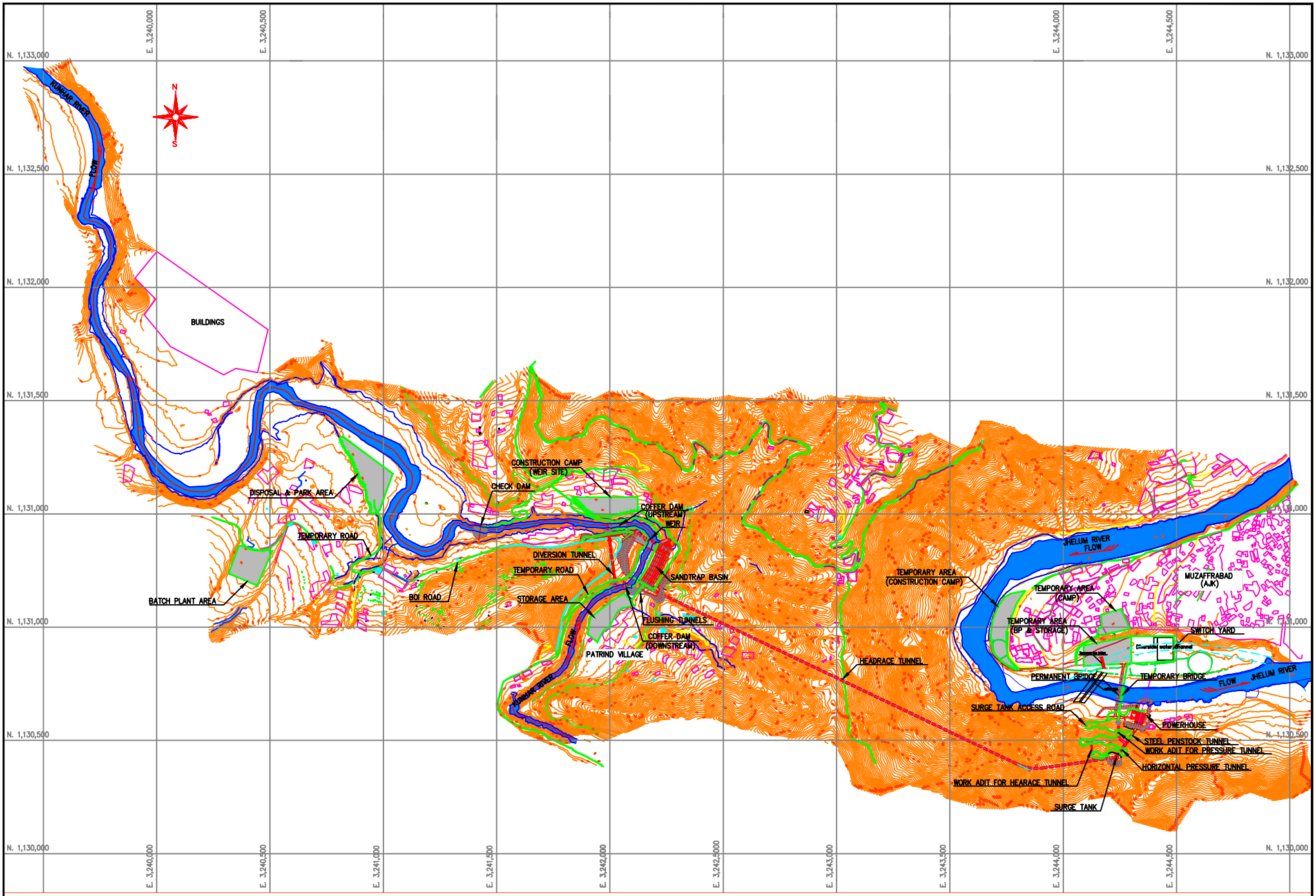


Figure 1.5 : Location of Construction Camp and Storage Areas at Weir Site and Powerhouse Site

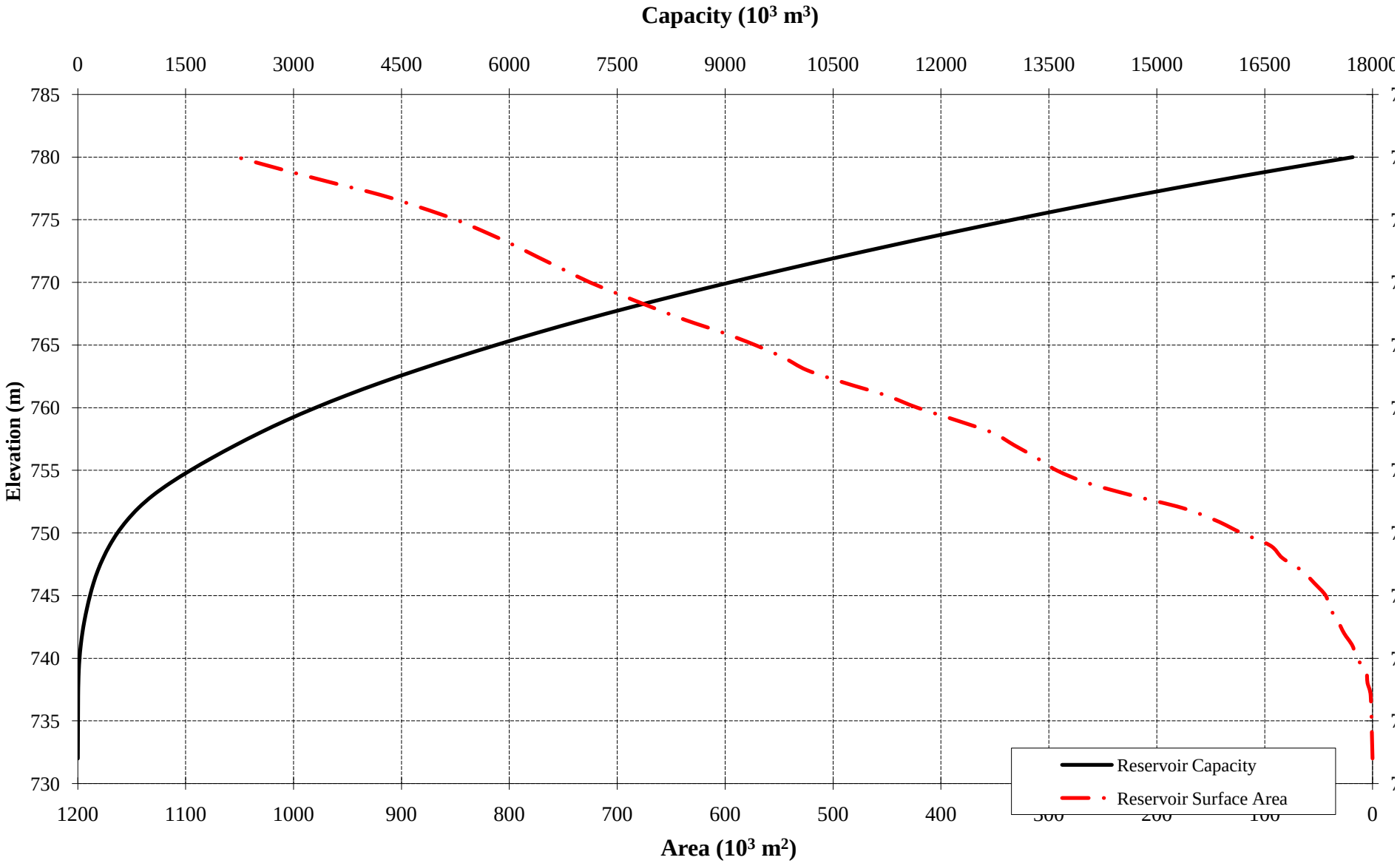


Figure 1.6 : Head Pond Surface Area-Elevation-Capacity Curve

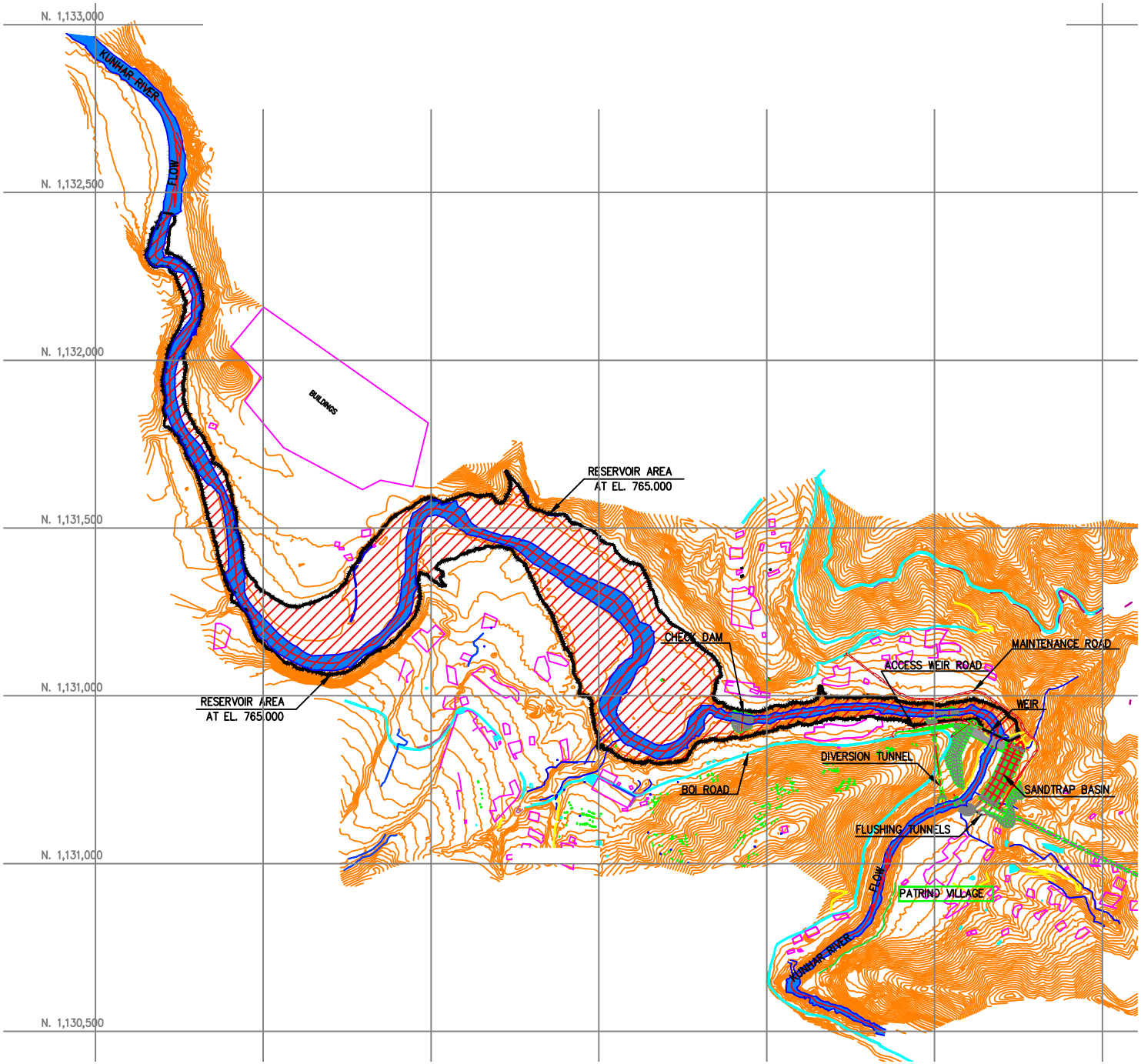
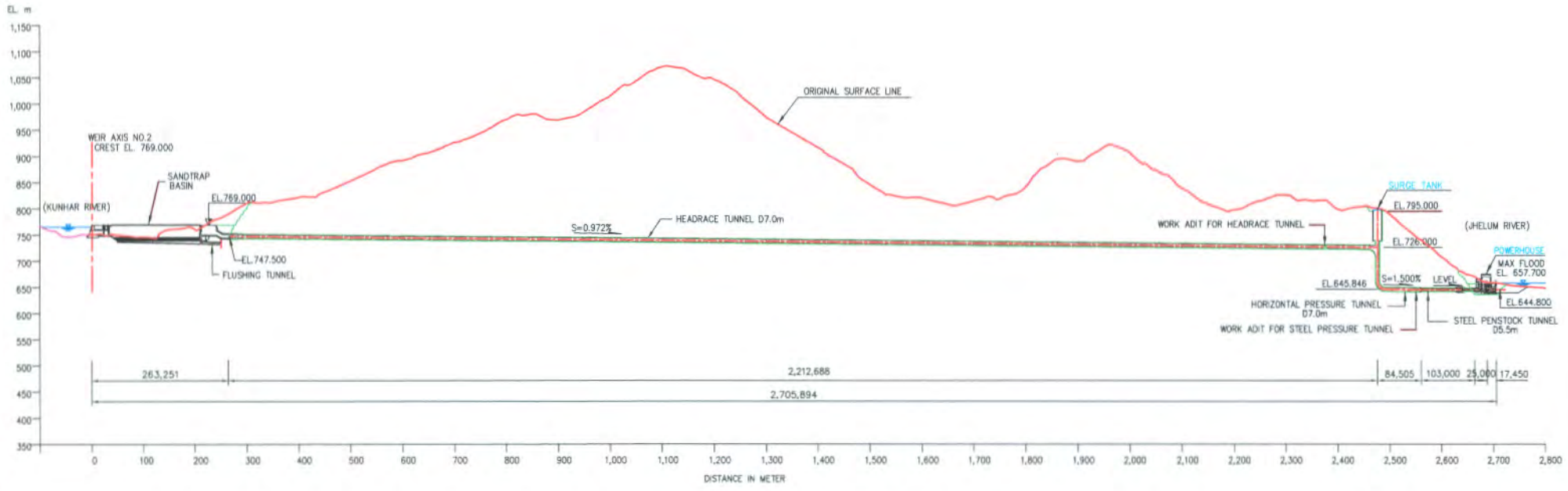


Figure 1.7 : Patrind Hydropower Project Headpond Surface Area at Conservation Level of 765m above mean sea Level



LONGITUDINAL SECTION

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. ALL LEVELS ARE IN METERS UNLESS OTHERWISE NOTED.
3. FEATURES OF MAJOR STRUCTURES CAN BE CHANGED ACCORDING TO HYDRAULIC MODEL TEST.

Figure 1.8 : EPC Modified Layout

CHAPTER – 2

LEGAL FRAMEWORK
FOR ENVIRONMENTAL ASSESSMENT AND RESETTLEMENT

2.1 NATIONAL POLICY

2.1.1 INTRODUCTION

Pakistan has had laws that contain provisions for environmental protection. These laws which were partly inherited from pre-independence days dealt with air and water quality, canal irrigation, land tenure and use, forest conservation, wildlife protection, energy development, pesticides use, noise, public health etc. Not only did these laws proved ineffective, punishment for violation was mild and easy to circumvent. These laws also did not adequately cover the subject areas and several of these laws became outdated. Many aspects of environmental degradation remained uncontrolled and under-regulated. Pakistan therefore responded to its environmental concerns by introducing laws, establishing environmental protection institutions and developing human resources and technical capability through local resources and foreign assistance.

Pakistan Environment Protection Act (PEPA − 97) which provides national policy on the subject was promulgated in December 1997. It is a single comprehensive law that provides for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution and promotion of sustainable development. The Act covers air, water, soil and noise pollution, including hazardous waste disposal and motor vehicular pollution. Environment Cell has been established in the National Planning Commission and one in each of the four provincial planning and development (P&D) departments.

The Act provides the requisite administrative framework for environmental protection in the country. It is reproduced as Annexure 2 of this report.

Pakistan Environmental Protection Council (PEPC)

Among its many functions, PEPC coordinates and supervises enforcement of PEPA-97, approves national environmental policies, and ensures their implementation. PEPC is required to meet at least twice a year.

Pakistan Environmental Protection Agency (Pak. EPA)

Under Section 5 of PEPA-1997 Pakistan Environmental Protection Agency (Pak.EPA) has been established with a Director General as its head. Sections 6

and 7 of PEPA 1997 describes the functions and powers of the Agency. Similarly provincial EPA's are functional in each province as provided in PEPA-1997. Azad Jammu and Kashmir has its own EPA.

Under Section 6(2) of the Act, Pak.EPA has the authority:

1. To undertake inquiries or investigations into environmental issues.
2. To request any person to furnish any information or data relevant to the functions of Pak.EPA.
3. To recommend to the Federal Government incentives, prizes, awards, subsidies, tax exemptions, rebates etc. for achieving environmental objectives and goals.

Under Section 7(a) of the Act Pak.EPA has been empowered:

a. To summon and enforce the attendance of any person for conduct of any enquiry/investigation into any environmental issue.
b. To enter and inspect any land, building and premises to verify an offence under the Act being committed.
c. To take sample of effluents, wastes or air pollutant being discharged or emitted and
d. To arrange for test and analysis of the samples at a laboratory 8certified by Pak.EPA.

Environmental Tribunals

Under Section 20 of the Act, Environmental Tribunals have been established to try cases of contravention or failure to comply with designated provisions of PEPA-1997.

2.1.2 ENVIRONMENTAL ASSESSMENT

Section 12 of Pakistan Environmental Protection Act 1997 lays down requirements for Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA). This section states that:

1) No proponent of a Project shall commence construction or operation unless he has filed with the Government Agency designated by Federal Environmental Protection Agency or Provincial Environmental Protection Agencies, as the case may be, or, where the Project is likely to cause an adverse environmental effects, an environmental impact assessment,

and has obtained from the Government Agency approval in respect thereof.

2) The Government agency shall, subject to standards fixed by Pakistan Environmental Protection Agency,

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 re-submitted after such modifications as may be stipulated or reject the Project as being contrary to environmental objectives.

Federal Government Notification August 2000 titled "Policy and Procedures for the Filing, Review and Approval of Environmental Assessments" contains schedules A, B and C listing requirements of IEE or EIA as follows.

EIA Requirements

Pak - EPA in August 2000 issued "Policy and Procedures for Filing, Review and Approval of Environmental Assessment", which includes Schedules A, B and C defining development projects in terms of requirements for EIA and IEE.

Schedule A defines projects which require an EIA. It deals with list of major projects which have the potential to affect a large number of people. The impact of such projects may be irreversible and could lead to significant changes in land use and in the social, physical and biological environment. The Section of Schedule A relating to Energy Sector is reproduced below.

Energy Sector – Schedule A

- Energy Sector : Hydroelectric power generation over 50 MW.

Schedule B defines projets which require an IEE. It deals with projects where the range of environnemental issues is comparatively narrow and issues can be understood and managed through less extensive analysis. The Section of Schedule B relating to Energy Sector is reproduced below.

Energy Sector – Schedule B

- Energy Sector : Hydroelectric power generation less than 50 MW.

Schedule C combines everything not in Schedule A and B. Illustrative example given in Schedule C include the following.

- Projects promoting energy efficiency

Thus Patrind Hydroelectric Project is covered by Schedule A which requires préparation of a full EIA report, for submission to provincial EPA KHYBER PAKHTUNKHWAH Peshawar for their approval.

2.1.3 NATIONAL ENVIRONMENTAL QUALITY STANDARDS (NEQS)

National Environmental Quality Standards (NEQS) for gaseous emissions and industrial/municipal effluents, issued earlier, were revised by Pakistan Environmental Protection Agency with effect from August 10, 2000 as SRO 549(1)/2000 and appear as Annexure 3 of this Report. Relevant NEQS were consulted in the preparation of EIA Report for Patrind Hydroelectric Power Project.

2.1.4 LAND ACQUISITION ACT 1894

The Land Acquisition Act 1894 is a "law for the acquisition of land needed for public purposes and for companies and for determining the amount of compensation to be paid on account of such acquisition". The raison de etre of this piece of legislation is, therefore, two-fold: firstly to fulfil the needs of government and companies for land required by them for their projects, and secondly, to determine and pay compensation to those private persons or bodies whose land is is so acquired. The exercise of the power of acquisition has been limited to public purposes. The principles laid down for the determination of compensation, as clarified by judicial pronouncements made from time to time, reflect the anxiety of the law-giver to compensate those who have been deprived of property, adequately. It is with this end in view that the association of the persons interested in the property, with the process of determination of its negotiated market value by the Collector is a highlight of this Act.

2.1.5 DRAFT NATIONAL RESETTLEMENT POLICY 2002

A draft of National Resettlement Policy was issued by Pakistan Environmental Protection Agency Islamabad in March 2002. After considering the problems

experienced in application of Land Acquisition Act 1894, the draft deals with basis of compensation and resettlement of project affected persons.

2.2 PROVINCIAL LEGISLATION

2.2.1 FOREST ACT 1927/NWFP FOREST ORDINANCE 2002

The Forest Act, 1927, and later amendments, establish the right of the government to designate areas for reserved forest, village forest and protected forest, and may acquire such areas for prohibiting or restricting the public use of the resources or other activities. NWFP Forest Ordinance 2002 has the objectives of protection, conservation, management and sustainable development of forests as well as promotion of the economic, social and ecological well-being of the local people.

2.2.2 SARHAD NATIONAL CONSERVATION STRATEGY 1996/ 2004

Pakistan Environmental Protection Act 1997 is the basis of environmental legislation and provides the framework for the implementation of the National Conservation Strategy (NCS) issued in 1991 by the Government of Pakistan in collaboration with IUCN. North Western Frontier Province N.W.F.P initiated the Sarhad Provincial Conservation Strategy in 1992 for completion in 1996; it was reviewed in 2004. This document has the goal to secure the economic, social and ecological well being of the people of KHYBER PAKHTUNKHWAH through the conservation and sustainable development of the province's natural resources.

2.2.3 AJK LG ACT 1997 AND OTHER LAWS

Law Department of Azad Government of the State of Jammu and Kashmir issued Local Government Act in 1997. This Act was later revised by AJK Government to include some amendments. In the preparation of this Report AJK Act 1997 as well as Antiquity Act (Government of Pakistan), Explosives Act, Factory Act etc. were consulted.

2.3 EXTERNAL SUPPORT AGENCIES

2.3.1 INTRODUCTION

Funds in the form of loans or grants for development Projects in Pakistan are generally available from external support agencies like the World Bank and Asian Development Bank. As a policy matter, these agencies lay emphasis on

the protection of environment from adverse impacts due to development projects. Proponents of projects in Pakistan planning to receive financial support from these organizations must ensure that the projects are not harmful to the environment, and that appropriate mitigation measures are carried out, as necessary, in accordance with the requirements laid down by these agencies.

2.3.2 THE WORLD BANK

For the Patrind Hydropower Project the latest policies of the World Bank, as one of the possible major financers, play an important role. These policies include Operation Policy (OP) 4.01 Environmental Assessment, Bank Procedures (BP) 4.01 Environmental Assessment December 1999 and OP/BP 4.12 Involuntary Resettlement. The Environmental Assessment Source Book Vol I and Vol II Sectoral Guidelines 1991 is designed to assist in the environmental assessment. It provides practical guidance and specific information for designing sustainable projects by incorporating fundamental environmental considerations. Noise levels laid down by World Bank Group appear as Annexure 4 of this Report.

2.3.3 ASIAN DEVELOPMENT BANK (ADB)

"ADB's 2009 Safeguard Policy Statement (SPS) sets out the policy objectives, scope and triggers, and principles for three key safeguard areas: (i) environmental safeguards, (ii) involuntary resettlement safeguards, and (iii) Indigenous Peoples safeguards. On environment, the SPS aims to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. On involuntary resettlement, the SPS aims to avoid involuntary resettlement wherever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups. With respect to Indigenous Peoples, the SPS aims to design and implement projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them. ADB has adopted a set of specific

safeguard requirements that borrowers/clients are required to meet in addressing environmental and social impacts and risks. The Patrind Hydropower Project will comply with ADB's Safeguards Requirements 1 on Environment and 2 on Involuntary Resettlement. Safeguards Requirement 3 on Indigenous Peoples is not expected to be triggered."

2.3.4 INTERNATIONAL FINANCE CORPORATION

Guidelines provided by IFC Handbook for Preparing a Resettlement Action Plan [19] are based on World Bank OP/BP 4.12. It explains how and under what circumstances OP/BP 4.12 applies and what actions IFC expects of project sponsors to manage involuntary resettlement defining rights, roles and responsibilities of all parties involved in involuntary resettlement. The IFC Guidelines of relevance to Patrind Hydropower Project have been kept in view in the preparation of this Environmental Impact Assessment and Resettlement Plan Report.

2.4 PATRIND HYDROPOWER PROJECT

In preparing EIA for Patrind Hydropower Project, the requirements/ guidelines laid down by WB/IFC/ADB and Pakistan Environmental Protection Act 1997 have been followed. In this respect land acquisition and resettlement aspects have been focused with reference to ADB Policy. Scope of land acquisition and resettlement as well as compensation payment based on views of affected persons/ market conditions has been dealt with in a subsequent chapter of this Report.

CHAPTER – 3

BASELINE CONDITIONS

3.1 INTRODUCTION

The project area covers administrative region consisting of Manshera and Abbottabad districts in Khyber Pakhtunkhwa and Muzaffarabad district in Azad Jammu and Kashmir (AJK). Overall, the area has a mountainous topography dissected by rivers, hill streams and springs. Kunhar and Jhelum are two major rivers in the project region. The baseline data has been collected by field surveys during the months of June, July and September 2006 as well as during March 2010. The purpose of field surveys was to investigate the planning area and the project layout for environmental and socio-economic conditions as well as resettlement aspects. Pre-designed proformas were used to collect baseline data. The collected information includes physical, biological and socio-economic conditions. Environmental features like type of land, land use, built-up property, economic trees, flora and fauna were recorded.

Relevant government departments, agencies and NGO's were visited during this period. These include Departments of Wildlife, Fisheries, Forest, Health and Agriculture in Muzaffarabad and Abbottabad. Representatives of NGOs like WWF and Sungi were also contacted in these cities. Published information relating to the project area available from various sources was collected. This included literature on geology, landforms, land use, climate, water resources and district census reports.

3.2 PHYSICAL ENVIRONMENT

3.2.1 Physiography

Catchment area of the Kunhar river is mountainous and rugged with a high relief amplitude and steep slopes. Up-north in Naran the elevation is 2,362 m above mean sea level falling to an elevation of 735 m at Patrind weir site. Geologic erosion on these mountains is substantial due to area's steep and rugged physiography. Much of the northern mountains confine the river flow within narrow valleys. The steepness of the topography in combination with weak and shattered rocks predisposes the area to landslides. In higher areas active scree slopes are formed. The only level areas in the catchment consist of

small terraces located along the river valleys supporting human settlements. The terrace at Patrind 484 ha in extent is a typical example of such parts. Otherwise settlements are established well above the valleys on topographically suitable ridges.

3.2.2 Geology

In the project region slopes along left bank of Kunhar river are steep, whereas the right side has comparatively gentler slopes with dips in upstream direction. Rocks are mostly slate. They are dark grey in colour, moderately hard to hard, thinly to medium bedded, sparsely jointed, non to sparsely fragmented, fresh to slightly weathered on exposed surfaces. The headrace tunnel route 2.2 km long also lies in slate. Jhelum river forms a meandering loop near the powerhouse site. The foundation rock of the powerhouse site is slate with geologic characteristics same as those at the weir site. Figure 3.1 shows the geological map of the Project area.

3.2.3 Seismicity

According to the Preliminary Seismotectonic Map of Pakistan (1979) the project region in parts belongs to one of the major earthquake zones. The recent earthquake of 8th October 2005 caused damage to lives and property with land and rock slides occurring in the vicinity of the project region. This indicated the importance of the seismicity in planning the layout and design of the project. For Patrind Hydropower Project a value of 0.52g has been adopted as maximum credible earthquake for design purposes as shown in Table 3.1 at the end of this Chapter.

3.2.4 Landform and Soils

The following landforms occur in the project region starting from weir site in district Abbottabad at Patrind to powerhouse site near Lower Chattar in Muzaffarabad district. The prominent landforms and soils relative to weir site, powerhouse site and along headrace tunnel route are described in the following sections.

Lower Slopes and Terraces

Some narrow strips of land occur as slightly raised terraces just above the Kunhar and Jhelum rivers, along straight sections of the river or on the inside of bends. These areas contain boulder beds and alluvial deposited soils. In some

areas deposits have been covered by landslides. Soils are either mixtures of young and poorly formed stony soils or are composed of infertile skeletal soils derived from landslides. In many cases steep middle to upper slopes of the Kunhar and Jhelum valleys extend all the way to the river channel. These areas are covered with poor forage grasses and several unpalatable shrubs.

Middle Terraces

Small terrace remnants above the lower slopes of Kunhar and Jhelum rivers are predominantly of colluvial origin and of low to moderate fertility. The soils can be affected by drought. In some villages springs are channelled to these areas for village irrigation systems for a range of crops including maize, rice and wheat cultivation. The terraces are subdivided into small farming areas. These areas are supporting the lower villages and the community infrastructure of mosques, schools and shops. Road access to the lower villages is normally inadequate. Middle terrace areas rise abruptly to upper valley slopes.

Middle to Upper Valley Slopes

Soils in middle to upper valley slopes are shallow, have low inherent fertility and contain shale, slates and phyllite rock fragments. These slopes are unstable and landslides are common. Wherever the rivers or roads have cut into the valley sides, rock outcrops are common. This area merges into upper ridge areas.

Upper Ridge Areas

Some older and deeper soils occur along the high mountain ridge which forms the watershed between the Kunhar, Neelum and Jhelum rivers. Only the upper areas which are wider and open, support permanent communities. Soils formed within these areas are better structured and have higher fertility. These areas are cooler and are used for vegetables and fruit trees. Snow occurs on these areas and grazing is restricted to the late spring and summer seasons. The lower communities also return during the summer for grazing flocks of sheep and goats as well as for agricultural activities such as vegetable cultivation. These areas retain some natural tree cover though are rapidly shrinking due to cutting for timber and fuel wood supplies. Access to many of these upper areas is poor and in many cases is limited to steep narrow tracks.

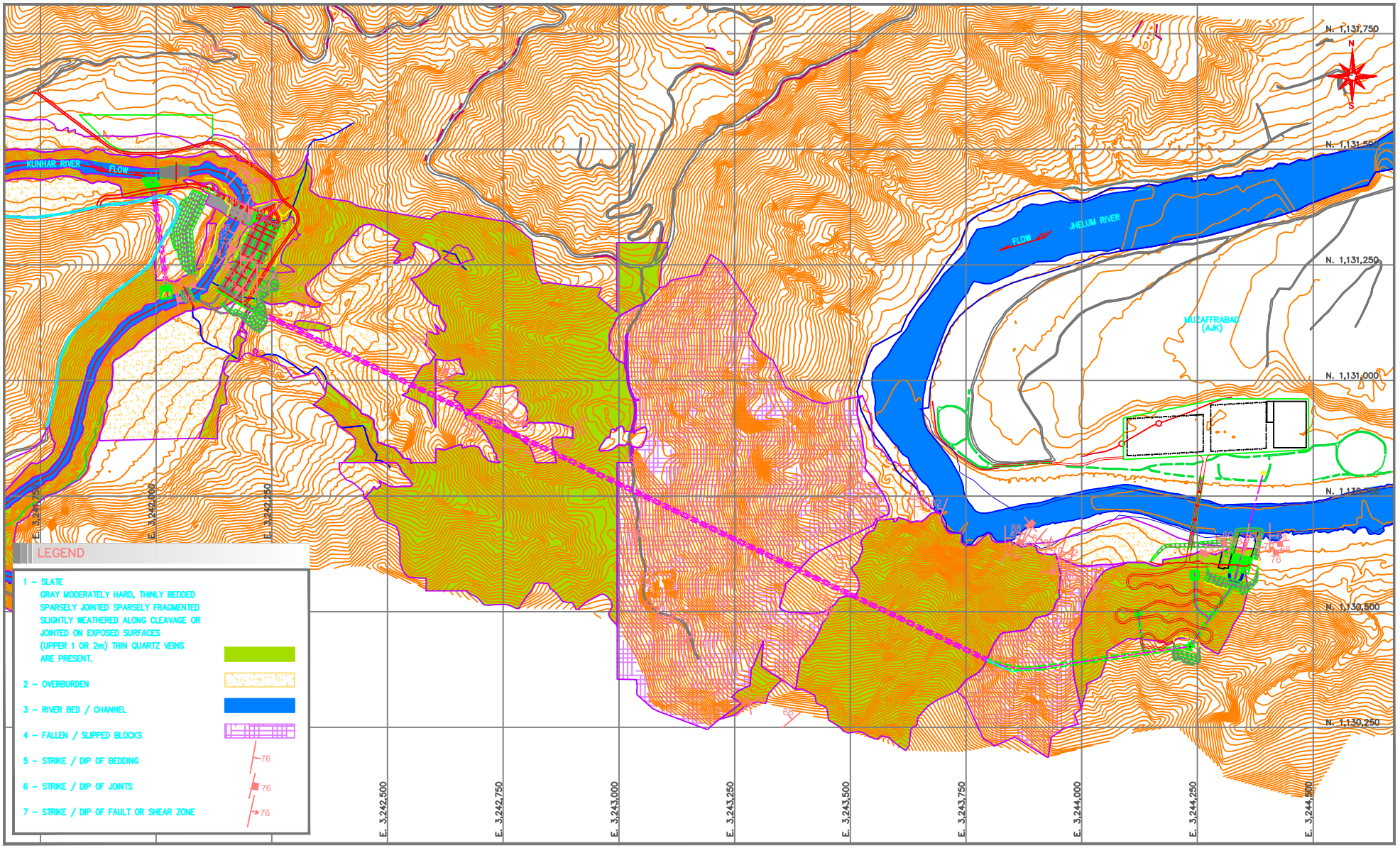


Figure 3.1 : Geological Map of Project Area

3.2.5 Climate

The climate of the project area is pleasant, characterised by mild summers and cold winters. The climatological data for weir site at Patrind is not available. Instead, the data of nearest meteorological stations at Balakot and Muzaffarabd is used, which has been recorded at these stations maintained by Surface Water Hydrology Project (SWHP) WAPDA.

Temperature

At Balakot the months of May to July are the hottest with average daily temperature ranging between 24°C to 28°C while December to February are coldest with temperature varying between 8°C to 10°C. At Muzaffarabad the months of May to July are the hottest months with temperature ranging between 26°C to 30°C while December to February are coldest with temperature varying between 10°C to 11°C. Average monthly temperatures are tabulated below.

Table 3.2: Average Monthly Temperature at Balakot and Muzaffarabad (1960-2003)

Month	Temperature °C	
	Balakot	Muzaffarabad
January	8.1	9.5
February	9.6	11.4
March	13.3	16
April	19.0	21.1
May	24.1	25.7
June	28.2	29.9
July	26.8	28.8
August	25.9	28.1
September	24.0	26.3
October	19.4	21.7
November	14.0	15.9
December	9.4	10.9

Rainfall

June and July are wettest months for both Balakot and Muzaffarabad and November the driest. At these places rain is caused by western disturbances and monsoon Average annual rainfall is 1538.5 mm for Balakot and 1351.9 m for Muzaffarabad. Average monthly and mean annual rainfall for both Balakot and Muzaffarabad are given in Table 3.3.

Table 3.3: Average Annual and Monthly Rainfall at Balakot and Muzaffarabad (1960-2003)

Month	Rainfall (mm)	
	Balakot	Muzaffarabad
January	81.6	79.7
February	132.1	128.4
March	159.6	142.6
April	113.5	95.4
May	69.4	72.1
June	87.1	101.7
July	351.1	273.3
August	275.4	215.5
September	117.5	100.8
October	50.3	43.7
November	37.1	34.0
December	63.7	64.8
Annual	**1538.5**	**1351.9**

3.2.6 Water Resources

Jhelum and Kunhar are the major rivers in the project region besides numerous small streams (nullahs) and springs. The Kunhar river length from Naran to the site of the Weir at Patrind is 80 miles (Figure 3.2). The Kunhar river catchment area of 938 square miles falling from an elevation of 2,362 m above mean sea level at Naran to 735 m above mean sea level at Patrind weir site. Surface Water Hydrology Project (SWHP) WAPDA has established gauging station at Garhi Habibullah since 1960. By extending Kuhnar river flows at Garhi Habibullah at Patrind proportionate to catchment area mean monthly flows of

Kunhar river at Patrind for the period 1960 to 2003 have been calculated. The flows at weir site vary from an average minimum of 24 cumecs in January to an average maximum of 285 cumecs in June as shown in Figure 3.3. The annual average flow is 104 cumecs. The low flow period of Kunhar river, from December to April will be used for construction of weir by diverting all flow stored behind coffer dam into the diversion tunnel.

Combined flows of the rivers of Jhelum, Neelum and Kunhar pass by the proposed site of the powerhouse. Taking account of the flows, the fluctuations in powerhouse tail water level have been determined at a minimum of 650 m above mean sea level to a maximum of 657 m above mean sea level.

Reserved Flow

Starting from weir up to powerhouse site, direct river flows are neither used for irrigated agriculture not for domestic water supplies due to high banks of the Kunhar river relative to its bed level. Instead springs as well as nullahs joining the Kunhar river flows are used to serve both these purposes.

Ecological considerations downstream of the weir require that flow of water should remain available throughout the year. All definitions of reserved or minimum flow place emphasis on the protection of natural life in the river. From the point of view of environmental considerations there are numerous methods and formulas for calculation of reserved flow or minimum flow [13]. The one used here is $Q = [(0.0651\ Q_{mm}+2)\ /100]\ Q_{am}$ (Ref. CEMAGREF: Agricultural and Environmental Research Institute, Antony, France; Formula developed for Minimum Flow for Ecological Requirements, 2006). where Q_{mm} is monthly mean and Q_{am} is annual mean discharge of the Kunhar river at the weir site. Referring to Figure 3.3 and using 23.56 cumecs for Q_{mm} and 103.5 cumecs for Q_{am}, the required ecological flow Q is equal to 3.7 cumecs as compensation flow. However, numerous small and two big hill torrents namely Boi-da-katha and Salol Nala join the Kunhar river stretch below the weir site. Though no gauging stations exist for the two hill torrents, substantial flows have been observed during field visits minimizing the stress on aquatic flora and fauna during low flow season. The flow contributions of these numerous streams and absence of any abstractions of water in the stretch of Kunhar river accompanied by 2 cumecs planned to be released from the headpond for ecological flow throughout the year is enough to take care of stress on acquatic flora and fauna including any fisheries potential which is very limited in any case. Mr. Rashid

Hussain, Assistant Director, Department of Wildlife/ Fisheries in a meeting held with him on 03 June 2006 stated that fisheries potential is insignificant in this reach of Kunhar river.

3.2.7 Water Quality

Kunhar river derives its flow from rainfall and snowmelt both of which do not contain any impurities. As the river flow proceeds over the drainage basin, water picks up sediment load, dissolved solids, toxic substances, and organic matter including bacteria from the surface of the earth. Domestic sewage though insignificant, may get into it. Sediment load is important with respect to the operation stage of the project. The suspended load of Kunhar river contains sand, silt and clay particles, their proportion varying in low and high flow seasons. The sediment load at the weir site has been estimated at 4.94 million tons on the mean annual basis. It carries bottom load of pebbles, boulders and suspended load of sand, silt and clay.

3.3 BIOLOGICAL ENVIRONMENT

3.3.1 FLORA

Climate is very conductive for the growth of mesophytes. Flora is in abundance in the area. A variety of herbs, weeds, flowers, plants and trees is growing in the area. Starting from Dhaman grass to Deodar and Spruce trees, all type of flora is met. In the project area both conifers and broad leave trees occur in the project area. Table 3.4 lists trees in the project region.

Table 3.4: Type of Trees in the Project Area

Sr. #	Botanical Name	Local Name
1.	*Pinus roxburghil*	Chir pine
2.	*Pinus wallichiana*	Blue pine
3.	*Abies pindrow*	Fir
4.	*Cederus deodara*	Deodar
5.	*Picca smythiana*	Spruce
6.	*Prunus padus*	Birdscherry
7.	*Ascer spp.*	Maple
8.	*Cornus macrophlla*	Kandar
9.	*Acacia modesta*	Phhulai
10.	*Robinia pseudocacia*	Kikar
11.	*Olea cuspidate*	Kau

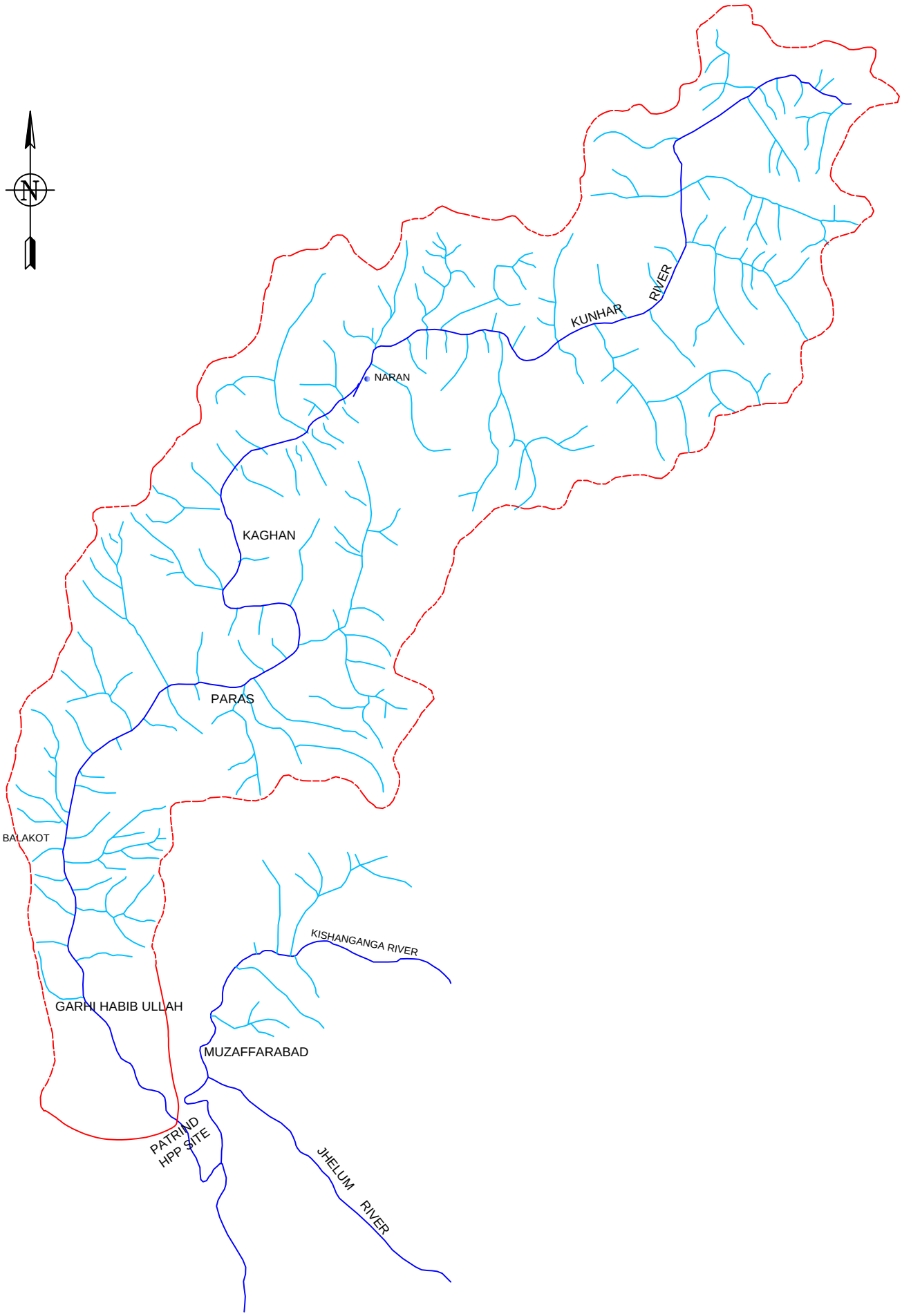


Figure 3.2 : Kunhar River Catchment Area.

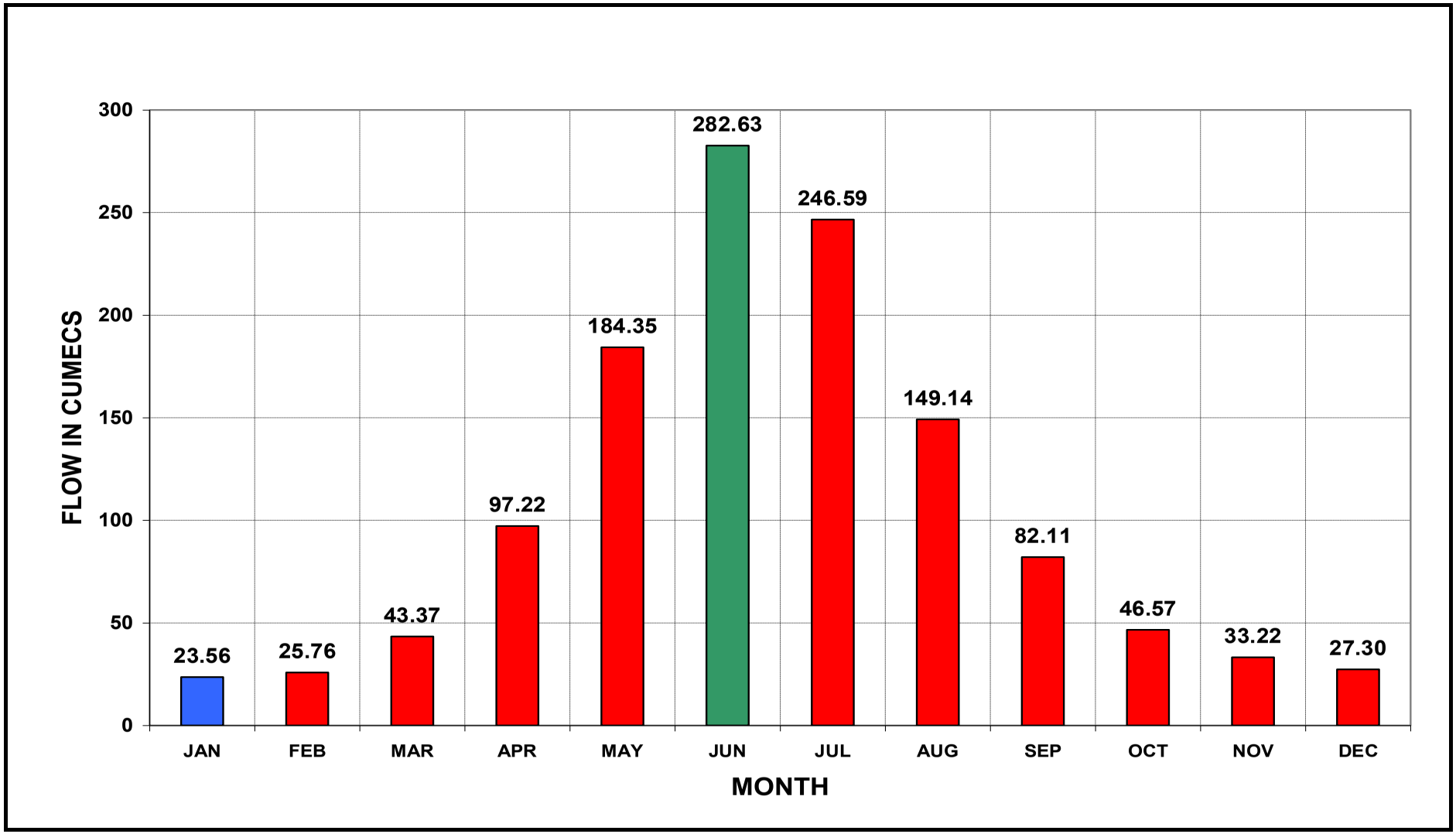


Figure 3.3: Mean Monthly Flows of Kunhar River at Patrind Weir Site (1960 - 2003)

Sr. #	Botanical Name	Local Name
12.	*Bauhinia variagata*	Kachnar
13.	*Azedarachta indica*	Bakain
14.	*Zizyphus jujube*	Ber
15.	*Pyrus pashia*	Batangi
16.	*Cedrela serrata*	Drawa
17.	*Salmalia malabaricum*	Simal
18.	*Acacia Arabica*	Punjabi Kikar
19.	*Cassia fistula*	Amaltas
20.	*Aesculus indica*	Bankhour
21.	*Juglans regia*	Akhrote
22.	*Grevia oppositifolia*	Tamman
23.	*Celtis australis*	Batkarar
24.	*Poplus spp.*	Saffeda

The flora of the region is characteristic of a dry temperature climate. Sixty-five species of trees and shrubs belonging to the *Dicot* family exist. Also, up to nineteen species of mushrooms can be found in the region, some of them harvested for sale. Algae in rivers comprising twelve species belonging to the *Chlorophycae* family represent an important part of *Phytoplankot*. Furthermore, aquatic algae of twenty nine genera with multiple species are found as well as aquatic rooted plants.

3.3.2 FORESTRY

Forest in the project region occur only in the upper valley sides and thus remain un-affected by the project, however forests in the region are classified into categories mainly determined by altitude and rainfall. The subtropical pine forests have an altitudinal range from 800 – 1700 m with a pronounced dry season and annual rainfall varying from 635 – 1270 mm. These areas are mainly covered by chir pine and include the lower sub-mountainous areas of Abbottabad and Muzaffarabad districts. Within these areas *Pinus roxburghii* is only conifer and is dominant. In association with the pine community are patches or pockets of broadleaved species such as olive (O*lea ferruginea)*, sanatha (*Dodonea viscose*). This lower area of pine forest has diminished and has been replaced in many areas by poor grasslands and shrubs used for

grazing. The dry temperate forests have an altitudinal range between 1400 – 3000 m where annual rainfall ranges from 1015 - 1270 mm, 60 percent of which may fall as snow. These forests occur within the upper Kunhar and Neelum valley slopes. The dominant species within this forest community are coniferous species and these include kail, (*Pinus wallichiana)*, deodar *(Cedrus deodara)* and fir *(Abies pindrow*). Other species include broad leaved species such as oak, *(Quercus spp*), chestnut (*Aesculus indica*), walnut (*Juglans regia*) and maple (*Acer spp*).

Forest areas are shrinking and forest is being lost at a substantially greater rate than regeneration. No figures are available for deforestation rates within the areas adjoining the project. The forested areas are now being progressively replaced by a mixed grassland and shrubland community. With majority of the population living in rural areas, there is a large demand for fuel wood which has to be provided by the surrounding forests in the project region. In case of Azad Jammu and Kashmir this is estimated by Forest Department (1985) to be 0.8m^3/person/year. Thus for a typical family of 8 persons the annual family requirement is in the order of 6.4 m^3 of wood. Likewise in Azad Jammu and Kashmir over 100,000 m^3 of timber (0.04m^3/person/year) are extracted each year from forests extending timber extraction into the more critical higher forested areas. Despite Forestry Department regulations and controls, the area continues to be logged for traditional uses through illegal cutting. Similar situation prevails in other parts of the project region.

3.3.3 WILDLIFE

The project area is located on the lower valley slopes and terraces separated from the upper forested areas. The valley slopes high above the project area are characterised by plant and animal biodiversity promoted by variations in altitude, topography and climate providing numerous habitats for several species of flora and fauna. The fauna of the project area consists of mammals, reptiles, amphibians, insects, and birds. For example in 1987 a wildlife survey in Khyber Pakhtunkhwa was conducted which was updated in 1993. The survey comprises important species of the mammals and avifauna in the area. Group of the mammals are represented by Rhesus monkey, wolf, jackal, brown/ black bear, leopard cat and common leopard. Furthermore, sparrow hawk and wood

cock can be found. Information on the vertebrate or on the invertebrate fauna in the region is scanty. Among the reptiles, the only species of snakes likely to occur is *Aqkistrodon mimalavansus.* It is one of the ten poisonous snakes in Pakistan. Also, the lizard *Agama tuberculata* may be found in rocky areas and crevices. Among the amphibians, *Bufo himalayanus, Rana cyanrophlyctis* and *Rana breviceps* exist in the area.

Wildlife Protection, Preservation, Conservation and Management Act of 1975 covers the project area in Khyber Pakhtunkhwa. However, its implementation is hampered by many administrative and socio-economic factors. Over the last 50 years the number of animal species has decreased. Growth of human population has put great pressure on the natural resources of the area, particularly the forests and on the wildlife. A lot of species are endangered by the destruction of habitats, by unrestricted hunting and by poaching. Immediate and effective conservation measures are needed to save the wildlife in the project region.

Endangered Species

As per wildlife survey of Pakistan Map published by the Zoological Survey Department (undated) Leopard Cat (*Felis bengalensia*), Leopard Panther (*Panther Pardus*), Pir Panjal Markhor (*Capra Falconeri Cashmiriensis*) and others like *Lutra Spp* have been declared as the endangered species. Leopard Cat and Leopard Panther both are found upto 3,500 m elevation in the pine forests of Pakistan. They may also be found in the south western part of the country, such as Malakand, Suleman Mountain range etc. Their attractive skin makes them a valuable prey because of which they have become endangered.

Markhor is another animal which has been declared endangered. Its name is derived from its horns i.e its horns are snake like. Its habitat is dry and steep mountains and generally eats Chestnut tree leaves and other leaves and herbs. It also exists from elevations 1,000 to 3,500 m. Although it occurs extensively in Pakistan i.e from Azad Jammu Kashmir upto Balochistan including Gilgit and Baltistan, Mardan, Swat, Dir, Chitral and Dera Ismail Khan, yet its existence is endangered because of its persistent hunting. It is known for its excellent smelling power.

Monkeys are common in the project area but Rheasus Monkey (*Macaca mylatta*) has been adjudged to be a vulnerable species by the Zoological Survey Department. Langur (*Presbytisentellus ajax*) has been rated as endangered

species. Musk deer (*Moschus moschiferus*) is also an endangered species.

Monal pheasant normally occurs between 2,000 to 5,000 m elevation in moist temperate forest and juniper scrubs in Swat, Dir, Hazara, Chitral, Indus Kohistan, Gilgit and Azad Jammu and Kashmir. Because of its beauty and colourful feathers it has become a bird of prey. It is designated as endangered species. Koklas pheasant is comparatively smaller in size and generally lives on comparatively lesser heights in a similar habitat as the Monal pheasant. This bird is rated as rare species. Chukar (*Alectoris chukar*) is found all over Pakistan leaving out plain parts of Punjab and Sindh provinces. This bird is also designated as rare species by the Zoological Survey Department.

With reference to elevations at which endangered species exist it would be seen that the wildlife habitats in general and endangered species in particular do not exist in the Project area.

3.3.4 LIVESTOCK

The people of the project area possess sheep, goats, donkeys, mules, buffaloes and cows. Donkeys and mules are kept for carrying loads while cows and buffaloes for milk. Livestock population in Muzaffarabd and Abbottabad Districts is given in Table 3.5.

Table 3.5: Livestock Population in Muzaffarabad and Abbottabad Districts

Sr. #	Livestock	Muzaffarabad*	Abbottabad**
		2005	1996
1.	Buffalo	4,91,615	1,33,463
2.	Sheep	2,09,600	32,217
3.	Goat	10,52,500	222,472
4.	Horse	7,872	8,661
5.	Mule	41,82	11,991
6.	Ass	72,110	37,378
7.	Cattle	5,13,175	1,15,805
8.	Poultry	38,30,000	6,22,649

* Azad Kashmir at a Glance 2005. Planning and Development Department, Muzaffarabad.

** District Census Report, Abbottabad 1998.

3.3.5 FISHERY

Kunhar is a cold water river that is swift, turbid and has low primary fish productivity. As the river is not productive it is not fished on commercial scale. Apart from opportunistic fishing, fish does not form part of any of the local communities diets. In describing aquatic ecology and fish of the river basin it is stated that Kunhar river is a tributary of river Jhelum. River Jhelum originates from Wular Lake situated in Indian occupied Kashmir. Apart from Kunhar two major tributaries viz Neelum and Poonch contribute to the river Jhelum, Neelum being the larger of the two. Temperatures of their waters before joining river Jhelum remains low (0-12°C) for most part of the year although for aquatic ecology frequency and intensity of temperature change are significant factors. The cold waters of Kunhar River carry *rainbow* and *brown* trout with indigenous *snow trout* dominating the fish stock in the far upper reaches of the river Kunhar (region of Kaghan valley) and not in the reach of river Kunhar at the project site. After the confluence of Kunhar river the water temperature in Jhelum increases and may reach 30°C till it reaches Mangla reservoir. In this stretch common *carp* dominates the fish species (Petr 1999).

Cold water and consequently the cold water fish are limited to natural waters of the higher latitudes of the northern part of Pakistan containing mountain ranges of the Hindu Kush, Karakoram and the Himalayas. Cold water streams and lakes are present in the Northen Pakistan where *Schizothoracines* genera are the major fish of cold water stream (Kunhar). The dominant fish species being *Schizothorax plagiostomus* as reported by Akhtar (1991). He listed 25 species of which 4 are introduced i.e *brown* and *rainbow* trout (*Oncorhynchus mykiss*), common carp (*Cyprinus carpio*) and gold fish (*Carassius auratus*). As far as impact on fish is concerned, the potential for fishery development exists in the headpond after the construction of the Project.

3.4 SOCIO-ECONOMIC INFORMATION AND PROFILE

3.4.1 INTRODUCTION

The collection of baseline data on socio-economic environment involved study of available documents, field surveys for socio-economic status of the project area in terms of land holdings, occupations and income. For this purpose participatory rural appraisal technique was used and scoping sessions were held during field survey June and September 2006. The aspect of acquisition of land in terms of land area requirement and infrastructure falling within the project area was also investigated. This involved consultations and scoping sessions

with primary and secondary stakeholders like owners of land, people of the area, shopkeepers, religious community leaders. Cost of land, built-up property, economic trees etc was discussed with the owners, local people, and revenue department staff. The baseline data collected in pre-designed proformas form part of existing socio-economic conditions discussed in the following sections.

Administrative and Social Set-up

The project area falls in Districts of Muzaffarabad (AJK) and Abbottabad (Khyber Pakhtunkhwa). Union Council, under Local Government Ordinance 2001, is the lowest tier of local government. Depending upon population, villages or urban settlements are grouped into Union Councils (UC). The UC's are formed of public representatives elected by popular vote. The next higher tiers of local government are Tehsil Council and District Council. The district administration is run by District Nazim elected by Union Council members. Social and physical infrastructure of a district is managed by District Nazim. District Coordination Officer (DCO) is the highest ranking administrative functionary of the government in a district.

Scoping Sessions

In order to obtain data on socio-economic profile, opinions and concerns of the project area population, scoping sessions were held in villages in the vicinity of weir and powerhouse sites. In particular people were informed about the scope of lost assets due to project implementation and compensation to be paid to them by the project sponsors. Annexure 5 gives summary and number of participants of scoping sessions held in the respective villages. In addition officials of relevant departments were also contacted during field surveys. A list of contact persons is given in Annexure 6.

3.4.2 POPULATION

The population survey of the villages in the vicinity of Weir and Powerhouse sites were conducted. The population in the project area are local people belonging to settled districts of Khyber Pakhtunkhwa/ AJK; it is neither characterised by ethnic diversity nor by any indigenous people. The project will not in any way affect them. The District Census Reports 1998 of Abbottabad and Muzaffarabad issued by Population Census Organisation Islamabad were also consulted.

Population of Weir Site Villages

There are 8 villages within 2 Km of weir site. Half of the villages fall in the Muzaffarabad district while other half in Abbottabad district as shown in Table 3.6. At annual growth rate of 2.99% and 1.82% for Tehsils of Muzaffarabad and Abbottabad, the present (2010) population of these villages totals 11,974. Number of households has decreased to 202 due to earthquake of October 8, 2005 demolishing almost all the Katcha houses in the area.

Population of Powerhouse Site Villages

There are five villages within 2 Km of Powerhouse site in Muzaffarabad district as given in Table 3.7. Their population according to Muzaffarabad District Census Report 1998 is 2,658. At annual growth rate of 2.99% for Muzaffarabad Tehsil, the present population of these villages totals 3,776.

3.4.3 SOCIO-ECONOMIC INDICATORS

Tables 3.6 and 3.7 also give socio-economic indicators of the population of villages within 2 Km of the weir and powerhouse site in terms of literacy ratio, availability of civic amenities like water supply and electricity.

Table 3.6: Population and Socio-Economic Indicators of Villages/ Human Settlements - Weir Site

Tehsil and District	Village Name	Area Acres	Kunhar River Bank	Population		Literacy Ratio 10^{+}	No. of Households		Household Size		Household Facilities (1998)	
				1998	2010		1998	2010	1998	2010	Potable Water	Electricity Connection
Muzaffarabad	Patrind	1195	LHS	2159	3066	48.6	336	-	6.4	-	28	335
Muzaffarabad	Tarcheela	-	LHS	-	752	-	-	-	-	-	-	-
Muzaffarabad	Raiter	114	LHS	321	456	72.8	37	-	8.7	-	26	37
Muzaffarabad	Gotha	436	LHS	868	1233	70.3	112	-	7.8	-	59	112
Abbottabad	Taitree	-	RHS	-	266	-	-	-	-	-	-	-
Abbottabad	Sarati	-	RHS	-	277	-	-	-	-	-	-	-
Abbottabad	Hundi	-	RHS	-	173	-	-	-	-	-	-	-

Tehsil and District	Village Name	Area Acres	Kunhar River Bank	Population		Literacy Ratio 10+	No. of Households		Household Size		Household Facilities (1998)	
				1998	2010		1998	2010	1998	2010	Potable Water	Electricity Connection
Abbottabad	Deedal Meera	463	RHS	1391	1975	46.5	217	-	6.4	-	106	216
Total				**4,739**	**8,198**							

LHS: Left Hand Side, RHS: Right Hand Side, Household Size: No. of Persons/Household

Table 3.7: Population and Socio-Economic Indicators of Villages/ Human Settlements - Powerhouse Site

Tehsil and District	Village Name	Area Acres	Kunhar River Bank	Population		Literacy Ratio 10+	No. of Households		Household Size		Household Facilities (1998)	
				1998	2010		1998	2010	1998	2010	Potable Water	Electricity Connection
Muzaffarabad	Thori	356	LHS	753	1070	60.7	144	-	5.2	-	2	144
Muzaffarabad	Sarar	492	RHS	704	1000	76.2	99	-	7.1	-	26	99
Muzaffarabad	Alora	184	RHS	278	395	82.4	42	-	6.6	-	42	42
Muzaffarabad	Hussan-abad	188	RHS	485	689	76.9	70	-	6.9	-	12	69
Muzaffarabad	Dhani	186	RHS	438	622	77.7	70	-	6.3	-	37	70
Total				**2,658**	**3,776**							

LHS: Left Hand Side, RHS: Right Hand Side, Household Size: No. of Persons/Household

3.4.4 AGRICULTURE AND OTHER PROFESSIONS

Agriculture in Muzaffarabad and Abbottabad districts is the dominant economic activity. Majority of the farmers have their own simple irrigation systems using water of streams and springs. Wheat, maize and rice are the major crops. Crop yields are variable and the most reliable estimates of crop yields are wheat 470 Kg/Acre, maize 452 Kg/Acre, rice 320 Kg/Acre. Other professions followed by

active male population of the project area are private businesses, service in government, and skilled/ semi-skilled labour.

3.4.5 HEALTH SERVICES

The availability of health services in terms of hospitals, clinics, dispensaries and of medicines is not satisfactory in the surveyed villages around weir and powerhouse sites. Health facilities like basic health unit (BHU) / rural health centre (RHC), medical practioner (qualified doctor or hakeem), lady health visitor (LHV) / lady health worker (LHW), traditional birth attendant (TBA) or dai are almost non-existent except for Hakeems, Dais and very small number of government or private clinics in the villages around weir and powerhouse sites. So the people have to travel long distances in case of emergency.

3.4.6 EDUCATION FACILITIES

The District Census Report 1998 gives 60.7% to 82.4% literacy ratio in villages around Power house site and 46.5% to 72.8% in the villages around weir site. The existing number of educational institutions in the villages within 2 Km of weir site and powerhouse site are shown in Table 3.8 and 3.9.

Table 3.8: Educational Facilities in the Surveyed Villages – Weir Site

Sr. #	Village Name	Educational Facilities							
		Primary School		Middle School		High School		Madrasa/ Masjid	
		Male	Female	Male	Female	Male	Female	Male	Female
1.	Patrind	0	1	1	-	-	-	6	1
2.	Tarcheela	1	1	-	-	-	-	1	-
3.	Raiter	1	-	1	-	-	-	1	-
4.	Gotha	1	1	1	-	-	-	1	-
5.	Taitree	1	1	1	-	-	-	1	-
6.	Sarati	-		-	-	-	-	-	-
7.	Hundi	-	-	-	-	-	-	-	-
8.	Dedal Meera	1	1	1	-	-	-	1	1
Total		**5**	**5**	**5**	**-**	**0**	**-**		**2**

It will be seen at present no male or female high school exists in the surveyed villages of weir site. However, there are five primary schools, 5 middle schools, 11 Madrassas for male and 5 primary school, and 2 Madrassas exist for female

population in the surveyed villages of weir site.

Powerhouse region has one high school each for male and female population. For males there are 4 middle schools 4 primary schools, 5 Madrassas and for females 4 primary schools, 5 middle schools and 2 madrasas in the surveyed villages.

Table 3.9: Educational Facilities in the Surveyed Villages - Powerhouse Site

Sr. #	Village Name	Educational Facilities							
		Primary School		Middle School		High School		Madrasa/ Masjid	
		Male	Female	Male	Female	Male	Female	Male	Female
1.	Thori	1	1	1	1	1	1	1	1
2.	Sarar	1	1	1	1	-	-	1	1
3.	Alora	-	-	-	1	-	-	1	-
4.	Hassanabad	1	1	1	1	-	-	1	-
5.	Dhani	1	1	1	1	-	-	1	-
Total		**4**	**4**	**4**	**5**	**1**	**1**	**5**	**2**

3.4.7 CULTURE

Mosques and graveyards exist in each village of the project area. There are no sites of archaeological and historical importance in the project area.

3.4.8 WOMEN IN PROJECT AREA

Life in the villages is entirely male-dominated and women face many problems due to restricted mobility, lack of decision-making, poor access to social services, limited productive employment opportunities, early marriages, no family planning practices and no awareness about health and hygiene. According to the women, health is one of the biggest problems in their villages. Diseases like diarrhea, cholerea, chest-infections, goiter, abdominal problems and seasonal inflections (cold, cough, etc.) are very common among the villagers. The women often suffer from health problems after childbirth and there are no regular immunizations of the children.

The people have difficulty in obtaining the necessary medicines. Serious illnesses force people to go to Abbttabad/ Mansahra for treatment and most of them cannot afford this. Since the women lack awareness about health and hygiene, the children suffer from various health problems due to poor hygienic conditions.

3.4.9 VULNERABLE GROUPS, INDIGENOUS PEOPLE

There are neither vulnerable or minority ethnic groups in project area nor are there any other groups which can be considered indigenous people. It is pointed out that Constitution of Pakistan does not recognise any ethnic/ linguistic indigenous groups, it takes notice only of religious minorities.

3.5 INFORMATION DISCLOSURE

The field team consisting of environmentalists, sociologist and ecologist undertook the process of informing community representatives and affected households about the Project and its impacts. Field trips were conducted in March and April 2010. The consultation process was conducted during the social survey preparing the affected community regarding land acquisition, helping to counter the rumours, preventing unnecessary distress, and bringing clarity on issues that might be raised by the affected persons. The process also includes the preparation of an introductory and information brochure in Urdu about the Project, its location, main impacts and benefits.

Participation of project affected people and of the community during the project implementation will be ensured through their involvement in a committee for redress of grievances. This will ensure satisfactory settlement of any issue regarding affected land, houses, crops etc.

3.6 COMMUNITY CONSULTATIONS

Community consultation process was started at an early stage in the project cycle. This ensures that feedback from communities and other stakeholders directly or indirectly affected by the project can be used to adjust and improve the project's design, planning, and implementation, and help structure the project to be both environmentally and socially acceptable.

During the field survey an extensive community consultation exercise was undertaken to incorporate the concerns and views of local communities in socioeconomic and environmental assessment survey. This consultation process entailed a thorough and simplified briefing of the technicalities and potential

impacts of the project on the communities.

For this purpose, apart from consultations with the local community, consultations with concerned public representatives and officials of the relevant line departments were also held. The details of community consultations showing names of participants are given in Annexure 5.

The consultants held meetings with primary stakeholders to assess any potential issues that could be raised due to the project activities. The survey team visited five villages in total that may be affected from the activities of the proposed project. During these consultations a simple, non-technical description of the project was given, along with an overview of the project's likely human and environmental impacts.

Following the project description, detailed discussions were held so that the participants could voice their concerns and opinions. These concerns and suggestions were recorded in field notes.

Outcome of Consultations

During scoping sessions/community consultations/question-answer meetings, the overall response from the project area population was positive. Everyone welcomed the project as being beneficial to the region.

- **Land Acquisition**

  Generally community apprehensions pertained to the land and houses acquired by the project implementation. They expected project authorities to pay them timely compensation on the basis of current market prices.

- **Traffic Hazards**

  The participants of the public consultations expressed concerns over the safety hazards that could result from the increase in the roadside traffic particularly during the construction phase of the project. Noise nuisance of traffic will produce heavy noise affecting the environment of the area. Participants emphasized to evolve realistic noise management plans to curtail its impact on rural community. In order to pre-empt roadside accidents of both humans and animals a traffic alert system like guards and traffic signs should be available before the construction starts.

- **Employment**

  The participants of the public consultation meetings emphasized the need to ensure the appointment of locals in all non-technical and support services through a transparent process. They demanded that during operation stage of the project employment should be given to the local on permanent basis.

- **Project Benefits**

  Local community also expressed the opinion that the project should be designed in a manner that all people including the poor should be benefited from the project like availability of electricity, establishment of school and health clinics.

- **Cooperation with the Community**

  The participants expressed that the project proponents should maintain and encourage a cooperative attitude towards the community paying due attention to their concerns arising out of project implementation.

- **Community Concerns**

  During scoping sessions it has been observed that more than 95% of participants did not express any objections to implementation of the proposed project with a small minority expressing some apprehensions about compensation payment. They demanded timely compensation for land and houses.

  A drinking water storage tank is located on the right bank of Kunhar river near the proposed route of diversion channel. Spring water is stored in the tank to meet the drinking water requirements of the adjacent settlements like Taitree and Sarati. The concerned people expressed their concerns to take care of it during construction activity.

  About 6 kanals of agriculture land is under cultivation on the right bank of Kunhar river near weir site. The owner of land also demanded that no damage may occur to the land during construction activities or else compensation for crops should be paid for the duration of construction activities.

3.7 MEETINGS WITH OFFICERS OF THE GOVERNMENT DEPARTMENTS

Offices of the government and NGO's were visited. They were apprised of the project by sharing available information with them. These include Departments of Wildlife, Fisheries, Forest, Health and Agriculture in Muzaffarabad and Abbottabad. Representatives of NGOs like WWF and Sungi were also contacted in these cities. Published information relating to the project area was collected. This included literature on forests, fisheries, wildlife, geology, landforms, landuse, climate, water resources and district census reports. Record of meetings with relevant Government Department Officers is given in Annexure 6.

Table 3.1: Seismic Design Parameters Adopted for Major Water Resources Development Projects of Pakistan Including Patrind HPP

Project	Location	Structure	Dam Type	Dam Height (m)	Major Tectonic Features	Normal Storage Capacity (MCM)	Return Period (Years)		Max 'g'		Remarks
							MCE	OBE	MCE	OBE	
Patrind	Muzaffarabad (AJ&K)	Weir	RCC	42	Main Boundary Thrust	5.81	10000	150	0.52	0.23	
Basha	Diamer	Dam	Arch Gravity Concrete	274	Main Mantle Thrust	9011.34	10000	100	0.63	0.25	MDE
Tarbela	Abbotabad	Dam	Earth and Rockfill	143.25	Tarbela Fault, Darband Fault	13949.06	100		0.5	0.25	Tarbela Fault passes under the dam
Mangla	Mirpur (AJ&K)	Dam	Earthfill	138.38	Jhelum Fault, Himalayan Thrust	9132	6000	100	0.35	0.11	0.14 for Embankments
Ghazi Barotha	Attock	Headpond Embankment	Earthfill	-	Pr/Attock Fault	15		60 - 100	0.5	0.26 - 0.30	
Kurram Tangi	Kurram (North Waziristan)	Dam	Concrete Faced Rockfill	89.92	Kurram Thrust, Daryoba Anticlines	1135.68			0.2	0.2	MDE
Satpara	Skardu	Dam	Earth and Rockfill	39	Stak Fault	115.277	10000	1000	0.34	0.19	
Neelum-Jhelum	Zaminabad (AJ&K)				Jhelum Fault			1000	0.45 - 0.6	0.25	
									0.3 - 0.4	0.17	

MCM: Million Cubic Meters

MCE: Maximum Credible Earthquake

OBE: Operational Basis Eqrthquake

MDE: Maximum Design Earthquake

CHAPTER – 4

ASSESSMENT OF ENVIRONMENTAL IMPACTS

4.1 INTRODUCTION

Patrind Hydropower Project design has incorporated a weir instead of a dam. The topography of the project area, combined with the elevation difference between head pond on Kunhar river and the powerhouse tailrace discharging into Jhelum river has made it possible to generate electrical energy which would otherwise have been possible only with a dam about three times the height of the proposed weir. By adjusting project design in terms of reduction in head pond elevation, the inundation area and largely the negative environmental impacts, have been minimized. The environmental and social costs have also been considerably reduced by incorporating cost effective corrective measures in the planning and design of the project components.

4.2 ENVIRONMENTAL RESOURCES UNDER PROJECT IMPACT

- The impacts regarding population displacement and land acquisition exist though to a moderate degree and are discussed in this Chapter.
- The access roads built for the project and the head pond may cause inroads into the watershed by farmers, hunters, timber exploiters etc. thereby accelerating losses in forests and wildlife as well as facilitating and accelerating encroachment into the watershed above the head pond. Therefore, protection and enhancement of environmental resources in the form of forests, wildlife habitat, parks etc. in the upper watershed is proposed.
- There are no historical, cultural monuments shrines, mosques requiring salvaging.
- Sediment load in terms of watershed erosion/ silt runoff may affect the life of the head pond if allowed at excessive filling rate. The weir design provides a limited control of sediment load by sluicing during flood flows. Sand trap has also been provided ahead of intake of the headrace.
- As a result of variation in hydrologic regime due to the creation of head pond, tube well irrigation around the head pond periphery would be of value to the rural population.

- The environmental problems due to project construction would require EPC contractor to provide safety of workers against accidents, workers camp sanitation, prevention and control of water-borne diseases, dust, odour, fumes, noise and vibrations resulting from drill-blasting operations.
- The environmental problems related to the diminution of river flow downstream of the weir at Patrind are not significant in terms of the downstream beneficial uses as the Kunhar river is not used for agriculture irrigation or drinking water supply. Numerous streams both large and small join Kunhar river in the reach between weir site and the confluence of Kunhar with Jhelum river.
- Head pond management would be essential to control water pollution, eutrophication, water quality, insect vector disease hazards, and head pond bank stability.

Table 4.1 at the end of this chapter has been prepared for Patrind Hydropower Project to enumerate environmental issues concerning project location, design, construction, operation including enhancement measures for environmental resources and values.

4.3 PROJECT LOCATION IMPACTS

4.3.1 LAND AREA REQUIREMENTS

Land for Construction of Access Roads

Implementation of the project for sites accessibility represents a significant impact on ecology of the mountainous region. No direct access road or communication infrastructure is available from the existing roads to get to the sites of the weir, surge chamber, powerhouse and switchyard. To build access roads would amount to an invasion of the ecologically sensitive areas, including acceleration of soil erosion at specific locations. This infrastructure of access roads including bridges required during construction phase will remain an essential part of the project operation and maintenance. Table 1.3 gives details of proposed roads in the project area requiring 1.27 Ha of land area.

Land for Project Structures

Land area of appropriate size is required for the project structures like the weir, intake for headrace tunnel, sand trap, surface surge chamber, temporary diversion channel and power house. Land requirements for project structures

discussed in Chapter 5 add up to 15 acres. Construction camps (12.62 acres and storage area (9.45 acres) will require additional 22.07 acres of the land. Land acquisition for these structures will not affect significantly any agricultural areas, forests or wildlife habitats.

Submergence of Land by Headpond

Major impacts on land would be due to submergence of land under the head pond estimated at 141.3 acres (57.2 hectares).

Construction Corridors

Construction corridors are only temporary parts of the construction phase and required only for related activities. Thus after finalisation of the construction activity, the areas of construction corridors will be rehabilitated in their original ecological status.

Workers Camp and Storage Areas

During construction phase, areas for residential colonies for professional staff and labour as well as equipment storage sites would be needed. Due to the mountainous character of the region suitable land areas are rare. However, it is pointed out that most of the work force would daily commute between construction sites and nearby villages or towns (Mansehra, Garhi Habibullah or Muzaffarabad) considerably reducing the requirement of housing needs at the sites of project construction. The land required for construction camps (12.62 acres) and for storage area (9.45 acres) has been estimated as 22.07 acres.

4.3.2 SPOIL MATERIAL

Excavation work including drill-blasting will result in spoil material. This will be used as fill material, as far as possible, for structure of weir, powerhouse and the stabilization of the head pond banks, embankment of access roads, coffer dams and for terracing of hill slopes. The surplus amount will be disposed off at sites discussed in subsequent chapter.

4.3.3 SANITARY WASTEWATERS

In order to manage sanitary wastewater from the construction camps a system of sewers would be laid leading to on-site wastewater treatment and disposal. This would be essential to prevent pollution of Kunhar and Jhelum rivers.

4.3.4 NOISE AND POLLUTION DUE TO VEHICLES EXHAUST

Noise, gaseous emission and dusty atmosphere will result from movement of heavy vehicles for transportation of equipment and construction materials. Similar effects would be caused by drill-blasting for the tunnel, pressure shaft and caverns. The EPC contractor would be required to control noise and exhaust pollution by construction management techniques which are sensitive to these effects.

4.4 IMPACTS ON PHYSICAL ENVIRONMENT

The project impacts on physical environment are described with respect to water resources, water quality, land use, and landscape in the following sections.

Water Resources

For the weir site it would be necessary to establish dry pit condition to carry out construction work across Kunhar river bed. It is planned that during low flow season (December to April) Kunhar river flow will be directed into diversion tunnel until the construction of weir is completed. During this period Kunhar river reach between the coffer dam and the outlet of the diversion tunnel will remain almost dry except for replenishment by nullah/ spring flows normally taking place within this reach. This change in river regime over a short reach will be temporary and of short duration.

At the powerhouse site, for the construction of permanent bridge across Jhelum river the flow will be diverted through the temporary diversion channel of about 445 m length for a period of about 4 months in low flow season. . The rock formation along right bank of Jhelum river will prevent backflow of river water through the tailrace alignment reaching the powerhouse complex under construction.

Water Quality

It is expected that river water quality will deteriorate during construction phase. This will mainly be due to the increase of suspended solids, turbidity and waste. This change in water quality will be temporary and over a short distance of the reach which, as pointed out in section 4.2, will not be significant because the reach is neither used for agricultural irrigation nor for drinking water supply. During operation phase river water quality, particularly in Kunhar river, will

undergo cyclical changes due to restricted flow.

Landscape

The construction and operation of the project will affect the landscape and aesthetic value of the project area. Besides roads, construction sites and vehicular traffic, landscape will also be affected by construction camps, storage areas and dust generation. However, this will be temporary and lasting for project construction period only.

4.5 BIOLOGICAL ENVIRONMENT

Impacts on biological environment of the project area with respect to forest, wildlife, fishery and protected areas/ reserves are discussed in the following sections.

Forests

As stated in Section 3.3.2 forests in the project region occur only in the upper valley areas characterised by sub-tropical pine forests and temperate forests depending upon the valleys altitude. Thus these forests remain unaffected by the project construction and operation. However, several factors put pressure on the existence of the forests in the upper valleys region. The most severe impacts arise from people collecting the wood for fuel. Although it is not allowed to cut trees for heating, it is done illegally in an extensive manner. This practice especially affects oak and deodar trees. In addition, shrubs are collected as firewood. Furthermore, the collection of dead wood creates significant problems. It results in the absence of decomposition interrupting the generation of humus as an essential feature for nutrients, rooting and germination. On an average, two truckloads of firewood are used by each family for cooking and heating during a year. Another serious damage of the upper valley forests comes up by grazing. The population keeps herds of goats and sheep. In summer, the herds graze on the pastures where they often invade into the forests. This results in deforestation by overgrazing and destroying the flora, especially the tree seedlings. During the winter months, when the pastures remain under a cover of snow, the animals are fed with leaves. For this reason oak trees are lopped to get fodder. The intensity of lopping is heavy, resulting in the removal of the young trees. Consequently, the protection layer against erosion and against landslides is getting destroyed permanently in the upper valleys region.

Economic Trees

Economic trees, and to a limited extent bushes and scrub forest, may be affected by construction activity at the sites of weir, powerhouse and surface surge chamber. While impact on bushes and scrub forest, because of their scope and extent, may be insignificant, the economic trees to be submerged in the project head pond have to be given due consideration because of their number and economic cost. Table 5.6 and 7.3 shows the number of such trees belonging to private owners. They will be compensated according to the type and size of the tree. The ecological impact resulting from loss of these trees will be offset by tree plantation around the periphery of the project head pond, proposed to be part of annual tree plantation campaign undertaken by Forest Department of the Government of Khyber Pakhtunkhwa.

Wildlife

The wildlife will be affected to the extent that project requirements of land for construction of roads, building structures, construction corridors and dumping of excavated material will have to be met. As discussed earlier the head pond would submerge a land area of 141.37 acres and the project components would require a total of 38.34 acres including land required for construction camps, storage areas and access roads. Occupation of land for project implementation will result in loss of habitats for flora and fauna in head pond area like trees, reptiles and insects etc. which do not include any endangered species; thus establishment of wildlife protection area is not needed as a mitigation measure because reptiles and similar fauna will move to safer places during sub-mergence. The on-going annual tree plantation campaigns by the Provincial Forest Department as well as creation of wildlife habitat along the river at least 10m away from the river bank can be seen on mitigation measures for wildlife habitats rehabilitation. Roads built for the project may provide entrance to sensitive and unspoilt regions. This will lead to disturbance of wildlife by human activities. Finally heavy vehicular traffic for transportation of men and material, as well as blasting and construction noise will drive out animals from their habitats, though for a temporary and short period.

Fishery

As discussed in Chapter 3, Kunhar river in the project area does not support fishery on a commercial scale nor there is any anglers' activity at any time in the area. This was confirmed by Mr. Rashid Hussain Assistant Director Fisheries, Department of Wildlife and Fisheries Muzaffarabad in a meeting held by the

Project Environmental on 3 June 2006. Therefore the impacts of construction and operation activities on fishery would be insignificant. However, the head pond holds a considerable fishery potential after the construction of the Project. With appropriate management of this potential, head pond fishery development during operation phase will substantially enhance the beneficial impact of the project on the local population.

Reserves and Protected Areas

There are no reserves, parks or protected areas in the project area. Ayubia National Park is located far away (about 40 Km air distance) from weir site and about 7 Km from powerhouse site with elevations differing from 765 m amsl at weir site and about 2000 m amsl for Ayubia National Park. As such no significant impacts are expected on the physical, biological or socio-economic environment of the Ayubia National Park. Manshi wildlife sanctuary (2,321 hectares) is located upstream of the weir site. The weir site is at about 765m amsl whereas the sanctuary has an average elevation of 1,500m amsl and at air distance of 20 Km from the weir site. It is therefore concluded that none of project components will have any significant impact on the sanctuary.

4.6 IMPACTS ON SOCIO-ECONOMIC ENVIRONMENT

The impacts during construction and operation of the project on socio-economic environment relate to land acquisition, houses, economic trees, culture, infrastructure, women and indigenous groups in the project area.

Loss of Houses and Population Displacement

A total of 13 (thirteen) houses will be taken over to construct the powerhouse on the right bank of Jhelum river and 1 (one) house on the weir side of the project. These houses are occupied by 146 persons who constitute the population which is subject to displacement.

There is no impact on commercial assets except for a small water mill (1/2 acre) which will be inundated by the project head pond.

Infrastructure

There is no infrastructure like roads, village tracks, telephone/ transmission lines which will be subject to inundation by the project head pond.

Compensation

To prepare an effective framework for compensation of lost assets, a comprehensive plan has been drawn up in accordance provisions of ADB Handbook on Resettlement Policy. The details of the compensation plan are described in Chapter 5 of this report.

Economy

Project implementation in terms of construction and operation will create employment opportunities which will help mitigate local opposition. This will also stimulate local economy. This will reduce population emigration and help find work for local unskilled workers. Also local market will benefit from increase in demand for consumer goods. Increased income in the project area will encourage the formation and growth of local businesses resulting in new indirect employment opportunities.

Culture

Historical and cultural sites in the form of mosques, shrines, graveyards or of archaeological significance will not be affected as the same do not exist at the sites of the project components or the head pond area.

Women in Project Area and Indigenous People

During the construction phase an inflow of outside workers will disturb the local socio-cultural life of the project area. As a result women could be restricted by a more strict application of purdah. There are no other vulnerable groups, nor any indigenous people in the project area.

4.7 UPSTREAM/ DOWNSTREAM IMPACTS OF FUTURE PROJECTS

With reference to cumulative impacts of existing projects, the proposed project or anticipated future projects it is stated that at present no hydropower projects exist on Kunhar river. The river, however, holds a high potential of development of hydropower generation in the form of cascade system of projects, particularly within its reach in Kaghan valley. The proposed projects each at Patrind and Suki Kunari are likely to be followed by more hydropower projects on Kunhar river. The impacts of all such proposed/ anticipated projects will be diversions/ storages of water for power production. The cumulative impacts are likely to give rise to issues of resettlement and/ or submergence of cultivable lands including adverse impacts on biological environment. Detail assessment of such projects in terms of environment, hydrology, health, and other social aspects is beyond the scope of Patrind Hydropower Project.

Table 4.1: Checklist of Environmental Issues and Impacts of Patrind Hydropower Project

Actions Affecting Environmental Resources and Values		Damages to Environment		Recommended Feasible Protection Measures		No Significant Effect	Significant Effect		
							Small	Moderate	Major
A.	**Environmental Problems Due to Project Location**								
1	Resettlement / Land Acquisition	1	Serious social inequities	1	Carefully planned resettlement and land acquisition programme, including hard budget				x
2	Encroachment into precious ecology	2	Loss of ecological values	2	Careful planning, plus use of offsetting measures		x		
3	Encroachment on historical/cultural values	3	Loss of these values	3	Careful planning, plus mitigation measures	x			
4	Watershed erosion silt runoff	4	Shortened reservoir life	4	Watershed management programme			x	
5	Impairment of navigation	5	-	5	-	-			
6	Effect on groundwater hydrology	6	Rise of water table around reservoir periphery; no water-logging	6	Expansion of tubewell irrigation		x		
7	Migrating valuable fish species	7	-	7	-	-			
8	Inundation of mineral resources	8	-	8	-	x			
9	Other inundation losses or adverse effects	9	Submergence of land and economic trees	9	Careful planning and design	x			

B.	**Environmental Problems Related to Design**							
1	Road erosion	1	Impairment of water quality and land values	1	Careful planning and design	x			
2	Reservoir site preparation	2	Affects reservoir water quality including nutrients for fishery	2	Prepare site to suit optimal reservoir uses	x			
3	Water rights conflicts	3	None	3	-	x			
4	Fish screens	4	None	4	-	x			
C.	**Environmental Problems Associated with Construction Stage**							
1	Soil erosion/silt runoff	1	Impairment of water quality and land values	1	Proper design and construction planning, plus monitoring		x		
2	Other Construction Hazards			2					
	(a) Safety of workers		(a) hazards to workers health/ safety		(a) Personal protective equipment and field clinic for workers and provision of protection against accidents.		x		
	(b) sanitation at workers camp		(b) hazards to health of worker and nearby communities		(b) Provision of sewerage and sewage treatment systems for sanitary waste water and solid waste management system for construction camp		x		
	(c) water-oriented diseases		(c) Water pollution/ malaria		(c) Vector control	x			

	(d) dust/odors/fumes/noises/vibrations		(d) hazards to workers and neighours	(d) Construction management measures		x		
	(e) blasting and hauling		(e) Noise and air pollution	(e) Construction management measures			x	
	(f) environmental aesthetics		(f) loss of scenic values	(f) Management and conservation of borrow areas		x		
3	Construction monitoring	3	Without it Construction Contractor not likely to observe constraints	3 Appropriate construction monitoring		x		
D.	**Environmental Problems Relating to Project Operation**							
1	Downstream flow variations	1	Disturbance to downstream fisheries, navigation and other uses	1 Minimum adverse effects	x			
2	Depreciation of downstream inundation fisheries	2	Loss of fisheries formerly growing in inundated fields	2 Offset by promotion of aquaculture	x			
3	Downstream erosion	3	Erosion of banks and river bottom damaging downstream riverside facilities	3 Careful design to control problem, plus monitoring	x			
4	Lack of reservoir management	4	Social conflicts in reservoir community	4 Appropriate reservoir management	x			
5	Eutrophication (aquatic weeds)	5	Heavy evaporation, plus impairment of fishing and power generation	5 Phenomena usually temporary	x			
6	Downstream water quality	6	Impairment of downstream water quality from flow restrictions	6 Careful operations planning to minimize problem		x		
7	Insect vector disease hazards	7	Community health hazard	7 Careful monitoring, plus use of appropriate control measures		x		

	8	Estuarine and marine fisheries impacts	8	-	8	-	x			
	9	Reservoir bank stability	9	Impairment of reservoir uses and water quality	9	Careful planning/ design for reservoir bank stability	x			
	10	Operation monitoring	10	Without it, operators not likely to comply with constraints	10	Appropriate monitoring	x			
E.	**Potential Environmental Enhancement Measures**									
	1	Reservoir fishery enhancement	1	Considerable extra reservoir fishery potential realized	1	Appropriate management of potential for reservoir fishery development			x	
	2	Drawdown agriculture	2	Extra agricultural production potential	2	Appropriate management of drawdown agriculture	x			
	3	Downstream community water supply	3	Improvement in community living standards	3	Planning for optimal use of stored water	x			
	4	Downstream aquaculture	4	-	4	-	x			
	5	Forestry/wildlife reserves	5	Conservation of forests/wildlife	5	Establishment of reserves to offset losses		x		
	6	Recreation	6	Improvement in quality of community life, including the poor	6	- Planning for optimal reservoir use - Recreation of Park on Left Bank of Jhelum river			x	
F.	**Additional Considerations**									
	1	Multipurpose management need	1	Opportunity to optimize overall project benefits	1	Integrated reservoir management		x		
	2	Rural electrification	2	Improving quality of life for rural poor	2	Planning to accommodate this need		x		
	3	Transmission Lines Project	Transmission Lines not a component of Patrind Hydropower							

G.	Critical Review Criteria							
1	Loss in irreplaceable natural resources	Damage to natural resources	1	Planning consistent with Pakistan Environmental Protection Act 1997. (P-EPA 1997) and ADB Policy Statement 2009	x			
2	Accelerated use of resources for short-term gains	Resources depletion	2	Planning consistent with P-EPA 1997/ADB Guidelines	x			
3	Endangering of species	-	3	-	x			
4	Undesirable rural-to-urban migration	-	4	-	x			
5	Increase in affluent/poor people gap	-	5	-	x			

CHAPTER – 5

LAND ACQUISITION AND RESETTLEMENT PLAN

5.1 INTRODUCTION

This chapter addresses issues resulting from socio-economic impacts of the Project particularly those relating to land acquisition, population displacement, loss of housing/ farm produce as well as loss of income and of income resources. The issues have been discussed within the framework of Asian Development Bank, the World Bank/ International Finance Corporation, AJK Environmental Protection Act 2000 as well as those of Pakistan Environmental Protection Act 1997.

5.1.1 RESETTLEMENT POLICY OBJECTIVES

The following policy objectives have been used to develop resettlement plan for the Project.

- Involuntary resettlement is an integral part of project design to be dealt with from the earliest stage of project planning.
- Involuntary resettlement should be avoided or minimized wherever feasible.
- Community participation should be encouraged in the planning and implementation of resettlement programme.
- Timely compensation for lost assets as well as redress of grievances of Affected Persons should be provided.
- The compensation process should be fully transparent.

5.1.2 PROCEDURE AND STRUCTURE OF INVESTIGATION

Resettlement process aims at ensuring an equitable and uniform treatment of affected persons resulting from implementation of development projects. The valuation of assets, determination of amount of compensation and procedure for its payment form essential components of resettlement process. The experience gained from implementation of development projects at national level has shown that people should be at the centre of all development processes. To achieve long term goals the people must be consulted, and compensated for

losses. Very often affected people are poor and vulnerable, and therefore unable to absorb adverse impacts of development projects in their lives.

The survey work consisted of collection of data for land acquisition and resettlement. Contacts with concerned officials of Government departments, and undertaking consultations with affected persons and communities in the villages were undertaken. This survey was conducted using pre-designed proforma, Annexure 7. The Urdu version of the questionnaire asked from the locals during field surveys on various aspects of land acquisition and resettlement plan is given in Annexure 8.

The visits and meetings for accomplishing the scope of work were performed from last week of March to 1st week of April 2010 in addition to the surveys conducted earlier in the year 2006, Annexure 5 and Annexure 6. In order to collect the required data and information relevant authorities and NGO's have been met. Task of the site visit was to investigate the planning area and impacts of the project layout on the environmental and socio-economic aspects. All collected data are based on the status of the EPC Contractor design of 2010.

5.2 RESETTLEMENT – RELATED BASELINE DATA

5.2.1 LAND ACQUISITION

The team of environmentalists visited sites of head pond, weir, powerhouse, spoil deposit areas, access roads and construction camps. They identified the types of land to be acquired at these sites, the number of houses and families directly affected, and the number of trees that would be lost as a result of project implementation.

The following table is a list of owners whose land will be acquired for the construction of the components of the Patrind Hydropower Project.

Table 5.1: Land Acquisition for Implementation of Patrind Hydropower Project

Sr. No.	Names of Affected Persons/ Household Head	Land Acquisition (Kanals)*			
		Farmland	Riverbed	Wasteland	Total
Submergence of Land Areas by Headpond					
1.	M. Ayoub s/o Pir Khan, Village Tercheela, Muzaffarabad	7	-	26	33
2.	M. Yousuf s/o Sher Zaman, Village Tercheela, Muzaffarabad	5	-	12	17
3.	Noor Zaman s/o Sikander Khan, Village Tercheela, Muzaffarabad	25	-	22	47
4.	M. Bashir s/o Faqir Muhammad, Village Tercheela, Muzaffarabad	6	-	32	38
5.	M. Rafiq s/o Pir Khan, Village Tercheela, Muzaffarabad	3	-	24	27
6.	M. Ali s/o Ghulam Hassan, Village Tercheela, Muzaffarabad	8	-	21	29
7.	Muzafar Hussain s/o Bahadur Ali, Village Tercheela, Muzaffarabad	6	-	12	18
8.	M. Ishtiaq s/o Ali Zaman, Village Tercheela, Muzaffarabad	4	-	19	23
9.	M. Sharif s/o Nadir Ali, Village Tercheela, Muzaffarabad	3	-	17	20

Sr. No.	Names of Affected Persons/ Household Head	Land Acquisition (Kanals)*			
		Farmland	Riverbed	Wasteland	Total
10	Malik Rafiq s/o Abdul Rehman, Village Tercheela, Muzaffarabad	20	-	32	52
11	M. Zaman s/o Abdul Rehman, Village Tercheela, Muzaffarabad	20	-	15	35
12	M. Farid s/o Gul Zaman, Village Tercheela, Muzaffarabad	6	-	13	19
13	Ali Zaman s/o Kale Khan, Village Tercheela, Muzaffarabad	12	-	8	20
14	Khalil Rehman s/o Kale Khan, Village Tercheela, Muzaffarabad	12	-	20	32
15	Nazeer Ahmed s/o Sher Zaman, Village Tercheela, Muzaffarabad	3	-	20	23
16	Settlers of Village Tarcheela, Muzaffarabad.	19	-	-	19
17	Mir Afzal s/o Abdullah, Village Tercheela, Muzaffarabad	-	-	23	23
18	Naimat Jan s/o Mir Muhammad, Village Tercheela, Muzaffarabad	-	-	17	17
19	M. Mushtaq s/o Ali Zaman, Village Tercheela, Muzaffarabad	-	-	31	31

Sr. No.	Names of Affected Persons/ Household Head	Land Acquisition (Kanals)*			
		Farmland	Riverbed	Wasteland	Total
20	M. Jan s/o Bahadur, Village Tercheela, Muzaffarabad	-	-	15	15
21	Haider Zaman s/o Qalander Khan, Village Tercheela, Muzaffarabad	-	-	18	18
22	M. Nasir s/o Sher Zaman, Village Tercheela, Muzaffarabad	-	-	16	16
23	M. Murad s/o Ghulam Jan, Village Tercheela, Muzaffarabad	-	-	18	18
24	Riazat Khan s/o M. Sharif, Village Tercheela, Muzaffarabad	-	-	12	12
25	M. Shafiq s/o M. Maskin, Village Tercheela, Muzaffarabad	-	-	18	18
26	GulZaman s/o Faqir Muhammad, Village Deedal Meera, Abbottabad	2	-	19	21
27	Ali Murad s/o Hassan Ali, Village Deedal Meera, Abbottabad	1	-	22	23
28	Abdul Qayyum s/o Sher Zaman, Village Deedal Meera, Abbottabad	2	-	20	22
29	M. Mohsin s/o Hashim Ali, Village Deedal Meera, Abbottabad	1	-	17	18

Sr. No.	Names of Affected Persons/ Household Head	Land Acquisition (Kanals)*			
		Farmland	Riverbed	Wasteland	Total
30	Roshan Ali s/o Hashim Ali, Village Deedal Meera, Abbottabad	1	-	16	17
31	Azizur Rehman s/o Hashim Al, Village Deedal Meera, Abbottabad i	1	-	16	17
32	M. Sadiq s/o Waris Ali, Village Deedal Meera, Abbottabad	4	-	18	22
33	Gohar Rehman s/o Waris , Village Deedal Meera, Abbottabad	4	-	16	20
34	Suleman s/o Hadayat Ali, Village Deedal Meera, Abbottabad	8	-	19	27
35	State Owned Land	-	324	-	324
	Sub Total	**183.0**	**324.0**	**624.0**	**1131.0**
Land Acquisition for Powerhouse Site					
1.	M. Ayoub s/o Moosa Khan	-	-	5	
2.	M. Arif s/o Fadi Khan	-	-	10	
3.	M. Yunus Khan s/o Moosa Khan	-	-	5	
4.	Khalil-ur-Rehman s/o Faqir	-	-	10	
5.	Abdul Qayyum s/o Meher Wali	-	-	18	
6.	Ali Zaman s/o Gohar Ali	-	-	2	
7.	Mehr Ali s/o Gohar Ali	-	-	19	
8.	Noor Zaman s/o Gohar Ali	-	-	11	
9.	Sail Ali s/o Kalu Khan	-	-	8	

Sr. No.	Names of Affected Persons/ Household Head	Land Acquisition (Kanals)*			
		Farmland	Riverbed	Wasteland	Total
10	M. Iqbal s/o Kalu Khan	-	-	8	
11	M. Pervez s/o M. Faqir	-	-	12	
	Sub Total	**-**	**-**	**108.0**	**108.0**
Land Acquisition for Weir					
1.	Aziz ur Rehman, M. Saleem	2.0	5.7	4.0	11.7
	Sub Total	**2.0**	**5.7**	**4.0**	**11.7**
Land Acquisition for Surge Chamber					
1.	State Owned Land	-	-	0.75	0.75
	Sub Total	**-**	**-**	**0.75**	**0.75**
Construction Camp at Weir Site on Left Side of Kunhar River					
1.	Muhammad Riaz s/o Gulzaman	15.0	-	-	15.0
2.	Muhammad Gulab s/o Gulzaman	15.0	-	-	15.0
3.	Ashraf s/o Gohar Rehman	4.0	-	-	4.0
4.	Haroon s/o Gohar Rehman	3.0	-	-	3.0
	Sub Total	**37.0**	**-**	**-**	**37. 0**
Storage Camp near Patrind Village at Weir Site Left Side of Kunhar River					
1.	Abdul Aziz s/o Fatah Ali	2.0	-	-	2.0
2.	Muhammad Yousif s/o Zafar Ali	2.0	-	-	2.0
3.	Gul Hassan s/o Nadir Ali	1.0	-	-	1.0
4.	Abdul Rashed s/o Faqir Muhammad	2.0	-	-	2.0

Sr. No.	Names of Affected Persons/ Household Head	Land Acquisition (Kanals)*			
		Farmland	Riverbed	Wasteland	Total
5.	Ali Rehman s/o Muhammad Zaman	1.0	-	-	1.0
6.	Muhammad Hasan s/o Qalandar Khan	3.0	-	-	3.0
7.	Shabir s/o Ali Zaman	1.0	-	-	1.0
8.	Rafiq s/o Hasan Ali	1.0	-	-	1.0
9.	Khalil-ul-Rehman s/o Jumma khan	1.0	-	-	1.0
10	Shahzaman s/o Nadir Ali	1.0	-	-	1.0
11	Sulaman s/o Faqirullah	1.0	-	-	1.0
12	Mushtaq s/o Sulaman	1.0	-	-	1.0
13	Pir Khan s/o Muhammad Khan	1.0	-	-	1.0
14	Ali Khan s/o Muhammad Khan	1.0	-	-	1.0
15	Abdul Aziz s/o Muhammad Khan	1.0	-	-	1.0
16	Abdul Rafiq s/o Abbas	1.0	-	-	1.0
17	Muhammad Azeem s/o Khairullah	1.0	-	-	1.0
18	Parvaiz s/o Gohar Rehman	1.0	-	-	1.0
19	Muhammad Jaan s/o Abdul Ghafar	1.0	-	-	1.0
20	Manzoor s/o Yaqoob	1.0	-	-	1.0

Sr. No.	Names of Affected Persons/ Household Head	Land Acquisition (Kanals)*			
		Farmland	Riverbed	Wasteland	Total
21	Fazal Rehman s/o Dawood Khan	1.0	-	-	1.0
22	Muhammad Saeed s/o Rehman	1.0	-	-	1.0
23	Taufiq s/o Bashir	1.0	-	-	1.0
24	Raheem s/o Azad	1.0	-	-	1.0
25	Wajid s/o Ali Rehan	1.0	-	-	1.0
26	Iqbal s/o Noor Zaman	1.0	-	-	1.0
27	Muhammad Muneer s/o Noor Aman	1.0	-	-	1.0
	Sub Total	**32.0**			**32.0**
Construction Camp at Powerhouse Site on Left Side of Jehlum River					
1.	State Owned Land	-	64.0	-	64
	Sub Total	**-**	**64**	**-**	**64**
Storage Camp at Powerhouse Site on Left Side of Jehlum River					
1.	State Owned Land	-	43.6	-	43.6
	Sub Total	**-**	**43.6**	**-**	**43.6**
Maintenance Road to Construction Camp, Weir Site and Storage Camp on Left Side of Kunhar River					
1.	Malak Awan s/o Gulzaman	1.0	-	-	1.0
2.	Hameed s/o Gulzaman	1.0	-	-	1.0
3.	Farid s/o Gulzaman	1.0	-	-	1.0
4.	Sain s/o Gohar Ali	0.5	-	-	0.5
5.	Noor Zaman s/o Sikandar	0.4	-	-	0.4

Sr. No.	Names of Affected Persons/ Household Head	Land Acquisition (Kanals)*			
		Farmland	Riverbed	Wasteland	Total
6.	Sarwar s/o Gohar Ali	0.4	-	-	0.4
7.	Yousif s/o Sherzaman	0.2	-	-	0.2
8.	Gulab s/o Gulzaman	0.5	-	-	0.5
9.	Pir Khan s/o Muhammad Khan	0.5	-	-	0.5
10	Ali Rehman s/o Muhammad Zaman	0.3	-	-	0.3
11	Aurangzaib s/o Jumma Khan	0.2	-	-	0.2
12	Ismail s/o Alyas	0.3	-	-	0.3
13	Ashraf s/o Khairullah	0.4	-	-	0.4
14	Naseem s/o Gulzaman	0.5	-	-	0.5
	Sub Total	**7.2**	**-**	**-**	**7.2**
Access Road along the Right Bank of Kunhar River to Weir Site					
1.	Aziz ur Rehman, M. Saleem and Ghulam Ali, Village Dadal Meera, Abbottabad	3.3	-	-	3.3
	Sub Total	**3.3**			**3.3**
Land Acquisition for Dumping Site for Spoil Material at Weir Site					
1.	Muhammad Maskeen s/o Hashim Ali	-	-	8	8
2.	Aziz-ul-Rehman s/o Hashim Ali	-	-	8	8
3.	Roshandin s/o Hashim Ali	-	-	8	8
4.	Ali Mardan s/o Hashim Ali	-	-	8	8
5.	Gohar Rehman s/o Waris Ali	-	-	8	8
6.	Shaikh Ahmed s/o Kala Khan	-	-	1	1
7.	Gulzaman s/o Faqir Muhammad	-	-	1	1
8.	Mir Khan s/o Waris Ali	-	-	1	1

Sr. No.	Names of Affected Persons/ Household Head	Land Acquisition (Kanals)*			
		Farmland	Riverbed	Wasteland	Total
9	Gohar Rehman s/o Bahadur Khan	-	-	5	5
	Sub Total			**48.0**	**48.0**
Land Acquisition for Dumping Site for Spoil Material at Weir Site					
1.	Noorzaman s/o Sikandar Khan	-	-	40	40
2.	Hyderzaman s/o Qalandar Khan	-	-	40	40
3.	Muhammad Ayob s/o Pir Khan	-	-	8	8
4.	Rafiq s/o Pir Khan	-	-	4	4
5.	Massehzaman s/o Alizaman	-	-	4	4
6.	Muhammad Bashir s/o Faqir Muhammad	-	-	8	8
7.	Muhammad Raifat s/o Muhammad Sharif	-	-	4	4
8.	Irshad Hussain s/o Ghulam Hussain	-	-	4	4
9.	Muhammad Mushtaq s/o Alizaman	-	-	4	4
10	Abdul Qayoom s/o Shahzaman	-	-	4	4
	Sub Total			**120**	**120**
Land Acquisition for Dumping Site for Spoil Material at Powerhouse Site					
1.	State Land	-	-	200	200
	Sub Total	**-**	**-**	**200**	**200**
Land Acquisition for Diversion Channel at Powerhouse Site					
1.	**State Land**			**80**	
	Sub Total			**80**	
	Total	**264.5**	**437.3**	**1,184.75**	**1,886.5**

*** 1 Ha = 10,000 m^2 = 2.471 Acre 1 Acre = 8 Kanal = 4047 m^2**

The total of land areas amounting to 1,886.55 kanals is sub-divided into land areas to be acquired as Permanent Land Acquisition (1261.95 kanals) and as Temporary Land Acquisition (624.6 kanals) as follows.

5.2.2 PERMANENT LAND ACQUISITION

In total 1253.95 kanals (= 63.43 ha) of riverbed, farmland and wasteland will be acquired permanently for constructing the Patrind Hydropower Project as shown in Table 5.2 below.

Table 5.2: Permanent Land Acquisition by Type and Extent of Land

Sr. No.	Project Component	Affected Land (Kanals*)			
		State owned Land/ Riverbed	Farmland	Wasteland	Total
1.	Reservoir Impounding	324.0	183.0	624.0	1,131.0
2.	Weir Structures	5.7	2.0	4.0	11.7
4.	Powerhouse	-	-	108.0	108.0
5.	Surface Surge Chamber	-	-	0.75	0.75
6.	Maintenance Road to Construction Camp, Weir site and storage camp	-	7.2	-	7.2
7.	Access Road along the Right Bank of Kunhar river to weir site	-	3.3	-	3.3
Total Permanent Land Acquisition		**329.7**	**195.5**	**736.75**	**1261.95**

*** 1 Ha = 10,000 m^2 = 2.471 Acre 1 Acre = 8 Kanal = 4047 m^2**

5.2.3 TEMPORARY LAND ACQUISITION

There is need for temporary acquisition of land for the construction camp, storage camp and temporary disposal of excavated material in the vicinity of the weir site and powerhouse site. The following Table 5.3 shows the details of the

land area proposed for temporary acquisition.

Table 5.3: Temporary Land Acquisition by Type and Extent of Land

Sr. No.	Project Component	Affected Land (Kanals)			
		State owned/ Riverbed	Farmland	Wasteland	Total
1.	Construction Camp at Weir Site	-	37.0	-	37.0
2.	Storage Camp at Weir Site	-	32.0	-	32.0
3.	Construction Camp at Powerhouse Site	64.0	-	-	64.0
4.	Storage Camp at Powerhouse Site	43.6	-	-	43.6
5.	Dumping Sites	200.0	-	168.0	368.0
6.	Diversion Channel	80			
Total Temporary Land Acquisition		**387.6**	**69.0**	**168.0**	**624.6**

*** 1 Ha = 10,000 m^2 = 2.471 Acre 1 Acre = 8 Kanal = 4047 m^2**

5.2.4 VALUE OF LAND

Market assessment in the project area as well as consultation with district revenue department officials were undertaken to arrive at prices of land. The land values given by the revenue department officials were slightly lower than market prices. The market prices were assessed on the basis of recent market transactions and consultation with the affected persons and other community members; in most cases transactions are verbal and not documented. The rates used in preparation of resettlement costs are given in Table 5.4.

Table 5.4 Land Prices in the Project Area

Sr. No.	Type of Land	Rate / Acre* (Rs.)	Rate / Acre** (USD)
1.	Farmland	1,920,000	22,857
2.	Wasteland	640,000	7,619
3.	State owned/ Riverbed Land	400,000	4,762

* Rate/ acre of land costs include 15% CAS for involuntary resettlement.

** Exchange rate 1 USD=84 Rs.

5.2.5 CROP COMPENSATION

The land areas where construction of workers and storage camps is to take place are cultivable. The construction of these camps may result in damage to standing crops. Where possible by the construction schedule, farmers will be permitted to harvest crops. Where this is not possible, compensation will be awarded on the basis of market value of the crop. Depending upon the crops, an assessment of market prices of the crops was conducted in consultation with officials of revenue department and agriculture department as well as local people. An average value of Rs. 15,000 per acre has been used as compensation for crops. This will apply to the land area of 69 Kanals which will be subject to temporary acquisition for construction of the camps.

5.3 AFFECTED HOUSES

While considering project layout alternatives and selecting areas for deposition of excavated material, efforts have been made to avoid overtaking of houses. However, 13 houses will be directly affected due to construction of powerhouse displacing 129 persons in village Alora. In addition, one house on Weir side will be directly affected displacing 17 persons. Table 5.5 give details of all these houses, names of their owner and number of occupants subject to displacement.

Table 5.5: Houses Directly Affected by Project Implementation

Sr. No.	Owner's Name	No. of Houses	No. of Occupants	No. of Rooms			No. of Kitchen	No. of Bathroom
				Type B	Type C	Type D		
Power House								
1.	Sarfraz Khan s/o Issa Khan	1	30	5	7	2	3	3
2.	M. Imran s/o M. Maskeen	1	2	-	2	-	1	-
3.	Mrs. Raisham Jan w/o M. Maskeen	1	3	-	-	2	1	1
4.	M. Pervez s/o M. Sulaiman	1	7	-	1	-	1	-
5.	M. Ashraf s/o Ghulam Ali	1	8	5	-	-	1	1
6.	M. Akbar s/o Mehar Wali	1	17	1	-	-	-	1

Sr. No.	Owner's Name	No. of Houses	No. of Occupants	No. of Rooms			No. of Kitchen	No. of Bathroom
				Type B	Type C	Type D		
7.	M. Farooq	1	5	-	7	-	1	1
8.	Abdul Qayyum s/o Mehar Wali	1	8	4	3	2	1	2
9.	M. Aslam s/o Samandar Khan	1	9	2	-	-	1	1
10	M. Nawaz s/o Samander Khan	1	6	-	-	2	1	1
11	Mahar Wali s/o Faqir Muhammad	1	15	2	3	2	1	2
12	M. Maskeen s/o Saif Ali	1	12	6	-	-	1	2
13	Tanveer Ahmad s/o Abdul Rashid	1	7	2	5	-	1	1
Diversion Tunnel at Weir Site								
14	Aziz ur Rehman, M. Saleem, Ghulam Ali s/o Hassan Ali	1	17	-	7	-	1	1
	Total	**14**	**146**	**27**	**35**	**10**	**15**	**17**

* Room Type B – Brick Masonary: mud mortar, roof: iron girders, RCC batons and bricks
* Room Type C – Bricks in mud mortar/ plaster, tin roof, wooden beams/planks, mud cover
* Room Type D – No bricks, wooden beams, mud cover

5.4 RELOCATION OPTIONS FOR PHYSICAL RESETTLEMENT

The following are the six options available for relocation and physical resettlement of displaced population.

- **No Resettlement**

  The option of no resettlement should be considered if alternatives are too expensive or policy objectives cannot be met.

- **On-Site Resettlement**

  Where the population densities are relatively low, it may be possible to consolidate members of an affected community in a single area thus making room for project facilities without having to relocate the community to another site.

- **Partial Resettlement**

  Where the whole site is not required for project facilities, it may be possible to minimize or isolate land take. As a result, only a fraction of the affected community may require physical relocation.

- **Resettlement to Nearby and Multiple Site**

  Where full resettlement is necessary, the impact of displacement can be minimized by relocating affected people to several small sites near the affected area; the extent to which this type of resettlement is possible or desirable depends on the structure of the community and on the land market.

- **Resettlement to Margins of Developed Area**

  The margins of developed areas offer cheaper land than more central locations but normally still have access to utilities and infrastructure.

- **Resettlement to Distant Sites**

  Land cost and availability considerations often favour the selection of resettlement sites far from project facilities, but the disadvantages of such sites include lack of employment and business opportunities and of wider social support networks; the cost of infrastructure provision is likely to be high; and social services will likely have to be specially provided.

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The project implementation will directly affect 14 houses displacing 146 persons. During field surveys, persons/ communities affected by Patrind Hydropower Project were individually as well as collectively interviewed to gather their opinion for resettlement and relocation. All owners of land and of houses directly affected by the project showed their interest in receiving cash compensation. None of them opted to receive land for land compensation or land for construction of new houses. As a result no resettlement sites have been identified or investigated.

5.5 COMMERCIAL ASSETS

The project implementation does not involve loss of any commercial assets except for water mill located in the headpond area. It will be submerged after the creation of headpond. It belongs to Mr. Muhammad Hussain of Schian village of Muzaffarabad district.

5.6 AFFECTED TREES

As shown in the following Table, an estimated total of 624 trees will need to be felled for constructing various components of the Project. It includes 126 mixed fruit, 31 timber and 498 firewood trees.

Table 5.6: Number of Affected Trees

Sr. No.	Name of Trees		Type of Trees	Numbers
	Common Name	Botanical Name		
Reservoir Impounding				
1.	Sherol	*Alnus nitida*	Firewood	30
2.	Shahtoot	*Morus alba*	Fruit	22
3.	Dhraik	*Melia Azadrach*	Firewood	16
4.	Wallnut	*Juglans regia*	Fruit	4
5.	Daraba	*Cedrela serrata*	Firewood	14
6.	Angeer	*Ficus carica*	Fruit Tree	16
7.	Nim	*Azadirachata indica*	Firewood	6
8.	Balkald	-	Firewood	25
9.	Kau	*Clea cuspidate*	Firewood	23
10.	Cheer	*Pinus roxburghlli*	Timber	14
11.	Tali	*Dilbergia sisso*	Timber	6
12.	Pipal	*Ficus religiosa*	Firewood	8
13.	Kiker	*Acacia nilotica*	Firewood	6
14.	Phulai	*Acacia modesta*	Firewood	7
15.	Beence	-	Firewood	6
16.	Deodar	*Cedrus deodara*	Timber	11
17.	Phagwar	*Ficus palmate*	Firewood	8
Sub Total				**222**
Powerhouse Site				
1.	Sherol	*Alnus nitida*	Firewood	200
2.	Phagwar	*Ficus palmate*	Firewood	19
3.	Wallnut	*Juglans regia*	Fruit Tree	9

Sr. No.	Name of Trees		Type of Trees	Numbers
	Common Name	Botanical Name		
4.	Mixed Fruit Trees	-	Mixed Fruit Trees	35
Sub Total				**263**
Construction Camp at Weir Site on Left Side of Kunhar River				
1.	Apricot	*Prunus armeniace*	Fruit tree	34
2.	Pear	*Pyrus cummunis*	Fruit tree	16
Sub Total				**50**
Maintenance Road to Construction Camp, Weir Site and Storage Camp on Left Side of Kunhar River				
1.	Dhraik	*Melia Azadrach*	Firewood	6
2.	Talhi	*Dilbergia sisso*	Firewood	1
3.	Bhala	*Gymnosporia spp.*	Firewood	6
4.	Sharool	*Alnus nitida*	Firewood	6
5.	Phagawar	*Ficus palmate*	Firewood	2
Sub Total				**21**
Access Road along the Right Bank of Kunhar River to Weir Site				
1.	Sherol	*Alnus nitida*	Firewood	7
2.	Phagwar	*Ficus palmate*	Firewood	5
Sub Total				**12**
Construction of Storage Camp near Patrind Village at Weir Structures Left Side of Kunhar River				
1.	Dhraik	*Melia Azadrach*	Firewood	20
2.	Phagwar	*Ficus palmate*	Firewood	10
3.	Dravia	*Cederela serrata*	Firewood	14
4.	Apricort	*Prunus armeniace*	Fruit Tree	12
Sub Total				**56**
Total				**624**

5.7 ORGANISATIONAL SETUP

The resettlement of people affected by Patrind Hydropower Project is the

responsibility of the Sponsor. The Company will, therefore, play a key role in implementing the resettlement components of the project. For the efficient implementation and management of resettlement activities, an Environmental Management and Monitoring Unit (EMU), headed by an employee of the Company, not below the rank of Director will be created. Director EMU will be responsible for implementing resettlement activities as follows:

- Ensure proper, timely and transparent payment of compensation to Affected Persons.
- Ensure EPC contractor(s) compliance requirements of safeguards for construction safety, occupational health, traffic management, dust suppression, solid waste disposal, wastewater disposal, air pollution, noise and vibration, biodiversity, occupational safety, transportation, storage of flammable and explosive materials.
- Ensure construction sites are screened to avoid dispersion of dust/ pollutants in the surrounding atmosphere.
- Avoid or control cutting of trees by EPC Contractor(s) in the project area.
- Liaise with neighbouring communities for their concerns about disturbance/ disruption due to construction activities.
- Ensure proper disposal of construction spoil.

5.7.1 INSTITUTIONAL ARRANGEMENTS

Keeping in view the resettlement related baseline data and scope of resettlement activities, Director EMU will have adequate staff.

The record of land and of land ownership is maintained in the District Revenue Departments in Abbottabad and Muzaffarabad. To initiate and proceed with land acquisition, District Revenue Officer (DRO) of each district will be designated as Land Acquisition Collector (LAC). In the capacity of LAC, the DRO will depute adequate number of revenue officials to work with EMU staff for performance of functions in acquisition of land/ assets required for Patrind Hydropower Project implementation.

Under Land Acquisition Act 1894 (LAA) only persons officially registered with land revenue department as owners or those who possess formal lease agreement are considered eligible for compensation. The process of land acquisition will, however, be shortened by replacing formal LAA method with

direct negotiation with land owners because LAA process often takes too long due to legal formalities and court interventions. Method of direct negotiation with owners is more practical and minimizes the subsequent grievances and lengthy litigation often involved in land acquisition cases. By using direct negotiations, the decisions have to be made in consensus with the Affected Persons. Thus it is a participatory approach to land acquisition by which Affected Persons concerns and interest can be taken care of beforehand.

5.7.2 COMPENSATION PAYMENT PROCEDURE

The institutional arrangements as explained in Section 5.7.1 above can be followed as the basis of procedure for payment of compensation for acquisition of land and other assets. The compensation payment procedure under this arrangement will consist of the following steps.

- Company will develop and maintain computer based Management Information System (MIS) to deal with resettlement related data and activities.
- The resettlement related baseline data as prepared for Resettlement Plan of the project will be studied/ assessed by EMU/ LAC staff.
- The staff of EMU and LAC will conduct field surveys to physically identify the land/ other assets to be acquired for project implementation.
- Ownership of land/ assets will be confirmed with reference to District Revenue Department records as well as by using all other available means.
- After valuation of land and other assets has been completed by Land Valuation Committee (LVC), payment of compensation will be made to the Affected Persons out of the Compensation Fund.
- In addition to compensation payment the affectee would be allowed to take the debris
- Exact details/procedures (SOP) would be finalized with the respective governments for the purpose of Land acquisition.

5.8 VALUATION OF ASSETS

The assets which are lost due to implementation of development projects

include land, houses/ built-up property, crops and trees.

In case of Patrind Hydropower Project, most significant is the loss of land with reservoir impounding claiming the largest proportion. Valuation of land for compensation begins with determining market value of land. In determining market value of land, following criteria can be used.

- The opinion of the valuators or experts
- The price paid within a reasonable time in bonafide transactions of lands in the neighbourhood and possessing similar advantages like location, type of usage, and level of productivity.
- By capitalizing the net annual income from the land.

It is proposed to achieve fair and timely compensation for lost assets through establishment of Land Valuation Committees (LVC) for each area, which will be charged with the responsibility of determining fair prices of land and assets in that area and recommending them to the Land Acquisition Collector for adoption in the award.

The Land Valuation Committee will consist of the following members.

- A representative of District Co-ordination Officer (DCO), who will serve as Chairman of LVC
- One representative from the Company
- Two representatives of Affected Persons (APs) from the concerned area, to be nominated by the AP's

LAC may join the Committee, but only as an observing member, with no voting rights. It is to be noted that LVC will be an advisory committee. However, LAC, who has the authority to fix the market value, will in most instances accept the recommendations of LVC, and thus in effect provide legal sanction to the Committee.

In order to determine realistic market value of land, LVC will consider the following aspects.

- One year averages of land sales in the concerned area for the year immediately prior to the data of commencement of land acquisition.
- Location of land i.e. proximity to settlements, roads, etc

- Type of land usage i.e. residential, agricultural, (irrigated, rain-fed) orchards, or other
- Any other factor considered pertinent

The weightage to be given to each of these aspects will be decided by the Committee of each village. The Committee will determine fair market values on the basis of the above and recommended them to LAC for a decision. An additional 15% of the market value of the land will be paid to the owners as Compulsory Acquisition Surcharge (CAS) for involuntary acquisition. Any AP if dissatisfied with the compensation award will have the right of appeal before the provincial Board of Revenue.

5.8.1 VALUATION OF HOUSES/ CROPS/ TREES

Assets like built-up property will be valued at full replacement cost i.e. the amount sufficient to replace lost asset plus transition cost. In applying replacement cost method, depreciation of structures/ asset should not be taken into account.

In case farmers are not permitted to harvest crops on land already acquired, due to exigency of construction schedule, cash compensation based on market value of crop will be made.

5.9 ENTITLEMENT PACKAGE

The project is committed to provide entitlements to persons who lose their land or other assets or to those others whose livelihood is directly affected by the acquisition of land. These entitlements will be supplemented by EMU through project activities such as training, work opportunities and facilitation for obtaining credit. The work opportunities provided to Affected Persons will consist of priority in project employment with construction contractor(s) through issuance of work permits.

5.10 CERTIFICATES OF COMPENSATION

EMU will prepare signed Certificate of Compensation for each landowner or other affectee. Following particulars will be noted on each certificate.

- Name of owner of land or other asset
- Physical details of land/ asset including name of village
- Value of land/ asset to be acquired and compensation due

- Terms on which such compensation will be made

Copies of Certificate of Compensation will be provided to LAC and the village elder to ensure both transparency and subsequent cross checking of actual payments. This is essential for equitable treatment of affectees.

5.10.1 TRANSPARENCY OF COMPENSATION PROCESS

Following measures will be adopted to ensure transparency of the compensation process.

- Representation of affectees on Land Valuation Committee
- Issuance of Certificates of Compensation to each affectee and public availability of these Certificates
- Payment of compensation directly into bank accounts of the affectees.

These measures will greatly help in minimising the possibility of affectees not receiving full compensation.

5.11 GRIEVANCE REDRESS

Regardless of its scale, involuntary resettlement inevitably gives rise to grievances among the affected population over issues ranging from entitlements, rates of compensation and eligibility criteria. Timely redress of such grievances is vital to the satisfactory implementation of resettlement and to the completion of the project on schedule. The Project therefore must ensure that affected persons have access to grievance redress procedures and that such procedures are in place to allow them to lodge a complaint or a claim.

Grievances are best redressed through project management, local civil administration, or other channels of mediation acceptable to all parties. Such channels of mediation may involve customary and traditional institutions of dispute resolution. The project management should make every effort to resolve grievances at the community level. Recourse to the legal system should be avoided except as a last resort.

In the case of Patrind Hydropower Project, major grievances that might require mitigation include the following:

- AP's not enlisted
- Compensation inadequate
- Dispute about ownership

- Delay in disbursement of compensation

This requires that a Grievance Redress Committee (GRC) is constituted to resolve such issues and provide AP's a public forum to address and resolve such issues adequately. The GRC may be comprised of the following members.

- District Revenue Officer, as the Chairman:
- Union Council Nazim, as Principal Member
- Three Affected Community Representatives, as Members

The GRC will meet at least once a month and discuss the existing problems. It shall deliver its decision within two to four weeks of registration of the case. The decision of GRC would be final.

5.12 RESETTLEMENT DATABANK

Management Information System (MIS) proposed in Section 5.7.2 of this Chapter will be used to maintain a computerised data involving information related to resettlement activities. This will include socio-economic status of AP's, information of acquired land, inventory of losses by individual AP's, compensation and entitlements and payments made as well as work permits issued to AP's who will be given priority in employment with Project Contractor(s).

The databank will form the basis of information for implementation, monitoring and reporting purposes and facilitate efficient resettlement management.

5.13 RESETTLEMENT PLAN AND IMPLEMENTATION

Resettlement Plan consists of the following activities. The agency responsible for implementation of resettlement activities is shown against each activity.

Table 5.7: Resettlement Activities and Agencies Responsible for Patrind Hydropower Project

Sr. #	Resettlement Plan Activity	Agency Responsible
1.	Establishment of Environment Management Unit (EMU) and Appointment of DRO as LAC.	STAR Hydropower
2.	Establishment of Compensation Fund with DRO.	STAR Hydropower
3.	Updating of Land Acquisition and Resettlement Data.	EMU
4.	Submission of Land Acquisition Request to DRO.	EMU
5.	Resettlement Training Workshop and Issuance of Work Permits	EMU
6.	Verification survey for Identification of Affected Persons/Land/Assets.	EMU/ DRO
7.	Preparation of Land Acquisition Plan.	EMU
8.	Community Consultation and Disclosure of Land/ Assets Acquisition/ Entitlements and Resettlement Plan to Affected Persons and the Community.	EMU
9.	Grievance Redress	GRC
10.	Compensation Award and Payment of Compensation.	EMU/ DRO
11.	Possession of Acquired Land/ Assets.	STAR Hydropower
12.	Handover of Acquired Land to Contractors for Construction.	STAR Hydropower

LAC: Land Acquisition Collector, EMU: Environment Management Unit, WAPDA: Water and Power Development Authority,
DRO: District Revenue Officer, GRC: Grievance Redress Committee

5.14 IMPLEMENTATION SCHEDULE FOR RESETTLEMENT

Section 5.13 has enumerated resettlement activities and corresponding agencies responsible for their completion. Within the project cycle, the implementation schedule provides the time frame for commencement and completion of the resettlement activities. Table 5.8 is the Implementation Schedule for Resettlement Plan of Patrind Hydropower Project.

Table 5.8: Implementation Schedule/Responsibilities for Resettlement Plan of Patrind Hydropower Project

Sr. No.	Resettlement Plan Activity	Responsibility		Year 0	Year 1				Year 2				Year 3				Year 4			
		Primary	Secondary	Pre-Project	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Community Consultations	EMU	LAC																	
2	RP Disclosure - Brochure in Urdu	EMU	-																	
3	Site Demarcation of Affected Lands	EMU	LAC																	
4	Request to LAC for Initiating Process	EMU	LAC																	
5	Notification under LAA Section 4	LAC	EMU																	
6	Inventory - taking of Lands/ Assets	LAC	EMU																	
7	Compensation Assessment (Revised)	LAC	EMU																	
8	Payment of Compensation	DRO	EMU																	
9	Grievance Redress	GRC	-																	
11	Possession of Land/ Assets for Project Works	LAC	EMU																	
12	Contractor Receives Approval	Contractor	Community																	
13	Start of Excavation / Construction Works	Contractor	EMU																	

AP : Affected Person
LAC : Land Acquisition Collector
EMU : Environmental Management Unit
RP: Resettlement Plan
DRO: District Revenue Officer